PROJECT MANUAL

Construction Documents

18 December 2024

North Carolina State University

NC STATE UNIVERSITY

Yarbrough Field Office

Raleigh, North Carolina

PW Project #:	820937.002
NCSU Project #:	202435102
State ID #:	24-29063-01A

Perkins&Will

411 W. Chapel Hill Street., Suite 200, Durhan, NC 27701 | 919.433.5300

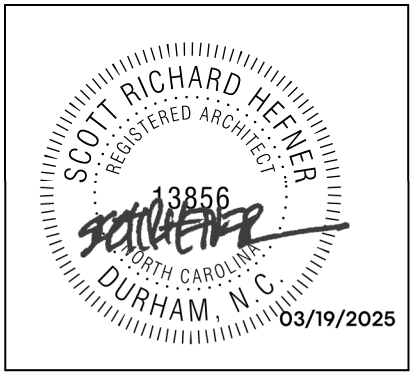
DOCUMENT 00 01 07

PROFESSIONAL SEALS PAGE

The following Documents and Specification Sections have been prepared by or under the direct supervision of the Architect:

ARCHITECT

Perkins&Will
411 W. Chapel Hill Street, Suite 200
Durham, North Carolina 27701
T: 919.433.5336



DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00 26 00 Procurement Substitution Procedures
Substitution Request Form (Procurement)

DIVISION 01 – GENERAL REQUIREMENTS

01 10 00 Summary
01 11 16 Work by Owner
01 14 00 Work Restrictions
01 25 00 Substitution Procedures
Substitution Request Form
01 26 00 Contract Modification Procedures
01 26 13 Request for Interpretation (RFI)
01 29 00 Payment Procedures
01 31 19 Project Management and Coordination
01 32 00 Construction Progress Documentation
01 32 16 Construction Progress Schedule
01 32 33 Photographic Documentation
01 33 00 Submittal Procedures
01 35 16 Alteration Project Procedures
01 35 73 Delegated Design Requirements
01 40 00 Quality Requirements
01 42 00 References
01 45 33 Code Required Special Inspections and Procedures
01 50 00 Temporary Facilities
01 51 00 Temporary Utilities
01 55 00 Vehicular Access and Parking
01 57 00 Temporary Controls
01 58 00 Project Identification
01 60 00 Product Requirements
01 73 00 Execution
01 74 19 Construction Waste Management and Disposal
01 77 00 Closeout
01 78 23 Operation and Maintenance Data

END OF DOCUMENT

DOCUMENT 00 01 07

PROFESSIONAL SEALS PAGE

The following Specification Sections have been prepared by or under the direct supervision of the Structural Engineer:

STRUCTURAL ENGINEER

Lynch Mykins Structural Engineers
301 N. West Street, Suite 105
Raleigh, NC 27603
919-782-1833

DIVISION 05 – METALS

05 12 00	Structural Steel
05 40 00	Cold-formed Metal Framing
05 53 13	Bar Gratings

END OF DOCUMENT

DOCUMENT 00 01 07

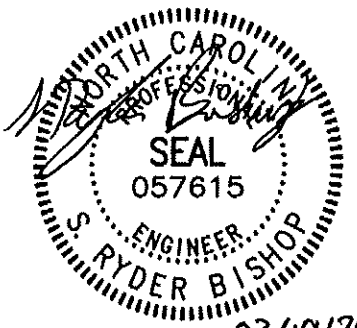
PROFESSIONAL SEALS PAGE

The following Specification Sections have been prepared by or under the direct supervision of the Mechanical/Electrical/Plumbing Engineer:

MECHANICAL/ELECTRICAL/PLUMBING/FIRE PROTECTION ENGINEER
Salas O'Brien North Carolina, Inc.
702 Oberlin Road, Suite 300
Raleigh, NC 27605
919-832-8118

DIVISION 21 – FIRE PROTECTION.....

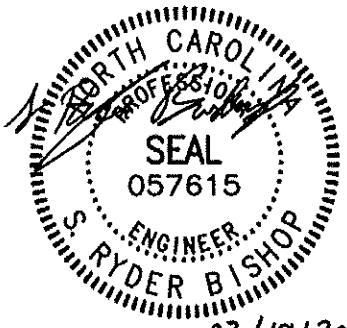
21 02 10	Fire Suppression Summary of Work
21 05 10	Fire Suppression Basic Requirements
21 05 29	Fire Suppression Piping Hangers and Supports
21 0 553	Fire Suppression Painting and Identification
21 10 00	Sprinkler and Standpipe Fire Suppression Systems



03/19/2025

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

23 02 10	HVAC Summary of Work
23 05 10	HVAC Basic Requirements
23 05 11	Electrical Provisions for HVAC Work
23 05 13	Electrical Motors for HVAC Equipment
23 05 17	Sleeves and Sleeve Seals for HVAC Piping
23 05 29	Hangers and Supports for Piping, Ductwork & Equipment
23 05 48	HVAC Vibration Control
23 05 53	HVAC Painting and Identification
23 05 93	HVAC Testing, Adjusting, and Balancing
23 05 96	HVAC Systems Commissioning
23 07 13	HVAC Duct Insulation
23 07 19	HVAC Piping Insulation
23 09 13	Instrumentation and Control Devices for HVAC
23 09 23	Extension of Existing Direct Digital Control System for HVAC
23 21 13	Above Ground Hydronic Piping
23 23 00	Refrigerant Piping
23 31 00	HVAC Ductwork
23 33 00	Air Duct Accessories
23 34 16	Centrifugal HVAC Fans
23 3 713	Diffusers, Registers, and Grilles
23 4 113	Particulate Air Filtration, Low Efficiency (MERV 6-8)
23 41 23	Particulate Air Filtration, Medium Efficiency (MERV 9-16)
23 62 00	Packaged Condensing Units
23 73 11	Blower-Coil Air-Handling Units, Indoor or Outdoor
23 82 16	Air Coils



03/19/2025

DIVISION 26 – ELECTRICAL

26 00 00	Summary of Electrical Work
26 05 00	Basic Electrical Requirements
26 05 19	Secondary Voltage Wires and Cables
26 05 26	Grounding
26 05 29	Supporting Devices
26 0 533	Electrical Identification
26 05 34	Raceways
26 05 35	Electrical Boxes and Fittings
26 05 93	Electrical Connections for Equipment
26 05 96	Lighting Systems Commissioning
26 08 00	Testing and Placing in Service
26 09 23	Lighting Control Devices
26 24 16	Panelboards
26 27 26	Wiring Devices
26 50 00	Lighting Fixtures

DIVISION 28 – ELECTRONIC SAFETY and SECURITY

28 31 10	Fire Alarm System Modifications

END OF DOCUMENT

PROJECT MANUAL

North Carolina State University

Yarbrough Field Office

Raleigh, North Carolina

Construction Documents **18 December 2024**

Owner
North Carolina State University
Facilities Division Design & Construction
2601 Wolf Village Way, Suite 331
Raleigh, North Carolina 27695-7520
Telephone: 919.515.2011
Contact: Mike Bell
Electronic Mail: jmbell@ncsu.edu

Facility
Yarbrough Field Office
2411 Yarbrough Drive
Raleigh, North Carolina 27695

Architect
Perkins&Will
411 W. Chapel Hill Street, Suite 200
Durham, North Carolina 27701
Telephone: 919.433.5336
Contact: Scott Hefner
Electronic Mail: scott.hefner@perkinswill.com

Structural Engineers
Lynch Mykins Structural Engineers
301 N. West Street, Suite 105
Raleigh, North Carolina 27603
Telephone: 919.782.1833
Contact: Jeff Morrison
Electronic Mail: jmorrison@lynchmykins.com

Mechanical / Electrical / Plumbing / Fire Protection Engineers
Salas O'Brien
1620 Midtown Place
Raleigh, North Carolina 27609
Telephone: 919.832.8118
Contact: Chris M. Martin Jr.
Electronic Mail: chris.martin@salasobrien.com

Project Numbers

PW Project #:	820937.002
NCSU Project #:	202435102
State ID #:	24-29063-01A

END OF DOCUMENT

DOCUMENT 00 01 10

TABLE OF CONTENTS

INDEX OF ISSUES

INDEX OF DISCIPLINES

A	(Architectural)	FS	(Food Service)	P	(Plumbing)
B	(Building Envelope)	FP	(Fire Protection)	S	(Structural)
C	(Civil)	L	(Landscape)	SC	(Security)
D	(Door Hardware)	M	(Mechanical)	T	(Technology)
E	(Electrical)	O	(Owner)		

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

DIVISION 01 – GENERAL REQUIREMENTS

END OF TABLE OF CONTENTS

ADVERTISEMENT FOR BIDS

Sealed proposals will be received until ***TBD*** (Time)

on ***TBD*** (Date), in ***Location TBD & Virtually to TBD,*** (Location)

for the construction of ***Yarbrough Field Office***

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

Complete plans and specifications for this project can be obtained from:

Perkins&Will 411 W Chapel Hill Street, Suite 200 Durham, NC 27701
(Designer Name and Address)

during normal office hours after ***TBD*** (Date)

Plan Deposit ***Not Applicable***

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

Signed: _____
(Owner)

_____

_____

STATE OF NORTH CAROLINA
STANDARD FORM OF INFORMAL CONTRACT
AND GENERAL CONDITIONS

FOR

North Carolina State University
Project Name: Facilities Division, Design & Construction
Building/Location: Yarbrough Field Office, Raleigh, North Carolina
Project Number: SCO ID # - 24-29063-01A

SCOPE OF WORK

Brief outline of work required:
This project is a tenant upfit of an empty suite within the 1924 section of Yarbrough Central Utility Plant (the original turbine room). The new use of the space is a field office for general contractor operations for an adjacent project at Mann Hall planned to be under construction.

NOTICE TO BIDDERS

Sealed bids for this work will be received by:

Construction Manager: Joshua Gray
North Carolina State University, Facilities Division, Design & Construction
, Administrative Services
Building III, 2601 Wolf Village Way, Raleigh, NC 27695
Telephone: (919) 513-7239
up to the time of: _____, on *the date of:* _____and immediately thereafter publicly opened and read aloud. Complete plans and specification and contract documents can be obtained from

■ *Designer/* ☐ *Owner:* Scott Hefner, of Perkins&Will *Email:* scott.hefner@perkinswill.com
Address: 411 W. Chapel Hill St, Suite 200, Durham, North Carolina 27701 *Telephone:* (919) 433-5336

Contractors are hereby notified that they must have proper license under the State laws governing their respective trades and that North Carolina General Statute 87 will be observed in receiving and awarding contracts. General Contractors must have general license classification for, (See Licensing Board Rules & Regulations).

No bid may be withdrawn after the opening of bids for a period of 30 days. The Owner reserves the right to reject any or all bids and waive informalities. Bids shall be made only on the BID/ACEPTANCE form provided herein with all blank spaces for bids properly filled in and all signatures properly executed.

Please note on the envelope – **Bid: Attn**: Mike Bell

Project Name: Yarbrough Field Office
Bid Date: _____
Contractor: _____
License Number: _____

Add any additional information such as Contact Person, site visit, hours, pre-bid conference, mailing instructions.

BID/ACCEPTANCE FORM
For

Project Name: Yarbrough Field Office *Project Number:* SCO ID # - 24-29063-01A

Building/Location: 2411 Yarbrough Drive, Raleigh, North Carolina 27695

*Designer to include Addendum language only if applicable to the project:*_____

We are in receipt of Addendum ☐*1* ☐*2* ☐*3* ☐*4* ☐*5*

The undersigned, as bidder, proposes and agrees if this bid is accepted to contract with the *State of North Carolina* through, North Carolina State University, for the furnishing of all materials, equipment, and labor necessary to complete the construction of the work described in these documents in full and complete accordance with plans, specifications, and contract documents, and to the full and entire satisfaction of the, *State of North Carolina* and North Carolina State University, for the sum of:

BASE BID: _____Dollars $ _____

Alternate #	Alternate Description	Add/Deduct	Alternate bid price	Accepted (*Owner Initials On Each Line Indicates Acceptance*)
1				
2				
3				
4				
5				
6				
7				
8				

Respectively submitted this _____day of _____20_____

_____
(Contractor's Name)

Federal ID#:_____ By: _____

Witness:_____ Title: _____
(*Owner, partner, corp. Pres. Or Vice President Proprietorship or Partnership)*
Address: _____

Email Address: _____

Attest: _____ *(corporation)*
(***Corporate Seal****)*

By:_____ License #:_____

Title:_____
(Corporation, Secretary/Ass't Secretary)

_____

ACCEPTED by the STATE OF NORTH CAROLINA, through North Carolina State University

Total contract amount accepted by the owner, including base bid and accepted bid alternates: $_____

BY:_____
TITLE: D. G. Morton; Associate Vice Chancellor, Facilities

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

1. GENERAL

It is understood and agreed that by submitting a bid that the Contractor has examined these contract documents, drawings and specifications and has visited the site of the Work, and has satisfied himself relative to the Work to be performed.

2. DEFINITIONS

Owner: "Owner" shall mean, The State of North Carolina through North Carolina State University

Contractor: "Contractor" shall mean the entity that will provide the services for the Owner.

Designer: 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 responsible for preparing the project plans and specifications. They will be referred to hereinafter as if each were of the singular number, masculine gender.

Contract Documents: "Contract Documents" shall consist of the Notice 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 bid; the contract; the performance bond if applicable; and insurance certificates. All of these items together form the contract.

INTENT AND EXECUTION OF DOCUMENTS

The drawings and specifications are complementary, one to the other. 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 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.

In such cases where the nature of the work requires clarification by the Designer/ Owner, the Designer/ Owner shall furnish such clarification. Clarifications and drawings shall be consistent with the intent of the Contract Documents, and shall become a part thereof.

4. AS-BUILT MARKED-UP CONSTRUCTION DOCUMENTS

Contractor shall provide one complete set of legible "as-built" marked-up construction drawings and specifications recording any and all changes made to the original design during the course of construction. In the event no changes occurred, submit construction drawings and specifications set with notation "No Changes." The Designer/Owner must receive "As-built" marked-up construction drawings and specifications before the final pay request can be processed.

5. SUBMITTAL DATA

The Contractor awarded the contract shall submit all specified submittals to the Owner/Designer. A minimum number of copies as specified by the owner, of all required submittal data pertaining to construction, performance and general dimensional criteria of the components listed in the technical specifications shall be submitted. No material or equipment shall be ordered or installed prior to written approval of the submittals by the Designer/Owner. Failure to provide submittal data for review on equipment listed in the technical specifications will result in removal of equipment by the Contractor at his expense if the equipment is not in compliance with the specifications.

6. SUBSTITUTIONS

In accordance with the provisions of G.S. 133-3, material, product, or equipment substitutions proposed by the bidders to those specified herein can only be considered during the bidding phase until five (5) days prior to the receipt of bids or by the date specified in the pre bid conference, when submitted to the Designer with sufficient data to confirm material, product, or equipment equality. Proposed substitutions submitted after this time will be considered only as potential change order.

Submittals for proposed substitutions shall include the following information:

a. Name, address, and telephone number of manufacturer and supplier as appropriate.

b. Trade name, model or catalog designation.

c. Product data including performance and test data, reference standards, and technical descriptions of material, product, or equipment. Include color samples and samples of available finishes as appropriate.

d. Detailed comparison with specified products including performance capabilities, warranties, and test results.

e. Other pertinent data including data requested by the Designer to confirm product equality.

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

7. WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE

The contractor shall maintain, in readable condition at his job site 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 owner, designer or his authorized representative.

The contractor shall maintain at the job site, 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 acceptance of the project.

8. MATERIALS, EQUIPMENT, EMPLOYEES

a. The contractor shall, unless otherwise specified, supply and pay for all labor, transportation, materials, tools, apparatus, lights, power, fuel, 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; the designer prior to the opening of bids shall make such approval or disapproval. 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.

g. The Contractor shall cooperate with the designer and the owner in coordinating construction activities.

h. The Contractor shall maintain qualified personnel and effective supervision at the site at all times during the project, and exercise the appropriate quality control program to ensure compliance with the project drawings and specifications. The designer is responsible for determining compliance with the drawings and specifications.

9. CODES, PERMITS AND INSPECTIONS

The Contractor shall obtain the required permits, if required, 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. 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 Owner, he shall bear all cost arising there from.

All work under this contract shall conform to the current North Carolina Building Code and other state and national codes as are applicable.

Projects constructed by the State of North Carolina or by any agency or institution of the State are not subject to county or municipal building codes and may* not be subject to inspection by county or municipal authorities. Where appropriate, the Contractor shall, cooperate with the county or municipal authorities by obtaining building permits. The contractor at no cost may obtain permits to the owner.

All fire alarm work shall be in accordance with the latest State Construction Office (SCO) *Guidelines for Fire Alarm Installation* (NFPA72). Where the contract documents are in conflict with the SCO guidelines, the SCO guidelines shall govern. The Contractor shall be responsible for all the costs for the correction of the work where he installs it in conflict with the latest edition of the SCO *Guidelines for Fire Alarm Installation*..

*****Inspection and certification of compliance by local authorities is necessary if an architect or engineer was <u>not</u> employed on the project, or if the plans and specifications were not approved and the construction inspected by the State Construction Office.

10. PROTECTION OF WORK, PROPERTY, THE PUBLIC AND SAFETY

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, except as indicated in the Supplemental General Conditions.

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 it. 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.

i. 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 13(b).

j. 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.

11. SUBCONTRACTS AND SUBCONTRACTORS

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.

12. CONTRACTOR-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. The Owner reserves the right to limit the amount of portions of work to be subcontracted as hereinafter specified.

13. CHANGES IN THE WORK AND CLAIMS FOR EXTRA COST

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 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. Should a claim for extra compensation by the contractor be denied by the designer or the owner, the contractor may pursue his claim in accordance with G.S. 143-135.3.

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

c. In determining the values of changes, either additive or deductive, contractors are restricted to the use of the following methods:

1. Where the extra work involved is covered by unit prices quoted in the proposal, or subsequently agreed to by the Contractor, Designer, Owner and State Construction Office the value of the change shall be computed by application of unit prices based on quantities, estimated or actual as agreed of the items involved, except 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 c (2) herein. If neither party elects to proceed under c (2), 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 work of their subs. ; Under Method "c(1)", no additional allowances shall be made for overhead and profit. In the case of deductible change orders, under Method "c(2)" and Paragraph (b) above, the contractor shall include no less than five percent (5%) profit, but no allowances for overhead.

e. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein shall be limited to the following:

1. The actual costs of materials and supplies incorporated or consumed as part of the work;

2. The actual costs of labor expended on the project site; labor expended in coordination, change order negotiation, record document maintenance, shop drawing revision or other tasks necessary to the administration of the project are considered overhead whether they take place in an office or on the project site.

3. The actual costs of labor burden, limited to the costs of social security (FICA) and Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of 30 days per year; retirement contributions; worker’s compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts; the total of which shall not exceed thirty percent (30%) of the actual costs of labor;

4. The actual costs of rental for tools, excluding hand tools; equipment; machinery; and temporary facilities required for the work;

5. The actual costs of premiums for bonds, insurance, permit fees and sales or use taxes related to the work.

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

f. Should concealed conditions be encountered in the performance of the work below grade, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the contract documents, the contract sum and time for completion may be equitably adjusted by change order upon claim by either party made within thirty (30) days after the condition has been identified. The cost of such change shall be arrived at by one of the foregoing methods. All change orders shall be supported by a unit cost breakdown showing method of arriving at net cost as defined above.

g. Change orders shall be submitted by the contractor in writing to the owner/designer for review and approval. 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**,** within seven (7) days of receipt.

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."

h. 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.

i. 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.

14. 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 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 (if applicable) 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 contractor, or the surety (if applicable) 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 (if applicable). 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 (if applicable) 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 (if applicable) shall be liable and shall pay to the owner the amount of said excess.

15. TERMINATION FOR CONVENIENCE

a. Owner may at any time and for any reason terminate Contractor's services and work at Owner's convenience, after notification to the contractor in writing via certified mail. 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.

b. 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 approved by Owner; (3) plus ten percent (10%) of the cost of the balance of the work to be completed 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.

16. 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.

17. REQUESTS FOR PAYMENT

Contractor shall refer to the Supplemental General Conditions for specific directions on payment schedule, procedures and the name and address where to send applications for payments for this project. It is imperative that invoices be sent only to the above address in order to assure proper and timely delivery and handling.

The Designer/Owner will process all Contractor pay requests as the project progresses. The Contractor shall receive payment within thirty (30) consecutive days after Designer/Owner's approval of each pay request. Payment will only be made for work performed as determined by the Designer/Owner.

Retainage:

a. Retainage withheld will not exceed 5% at any time.
b. The same terms apply to general contractor and subcontractors alike.
c. Following 50% completion of the project no further retainage will be withheld if the contractor/subcontractor has performed their work satisfactorily.
d. Exceptions:
    1. Owner/Contractor can reinstate retainage if the contractor/subcontractor does not continue to perform satisfactorily.

2. Following 50% completion of the project, the owner is authorized to withhold additional retainage from a subsequent periodic payment if the amount of retainage withheld falls below 2.5%.

Final payment will be made within forty-five (45) consecutive days after acceptance of the work, receipt of marked-up “as-built” drawings and specifications and the submission both of notarized Contractor's affidavit and final pay request. All pay requests shall be submitted to the Designer/Owner for approval.

THE CONTRACTOR'S FINAL PAYMENT AFFIDAVIT SHALL STATE: "THIS IS TO CERTIFY THAT ALL COSTS OF MATERIALS, EQUIPMENT, LABOR, SUBCONTRACTED WORK, AND ALL ELSE ENTERING INTO THE ACCOMPLISHMENT OF THIS CONTRACT, INCLUDING PAYROLLS, HAVE BEEN PAID IN FULL."

18. PAYMENTS WITHHELD

The designer with the approval of the Owner may withhold payment for the following reasons:

a. Faulty work not corrected.

b. The unpaid balance on the contract is insufficient to complete the work in the judgment of the designer.

c. To provide for sufficient contract balance to cover liquidated damages that will be assessed.

d. The secretary of the Department of Administration may authorize the withholding of payment for the following reasons:

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

ii. Evidence that subcontractors have not been paid.

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 as provided in G.S. 143-134.**1.** As provided in G.S. 143-134.1(e), the owner shall not be liable for interest on payments withheld by the owner for unsatisfactory job progress, defective construction not remedied, disputed work, or third-party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

19. MINIMUM INSURANCE REQUIREMENTS

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

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

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

b. **Public Liability and Property Damage**

The contractor shall provide and maintain, until final acceptance, comprehensive general liability insurance, including coverage for premises operations, independent contractors, completed operations, products and contractual exposures, as shall protect such contractors from claims arising out of any bodily injury, including accidental death, as well as from claims for property

damages which may arise from operations under this contract, whether such operations be by the contractor or by any subcontractor, or by anyone directly or indirectly employed by either of them and the minimum limits of such insurance shall be as follows:

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

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

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

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

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

d. **Deductible**

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

e. **Other Insurance**

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

f. **Proof of Carriage**

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

20. ASSIGNMENT

No assignment of the Contractor's obligations or the Contractor's right to receive payment hereunder shall be permitted. However, upon written request approved by the Owner and solely as a convenience to the Contractor, the Owner may: (1) forward the Contractor's payment check directly to any person or entity designated by the Contractor, and (2) include any person or entity designated by Contractor as a joint payee on the Contractor's payment check. In no event shall such approval and action obligate the Owner to anyone other than the Contractor, and the Contractor shall remain responsible for fulfillment of all contract obligations.

21. CLEANING UP AND RESTORATION OF SITE

The Contractor shall keep the sites and surrounding area reasonably free from rubbish at all times and shall remove debris from the site from time to time or when directed to do so by the Owner. Before final inspection and acceptance of the project, the Contractor shall thoroughly clean the sites, and completely prepare the project and site for use by the Owner.

At the end of construction, the contractor shall oversee and implement the restoration of the construction site to its original state. Restoration includes but not limited to walks, drives, lawns, trees and shrubs, corridors, stairs and other elements shall be repaired, cleaned or otherwise restored to their original state.

22. GUARANTEE

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 final acceptance of the work and shall replace such defective materials or workmanship without cost to the owner.

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.

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.

Guarantees for roofing workmanship and materials shall be stipulated in the specifications sections governing such roof, equipment, materials, or supplies.

23. STANDARDS

All manufactured items and/or fabricated assemblies subject to operation under pressure, operation by connection to an electric source, or operation involving a connection to a manufactured, natural, or LP gas source shall be constructed and approved in a manner acceptable to the appropriate State inspector which customarily requires the label or re-examination listing or identification marking of appropriate safety standard organization, such as the American Society of Mechanical Engineers for pressure vessels; the Underwriters Laboratories and/or National Electrical Manufacturers Association for electrically operated assemblies; or the American Gas Association for gas operated assemblies, where such approvals of listings have been established for the type of device offered and furnished. Further, all items furnished shall meet all requirements of the Occupational Safety and Health Act (OSHA), and State and federal requirements relating to clean air and water pollution.

All equipment and products must be independent third party tested and labeled (UL, FM, or CTS) before final connections to Owner services or utilities.

24. TAXES

a. Federal excise taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3442(3)).

b. Federal transportation taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3475(b) as amended).

c. North Carolina sales tax and use tax, as required by law, do apply to materials entering into state work and such costs shall be included in the bid proposal and contract sum.

d. Local option sales and use taxes, as required by law, do apply to materials entering into state work as applicable and such costs shall be included in the bid proposal and contract sum.

e. **Accounting Procedures for Refund of County Sales & Use Tax**

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

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

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

delivered should be listed. The contractor should also be notified that the certified statement may be subject to audit.

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

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

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

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

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

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

25. 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.

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.

26. MINORITY BUSINESS PARTICIPATION

GS 143-128.2 establishes a ten percent (10%) goal for participation by minority business in total value of work for each State building project.

For construction contracts with a value of less than $300,000, the Owner has the responsibility to make a good faith effort to solicit minority bids and to attain the goal. The contractor shall include with his bid a completed Identification of HUB Certified/Minority Business Participation form. Contractor shall submit completed Appendix E MBE Documentation for Contract Payments form with final payment request.

For construction contracts with a value of $300,000 or greater, the contractor shall comply with the document *Guidelines for* Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts including Identification of Minority Business Participation, Affidavits A, B, C, and D, and Appendix E. These forms provided herein are hereby incorporated and made a part of this contract.

27. ACCESS TO PERSONS AND RECORDS

The State Auditor shall have access to persons and records as a result of all contracts or grants entered into by the Owner in accordance with General Statute 147-64.7. 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 lost 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.

28. GOVERNING LAWS

This contract is made under and shall be governed by and construed in accordance with the laws of the State of North Carolina. The Contractor shall comply with all applicable federal, State and local laws, statutes, ordinances and regulations including, but not limited to, the Omnibus Transportation Act of 1991 and its implementing regulations.

29. 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 projects. In addition to final evaluation, an interim evaluation may be prepared during the progress of project. The owner may request the contractor's comments to evaluate the designer.

NORTH CAROLINA STATE UNIVERSITY
SUPPLEMENTARY GENERAL CONDITIONS FOR INFORMAL PROJECTS

(Revised 09/23/2022)

GENERAL INSTRUCTIONS

The attached Supplementary General Conditions For Informal Projects, are current as of the revised date and in addition to the General Conditions are part of the binding contract documents. Where numbered, these Supplementary General Conditions supplement to the same-numbered article of the General Conditions for Informal Projects. Should these Supplementary General Conditions For Informal Projects be superseded, the revision current at the date of execution of the contract by the Owner shall be binding.

TIME OF COMPLETION

The Contractor shall commence work to be performed under this Contract on a date to be specified by the owner and shall fully complete all work hereunder within (90) consecutive calendar days, beginning on 4/1/2025 and ending on, 6/30/2025. For each day in excess of the above number of days, the Contractor shall pay the Owner the amount of NA Dollars ($ NA) as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the Owner should the Contractor fail to complete the Work within the time specified.

If the Contractor is delayed at anytime in the progress of his work by any act or negligence of the Owner, his employees or his separate contractor, by changes ordered in the work; by abnormal weather conditions; by any causes beyond the Contractor's control or by other causes deemed justifiable by Owner, then the contract time may be reasonably extended in a written order from the Owner upon written request from the contractor within ten days following the cause for delay.

PERFORMANCE AND PAYMENT BONDS

When required by the Owner, the 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 (Forms 307 & 308). An authorized agent of the bonding company who is licensed to do business in North Carolina shall countersign all bonds.

2. DEFINITIONS

A. This further defines the Owner as North Carolina State University (NCSU), Construction Services Department and its project managers, or other entity of North Carolina State University (NCSU) that executes the contract.

3. MATERIALS, EQUIPMENT, EMPLOYEES

A. The Contractor shall under no circumstances interrupt the building's operation without prior authorization from the Owner.

B. The Contractor shall consult with the Owner prior to making any penetration or alteration of roof deck or existing roofing application, and shall obtain concurrence prior to, during and upon completion of the work. All roof work must be performed by a licensed roof contractor and approved by the Owner prior to the project start. Adequate temporary protection shall be installed on each roof penetration to protect the Owner's property. All damage to roof structure and waterproof membrane resulting from Contractor's activity shall be repaired (during the period of this contract, and as soon as possible) by the Contractor, at the expense of the Contractor, in a manner to meet any and all warranties that may be in effect.

C. The Contractor shall be responsible for coordinating all project landscaping with NCSU Grounds and Building Services through the NCSU Construction Services Department Construction Project Manager in accordance with the, Landscape Construction Guidelines and shall be responsible for the landscaping elements as defined therein.(See Attachment #1)

D. The University Construction Project Manager shall complete a Roof Key Check Out form prior to beginning any job requiring roof access.

E. Twenty-four hours' notice to the Owner is required prior to gaining roof access.

F. The Contractor shall give forty-eight (48) hours' notice of intention to block any roadway or driveway for any purpose and may proceed upon approval from the Owner.

G. The Contractor shall notify and coordinate with the Owner, the department and or room occupant prior to beginning any work in a room.

H. The Contractor shall provide ten (10) working days' notice to the Owner for any utility shutdown affecting areas other than the immediate construction area. Need for shutdown, the location and the extent shall be verified and cleared through the NCSU Facilities Customer Service Center up to (10) working days prior to the actual shutdown and performance of work. It is imperative that campus utilities and other campus services be maintained at all times except for scheduled interruptions. the Owner shall clear any necessary utility interruptions with NCSU Facilities Division Personnel. If necessary, the work shall be performed at night, over the weekend, or during holidays. No extra payment will be made for such work. University personnel will perform certain functions in connection with utility outages, such as operating existing electrical switches, operating water and steam valves, placing existing building systems back in operation, operating existing fire alarm systems, etc. The University will bear these expenses; however, when the Contractor(s) requires extra outages because of the shortage of material, improper material, shortage of labor, poor coordination, etc., the Contractor(s) must pay the University all expenses incurred for extra outages. Contractor shall be responsible for the verification of existence and location of utility services (underground and above ground) and the verification of quantities. See Attachment # 2

(Utilities and Site Use)

I. The Contractor shall not use the Owner's toilets unless specifically permitted to do so by the Owner. Such use shall be clarified in the Pre-bid, or Pre-Construction Conference by the Owner. In the absence of such clarification, the Contractor shall include in his base bid a temporary outside Port-o-Jon type facility for use by his personnel.

J. The Owner shall operate all breakers, valves, fire alarm, sprinkler, or other utility disconnect devices as shall be requested by the Contractor. Such requests shall be with a ten (10) working day written notice from the Contractor to the Owner. All such costs shall be borne by the Contractor.

K. The Contractor shall arrange for, and pay costs associated with staging area and parking vehicles on campus with NCSU Transportation, (919) 515-3424, before beginning work. The Contractor shall be responsible for keeping all construction activity within the project limits and staging areas. Any changes in staging areas or site access must have prior approval by NCSU Construction Services Project Manager, NCSU Transportation, and Designer. Parking is allowed in approved University spaces ONLY. No parking is allowed on lawn areas, sidewalks, courtyards, etc., without proper permits and bridging. The Contractor is responsible for becoming familiar with and following NCSU parking regulations, and blocking off any spaces that are approved for staging.

L. The Contractor shall be responsible for the restoration of all landscape areas damaged during construction, including but not limited to: lawn areas, plant beds, trees and shrubs, sidewalks, patios and courtyards and damaged plant material shall be replaced in kind. Where plant and lawn areas are damaged, the Contractor shall engage NCSU Grounds and Building Services for restoration work. Any desire by contractor for pruning, removal of plant material, changes in tree protection, etc., not described in the drawings must be approved by NCSU Construction Services prior to any such actions. The General Contractor shall be responsible for the actions of his subcontractors with regard to protection of the landscape. Plywood shall be laid on brick pavers in areas where the Contractor desires vehicular or equipment traffic. Damage to brick pavers shall be repaired by the Contractor at no cost to the Owner.

M. The Contractor shall bridge all access and staging areas including but not limited to brick paving, planting beds, grass areas, sidewalks, curbs, etc. Contractor will provide bridging materials, min. 3/4"x 4' x 8' sheet plywood for up to 9,000 lbs. Two layers of 3/4" plywood sheets are required for loads exceeding 9,000 lbs. An access permit must be obtained from NCSU Grounds and Building Services at 515-9871, five (5) working days prior to commencement of construction. An inspection of existing conditions will be made prior to installation and documented. It shall be the contractor's responsibility to return all damaged areas to preconstruction conditions at the completion of the project. Contractors must provide their own plywood.

N. Contractors requesting access to areas limited by bollards must first obtain a permit, and then check out a bollard key to a specific location from Landscape Services on Sullivan Drive. The keys may be checked out

Monday through Friday between 7:00 am and 3:45 pm by calling 515-9871, and returned by 3:45 pm that day. After these hours and on weekends, keys may be obtained from Campus Police. Grounds and Building Services will review the bollards and the Contractor will be held responsible for its condition. Any costs incurred by lost keys shall also be the responsibility of the Contractor.

O. The Contractors shall keep the building and the surrounding area reasonably free from rubbish at all times and shall remove debris from the site from the time or when directed to do so by the Owner. Before final inspection and acceptance of the work, 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 area for use by the Owner.

P. When utility services to University facilities cannot be interrupted for the length of time required by the Contractor, the Contractor shall make provisions for temporary services at the Contractor's expense.

Q. CUTTING AND PATCHING, DIGGING - Each contractor performing excavation work shall be responsible for locating underground utilities prior to excavation. The contractor must call 811 prior to breaking ground. The contractor is required to hand excavate to expose all known or located underground utilities prior to using backhoes, trenchers or motorized excavation equipment. The contractor shall be responsible for the cost expended by the University for repairing utility interruptions caused by excavations, the minimum charge will be $1,000.00 per utility interruption caused by the contractor's failure to exposed known or located utilities by hand

R. Road and sidewalk cuts shall be scheduled in advance and made only after the Owner has approved them. Appropriate detours shall be planned, subject to approval by the Owner, giving consideration to the handicapped. Warning barricades and signs shall be installed by the Contractor, as well as information signs indicating detours. No service disruptions or excavations may be made until barricades and signs are in place to protect the public. Barricades and signs must be maintained and be neat and legible at all times. Hand-made signs are not acceptable.

S. Staging areas: When required by the documents the project shall have a staging area. The contractor shall enclose the staging area with new chain link fence and chain link swing gate(s). The fence shall be six feet in height and have a top, tubular rail. Staging areas must be kept up and maintained free of debris. Grass inside the staging areas shall be mowed at least once per week.

T. Dust barriers. The contractor shall include in the bid of the project the construction, maintenance and removal of temporary dust barriers that may be required to contain dust produced by construction work to within the project limits. The contractor shall install temporary filter fabric to all return air grilles located within the project limits during dust creating construction events.

U. Vehicle use and parking must comply with the NCSU Transportation parking policy in force at the date of the notice to proceed.

(Sustainability)

V. The Contractor shall comply with NCSU Sustainability requirements for the project as indicated by the NCSU Green Building Checklist (Attachment 5)
The NCSU guideline, Management of NON – Hazardous Construction and Demolition Reuse, Recycling and Waste Materials (Attachment 6), shall apply for compliance with non-hazardous waste diversion requirements. The Designer or Owner shall determine if the sustainability requirements for the project have been achieved.

(Sedimentation Pollution Control Act Of 1973)

V. 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).

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.

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.

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.

The contractor shall comply with the following requirements:

Equipment utilized during the construction activity on a site must be operated and maintained in such a manner as to prevent the potential or actual pollution of the surface or ground waters. Fuels, lubricants, coolants, and hydraulic fluids, or any other petroleum products shall not be discharged on to the ground or into surface waters. Spent fluids shall be disposed of in a manner so as not to enter the waters, surface or ground, and in accordance with applicable state and federal disposal regulations. Any spilled fluids shall be cleaned up to the extent practicable and disposed of in a manner so as not to allow their entry into the waters, surface of the ground, storm sewers, or drains on private or public (State) property.

Herbicide, pesticide, and fertilizer usage during the construction activity shall be restricted to those materials approved by EPA and shall be used in accordance with label restrictions.

All wastes composed of construction materials shall be disposed of in accordance with North Carolina General Statutes, Chapter 130A, Article 9 - Solid Waste Management, and rules governing the disposal of solid waste (North Carolina Administrative Code Section 15A NCAC 13B).

Minimum Monitoring and Reporting Requirements (unless otherwise approved in writing) by the Division of Environmental Management)

The contractor installing any erosion control device shall comply with the following requirements:

a. All sedimentation and erosion control of facilities shall be inspected by the contractor at least once every seven (7) calendar days and with the designer within 24 hours after any storm event of greater than one inch (1”) inch of rain per 24 hour period. Signed inspection forms shall be delivered to the owner at the progress meetings.

b. Storm water runoff discharges shall be inspected by visual observation for color, foam, outfall staining, visible sheen; dry weather flows and muddy water (at the frequency described above) to evaluate the effectiveness of the pollution control facilities or practices. If any visible off-site sedimentation is leaving the site, corrective action shall be taken to reduce the discharge of sediments.

c. The contractor shall submit to the Owner a written report of weekly inspections signed by the Designer of Record for the sedimentation and erosion control plan. Visible sedimentation found off the site shall be recorded with a brief explanation as to the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site. This record shall be made available to DENHR or authorized agent upon request.

The contractor shall keep all erosion control devices and materials in good repair. The Owner reserves the right, with 24 hours prior notice to the contractor, to repair any erosion control measures or materials as required, and deduct the cost of those repairs from the contractor’s application for payment. The Owner, through the NC State University Department of Environmental Health and Safety, shall be the sole judge as to the condition of the erosion control devices and materials.

10. PROTECTION OF WORK, PROPERTY, THE PUBLIC AND SAFETY

A. If at any time during the construction and completion of the work covered by these contract documents, the conduct of any workman of the Contractor, subcontractors, or vendors judged by the Owner to be a nuisance, or if any workman be considered detrimental to the work, the Contractor shall order such parties removed immediately from the grounds.

B. The Contractor shall provide cover and protect all portions of the site when the work is not in progress, including but not limited to, temporary roofs, covers for doorways, sashes and windows, and all other materials necessary to protect all the work on the site whether set by him, or any of the subcontractors. Any site damage caused by the lack of proper protection shall be repaired or replaced back to original state or as directed without extra cost to the Owner.

C. When directed by the construction documents, the Contractor shall give the Owner one (1) week notice for removal of any plant material to be removed by the University.

D. The Contractor shall notify the Owner immediately upon encountering any suspected asbestos product. Any removal must be coordinated through Construction Services Department by approved contractors. NCSU is not responsible for compensation due to delays by asbestos removal. Schedules will be revised upon completion of abatement for the project completion.

E. A Hotwork Permit is required when any indoor or outdoor work will involve Hotwork, defined as use of flame, welding, soldering, cutting, brazing, grinding that causes sparks, use of asphalt or tar kettles, or other work that might create sufficient heat or spark to start a fire. Requirements for Contractors performing this work are contained in a 4-page document entitled “Hot Work Program” (Attachment # 4) that is a part of the specifications package.

F. All life safety systems shall be kept operating as much as possible at all times. The Contractor is to use all available means to avoid the need of disabling fire alarm and sprinkler systems. The Contractor shall notify the Owner of all plans for contact/interface with any alarm detection devices (i.e. smoke detectors, pull stations, horns, panels, etc.). If any disabling, disconnection, or connection of fire alarm system equipment is necessary, the Contractor shall give the Owner at least 10 days notice to make arrangements. Any disabling or disconnection of fire alarm systems shall be for the minimum period required.

G. Fire Alarm – The Contractor shall avoid interference with any alarm detection devices (smoke detectors, pull stations, horns, panels, etc.), including heat, dust and fumes from welding, grinding, painting, etc. If any disabling, disconnection or connection of fire alarm system equipment is necessary, the Contractor shall notify the Owner with 3 working days notice to make arrangements. Disabling or disconnection shall be limited to one working day per occasion, or shorter periods when possible. If the system does not come on line properly due to incomplete or faulty work by the contractor, or damage to the system caused by the contractor, the re-connection will not be completed. The contractor will be responsible for providing fire watch with a University approved vendor until such time as all troubles on the panel have been cleared. Daily disconnection / re-connection charges will continue to accrue until re-connection is completed successfully. The cost of these disconnections and reconnections shall be billed to the contractor at the rate of $150 each. Contractor invoices shall be adjusted accordingly. See Attachment # 3 for further information

H. Blasting on university property is prohibited.

I. The Owner will use reasonable efforts to notify the Contractor of known or suspected asbestos-containing materials located in or adjacent to the work area. Notwithstanding the foregoing, the Contractor has the affirmative duty of contacting the Owner to investigate whether or not the materials located in or adjacent to the work area are known or suspected as asbestos containing materials. In addition, the Contractor shall notify the Owner immediately on encountering any other suspected asbestos product. Any removal must be coordinated through the Owner by approved contractors. North Carolina State University is not responsible for compensation due to delays for asbestos removal.

J. Contractors are reminded of the presence on campus of handicapped students, staff, and faculty. All barricades, temporary walkways, excavations, and stockpile materials shall be formed in such a manner as to accommodate and to adequately warn this segment of campus users.

K. No Smoking Policy - The Contractor shall comply with the NCSU Smoking Regulation for University Facilities. Smoking is not permitted unless the Owner designates and identifies an approved smoking area.

L. The Contractor shall abide by the NC State University Facilities Division Informal Contractor Safety Requirements.

11. CHANGES IN THE WORK AND CLAIMS FOR EXTRA COST

A. Overhead shall also include all general conditions of the contract and all general requirements such as project management, scheduling, home office expense, engineering and layout, reproduction expenses, shop drawing processing and coordination, supervision, coordination, small tools, all vehicle expenses, temporary facilities, safety provisions, as built drawings, estimating, and general overhead.

B. The change order cost break down shall include: labor ($/hr) and material ($/ea, l/ft, sq/ft etc) quantities, unit prices, (as listed in the contract documents) including such breakdowns for work performed by subcontractors and the cost extensions for the labor and material quantities. The cost extensions shall be added into a labor and material subtotal. The labor shall then show a percentage for labor burden, the materials shall show the applicable sales tax. These subtotals shall then be shown as a total for labor and material costs. The labor and material cost shall then show the allowed mark-up, and a final total. Subcontractor quotes shall be presented in the same format on the subcontractor's letterhead. Each item totaled on the contractor's summary sheet shall be clearly organized and separated in the back up documentation. For change orders that delete any part of the work within the change order and/or contain deductive costs, the backup shall show the original material and labor for the deleted work or costs. If the change order contains both adds and deducts for the same type of work then the material unit and labor unit costs shown on the back up for the deleted work and the added work shall be the same and the net difference shown. Deductive change orders shall show the proper reduction in OH&P and for bonded projects, the bond. The contractor shall also provide HUB utilization information on the Owner's Hub Utilization form. Failure by the contractor to provide the information requested in this paragraph shall result in rejection of the change order by the designer and a request for re-submittal

C. In all change orders the procedure will be for the designer, on the owner's behalf, or the owner to request written proposals for the change order work. The contractor will provide such proposals and supporting data in suitable format and as required in General Conditions Article 13 – Changes in the Work, paragraph "c", "d", and "e". The designer, on the owner's behalf, or the owner shall verify correctness and determine that the contractor's proposed costs are equitable. After receipt of the contractor's proposal and if the proposal is correct and it is agreed to by the designer and Owner that the cost is equitable then the Owner shall prepare a change order and forward it to the contractor for his signature. If the change order proposal is incorrect, or the cost has not been agreed upon by the designer and Owner then the designer shall notify the contractor that the proposal is rejected and the proposal shall be re-submitted. If the proposal is rejected because the costs are deemed not to be equitable then the contracting parties shall negotiate and agree upon the equitable value of the change and the proposal shall be resubmitted with costs determined under General Conditions Article 13 – Changes in the Work Paragraph "e". 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 to the Owner for his signature.

D. Delay in the processing of the change order due to lack of proper submittal by the contractor in accordance with the aforementioned paragraphs, or due to errors in the change order calculations shall not constitute grounds for a time extension or basis for a claim.

A rain day is defined as any day that rain exceeds one tenth of one inch (0.1"). The contractor may only be entitled to extension of the contract period for the number of rain days that exceed the normal number of rain days. For the purpose of determining extent of delay attributable to unusual weather, a determination shall be made by comparing the weather for the contract period with the average of the preceding five (5) year climatic range average during the same time interval based on statistics kept at NC State's Marine, Earth and Atmospheric Sciences department located on the NC State University campus and on daily weather logs kept on the jobsite by the Contractor, reflecting the effect of the weather on progress of the work and initialed by the designer's representative. Time extensions for weather delays do not entitle the Contractor to "extended overhead

Notwithstanding the immediately preceding paragraph, not all rain days above the normal number of rain days will warrant a contract time extension. Justification for the request for rain related contract time extensions must also be based on the effect of the rain on critical path work activity in progress during the period of the request and additionally be predicated on the contractor's diligent prosecution of the work. No additional rain days shall be granted for building projects after building "dry-in" as determined by the Designer. The contract time extension request must incorporate work logs kept at the jobsite by the project superintendent showing the effect of the weather on the progress of the critical path work and the critical path schedule, both initialed by the Designer.

Requests for contract time extensions based on rain days must be received by the Designer on or before the 20th day of the month immediately following the month in which the rain occurred. The request must

include all required documentation. All parties to this contract agree that the contractor has no right to claim a contract time extension if the request is not received by the Designer in strict accordance with the procedure set forth in this paragraph.

For other types of weather delays, the Contractor is granted one (1) day of contract extension for each day the University is closed due to weather. Time extensions for rain and other weather delays do not entitle the Contractor to "extended overhead" cost recovery and are in all other ways non-compensable.

17. REQUESTS FOR PAYMENT

A. All invoices must include the following information:

NCSU project name,
NCSU project number,
NCSU Project Manager's name, and
NCSU Purchase Order (PO) or a Small Purchase Authorization (PA) number.

B. The form of invoicing shall be on AIA G702 Billing Form. Invoices received without any of the above information shall be considered incomplete and will be returned to the Contractor as incomplete.

C When the scheduled project duration exceeds 30 calendar days, partial payments will be accepted when agreed to by the owner in advance.

Project Closeout

A. Executed contract documents, insurance certifications, and, upon completion and acceptance of the work, invoices and other information requested are to be sent to:

Construction Project Manager's Name
Construction Services Department
North Carolina State University
Box 7216
Raleigh, North Carolina 27695-7216

It is imperative that contract documents, invoices, etc., be sent only to the above address in order to assure proper and timely delivery and handling. Email is an acceptable alternative.

B. As built drawings (construction mark ups) are to be delivered to the designer at final inspection. For projects where there is no designer, as built drawings are to be delivered to the NCSU construction project manager. Submittal of as built drawings shall be a requirement for before final payment to the contractor.

Documents required for closeout

A. As-built drawings.

O & M manuals and a written list of mechanical equipment, including manufacturer, type of equipment, model and serial numbers supplied by the contractor in the form of:

- One (1) portable document format (.pdf) copy on optical media (CD, Flash Drive or DVD).

B. Written certification that all vendors, suppliers and subcontractors have been paid for services rendered.

C. Transmittal of any items pertaining to project, i.e. cabinet keys, to be given to owner.

D. Written guarantee of materials and workmanship against defect due to faulty materials or faulty workmanship or negligence for a period of at least twelve (12) months, following the final acceptance.

E. In projects involving electrical work, the original of the State Construction Office (SCO) inspection certificate shall be submitted with invoices prior to payment.

F. Final invoice.

21. CLEANING UP AND RESTORATION OF SITE

A. The Contractor shall keep the building and the surrounding area reasonably free from rubbish at all times and shall remove debris from the site on a daily basis or when directed to do so by the Owner. 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.

B. The Contractor is responsible for the removal of all debris from the project from campus. Campus dumpsters shall not be used for disposal. Arrangements may be made for locating a dumpster near the project site as necessary. The Owner shall be notified prior to placement of any dumpsters.

C. Pedestrian traffic around the construction limits must be maintained in a clean and safe condition at all times. Additionally, The Owner reserves the right to proceed with street cleaning should the Contractor fail to comply with this requirement within 48 hours of verbal notice, AND deduct the cost of the cleaning cost from the Contractor's Application for Payment.

D. The contractor shall protect campus streets connecting to the project from mud, sand, and stones/gravel. Streets and adjacent property sites shall be kept free from run-off, litter and/or debris in any form from the project site. Mud, litter and/or debris from the construction site that appears on adjacent property sites shall be removed immediately. All mud collected on vehicle tires shall be removed before leaving the construction area. Should any mud or debris from the project site collect on the streets it shall be removed immediately to prevent any hazards to vehicular or pedestrian traffic as well as from entering the storm sewer system. In any event, all streets and property sites adjacent to the project site shall be cleaned of construction related debris, dust, litter and mud daily. The Contractor shall not discharge any waste products from concrete trucks or from concrete coring work, or any other unsuitable materials, fluids or other products on the site or into the storm sewer system. Should the Contractor fail to comply with these requirements, N. C. State University reserves the right, with twenty-four (24) hours' prior notice to the Contractor, to clean and or remove mud, trash, litter, debris or any unauthorized discharge from the project and/or the adjacent streets or properties. In such case the cost of the cleaning and/or removal or mobilization for cleaning and/or removal shall be deducted by the Owner from the contractor's next application for payment.

22. GUARANTEE

A. Roof Guarantees are at least two years for installation and 10 year manufacturer's guarantee for roofing materials.

B. The Contractor shall be responsible for paying all fire alarm and utility disconnect work performed during the warranty period, which shall be payable by the Contractor to NCSU within thirty (30) calendar days of billing by NCSU.

C. Any contractor who has outstanding unpaid invoices to NCSU for any work shall not be permitted to bid further work until paying such bills.

TECHNICAL SPECIFICATIONS
SHOULD FOLLOW THE SUPPLEMENTARY GENERAL CONDITIONS.

Attachment #1

Landscape Construction Specifications

- NC State Grounds and Building Services shall install all plant material, prepare soil and beds, apply mulch, and supply a one-year warranty on construction.
- Contractor shall install all hardscapes, irrigation, perform all grading and erosion control measures, and stabilize landscape,.
- Contractor shall leave subsoil 2” below final grade to allow for topsoil / amendment addition by Grounds and Building Services. Contractor shall remove all rock and debris larger than 1” from surface of subsoil.
- Stabilization of landscape by Contractor shall mean seeding with seasonally appropriate grass, all areas designated as “lawn” and/or slopes immediately after finish grading with seed according to specifications. On steep slopes (exceeding 3:1) use hydro-seeding or excelsior mats to ensure rapid stabilization.
- Stabilization of landscape by Contractor also includes applying pine straw to all planting beds immediately after finish grading.
- Contractor shall give Construction Services Project Manager 7 days notice prior to the start of landscape construction.
- Contractor is not responsible for the removal of erosion control measures. All erosion control measures shall be removed by Grounds and Building Services.

NC STATE UNIVERSITY

Attachment # 2

FACILITIES DIVISION

Scheduling an Utility Outage

To insure that the effect of utility interruptions on campus operations is minimized – please follow the procedures below:

Requests for utility interruptions should be approved/signed, and submitted to the Facilities Customer Service Center prior to 3:00 p.m. otherwise they will be considered received the next working day.

1. Purpose

To insure that the effect of utility interruptions on campus operations is minimized and that the Campus community is given sufficient notice to avoid the disruption of critical functions.

2. Intent

To clearly define coordination responsibility related to utility outages affecting major buildings or portions of buildings/systems. Minor or localized outages are not subject to the following procedures.

3. Procedure

Warning: Contractors may not interrupt any service without coordinating with Facilities. All cutoffs and restoration of service will be performed by Facilities personnel.

3.1 When a utility interruption is required, the requestor is responsible for determining the type of interruption that needs to be performed.

3.2 The requestor is responsible for determining the area(s) building(s) that will be affected.

3.2.1 The requestor must submit a Work Request Form to the Customer Service Center. (See #5 below) The Customer Service Center will provide the requestor with the utility interruption form and refer them to the appropriate shop/zone and contact person.

3.2.2 The requestor must contact the shops/zones personnel to complete the utility interruption form. In the case of fire alarm shutdowns, approval by Fire Protection is also required. The requestor will return the utility interruption form to the Customer Service Center.

3.3 Upon receipt of the completed utility interruption form, the Customer Service Center will schedule the utility interruption by notifying all affected parties. The Customer Service Center will advise the requestor that notifications are complete.

3.4 After the Customer Service Center has completed processing the request form/utility interruption, it will be the requestor's responsibility to notify both the Customer Service Center and the shop regarding any modifications to the schedule or extent of the outage. Modifications may require rescheduling of the outage.

3.5 The following is the minimum amount of notice (working days) that should be allowed for a utility interruption:

Primary (Total Building) Power 10 working days Required Approval Power Systems/Zone Maintenance	Distilled Water Interruption 3 working days Required Approval Zone Maintenance

Secondary Power Feeders 4 working days Required Approval Zone Maintenance	Steam Interruption 5 working days Required Approval Utilities Distribution/Zone Maintenance
Cold/Hot Water Interruption 4 working days Required Approval Zone Maintenance	Gas Interruption 5 working days Required Approval Utilities Distribution/Zone Maintenance
A/C/Heat Interruption 4 working days Required Approval Zone Maintenance	Lab Air Interruption 4 working days Required Approval Zone Maintenance
Fire Sprinkler Disconnect 3 working days *See Fire Alarm Disconnect* Required Approval Zone Maintenance	Sanitary/Storm Sewer 3 working days Required Approval Utilities Distribution

For disconnect approvals see Energy Systems Organization Chart and Zone Maintenance Map or contact the Customer Service Center for more information.

The above time frames are focused on major service interruptions. Minor electrical/plumbing/mechanical outages for single branch circuits/supply pipes serving a limited area are not covered by this policy. It is the responsibility of the shop/contractor performing the work to notify building occupants in advance and to provide alternate sources and services as required.

3.6 All requests for utility interruptions should be submitted to the Customer Service Center prior to 3:00 p.m. The Customer Service Center reserves the right to refuse to schedule a utility interruption if the above criteria are not met.

Attachment # 3

FACILITIES DIVISION

Fire Alarm Disconnect Procedure

1. Procedure

1. NC State Facilities Division personnel and Facilities Liaisons are the only persons authorized to initiate a fire alarm disconnect request. Faculty, staff, contractors, campus auxiliaries, or others needing to schedule a fire alarm disconnect must submit all disconnect requests through their building's Facilities Liaison or Facilities Division project managers.

1.1. If the fire alarm disconnect involves disrupting the sprinkler system or the air handling/HVAC units, the Utility Interruption form will also need to be completed.

2. Fire Alarm disconnects will be performed during the normal working hours of 7:30 am to 5:00 pm, Monday through Friday. Requests for off hours fire alarm disconnects will be coordinated through the Facilities Liaison or Facilities Division project managers and the Facilities Electronic Shop. Requests shall be submitted 24 hours before the work is scheduled to start. Requests received after 3:00 pm will be considered submitted the next business day.

2.1. A request resulting in the audible/strobe testing of the fire alarm system shall be submitted 72 hours before the work is scheduled to start, following the times set above. This extended time allows the building occupants time to communicate any unintended interruption to daily business an audible/strobe test would create.

3. Emergency and short notice requests inside of the 24-hour window, will require verbal approval from the Facilities Electronics Shop to submit the written request by calling 919-515-9912. In the event the Electronic Shop is unavailable for approval, the Director of Building Maintenance and Operations may approve these short notice requests.

4. For Facilities Division personnel or Facilities Liaisons to initiate scheduling of a fire alarm disconnect, follow the steps based on if a work order is available or needed.

4.1. If a work order is available:

4.1.1. Complete the request via the Fire Alarm Disconnect Form. The request must include a reasonable description of the requested outage along with start/stop dates and times. Please indicate if this is a weekend event needing to take place on Saturday and/or Sunday or a holiday event needing to take place on a designated University holiday. Once complete, email the form to efacmainppa@ncsu.edu, which notifies the Electronics Shop for review and action.

4.2. If a new work order is needed:

4.2.1. Submit a work order request via AIM requesting a fire alarm disconnect. You can also call the Facilities Customer Service Center at 919-515-2991. The request must include a reasonable description of the requested work.

4.2.2. Once a work order number has been obtained, complete the instructions outlined in section 4.1 above.

5. The Electronics Shop will review the requests and notify the Facilities Customer Service Center by 3:30 pm that the disconnect has been approved. The Electronics Shop will evaluate the request based on workload, time frame, and other technical and safety issues. If a request is not approved, the original requestor will be notified of why by the Electronics Shop via the email or phone number provided.

6. When steps 1 through 5 are complete, the Customer Service Center will notify the original Facilities Division personnel or project manager requestor and appropriate Facilities Liaisons via email of the planned outage. The Facilities Liaisons should remind all occupants to remain vigilant and be prepared to call 919-515-3000 to report any unsafe conditions including anything fire related to Campus Police while the fire protection system is temporarily out of service. If a scheduling issue arises, the Facilities Liaison must contact the requestor to coordinate. The Customer Service Center will also email Campus Police, Fire Protection, the Electronics Shop, and the original requester that the disconnect has been scheduled. If the disconnect is an emergency, Facilities Liaisons will be called as well.

7. If at any point there is a change to the schedule or an extension is required, the original requester shall contact the Facilities Electronics Shop and the Facilities Customer Service Center immediately by emailing efacmainppa@ncsu.edu.

Attachment # 4

Office of Finance and Administration
Environmental Health and Safety
Life Safety, Fire-EMS
ehs.ncsu.edu/home-page-info/fire-marshal/

Campus Box 7220
Raleigh, NC 27695-7220
P: 919.515.2568
F: 919.515.6307

Hot Work Permit Program **April 5, 2019**

Hot Work

Hot work is defined by the 2018 NC Building Code: Fire Prevention Code as, operations including cutting welding, Thermite welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of torch-applied roof systems or other similar activities.

Hot Work Area

The area exposed to sparks, hot slag, radiant heat, or convective heat as a result of the hot work.

Hot Work Equipment

Electric, or gas welding, or cutting equipment used for the hot work.

Hot Work Permits

Permits shall be issued by a responsible person at the facility under the hot work program permitting welding or other hot work to be done in locations referred to in section 3501.3 and pre-permitted locations by the fire code official.

(3501.3: Restricted areas. Hot work shall only be conducted in areas designed or authorized for that purpose by the personnel responsible for the Hot Work Program. Hot work shall **NOT** be conducted in the following areas unless approval has been obtained from the fire code official (NCSU Fire &Life Safety):

1. Areas where an existing sprinkler system have been impaired.
2. Areas where there exists the potential of an explosive atmosphere, such as locations where flammable gases, liquids, or vapors are present.
3. Areas where readily ignited materials, such as storage of large quantities of bulk sulfur, baled paper, cotton, lint, dust, or loose combustible materials.
4. On board ships at dock or ships under construction or repair.
5. At other locations specified by the fire code official (NCSU F&LS).

Hot work permits, issued by an approved responsible person under the Hot Work Program, shall be available for review by the fire code official (NCSU F&LS) at the time the work is conducted and for 48 hours after the work is completed. A permit for hot work operations shall not be issued unless the individuals in charge

of performing such operations are capable of performing the hot work safely. The individual responsible for the hot work area, temporary or fixed, shall maintain a log of pre-work checks in accordance with NCFC Section 3504.3.1. The reports shall be maintained on the premises for not less than 48 hours after the work is completed.

Visible hazard identification signs shall be provided where required by the fire code official (NCSU F&LS). Where the hot work area is accessible to persons other than the operator of the hot work equipment, conspicuous signs shall be posted to warn others before they enter the hot work area. Examples of the sign(s) include:

CAUTION
HOT WORK IN PROGRESS
STAY CLEAR

Hot work areas, temporary or fixed, shall not contain combustibles. If combustibles cannot be removed from the area they shall be shielded to prevent heat or sparks from igniting them. Openings in walls, floors, ceilings, ducts, shafts, etc. shall be covered to prevent the passage of sparks to adjacent or hidden spaces containing combustible materials. Welding curtains shall be required for welding in exposed (outdoor) work areas and fixed work areas. Fixed hot work areas shall have non-combustible floor surfaces. Hot work shall **NOT** be performed on containers or equipment that contain or have contained flammable liquids, gases or solids until the container or equipment have been thoroughly cleaned, inerted or purged. “Hot Tapping” shall be allowed on tanks or pipe lines where such work is to be performed by approved (trained/certified) personnel. Automatic sprinkler protection shall not be impaired while hot work is being performed. Non-combustible barriers shall be in place for hot work near active sprinkler heads and piping. The University Fire Marshal for NC State EH&S shall approve hot work in areas where fire sprinklers are impaired or non-existent. A dedicated fire watch shall be established by a responsible person trained in the use of portable fire extinguishers during hot work. Not less than one portable extinguisher with a minimum rating of 2-A 20-B:C shall be readily accessible within 30 feet of the hot work area. Extinguishers may **NOT** be removed from mounted locations in NC State buildings for standby use during hot work. Before hot work is permitted and not less than once per day while the permit is active the hot work area shall be inspected by the person responsible for authorizing the hot work operations (NCSU F&LS) to guarantee the area remains safe for hot

work. A pre-work hot work area check shall be conducted prior to the hot work starting to ensure that all equipment in use is safe, hazards are recognized and protected (or removed), and proper signage or other protective measures are in place. The following shall be determined in the pre-work check:

1. Hot work equipment to be used shall be in satisfactory condition and in good repair.
2. Hot work site is clear of combustibles or combustibles are protected.
3. Exposed construction is of non-combustible materials or protected if combustibles are present.
4. Openings are protected.
5. Floors are clear.
6. No exposed combustibles are on the opposite side of partitions, walls, floors, or ceilings affected by the hot work.
7. A fire watch is in place.
8. Approved actions have been taken to prevent accidental activation of suppression or detection systems.
9. Fire extinguisher(s) are operable and available.

Hot work permits can be obtained the day of the hot work commencing by contacting the NC State Fire & Life Safety Office at 919-515-2568, alternatively an individual may call 919-515-3000 (NC State Univ. Police) and request a hot work permit response from the Fire & Life Safety Office. A representative from the office will report to the location requested as soon as possible to issue the hot work permit. During the issuance of the permit the hot work area will be established, the equipment will be inspected, and the work to be completed will be reviewed. Hot Work permits will be issued for up to 72 hours for hot work not involving welding in temporary work areas. Welding work in a temporary hot work area will be permitted on a daily basis. For extended operations beyond 72 hours, a fixed hot work area can be established and the permit issued for a longer period of time. Extended hot work operations will require a daily check-in with the Fire & Life Safety Office to confirm continued work and site conditions. If a Fire Alarm Interruption is desired to minimize the risk of activating the fire detection system there is a 3-day notice required by NC State University Facilities Operations/Energy Systems. The NC State Project Manager will have to pursue the Fire Alarm Interruption before the work can be scheduled or the Hot Work Permit requested. Fire Alarm devices will still have to be protected during the hot work to prevent contamination of the devices. Protective measures must be removed daily when the work period ends for the day and there is not a fire watch in place. Hot work requiring a permit over a weekend or during a University

closure needs to be planned for, approved, and permitted before the close of business on the last day prior to the weekend or closure. An after-hours hot work permit request will result in a 2-hour minimum charge to the project from the Fire & Life Safety Office ($42/hr.).

The issued hot work permit must be conspicuously posted in the space where the hot work is being performed. The permit must be maintained by the person performing the hot work or on-site for 48 hours after the work is completed. A 30-minute post work inspection is required of all hot work by the person performing the hot work. The area must be checked for hot surfaces, embers, slag, or other heated materials resulting from the hot work.

NC State Fire & Life Safety (Environmental Health & Safety)
2610 Wolf Village Way
Campus Box 7220
919-515-2568
firesafetyhelp@ncsu.edu

Jon Brann
Fire & Life Safety Manager
University Fire Marshal
NC State Environmental Health and Safety
919-513-2120
jlbrann@ncsu.edu

HOT WORK PERMIT

Environmental Health and Safety
Fire & Life Safety Section

Fire & Life Safety Office 919-515-2568
University Police 919-515-3000
EMERGENCY: DIAL 911

Building:

Location:_____ **Issue Date:**____/____/____

Issued to:_____ **Expiration Date:**____/____/____

Only work documented on this permit is allowed to take place.

Welding Soldering **Hot Work Information** Cutting Grinding

	Y	N	N/A
Has an inspection been done of the unit/equipment to be worked on?			
Where inspected, was it found to be free of corrosives, toxics, and flammable materials?			
Is there an adequate supply of fresh air?			
Do the unit/equipment and atmospheric conditions permit safe work?			
Has the unit/equipment been secured from utility connections?			
Has the equipment been adequately protected? (Specify):			
Have combustible materials been removed from the area?			
Are nearby sewers protected, if applicable to the work being performed?			
Required fire protection (Circle): Extinguisher Welder's blanket/curtains Special Fire Watch Disconnect			
May underground or overhead obstructions or utilities be encountered?			
Are there any radiation concerns or precautions to follow?			
Have MSDS sheets been referenced for adverse reactions to the work being performed?			
Are any special procedures required during the work (pyrophorics, asbestos, confined space)?			
Is it permissible to use: Electrical equip. Y N Diesel equip. Y N Gasoline equip. Y N Propane equip. Y N			
Is welding permitted?			
Notes:			

Cooking Information

Fuel Supply:			
Fire Extinguisher type and size:			
Will there be grease fried foods?			
Valid Pressurized Liquid Extinguisher on site ('Purple K')?			

Permit recipient:_____	Issued by:_____
Contact #:_____	Title:_____

	Attachment # 5 **NC State University** **Sustainability Project Requirements**	I	II	III
	Integrated Design			
I1	Integrated design kickoff meeting notes, with sustainability goals, including items that can be reused or recycled, attached.	X	X	
I2	LEED scorecard (Tier I) with a LEED action plan for each credit, attached.	X		
I3	A commissioning agent was brought into schematic design and provided review and testing through the completion of the project.	X	X	
I4	Forall projects , refer to Stormwater Design Manual.	X	X	X
I5	Ensure Tree Protection plan is developed and adhered to for exterior projects	X	X	X
	Indoor Air Quality			
A1	Zero VOC paints in all public spaces, classrooms, and offices, excluding metal.	X	X	X
A2	Eliminate the use of adhesives for carpet.	X	X	X
A3	Use only low VOC adhesives and sealants.	X	X	X
A4	No use of aerosol adhesives.	X	X	X
A5	Follow 6 SMACNA guidelines for indoor air quality during construction AND utilize supplemental filtration in occupied buildings.	X	X	X
A6	Investigate the need for duct hygiene in projects with HVAC renovations	X	X	X
	Materials			
M1	Equipment and materials are chosen for compatibility across campus	X	X	X
M2	Equipment and materials are repaired, when feasible, before replacement becomes cost effective.		X	X
M3	Prefer NC manufactured materials (concrete, lumber, steel, textiles, masonry).	X	X	X
	Recycling and Reuse			
R1	Reuse materials when possible. Leftover scraps are placed in Shop Storage, Student Reuse Trailer, or Campus Satellite Staging Areas.			X
R2	Donate or allocate reusable materials. Input reuse information on Reuse Tracking Form. Order of diversion options: A.) Surplus B.) Habitat for Humanity C.) Waste Reduction and Recycling (WRR) (Tiers I-III)	X	X	X
R3	Recycle what cannot be reused, with a goal of 75%. Waste diversion is tracked by WRR. Input waste information on LEED Online (Tier 1) or Construction Waste Management tracking sheet (Tier II and III).	X	X	X
R4	Assure that building occupants have access to recycling.	X	X	X
	Efficiency			
E1	Completed Lifecycle Cost templates per State Construction requirement with narrative explanation for any phase of value engineering. Inclusion of building operations staff in value engineering reviews.	X		
E2	Energy model was used as an iterative tool. An as-built energy model, with a summary of assumptions, is attached.	X	X	
E3	Meters and sub-meters are tied into the Enterprise Level Control System	X	X	X
E4	Project's M&V plan was developed and attached (LEED and SB 668 projects)	X		

E5	Target energy and water savings of 30% and 50% respectively. Energy savings are tracked on Request for Project Number form (Tier I and II). Energy savings are identified in AIM with Energy Management (Tier III).	X	X	X
E6	Campus Satellite Staging Areas reduce total driving time and energy use			X
	Close out			
C1	Electronic as-built energy model, with summary of inputs and outputs, submitted	X		
C2	LEED documentation submitted on LEED Online	X		
C3	Sustainability lessons learned summary meeting	X	X	

Tier 1 and Tier 2* Attachments

	Integrated Design kickoff meeting notes*	Schematic Design
	Sustainability/ LEED Action Plan- list of credits with narrative plan	Schematic Design
	Measurement and Verification Plan	Design Documents
	Energy model (digital copy of raw file)	As-built
	Lessons Learned*	As-built

KEY

Tier I- Budget of $2 million + AND construction over 20,000 GSF and renovations if the replacement value > than insurance value

Tier II- Budget of $250,000 to $2million +

Tier III- Budget of $0-$250,000

Attachment # 6

North Carolina State University
Management of NON – Hazardous Construction and Demolition Reuse, Recycling and Waste Materials

1.1 Purpose
Implement a solid waste management plan which results in a minimum 65% diversion rate from landfill disposal. The project's diversion rate will be achieved by adhering to the performance requirements and reporting detailed in sections 1.3 through 1.5

1.2 Definitions
Construction and Demolition Waste is solid waste resulting solely from construction, remodeling, repair, or demolition operations on pavement, buildings, or other structures, but does not include inert debris, land-clearing debris or yard debris.
Diversion Rate is the rate or percentage of a potentially reusable or recyclable material that has been diverted out of the waste disposal stream and therefore not put into landfills.
Inert debris is a solid waste which consists solely of material that is virtually inert and that is likely to retain its physical and chemical structure under expected conditions of disposal.
Recovered material is a material that has known recycling potential, can be feasibly recycled, and has been diverted or removed from the solid waste stream for sale, use, or reuse. In order to qualify as a recovered material, a material must meet the requirements of G.S. 130A-309.05(c).
Recycling is any process by which solid waste, or materials which would otherwise become solid waste, are collected, separated, or processed, and reused or returned to use in the form of raw materials or products.
Reuse is a process by which resources are reused or rendered usable.
Solid waste management is the purposeful, systematic control of the generation, storage, collection, transport, separation, treatment, processing, recycling, recovery and disposal of solid waste.
Special wastes solid wastes that can require special handling and management, including white goods, whole tires, used oil, lead-acid batteries, and medical wastes.

1.3 General
Prior to demolition phase, existing materials or fixtures will be identified as reusable in the project, by the University or as donations to the designated Habitat for Humanity ReStore.
Recycling materials will be separated at the project site to the maximum extent that is practical.
All non sorted C&D waste shall be hauled to a construction and demolition recycling and reclamation facility located within a twenty-five (25) mile radius of the main NC State campus located in Raleigh. The Solid Waste Management Facility must be permitted to operate by NCDENR in accordance with **15A NCAC 13B .0201**

Construction and demolition waste shall be tracked and reported by:
Disposition type (reuse, recycle, C&D reclamation, and landfill)
Weight (actual and estimated)
Cost (revenue, hauling and tipping fees)

Special or Hazardous waste must be managed in accordance with all applicable local, state and federal law. Refer to the University's Hazardous Waste Management plan for Building Demolition Debris.

1.4 Performance and Separation Requirements
Reuse - Prior to demolition phase, existing materials or fixtures will be identified as reusable in the project, by the University or as donations to the designated Habitat for Humanity ReStore.

- Contractor and University Project Manager (PM) will identify fixtures or furnishings with the potential to be reused.
- Reuse options include; in the project, by the University, donation to local Habitat for Humanity ReStore.
- Contractor and PM will arrange notification and disposition of reusable materials to the appropriate end user.
- The contractor will be responsible for removal of fixtures or furnishings and the end user will be responsible for pick up and hauling.

Recycling - Recycling materials will be separated at the project site to the maximum extent that is practical.

- Provide appropriately marked containers or bins to source separate recyclable materials collected in high volume.
- Haul separated recyclable materials to processors located within a twenty-five (25) mile radius of the main NC State campus in Raleigh.
- Common source separated recycling include; cardboard, scrap metal/wire, gypsum board, untreated wood/pallets, aggregate, ceiling tiles, carpet/pads, shingles and yard waste.

Non Sorted C&D Waste - shall be hauled to a construction and demolition recycling and reclamation facility located within a twenty-five (25) mile radius of the main NC State campus in Raleigh.

- Landfill disposal of non sorted C&D waste is not permitted.
- Provide appropriately marked container for non sorted C&D waste.
- Provide hauling to C&D Recycling and Reclamation Facility.
- The recycling and reclamation facility for C&D waste must have an onsite process for segregating the following materials from non sorted loads hauled to the facility:
    - Scrap metal/wire, cardboard, untreated wood/pallets, gypsum board, aggregate.

Special or Hazardous waste - must be managed in accordance with all applicable local, state and federal law.

- Refer to the University's Hazardous Waste Management plan for Building Demolition Debris.

1.5 Reporting Requirements – All C&D waste generated from the project shall be tracked and compiled as a report.

- Tracking will include all types of disposition:
    - Reuse
    - Recycling
    - Non-Sorted C&D Recycling and Reclamation
    - Landfill Disposal (if applicable)
    - Hazardous or Universal Waste
- The report shall include:
    - Track and list all facilities and processors used in the disposition of materials.
    - Copies of original weight tickets from facilities or processors (when available).
    - Estimated weights for reuse materials.
    - Breakdown of cost for materials disposition; container rental, hauling, tipping fees, revenue from sales of recycling and avoided landfill tipping fees.

1.6 Contact Information for NC State Waste Reduction and Recycling Office – Contact the WRR office if you have questions regarding the recycling or reclamation of construction and demolition waste.

- 919-515-9421
- recycling@ncsu.edu
- Hours: Monday – Friday 7:00 am – 3:45 pm

North Carolina State University
Facilities Division
Construction Services Department
Box 7541
Raleigh, NC 27695
919.515.5319

Acknowledgement of the Standard Form of Informal General Conditions and North Carolina State University Supplementary General Conditions for Informal Projects

_____ I have read and understand the Standard Form of Informal General Conditions and the North Carolina State University Supplementary General Conditions for Informal Projects

_____ I agree to abide by the Standard Form of Informal General Conditions and the North Carolina State University Supplementary General Conditions for Informal Projects for all work done for the University and managed by the North Carolina State University Facilities Division under this agreement

Informal Contractor Prequalification is subject to the acknowledgement and agreement to the above and to review by the North Carolina State University Facilities Division in accordance with the terms of NCSU Facilities Informal Contractor Prequalification as stated in the, Instructions for Soliciting Construction Work and the Bid Rules for Informal Contracts, and may be modified, or rescinded at any time.

Agreed and Accepted by:

Signature: (**Authorization Signature)**

_____

Date: _____

Title: _____

Company: _____

Address: _____

DOCUMENT 00 26 00

PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 01 25 00 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

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

1.3 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:
   1. Extensive revisions to the Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
   3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing in compliance with the following requirements:
   1. Requests for substitution of materials and equipment will be considered if received no later than seven (7) calendar days prior to date of bid opening.

2. Submittal Format: Submit three copies of each written Procurement Substitution Request, using form bound in Project Manual.
    a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
    b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
        1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
        2) Copies of current, independent third-party test data of salient product or system characteristics.
        3) Samples where applicable or when requested by Architect.
        4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. 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.
        5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
        6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
        7) 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, which will become necessary to accommodate the proposed substitute.
    c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
    d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:
    1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

1.5 ATTACHMENTS

A. Substitution Request Form (Procurement Period).

END OF SECTION

SUBSTITUTION REQUEST FORM
(Procurement Period)

To: Perkins&Will
411 W. Chapel Hill Street, Suite 200
Durham, North Carolina 27701

From:

_____

_____

Substitution Request No: _____ DATE: _____

Bidder hereby requests acceptance of the following product or system as a substitution in accordance with provisions of Division 01 Section "Substitution Procedures":

PROJECT SPECIFICATION

Specification Name/Number: _____
Article, Paragraph, Page Number: _____
Item/System to be Substituted: _____

REASON FOR SUBSTITUTION REQUEST

SPECIFIED PRODUCT . . .

- ☐ Is no longer available.
- ☐ Is unable to meet project schedule.
- ☐ Is unsuitable for the designated application.
- ☐ Cannot interface with adjacent materials.
- ☐ Is not compatible with adjacent materials.
- ☐ Cannot provide the specified warranty.
- ☐ Cannot be constructed as indicated.
- ☐ Other: _____
- ☐ Cannot be obtained due to one or more of the following:
  - ☐ Strike
  - ☐ Lockout
  - ☐ Bankruptcy of manufacturer or supplier
  - ☐ Similar occurrence

PROPOSED PRODUCT . . .

- ☐ Will reduce the Contract Time by _____ days.
- ☐ Will reduce the Contract Sum by $ _____.
- ☐ Is an Owner-initiated substitution.

Explanation of each item marked above (attach documentation):

_____

_____

EFFECT OF SUBSTITUTION

Proposed substitution affects other work or trades: ☐ No ☐ Yes (if yes, explain)

_____

_____

Proposed substitution requires dimensional revisions or redesign of architectural, structural, mechanical, electrical, plumbing, life safety, or other work:

☐ No ☐ Yes (if yes, attach data explaining revisions)

PRODUCT COMPARISON

Provide side-by-side comparison between proposed substitution and specified product to facilitate review of Substitution Request:

	SPECIFIED PRODUCT:	**PROPOSED PRODUCT:**
Manufacturer:	_____	_____
Name / Brand:	_____	_____
Catalog No.:	_____	_____
Supplier:	_____	_____
Features:	_____	Variations: _____
	_____ (Attach additional sheets if necessary)	_____ (Attach additional sheets if necessary)

Local Distributor or Supplier: _____

Manufacturer's Representative: _____

Maintenance Service Available: ☐ Yes ☐ No

Spare Parts Source and Location: _____

Warranty Available is equivalent to the specified warranty: ☐ Yes ☐ No _____ Years

Describe any variation from specified warranty: _____

Product Manufacturing History ☐ New ☐ 2-5 yrs ☐ 6-10 yrs ☐ More than 10 yrs old

SUPPORTING DATA ATTACHED (REQUIRED WHERE APPLICABLE)

☐ Point-by-point comparison of performance criteria, materials, and components of specified product with proposed substitution.

☐ Drawings ☐ Specifications ☐ Product Data ☐ Samples

☐ Tests ☐ Reports ☐ LEED Compliance ☐ Warranty

REFERENCED INSTALLATIONS

Identify at least **three** similar local projects on which proposed substitution was used:

PROJECT #1:

Project: _____ Date Installed: _____

Address: _____

_____

Owner: _____

Contact: _____ Telephone: _____

Architect: _____

Contact: _____ Telephone: _____

Contractor: _____

Contact: _____ Telephone: _____

PROJECT #2:

Project: _____ Date Installed: _____

Address: _____

_____

Owner: _____

Contact: _____ Telephone: _____

Architect: _____

Contact: _____ Telephone: _____

Contractor: _____

Contact: _____ Telephone: _____

PROJECT #3:

Project: _____ Date Installed: _____

Address: _____

_____

Owner: _____

Contact: _____ Telephone: _____

Architect: _____

Contact: _____ Telephone: _____

Contractor: _____

Contact: _____ Telephone: _____

ACKNOWLEDGEMENTS: The undersigned certify that:

- **Performance**: Proposed substitution has been fully investigated and determined to be equal or superior in all respects to the specified product, including appearance, quality, performance, code compliance, and sustainability compliance.
- **Warranty:** Same warranty will be furnished for proposed substitution as for specified product.
- **Operations and Maintenance**: Same maintenance service and source of replacement parts, as applicable, are available locally for the proposed substitution.
- **No Adverse Effect**: Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- **No Adverse Time or Cost**: Cost data and time as stated above are complete. Contractor bears all costs for labor and materials associated with fully integrating proposed substitution into the Project. Claims for additional costs or time related to accepted substitution which may subsequently become apparent are waived.
    - Payment will be made to the Owner for changes to the project design, including Architect's and Engineer's redesign fees and engineering, detailing, special inspection, and construction costs incurred by the Owner caused by acceptance of the substitution.
    - Coordination necessary to fully integrate the proposed substitution, and any associated modifications to related or adjacent Work, have been or will be performed.
- **Dimensions and Clearances**: Proposed substitution does not affect dimensions or functional clearances.
- **Conditions of Acceptance**: The Architect's recommendation for approval, if granted, relies on data submitted and the opinion and knowledge of the Architect at the time decision is rendered. The approval is conditional in nature and subject to reevaluation and reconsideration if additional data or materials are submitted, or coordination with other work is observed to invalidate claims that substitution is equal to item originally specified.

Contractor: _____

(Name of Contractor)

Date: _____ By: _____

Subcontractor: _____

(Name of Subcontractor)

Date: _____ By: _____

Note: *Substitution requests are not part of the standard submittal process and shall not be submitted as part of Shop Drawings, Product Data, or Samples submittals. Substitution requests must be filled out completely. Unresponsive or incomplete requests will be rejected and returned without review.*

ARCHITECT'S REVIEW AND ACTION

- ☐ Substitution acceptance is recommended.
- ☐ Substitution acceptance is recommended, with the following comments: _____
  _____
- ☐ Architect's additional services proposal attached.
- ☐ Resubmit Substitution Request:
  - ☐ Provide the following: _____
  - ☐ Provide proposal indicating amount of savings / credit to Owner.
- ☐ Substitution acceptance is not recommended:
  - ☐ Substitution Request received too late.
  - ☐ Substitution Request received directly from subcontractor or supplier.
  - ☐ Substitution Request not submitted in accordance with requirements.
  - ☐ Substitution Request Form is not properly executed.
  - ☐ Substitution Request does not indicate what item is being proposed.
  - ☐ Insufficient information submitted to facilitate proper evaluation.
  - ☐ Proposed product does not appear to comply with specified requirements.
  - ☐ Design Team has no experience with product / manufacturer and is therefore unable to comment on the track record of quality, performance, or reliability.
  - ☐ Proposed product will require substantial revisions to Contract Documents.

PERKINS&WILL

Perkins&Will acknowledges its reliance upon information provided by the Contractor, and makes no claim as to the accuracy, completeness, or validity of such information. If an accepted substitution is later found to not comply with requirements of the Contract Documents, the Contractor shall be solely responsible for performance of the work in accordance with requirements of the Contract Documents.

By: _____ Date: _____

END OF FORM

GUIDELINES FOR
RECRUITMENT AND SELECTION OF MINORITY BUSINESSES
FOR PARTICIPATION IN THE UNIVERSITY OF NORTH CAROLINA
CONSTRUCTION CONTRACTS

In accordance with G.S. 116-31.11 and G.S. 143-128.2 these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, design-build, public-private partnership, and alternative contracting methods, on University of North Carolina construction projects in the amount of $100,000 to $4,000,000. The legislation provides that the State, including the University of North Carolina System, 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 through The University of North Carolina, its constituent institutions, and/or affiliates (hereafter The University of North Carolina) as awarding authorities 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 business, minority person, and socially and economically disadvantaged individual - G.S. 143-128 (g) includes the following definitions. Any changes to G.S. 143-128 (g) are incorporated herein upon enactment:

   (1) The term "minority business" means a business:
   - a. In which at least fifty-one percent (51%) is owned by one or more minority persons or socially and economically disadvantaged individuals, 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.

   (2) The term "minority person" means 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, or the Pacific Islands;
   - d. American Indian, that is, a person having origins in any of the original Indian peoples of North America; or
   - e. Female.

   (3) The term "socially and economically disadvantaged individual" means the same as defined in 15 U.S.C. 637.

2. Public Entity – The State of North Carolina and all public subdivisions and local governmental units.

3. Owner - The State of North Carolina, through the constituent institution named in the contract.

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

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

6. 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.

7. 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.

8. Subcontractor - A firm under contract with the prime contractor, construction manager at risk, design-builder, or private developer under public-private partnerships 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 University of North Carolina 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. The University of North Carolina System Office: The University of North Carolina System Office will be responsible for the following:

a. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal prior to award of construction contracts within their awarding authority. The State through The University of North Carolina, reserves the right to reject any or all bids and to waive informalities.
b. Assisting constituent institutions in monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
c. Consulting and advising institutions and affiliates regarding changes in HUB statutes, executive orders, or state procedures.
d. Resolving any protest and disputes arising on projects within The University of North Carolina System Office award authority.

3. Constituent Institutions and Affiliates of The University of North Carolina: Before awarding a contract, the constituent institution shall do the following:

    a. Implement The University of North Carolina HUB plan.
    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 its efforts 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 University of North Carolina.
    g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to University of North Carolina.
    h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment**.**
    i. Document evidence of implementation of Owner's responsibilities.

4. Designer
    Under the single-prime bidding, separate prime bidding, construction manager at risk, design-build, public-private partnership, 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), including the 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.
f. Make documentation showing evidence of implementation of Designer's responsibilities available for review by The University of North Carolina System Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, Design-Builder, Public-Private Partnership developer and Its First-Tier Subcontractors: Under all construction delivery 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. 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. 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.

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 Subcontractor responsibilities available for review by the University of North Carolina System 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 B) indicating bidder's 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) and has all material and supplies required for the project. Bidder may be asked to provide additional documentation in support of the claim of self-performance and regarding the Good Faith Effort to utilize minority suppliers where possible. (2) 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; (3) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal (Affidavit D). 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 for formal contracts (>$500,000) as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
i. The contractor(s) on formal contracts (>$500,000) shall submit with each monthly pay request(s) and final payment(s), "MBE Documentation for Contract Payment" – (Appendix E), for designer's review. This documentation is also required for contracts under informal bidding, but these projects, typically of shorter duration, may have a single payment request at project completion.
j. During the construction of a project, at any time**,** if it becomes necessary to replace a minority business subcontractor, immediately advise the owner, The University of North Carolina System 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 that these requirements apply to all contractors and first tier subcontractor under any of the approved construction delivery methods permittedon 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 D: 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 E: EFFECTIVE DATE

These guidelines shall apply upon promulgation on university construction projects. Copies of these guidelines may be obtained from The University of North Carolina System Office website:https://www.northcarolina.edu/offices-and-services/finance-and-administration/capital-design-and-construction/.

SECTION F: FORMS

In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing MBE participation in State, through The University of North Carolina, building projects. An explanation of the process follows, titled “MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)” along with relevant forms for its implementation (“Identification of Minority Business Participation” form, Affidavits A, B, C, D, and Appendix E).

MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

APPLICATION:

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in University of North Carolina 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 University of North Carolina System Office website: https://www.northcarolina.edu/offices-and-services/finance-and-administration/capital-design-and-construction/

MINORITY BUSINESS SUBCONTRACT GOALS:

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

The bidder must identify on its bid (by using the "Identification of Minority Business Participation" form provided in the bid document), 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).

Failure to submit these documents is grounds for rejection of the bid. Bid amounts from rejected bids shall not be read aloud at public bid openings.

The lowest responsible, responsive bidder must provide:

Affidavit C, if the portion of work to be performed by minority firms is equal to or greater than 10% of the bidder's total contract price. Affidavit C includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, and lists the participating minority firms with the dollar value of their contracts.

OR

Affidavit D, if the portion of work to be performed by minority firms is less than 10% of the bidder's total contract price. Affidavit D includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, lists the participating minority firms with the dollar value of their contracts, and must include adequate **documentation of Good Faith Effort.**

AND

Affidavit B (with bid), if the bidder does not customarily subcontract work on this type project and has all material and supplies required for the project. Bidder may be asked to provide additional documentation in support of the claim of self-performance and regarding the Good Faith Effort to utilize minority suppliers where possible.

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

Summary of required submissions: Use check boxes to assist in ensuring that all appropriate forms are submitted.

ALL BIDDERS MUST SUBMIT TWO FORMS WITH THEIR BID:

☐ "Identification of Minority Business Participation" form

AND EITHER

☐ Affidavit A – "Listing of Good Faith Efforts"

OR

☐ Affidavit B – "Intent to Perform Contract with Own Workforce"

The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid. Bid amounts from rejected bids shall not be read aloud at public bid openings.

==========

IN ADDITION, THE APPARENT LOWEST RESPONSIVE, RESPONSIBLE BIDDER SUBMITS:

☐ **Affidavit C** – "Portion of the Work to be Performed by Minority Firms" if the percentage of work to be performed by minority firms is 10% or more. This form is to be submitted within 72 calendar hours of notification of being low bidder.

OR

☐ **Affidavit D** – "Good Faith Efforts" if the percentage of work to be performed by minority firms is less than 10%. This form is to be submitted within 72 calendar hours of notification of being low bidder.

The above information is mandatory. 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 (The University of North Carolina) 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 (The University of North Carolina) 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 (The University of North Carolina) whether to terminate the contract for breach.

In determining whether a contractor has made a Good Faith Effort, the University of North Carolina 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 were 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.

****THIS DOCUMENT MUST BE SUBMITTED WITH EACH PAY REQUEST & FINAL PAYMENT****

APPENDIX E
MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments to be made to minority business contractors 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**) Socially and Economically Disadvantaged (**D**)

Date: _____ Approved/Certified By: _____

Name

_____

Title

_____

Signature

Signature certifies that any minority firms not previously verified in the bid/award process have been appropriately verified, services have been rendered, and payment is due as processed.

CONTRACTOR'S STATEMENT OF RESPONSIBILITY

PROJECT: Yarbrough Field Office

LOCATION: 2411 Yarbrough Drive, Raleigh, North Carolina 27695

SCO ID#: 24-29063-01A

BUDGET CODE: _____ ITEM: _____ DATE: _____

OWNER: North Carolina State University

DESIGNER: Perkins&Will 411 W. Chapel Hill St., Suite 200 Durham, NC 27701

PRIME CONTRACTOR: _____

CONTRACTOR RESPONSIBLE: _____

SYSTEM/COMPONENT: _____

I (we) acknowledge the special requirements outlined in the quality assurance plan. I (we) also acknowledge that control will be exercised to obtain conformance with the construction documents as approved by the Office of State Construction.

The following procedures will be established and strictly followed to maintain control within our organization:

_____

_____

_____

_____

The following reporting will be submitted to the Special Inspector, Owner and Office of State Construction at the following frequency:

Reporting method: _____

Frequency: _____

The following individuals(s) will be responsible for monitoring the procedures as set forth above:

Name: _____

Title: _____

Qualifications: _____

Signed this ____day of _____.

_____ _____

Name *Title*

NC STATE UNIVERSITY

Designer Waste Information Form

Project Name: Yarbrough Field Office	
Project Designer: Perkins&Will	Date: 12/17/2024

This form is to be completed by the designer and included with SD documents. Waste Management Plan will be based off of this form.

Waste Type (Condition of waste can determine category. Damaged Universal Waste can become Hazardous Waste)	Present at Site (Y/N)	Comments
Hazardous Waste and Material		
Asbestos	N	Abated in 1996
Chemical Waste (liquid and solid)	N	
Lead Containing Paint/ Lead Based Paint Chips/ Lead Debris	N	Likely encapsulated by previous renovations
PCB containing items (ballasts, caulk, etc.)	N	No old windows
Mercury contaminated debris/ piping/ P-traps	N	
Broken fluorescent lamps	N	
Universal Waste		
Mercury containing items (batteries, switches, etc.)	N	
Batteries (all types)	N	
Fluorescent Lamps - Intact	Y	Existing lighting is fluorescent
Non-Regulated Waste		
Drywall	N	
Insulation	N	
Broad loom carpet	N	
Vinyl composition tile	N	
Acoustic ceiling tile	N	
Treated wood and MDF	N	
Other Regulated Waste		
Refrigeration equipment	N	
Tires	N	
Recyclable		
White goods (lab refrigerators to be disposed of)	N	
Roofing materials (asphalt, shingles, gravel, metal) non-ACM or lead	N	
Oil	N	
Metal (fixtures, piping, ductwork, studs, wiring)	Y	Demolishing existing lighting
Cardboard	N	
Untreated wood	N	
Aggregate, concrete, brick, asphalt	Y	Demolishing areas of brick/block
Carpet tile	N	
Non-PCB ballasts	Y	Existing lighting is fluorescent

Email completed form to EH&S Hazardous Waste Program Manager (mdlong3@ncsu.edu) and Waste Diversion Coordinator, ajbensle@ncsu.edu		
Waste Type (Condition of waste can determine category. Damaged Universal Waste can become Hazardous Waste)	**Present at Site (Y/N)**	**Destination for Reuse (Same or different project, Surplus, etc.)**
Salvagable		
Furniture	N	
Fixtures	N	
Electronic equipment	N	
Doors	N	
Windows	N	
Cabinets	N	
Shelves	Y	Surplus
Sinks, water fountains, etc.	N	
Dry earase boards, chalkboards, cork boards	N	
Brick pavers	N	
Other…		
Email completed form to EH&S Hazardous Waste Program Manager (mdlong3@ncsu.edu) and Waste Diversion Coordinator, ajbensle@ncsu.edu		

SUBCONTRACTORS AND MAJOR MATERIAL SUPPLIERS LIST

PROJECT: _____

_____

TO (A/E): _____

_____

FROM (CONTRACTOR): _____

DATE: _____

A/E PROJECT NUMBER: _____

CONTRACT FOR: _____

LIST SUBCONTRACTORS AND MAJOR MATERIAL SUPPLIERS PROPOSED FOR USE ON THIS PROJECT AS REQUIRED BY THE CONSTRUCTION DOCUMENTS. ATTACH SUPPLEMENTAL SHEETS IF NECESSARY.

NUMBER SECTION	SECTION TITLE	FIRM	ADDRESS	PHONE NUMBER	CONTACT

☐ **Attachments**

SIGNED BY: **DATE:**

COPIES: ☐ **Owner** ☐ **Consultants** _____ ☐ _____ _____ ☐ _____ ☐ _____ _____ ☐ **File**

REQUEST FOR INFORMATION

PROJECT: _____ **R.F.I. NUMBER:** _____

_____ **FROM:** _____

TO: _____ **DATE:** _____

_____ **A/E PROJECT NUMBER:** _____

RE: _____ **CONTRACT FOR:** _____

This Clarification Notice is issued for the purpose of clarifying the Contract Documents based on an interpretation reasonably inferable from the Contract Documents, and therefore has no effect on the Contract Sum or Contract Time. Proceeding with Work in accordance with this Clarification Notice indicates acceptance with no change in the Contract Sum or Contract Time.

SPECIFICATION SECTION: **PARAGRAPH:** **DRAWING REFERENCE:** **DETAIL:**

REQUEST:

SIGNED BY: **DATE:**

RESPONSE:

☐ **Attachments**

RESPONSE FROM: **TO:** **DATE REC'D:** **DATE RET'D:**

SIGNED BY: **DATE:**

COPIES: ☐ **Owner** ☐ **Consultants** ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ **File**

CSI Form 13.2A (April 2022 version)

REQUEST FOR INFORMATION LOG

PROJECT: ______________________ **A/E PROJECT NUMBER:** ______________________

OWNER: ______________________ **CONTRACTOR:** ______________________

R.F.I. NO.	DATE REC'D	BRIEF DESCRIPTION OF INFORMATION REQUESTED	DATE OF RESPONSE	R.F.P. NO.

CSI Form 13.2B (April 2022 version)

NC STATE UNIVERSITY

June 14, 2024

SUBSTITUTION REQUEST FORM

Project Name:
NC State Project Number:
SCO Project Number:

Substitution Request Number: _____

SPECIFICATION TITLE: _____ Section: _____ Page: _____	DESCRIPTION: _____ Article/Paragraph: _____

PROPOSED SUBSTITUTION: _____

MANUFACTURER: _____	ADDRESS: _____	PHONE: _____
TRADE NAME: _____		MODEL NO.: _____
INSTALLER: _____	ADDRESS: _____	PHONE: _____

HISTORY:	○ New Products	○ 1-4 years old	○ 5-10 years old	○ Over 10 years old

DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED PRODUCT:
_____
_____
_____

○ Point-by-point comparison data attached

REASON FOR NOT PROVIDING SPECIFIED ITEM:
_____
_____
_____

SIMILAR INSTALLATION

PROJECT: _____ ADDRESS: _____ _____	ARCHITECT: _____ _____ OWNER: _____ _____

WILL PROPOSED SUBSTITUTION AFFECTS OTHER PARTS OF WORK? Yes or No If yes, please explain.
_____
_____

Project Name:
NC State Project Number:
SCO Project Number:

Substitution Request Number: _____

_____
_____

SAVINGS TO OWNER FOR ACCEPTING SUBSTITUTION: _____

WILL PROPOSED SUBSTITUTION CHANGE CONTRACT TIME? Yes or No If yes, please explain.

_____
_____
_____
_____

Supporting data attached	○ Drawings	○ Product Data	
○ Samples	○ Tests	○ Reports	○ _____

The Undersigned certifies:

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

Submitted by: _____
Signature: _____
Firm: _____
Address: _____
Contact number: _____

A/E's REVIEW AND RECOMMENDATION

- ○ Approve substitution – Make submittals in accordance with Specification Section 01-33-00 Submittal Procedures
- ○ Approve substitution as noted – Make submittals in accordance with Specification Section 01-33-00 Submittal Procedures
- ○ Reject substitution – Use specified materials
- ○ Substitution Request received too late – Use specified materials

Project Name: **NC State Project Number:** **SCO Project Number:**	**Substitution Request Number: _____**
Signed by:	Date:

OWNER'S REVIEW AND ACTION

- ○ Substitution approved – Make submittals in accordance with Specification Section 01-33-00 Submittal Procedures. Prepare change order.
- ○ Substitution approved as noted - Make submittals in accordance with Specification Section 01-33-00 Submittal Procedures. Prepare change order.
- ○ Substitution rejected – Use specified materials

Signed by:	Date:
Additional Comments Attached	

○ Contractor	○ Subcontractor	○ Supplier	○ Manufacturer	○ A/E

Change Order Request #

Contractor's Change Order Request Summary (Sheet "A")

Item: Code: N.C.S.U. Project #

(Project Name)

Company name
Street Address
City, State Zip

(Line 17.) on sheet "B"

C.O.R. Request Total*	$ -

* Do Not Round Off Numbers

Signature: _____ Date: _____

Print Name: _____

Contractor Summary - (Sheet "B")

C.O.R. #

Project Name
NCSU Project #
SCO #
Code: Item:

Summary of Contractor's Self Performed Work

(1.)	(= line e. from Sheet "C").	Total Material*	$ -
(2.)	(=Line e. from Sheet "D").	Total Labor*	$ -
(3.)	(= line e. from Sheet "E").	Total Equipment*	$ -
(4.)	(=lines 1 + 2 + 3)	**Total of Self Performed Work***	**$ -**

Summary of Quoted Work (subcontractors)

(5.)	Quote - Subcontractor #1 (company name)	Quote #1 Total* (without General Contractor OH&P)	$ -
(6.)	Quote - Subcontractor #2 (company name)	Quote #2 Total* (without General Contractor OH&P)	$ -
(7.)	Quote - Subcontractor #3 (company name)	Quote #3 Total* (without General Contractor OH&P)	$ -
(8.)	Quote - Subcontractor #4 (company name)	Quote #4 Total* (without General Contractor OH&P)	$ -
(9.)	(lines 5 + 6 + 7 + 8)	**Subtotal - Quoted (subcontract) Work*** (w/o Gen Contractor OH&P)	**$ -**
(10.)	(on line 9.)	5% max (or as negotiated) ____ %OH&P	**$ -**
(11.)	(lines 9 + 10)	**Total Quoted (subcontractor) Work** (with Gen Contractor OH&P)	**$ -**
(13.)	(lines 4 + 11)	**Total All Work*** (without bond and ins)	**$ -**
(14.)	(on line 13.)	____ %Bond*	$ -
(15.)	(on line 13)	____ % Ins.*	$ -
(16.)	(lines 14 + 15)	Bonds & Insurance*	**$ -**
(17.)	(lines 13 + 16)	**Grand Total All Work***	**$ -**

*** Do Not Round Off Numbers**

Material Break Down - (Sheet "C")

Material Description	Quantity	Unit		Price	Unit		Extension*
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		ea.	@	$ -	/ ea.	=	$ -
		lin. feet	@	$ -	/ lin. foot	=	$ -
		lin. feet	@	$ -	/ lin. foot	=	$ -
		lin. feet	@	$ -	/ lin. foot	=	$ -
		lin. feet	@	$ -	/ lin. foot	=	$ -
		lin. feet	@	$ -	/ lin. foot	=	$ -
		lin. feet	@	$ -	/ lin. foot	=	$ -
		lin. feet	@	$ -	/ lin. foot	=	$ -
		sq. yds	@	$ -	/ sq. yd	=	$ -
		sq. yds	@	$ -	/ sq. yd	=	$ -
		sq. yds	@	$ -	/ sq. yd	=	$ -
		sq. yds	@	$ -	/ sq. yd	=	$ -
		cu. yds.	@	$ -	/ cu. yd.	=	$ -
		cu. yds.	@	$ -	/ cu. yd.	=	$ -
		cu. yds.	@	$ -	/ cu. yd.	=	$ -
		tons	@	$ -	/ ton	=	$ -
		tons	@	$ -	/ ton	=	$ -
		gals	@	$ -	/ gal	=	$ -
		gals	@	$ -	/ gal	=	$ -
		gals	@	$ -	/ gal	=	$ -

	a.	Total Materials*	$	-
(on line a.)	b.	%	Sales Tax	$ -
(lines a. + b.)	c.		Subtotal*	$ -
(on line c.) - max 10% (or as negotiated)	d.	%	O.H.&P.	$ -
(lines c. + d.)	e.	**Total Material***	**$**	**-**

*** Do Not Round Off Numbers**

Labor Break Down (Sheet "D")

Labor Description	Time	Unit		Cost	Unit		Extension*
Foreman		/hr	@	$ -	/hr	=	$ -
Tradesman		/hr	@	$ -	/hr	=	$ -
Tradesman		/hr	@	$ -	/hr	=	$ -
Tradesman		/hr	@	$ -	/hr	=	$ -
Tradesman		/hr	@	$ -	/hr	=	$ -
Tradesman		/hr	@	$ -	/hr	=	$ -
Journey Man		/hr	@	$ -	/hr	=	$ -
Journey Man		/hr	@	$ -	/hr	=	$ -
Journey Man		/hr	@	$ -	/hr	=	$ -
Journey Man		/hr	@	$ -	/hr	=	$ -
Journey Man		/hr	@	$ -	/hr	=	$ -
Laborer		/hr	@	$ -	/hr	=	$ -
Laborer		/hr	@	$ -	/hr	=	$ -
Laborer		/hr	@	$ -	/hr	=	$ -
Laborer		/hr	@	$ -	/hr	=	$ -
Apprentice		/hr	@	$ -	/hr	=	$ -
Apprentice		/hr	@	$ -	/hr	=	$ -
Apprentice		/hr	@	$ -	/hr	=	$ -
Apprentice		/hr	@	$ -	/hr	=	$ -

	(a.)	Subtotal Labor*		$ -
(on Line a.) max 30%	(b.)	%	Burden	$ -
(lines a. + b.)	(c.)		Subtotal*	$ -
(on Line c.) max 10% (or as negotiated)	(d.)	%	O.H.&P.	$ -
(lines c. + d.)	(e.)	**Total Labor**		**$ -**

*** Do Not Round Off Numbers**

Equipment Break Down (Sheet "E")

Equipment Type	Rental Per Hour			Rental Per Day			Rental Per Week			Extension*
	# Hour(s)		Charge	# Day(s)		Charge	# Week(s)		Charge	
	hr(s)	@	$ - /hr	day(s)	@	$ - /day	wk(s)	@	$ - /wk(s)	$ -
	hr(s)	@	$ - /hr	day(s)	@	$ - /day	wk(s)	@	$ - /wk(s)	$ -
	hr(s)	@	$ - /hr	day(s)	@	$ - /day	wk(s)	@	$ - /wk(s)	$ -
	hr(s)	@	$ - /hr	day(s)	@	$ - /day	wk(s)	@	$ - /wk(s)	$ -
	hr(s)	@	$ - /hr	day(s)	@	$ - /day	wk(s)	@	$ - /wk(s)	$ -
	hr(s)	@	$ - /hr	day(s)	@	$ - /day	wk(s)	@	$ - /wk(s)	$ -
	hr(s)	@	$ - /hr	day(s)	@	$ - /day	wk(s)	@	$ - /wk(s)	$ -

		a.		Subtotal Equipment*	$ -
(No sales tax charge on contractor owned equipment)	(on line a.)	b.	%	Sales Tax	$ -
	(lines a. + b.)	c.		Subtotal*	$ -
maximun 10% (or as negotiated)	(on Line c.)	d.	%	O.H.&P.	$ -
	(lines c. + d.	e.		**Total Equipment***	$ -

*** Do Not Round Off Numbers**

Change Order Minority Participation

Code /Item:	Code: XXXXX Item:XXX
NCSU Project #:	072044
Contractor:	XXXXXXXXXXX
C.O. Number	**G-X**
C.O. Scope of Work:	XXXXXXXXXXX
C.O. Cost:	

HUB Subcontractor	Minority Category [1]	Contractor Trade [2]	C.O. Dollar Value	Revised Contract Total
	N/A	N/A	N/A	N/A

[1] Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Economically& SociallY Disadvantaged (D)

[2] Contractor Trade - Select number (i.e. "2" for General - Demolition)

Contractor Trades

1. Div 1 – General Contractor	**55**. Div 6 – Wood & Plastics – Architectural Woodwork	**5**. Div 10 – Specialties – Fire Extinguishers and Cabinets	**24**. Div 15A – Plumbing – Pipe & Pipe Fittings
2. Div 1 – General – Demolition	**56**. Div 6 – Wood & Plastics – Carpentry	**6**. Div 10 – Specialties – Identification Devices (Signage, etc.)	**25**. Div 15A – Plumbing – Pipe Insulation
3. Div 1 – General – Cleaning	**57**. Div 7 – Thermal/Moisture Protection – Building Insulation	**7**. Div 10 – Specialties – Toilet Accessories	**26**. Div 15B – Mechanical – Controls Work
4. Div 1 – General – Temp Facilities (fencing, trailers, etc)	**58**. Div 7 – Thermal/Moisture Protection – Fireproofing	**8**. Div 10 – Specialties – Toilet Partitions	**27**. Div 15B – Mechanical – Ductwork
40. Div 2 – Site Work – Grading	**59**. Div 7 – Thermal/Moisture Protection – Joint Sealing/Caulking	**9**. Div 11 – Equipment – Audio-visual (Projectors, Screens, etc.)	**28**. Div 15B – Mechanical – Mechanical Equipment
41. Div 2 – Site Work – Hauling	**60**. Div 7 – Thermal/Moisture Protection – Roofing	**10**. Div 11 – Equipment – Food Service	**29**. Div 15B – Mechanical – Pipe Duct Insulation
42. Div 2 – Site Work – Landscaping (seeding, planting, etc.)	**61**. Div 7 – Thermal/Moisture Protection – Waterproofing	**11**. Div 11 – Equipment – Residential	**30**. Div 15B – Mechanical – Pipe & Pipe Fittings
43. Div 2 – Site Work – Paving	**62**. Div 8 – Doors/Windows – Doors	**12**. Div 12 – Furnishings – Floor Mats	**31**. Div 15B – Mechanical/HVAC General
44. Div 2 – Site Work – Soil/Sediment Erosion & Control	**63**. Div 8 – Doors/Windows – Finish Hardware	**13**. Div 12 – Furnishings – Systems Furniture	**32**. Div 16 – Electrical – High/Medium Voltage (Transformers, Switches, etc.)
45. Div 2 – Site Work – Water/Sewer System	**64**. Div 8 – Doors/Windows – Glass & Glazing	**14**. Div 12 – Furnishings – Window Treatments	**33**. Div 16 – Electrical – Conduit
46. Div 3 – Concrete – Plain Concrete (sidewalks, curb & gutter, etc.)	**65**. Div 8 – Doors/Windows – Windows	**15**. Div 13 – Special Construction – Fire Protection (Sprinklers, etc.)	**34**. Div 16 – Electrical – Fire Alarm & Smoke Detection Systems
47. Div 3 – Concrete – Pre-cast Concrete	**66**. Div 9 – Finishes – Acoustic Panel Ceilings	**16**. Div 13 – Special Construction – Hazardous Materials Abatement	**35**. Div 16 – Electrical – General
48. Div 3 – Concrete – Structural Concrete	**67**. Div 9 – Finishes – Carpet	**17**. Div 13 – Special Construction – Security Systems	**36**. Div 16 – Electrical – Lighting Fixtures
49. Div 4 – Masonry – General	**68**. Div 9 – Finishes – Gypsum Drywall	**18**. Div 14 – Conveying Systems – Elevators	**37**. Div 16 – Electrical – Site Lighting
50. Div 4 – Masonry – Labor Only	**69**. Div 9 – Finishes – Hard Flooring (tiles, slate, etc.)	**19**. Div 14 – Conveying Systems – Escalators	**38**. Div 16 – Electrical – Telecommunications Systems
51. Div 5 – Metals – Architectural Metal (railings, etc.)	**70**. Div 9 – Finishes – Painting/Wallcoverings	**20**. Div 15A – Plumbing – Exterior Work	**39**. Div 16 - Electrical – Wiring & Wiring Devices
52. Div 5 – Metals – Light Gauge Metal (decking, etc.)	**71**. Div 9 – Finishes – Plaster	**21**. Div 15A – Plumbing – Fixtures	
53. Div 5 – Metals – Structural Steel	**72**. Div 9 – Finishes – Soft tile Flooring	**22**. Div 15A – Plumbing – Fuel Gas Piping & Equipment	
54. Div 5 – Metals – Structural Steel Erection	**73**. Div 9 – Finishes – Wood Flooring	**23**. Div 15A – Plumbing – General	

State Construction Office

Field Order # _____

Project: _____ Location: _____ Project ID: _____

Description of Change: _____

Justification of Change: _____

CONTRACTOR:
A total cost change not to exceed a lump sum cost is $ _____ or a unit cost of _____ extended using estimated quantities to not exceed is $ _____. The contractor will need a maximum number of _____ days time extension to the contract. The actual cost, not to exceed stated cost, shall be based on a realistic estimate based on current acceptable market values submitted with change order for approval by designer, owner, and State Construction Office.

DESIGNER:
The quoted price and need for the change are in the best interests of the owner to have the work accomplished. A formal change order will be prepared for contractor's signature within seven (7) days.

OWNING AGENCY:
The owning agency agrees to the change as being in the owner's best interest. Adequate funds are available to pay the cost for the change.

STATE CONSTRUCTION OFFICE:
The State Construction Office approves the request for the change.

SIGNATURES:

Contractor: _____ Date: _____

Designer: _____ Date: _____

Owning Agency: _____ Date: _____

State Construction Office: _____ Date: _____

Request for Designers Pre-Final Inspection Checklist

Project Name: _____

NC State Project Number: _____

NC State Code / Item: _____

SCO Project Number: _____

All items must be complete and verified by the Designer. Once items are verified as complete, Designer shall note the date complete and initial the line. If items are not applicable to the project, Designer shall note "N/A" in the date line.

Item	Date	Initials
Contractors Statement of Completion with Request for Designers Inspection, include Contractors Completion List		
Initial Submission of the TAB Report		
Pre-Functional Testing Report		
Operation & Maintenance Submittal Log showing all required O&M's have been approved		
Schedule of Owner Trainings		
Certification all Fire Extinguishers have been installed or delivered to N.C. State		
Demonstration of the operation of fire pumps to the N.C. State Fire Marshall		
Final Clean is Complete		
Laboratory Hood Certification by Contractors 3rd Party Inspector (if applicable)		
Roof & Window Water Test Reports (if applicable)		

Designers Approval: _____ Name _____ Signature _____ Date

Request for Final Inspection Checklist

Project Name: _____

NC State Project Number: _____

NC State Code / Item: _____

SCO Project Number: _____

All items must be complete and verified by the Designer. Once items are verified as complete, Designer shall note the date complete and initial the line. If items are not applicable to the project, Designer shall note "N/A" in the date line.

_____ (Designer of Record) provides information to the Owner and the State Construction Office that the project has been evaluated and field inspected to assure Life Safety Construction involving Fire Protection Systems (Fire Alarm, Sprinkler, etc.), egress, fire rated walls, and egress travel distances are constructed in accordance with the Contract Documents for Final Inspection to allow occupancy by the Owner.

_____

Designer's Representative

Item	Date	Initials
Contractors Statement of Completion with Request for Designers Inspection, include Contractors Completion List		
Designer's Pre-Final Punch List Inspection		
SCO Final Inspection Scheduled for _____		
SCO Electrical Inspection (Certificate of Electrical Completion)		
Installer's Fire Alarm System Record of Completion (Certification) as required by NFPA 72		
Installers Sprinkler System Material & Test Reports:		
NFPA 13 (Sprinkler Systems)		
NFPA 14 (Standpipe & Hose Systems)		
NFPA 20 (Centrifugal Fire Pumps)		
NFPA 22 (Water Tanks for Private Fire Protection)		
NFPA 24 (Private Fire Service Mains)		
SCO Approval Letter for Sprinkler System		
Engineer's Approval of Battery Powered Emergency Devices		
Engineer's Approval Emergency and Standby Generator NFPA 110 Tests		
Engineer's Approval Electrical Service Ground Test Report		
Department of Labor Approval for Elevator		
Department of Labor Approval for Boiler & Pressure Vessels		
Department of Agriculture Approval for Fuel Tanks		

Item	Date	Initials
Health Department Inspection and Acceptance for Use		
Domestic Water Test Report and Acceptance for Use		
Laboratory Hood Certification by Contractors 3rd Party Inspector		
Laboratory Hood Certification by N.C. State EH&S		
Engineers Approval of Test & Balance Report		
Engineers Verification Letter of Fire Damper Operation		
Backflow Preventer Certification		
Designers Approval of Stair / Ramp Survey		
Metal Building Manufacturer's Warranty		
Roofing Manufacturer's Warranty		
Commissioning Agents Approval		
Lightning Protection UL Master Label		
Special Inspectors Final Report / Resolutions		
Designer's Approval of Site Survey		

Designers Approval: _____ (Name) _____ (Signature) _____ (Date)

NCSU Approval: _____ (Name) _____ (Signature) _____ (Date)

North Carolina
State Construction Office

PROJECT APPROVAL AUTHORIZATION
PARTIAL UTILIZATION: (BENEFICIAL OCCUPANCY)

Project: _____

SCO Identification Number: _____ Contract Completion Date: _____

Project Owning Agency: _____

Owning Agency's Requester: _____ Date: _____

Designer's Statement:

_____ (Designer's Firm Name) provides information to the owner and the State Construction Office that the project has been evaluated and field inspected to assure that construction meets contract requirements for partial utilization and/or occupancy by the owning agency.

_____
Designer's Representative Name

Project Description: _____

Project Partial Utilization Description: _____

BACK-UP DATA:
CONTRACTOR'S APPROVAL DOCUMENTS:

General Construction Contractor's Approval:	Date _____	N/A ☐
Electrical Construction Contractor's Approval:	Date _____	N/A ☐
Mechanical Construction Contractor's Approval:	Date _____	N/A ☐
Plumbing Construction Contractor's Approval:	Date _____	N/A ☐
Sprinkler Installation Contractor's Approval:	Date _____	N/A ☐
Asbestos Removal Contractor's Approval:	Date _____	N/A ☐
Other: _____	Date _____	N/A ☐
Other: _____	Date _____	N/A ☐
Other: _____	Date _____	N/A ☐
Certificate of Occupancy by Local Authority Having Jurisdiction (Community College):	Date _____	N/A ☐

Rev.(4/23/10, 7/14/2020)

North Carolina
State Construction Office

Beneficial Occupancy Inspection:	Date _____	N/A ☐
Beneficial Occupancy Punch List to be completed:	Date _____	N/A ☐
Owner's Assumption of Responsibility for Maintenance, Heat, Utilities, and Insurance: Comments: _____ _____	Date _____	N/A ☐
Established Date for Guarantees and Warranties. Comments: _____ _____	Date _____	N/A ☐
Consent of Surety:	Date _____	N/A ☐
Insurance Company Permitting Occupancy:	Date _____	N/A ☐
SCO Electrical Inspection (Certificate of Electrical Completion):	Date _____	N/A ☐
Installer's Fire Alarm System Record of Completion (Certification) as required by NFPA 72:	Date _____	N/A ☐
Installer's Sprinkler System Material and Test Reports as required by:		
NFPA 13-(Sprinkler Systems)	Date _____	N/A ☐
NFPA 14-(Standpipe and Hose Systems)	Date _____	N/A ☐
NFPA 20-(Centrifugal Fire Pumps)	Date _____	N/A ☐
NFPA 22-(Water Tanks for Private Fire Protection)	Date _____	N/A ☐
NFPA 24-(Private Fire Service Mains)	Date _____	N/A ☐
Other: SCO Approval Letter Sprinkler System	Date _____	N/A ☐
Engineer's Approval of Battery Powered Emergency Devices:	Date _____	N/A ☐
Engineer's Approval Emergency and Standby Generator NFPA 110 Tests:	Date _____	N/A ☐
Engineer's Approval Electrical Serv Ground Test Report:	Date _____	N/A ☐
Dept. of Labor Approval for Elevator:	Date _____	N/A ☐
Dept. of Labor Approval for Boiler & Pressure Vessels:	Date _____	N/A ☐
Dept. of Agriculture Approval for Fuel Tanks:	Date _____	N/A ☐
Health Dept. Inspection and Acceptance for Use:	Date _____	N/A ☐

Rev.(4/23/10, 7/14/2020)

North Carolina
State Construction Office

Domestic Water Test Report and Acceptance for Use:	Date _____	N/A ☐
Laboratory Hood Certification:	Date _____	N/A ☐
Engineer's Approval of Test and Balance Report:	Date _____	N/A ☐
Engr's. Verification Letter Fire Damper Operation:	Date _____	N/A ☐
Agreement & Means for Separation of Owner Occupied Area from Construction Work Area:	Date _____	N/A ☐
Designer's Inspection to Assure Life Safety Construction involving Fire Protection Systems (Fire Alarm, Sprinkler, etc.), egress, fire rated walls and egress travel distances are constructed in accordance with contract documents:	Date _____	N/A ☐
Backflow Preventer Certification:	Date _____	N/A ☐
Engineer's Approval Stair/Ramp Survey:	Date _____	N/A ☐
Engineer's Approval Site Survey (DENR):	Date _____	N/A ☐
Metal Building Manufacturer's Warranty:	Date _____	N/A ☐
Roofing Manufacturer's Warranty:	Date _____	N/A ☐
Commissioning Engineer's Approval:	Date _____	N/A ☐
Lightning Protection UL Master Label:	Date _____	N/A ☐
Special Inspector's Final Report/Resolutions:	Date _____	N/A ☐

Designer's Approval:	Date: _____	Printed Name: _____		
Owning Agency Approval:	Date: _____	Printed Name: _____		
SCO Approval:	Date: _____	Printed Name: _____		

Final Acceptance Checklist

Project Name: _____

NC State Project Number: _____

NC State Code / Item: _____

SCO Project Number: _____

Item	Date	Initials
Signed Request for Final Inspection Checklist		
SCO Beneficial Occupancy Form(s) for Project's Phases		
Designer's statement to Owner the Designer's Punch List has been Completed		
SCO Final Acceptance Inspection		
SCO Final Acceptance Punch List Issued		
Contractors Work Plan for SCO Final Acceptance Punch List		
Owner's Assumption of Responsibility for Maintenance, Heat, Utilities, and Insurance		
Cancellation of Contractors Insurance Carriers Public Liability, Property Damage, and Builders Risk		
Established Date for Guarantees and Warranties		
Insurance Company Permitting Occupancy		
Record of Owner's Trainings: Plumbing HVAC/Controls Electrical Fire Alarm		
NCSU Fire Marshall's inspection of life safety systems (FAS, Sprinkler System, Emergency Generator, Fire Pumps etc)		
NCSU Lock Shop to installed permanent lock cores on Project's doors		

Date of Project's Final Acceptance: _____

	Name	Signature	Date
Designers Approval:	_____	_____	_____
NCSU Approval:	_____	_____	_____
SCO Approval:	_____	_____	_____

Project Closeout Checklist

Project Name: _____

NC State Project Number: _____

NC State Code / Item: _____

SCO Project Number: _____

Item	Date	Initials
Signed Request for Final Inspection Checklist		
Signed Final Acceptance Checklist		
Contractors Final Payment Application		
Contractors Affidavit of Release of Leins		
Contractors Affidavit of Payment of Debts & Claims		
Consent of Surety to Final Payment		
Certificates of Compliance – by each Designer who sealed documents		
Certificate of Completion – by Lead Designer		
Complete Tax Statement Form		
MBE Appendix E Form		
Survey of New & Existing Sub-surface Utilities		
All Contractors Keys Returned to Lock Shop		
NCSU Stormwater Program Manager Approval		
SCO Punch List Complete		
List of Contractors & Subcontractors		
As-Builts & Record Documents		

	Name	Signature	Date
Designers Approval:			
NCSU Approval:			
SCO Approval:			

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

CONTRACTOR: _____ Page _____ 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 _____, 19____

_____
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: _____ Page _____ of _____

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.

STORED MATERIAL SUMMARY

NC STATE UNIVERSITY

PROJECT: _____	APPLICATION PERIOD: _____
OWNER: _____	APPLICATION NUMBER: _____
A/E PROJECT NUMBER: _____	APPLICATION DATE: _____

Invoice No.	Submittal Transmittal No.	Material Description	Stored Previous		Stored This Month		Incorporated In Work		
			Date (Mo/Yr)	Amount ($)	Amount ($)	Subtotal ($)	Date (Mo/Yr)	Amount ($)	Materials Remaining in Storage ($)

FACILITIES DIVISION

REQUEST FOR UTILITY INTERRUPTION WORK SHEET

REQUESTOR

NAME : _____ DATE : _____

DEPT : _____ PHONE : _____

WORK REQ #: _____ ACCT #: _____ CAMPUS BOX : _____

BUILDING INFORMATION / DATE & TIME

BUILDING(s): _____ ENTIRE BLDG or SPECIFIC ROOM : _____

BEGIN DATE : _____ END DATE : _____

BEGIN TIME : _____ END TIME: _____

DISCONNECT INFORMATION

POWER	RUNNING WATER	FIRE ALARM	
Primary ☐	Hot ☐	Disconnect ☐	HEATING ☐
Secondary ☐	Cold ☐	Testing ☐	STEAM SYSTEMS ☐
	Distilled ☐	Sprinkler Operational Yes / No	AIR CONDITIONING (Chilled Water) ☐
			PROPANE/NATURAL GAS ☐

OTHER : _____

For all Fire Alarm / Sprinkler Disconnects or Testing, please first obtain approval from the Electronics Shop: http://facilities.ofa.ncsu.edu/fire-alarm-disconnect/(separate form).

REASON FOR INTERRUPTION (Scope of Work):

Shop Supervisor Signature: _____ Date: _____

Addtl. Supervisor (s) Signature: _____

POLICY # 806 – ROUTINE UTILITY INTERRUPTION REQUEST – ADV NOTIFICATION PERIODS

Primary (Total Building) Power – 10 working days
Secondary Power Feeders – 4 working days
Cold/Hot Water Interruption – 4 working days
A/C/Heat Interruption – 4 working days
*Fire Alarm Disconnect/Testing – 3 working days
Distilled Water Interruption – 3 working days
Steam Interruption – 5 working days
Gas Interruption – 5 working days
Lab Air Interruption – 4 working days
Sanitary/Storm Sewer – 3 working days

PLEASE NOTE: The Customer Service Center will make notifications for the disconnect if it is submitted within the appropriate number of days. The CSC will also make notifications for Emergency disconnects. If it is not submitted within the appropriate number of days, it is the Requestor's responsibility to make the notifications to all personnel.

PROJECT NAME
NCSU Project Number
Building Name: XYZ Hall
MOP-XXX

Method of Procedure

Requested Start Date: DD/MM/YYYY

Requested Work Window: XX hours or YY days

Backup Dates:

1.0 **Purpose / Scope of Work**

1.1 The purpose of this procedure is to [description of the work to be performed].

2.0 **Personnel**

2.1 Contractors Personnel

2.1.1 [List Name, Title, and Contact Information for the Contractors Personnel]

2.2 NC State Personnel

2.2.1 [List Name, Title, and Contact Information for the Contractors Personnel]

2.3 Other Personnel

2.3.1 [List Name, Title, and Contact Information for the Contractors Personnel]

3.0 **Planned Impact to Environment / Equipment**

3.1 [Describe the intended impact of the work].

4.0 **Risks & Potential Hazards**

4.1 [List the risks and potential hazards associated with the work]

5.0 **Stakeholders Impacted**

5.1 [List the stakeholders impacted by the work]

6.0 **Contingency Plan**

6.1 [Describe the contingencies planned by the contractor to mitigate risks associated with the work not going according to plan.]

7.0 **Attachments & References**

7.1 [List the attachments associated with the MOP.]

7.2 [List the reference documents & details associated with the MOP.]

8.0 **Prerequisites**

8.1 [Description of Prerequisite #1.]

Prerequisite #1 is complete.

[ENTITY]: _____

Signature Print Name Date

8.2 [Description of Prerequisite #2.]

9.0 Prerequisite #2 is complete.

[ENTITY]: _____

Signature Print Name Date

10.0 **Procedure**

10.1 [Step 1]

10.2 [Step 2]

10.3 [Step 3]

PRECONSTRUCTION MEETING AGENDA

Project Name: _____

Project number: _____ Code: _____ Item: _____ SCO ID #: _____

Date and location of Meeting: _____

Attendees:

1.) Introductions

2.) Correspondence Protocol;

a. All correspondence shall have the NCSU Project Name and Number as indicated on SCO's letter of award.

b. Owner and Contractor will endeavor to direct all communications through the Design Representative.

c. Correspondence from Designer to Owner will be addressed to the NCSU Project Manager.

d. Correspondence between Designer and Contractor requires copy to the NCSU Project Manager.

e. Correspondence from Owner and Contractor to Designer will be addressed to the Design Representative.

3.) Schedule

a. Bar chart, Network plots. Project schedule, signed by all major subcontractors, is due to the designer within 30 calendar days of the notice to proceed. A Schedule of Values shall be submitted within 30 calendar days of the notice to proceed.

b. Monthly schedule updates, signed by all major subcontractors, shall be required with each payment application.

c. Milestones:

Notice to Proceed Date: _____

Project Start Date: _____

Duration: _____

Project Completion Date: _____

Adjustment(s) to the completion of a project will only be allowed by a justifiable change order approved by the designer, the owning agency and the State Construction Office.

One copy of the approved schedule is to be posted at the project site and marked daily showing actual progress of the work.

The submission of an approved schedule and schedule of values to the designer shall occur prior to submitting the first request for payment. The schedule of Values shall include dollar value of each subcontractor and shall identify MBE subcontract work.

A list of subcontractors and material suppliers are to be provided to the designer with a copy for the State Construction Office within 14 days of the notice to proceed in accordance with article 16 of the general conditions.

d. Weather Delays: The general conditions states the contractual method by which the contractors were to use to establish the expected number of weather days to include in the contract(s). For weather impact greater than what is in the contract, the contract is due to be adjusted. The contractors' project administrators should develop a daily log on construction events covering construction progress and daily weather conditions that affect the construction progress. Copies of the logs should be directed to the designer's representative on a weekly basis for his initial. Copies of the logs should be turned in to the designer on a monthly basis with a request for weather time extensions if justifiable. The requests will be evaluated and approved by the designer, owning agency and State Construction Office if deemed valid. The designer shall keep a running total of time of weather relating delays for granting one change order per prime contract at the end of the project for contract adjustment to the date of completion of the project.

e. Liquidated Damages: The contract contains a clause allowing an assessment of a sum of _____ dollars per day as liquidated damages for each calendar day the project construction is delayed beyond the adjusted scheduled completion date.

f. It is important all prime contractors become familiar with the general and the supplementary general conditions of the contract(s).

4.) <u>Progress Meetings</u>

a. SCO/Owner's/Designer's Regular monthly progress meetings will be held on:

Location: _____

Time: _____

Prime contractors shall be represented by office and project representatives having the authority to make bindings contractual decisions on the contract. The meetings are open to subcontractors, material suppliers and others that may contribute to the progress toward project completion. The meetings are to enhance coordination, to enhance cooperation, to assist the support of the project schedule, to facilitate in the resolution of problems, and to review pending changed conditions.

b. Contractor's regular weekly progress meetings will be held on:

Location: _____

Time: _____

Meeting Agenda. A sample agenda for these meetings is included in the Project Manual.

5.) <u>Change Orders</u>

For Changes in the Work - follow General Conditions Article 19 and see Attachment 2:

a. Provide breakdown of materials, labor rates, and correct OH&P

b. Each request will be identified as "change proposal" or "change request" and will be number consecutively.

c. Designer will prepare field orders to the Contract on State Construction Office forms.

d. Owner and Designer will prepare change orders to the Contract on State Construction Office forms or using SCO Interscope Website to process electronically.

e. Designer shall maintain a change order log.

f. *Time extension requests must be supported by a marked-up schedule showing the impact of the delay(s) on the critical path.*

g. The University requires 6 original change orders for processing.

h. Only the designer has the authority to issue change orders to change the work of Contractor

i. All User or other departmental requests for changes in the work will be channeled through the N.C.S.U. Project Manager to the designer as necessary.

6.) <u>Pay Applications/Schedule of Values:</u>

a. Shall be submitted on *AIA G702 forms*. Applications submitted on any different format will be returned *NOT APPROVED.* The University requires three originals only.

b. A copy of *NC Sales Tax Report* shall be included with each pay application.

c. Contractor will submit pay applications to the Designer for approval.

d. Submittal date to designer will be: _____.

e. Schedule of values *must be approved by Designer and Owner* prior to first pay application.

f. Pay applications must clearly identify the type of contract (general, mechanical, plumbing, electrical, etc.). Project name, code and item number, NCSU project number, and SCO ID number must be shown.

g. All Pay Applications must be accompanied by a *Consent of Surety* and up to date *MBE (HUB) Form*.

h. Contractor's pay applications are due at Capital Project Management by the fifth of each month.

i. A copy of the payment application will be submitted to the SCO Project Monitor.

7.) **<u>Project Close-Out</u>**:

The following must all be complete and included:

a. As-Builts, including registered survey and certification of stairs.

b. O&M Manuals

c. Special Inspections Report

d. Consent of Surety

e. Affidavit of Payment of Debts and Claims and Lien waivers

f. Special warranties/bonds, certificates of completion and compliance

g. Certification of equipment demonstrations and training for Owner personnel.

h. Commissioning of building systems if required

i. Contractor and Designer evaluations

8.) **Personnel Conduct**

a. Zero tolerance for harassment of any sort of any member of the University community.

b. Smoking Policy - No smoking inside of existing facility or addition.

c. Protection/Safety

1.) OSHA Regulations:

a) Fire control

b) Barricades - work areas, excavation, pedestrian access, etc.

c) Housekeeping - keep site clean, keep mud off streets daily

2.) Working in and around occupied facilities - must be sensitive to the needs of occupants. Coordinate with Project Manager. Noise hours.

3.) Scheduling of cutting of floors in occupied spaces. Precaution to protect activities in floors below

4.) Hot Work Permits: Fire Marshals Office: 515-2568

5.) Contractors shall familiarize themselves with article 11 of the general conditions. The requirements are a mandatory part of the contract.

d. Accident Reports - Owner requires copy of First Report of Injury.

e. It is illegal for any person to have firearms at the project site, any type of alcoholic beverages, or drugs other than prescribed by a physician. Everyone at the project site is expected to exhibit proper behavior. Indecent language, acts or dress will not be accepted. Anyone in violation of proper behavior will be ejected from the construction site by the proper authorities.

9.) **Temporary Services and Facilities**:

1.) Sanitary:

2.) Water:

3.) Power:

4.) Heat:

5.) Telephone:

6.) Trailers:

7.) Job Sign:

8.) Parking:

9.) Waste Disposal Dumpster:

10.) Restroom facilities are to be:

b. Service Continuity:

1.) All interruption of services will be coordinated through the NCSU project manager

2.) Contractor will not interrupt existing services, i.e., Owner will throw switches, turn valves, etc.

3.) 5 days minimum notice, longer for major utility outages, up to 10 days for high voltage or building electricity interruptions.

c. Cleaning of Streets - any mud, debris, etc., will be removed by Contractor daily.

d. Site Considerations:

1.) Project limits and staging - see drawings.

2.) Store materials properly.

3.) Erosion control.

4.) Tree protection.

5.) Concrete wash-down areas - keep clean - do not was out near trees, storm drain inlets.

6.) Pre-Excavation Process:

a) The Contractor shall lay out excavations.

b) The Contractor shall be responsible for having existing utilities located.

c) The Contractor may start excavation only when all known utilities have been located or verified as per the specifications.

10.) <u>Special Requirements of the Owner:</u>

a. Asbestos:

1.) If applicable, Owner will survey for, and deal with asbestos removal prior to work on this contract commencing.

2.) If the Contractor encounters any material that is suspected to be asbestos, work will cease immediately in the area, and the area will be barricaded, etc.

3.) Owner shall be notified immediately is the presence of asbestos is suspected.

b. Submittals:

1.) Submit ___ copies to Designer. NCSU requires one full set of approved submittals at the end of the project.

2.) Submittals to be numbered consecutively and specification section will be referenced.

3.) Contractor approval stamp required prior to submission to the Designer.

4.) Designer shall maintain submittal log.

5.) *See Attachment 3 for a list of Submittals to be reviewed by the owner.*

c. Requests For Information:

1.) Contractor is responsible for thoroughly reviewing contract documents prior to request for information.

2.) Designer shall maintain a RFI (request for information) log.

d. Normal working Hours: _____

11.) <u>Final Inspections:</u>

a. State Inspections must be complete and approved. (SCO Electrical, NFPA Testing, and DOL: elevator, boilers, pressure vessels, etc.)

b. Satisfactory review of project completeness by the Designer.

c. The designer shall coordinate and notify all parties of the time and date of the formal final inspection.

d. Upon correction by the contractor and verification by the designer that the work has been completed, a formal final inspection shall be coordinated and performed by the designer in cooperation with the contractor in the present of the owning agency and the State Construction Office.

12.) <u>As-Built Drawing:</u>

a. Contractor to keep record set of drawings on site for record drawing purposes exclusively.

b. Designer and Owner will review the record drawings once a month at construction meeting.

13.) **<u>State Construction Office Requirements</u>**: Show project SCO ID on all correspondence. Provide a copy of all designers' weekly inspection reports to the project monitor.

MONTHLY MEETING AGENDA

Project Name: _____
Project number: _____ Code: _____ Item: _____ SCO ID #: _____

Date and location of Meeting: _____

Attendees:

1.) Review previous minutes of the meeting and resolve any corrections.
2.) Work performed in the last 30 days.
3.) Work to be performed in the next 30 days.
    a. Review Project Schedule Summary and attach to the meeting minutes.
    b. Review updated schedule and attach to the meeting minutes.
    c. Review Monthly Progress Summary and attach to the meeting minutes.
4.) Requests for Proposals.
5.) Review Pending Change Orders. Attach an updated Change Order Log to the meeting minutes.
6.) Review Requests for Information. Attach an updated RFI log to the meeting minutes.
7.) Review Submittals. Attach an updated Submittal Log to the meeting minutes.
8.) Discuss Coordination Issues.
9.) Designer Weekly Inspection Reports.
10.) Erosion Control & Tree Protection Review.
11.) Site Cleanliness.
12.) Safety.
13.) Open Discussion.
14.) Attach photos of work progress, taken within two days of the meeting, to the meeting minutes.

PROJECT SCHEDULE SUMMARY

Notice to Proceed Date	_____
Contract Completion Date	_____
Contract Calendar Days	_____
Number of Contract Calendar Days Expended to Date Thru __/__/__	_____
Percentage of Contract Time Expended to Date Thru __/__/__ (Days Expended/Contract Duration)	_____
Previous Percentage of Contract Time Expended to Date	_____
Pending Time Extensions (Weather – Calendar Days)	_____
Pending Time Extensions (Scope – Calendar Days)	_____
Approved Time Extensions (Weather – Calendar Days)	_____
Approved Time Extensions (Scope – Calendar Days)	_____
Completion Date per Updated Schedule	_____
Actual Percentage Complete (Work in Place less stored Materials) thru __/__/__	_____ _____
Previous Percentage Complete	_____

MONTHLY CONSTRUCTION PROGRESS REPORT

Designer		Address	
Location		Date	
Job Title		Starting Date	
SCO ID#			

PERCENT COMPLETION

	% Previous Month	%This Month	% Total to Date	% Scheduled	Completion Date
General Contract					
Plumbing Contract					
Mechanical Contract					
Electrical Contract					

Change Orders Since Last Report:

Change Order Number	Amount	Purpose

Insurance up to Date: Yes ___ No ___
Explanation (if no):

Financial Status:	Previously Authorized	Authorized This Month	Total Contract Inc. Extras	% of Total Authorization
General				
Plumbing				
Mechanical				
Electrical				
Totals				

If work is behind schedule, what action has been taken?

WEEKLY MEETING AGENDA

Project Name: _____
Project number: _____ Code: _____ Item: _____ SCO ID #: _____

Date and location of Meeting: _____

Attendees:

1.) Contractor's Construction Schedule:

   a. 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.
   b. Review schedule for the upcoming two-week period.
   c. Discuss long-term schedule needs as necessary.

2.) Safety, hazards and risks.

3.) Change Order Requests and Change Orders.

4.) Request for Information.

5.) Submittals.

6.) Designer Inspection Reports.

7.) Erosion & Sedimentation Update (if applicable).

8.) Review condition of tree protection (if applicable).

9.) Progress cleaning and site cleanliness.

10.) Changes to Site Logistics or Emergency Action Plan.

11.) Sequence of operations.

12.) Resolution of BIM component conflicts.

13.) Status of upcoming samples and/or mockups, and location for review.

14.) Deliveries.

15.) Off-site fabrication.

16.) Access.

17.) Site utilization.

18.) Temporary facilities and controls.

19.) Atypical work hours.

20.) Quality and work standards.

21.) Pending changes

22.) Pending claims and disputes.

23.) Documentation of information for payment requests.

24.) Testing and inspection requirements.

25.) Other business relating to the Work.

NC State University Lift Plan Approval Request

Date Submitted:_____
Submitted by:_____
NCSU Group Leading Project:_____
Lift Date:_____

- The identity of the controlling entity, meaning the employer with the overall responsibility for construction operations associated with the crane lift.
- Identify a lift director (i.e. primary signal person) and method of communication (hand signals, radio, etc.).
- Contractors conducting crane operations are required to obtain required FAA permits according to 14.CFR Part 77; to be submitted with the lift plan.
- Equipment positioning locations, including load staging and movement and paths to and from the working position
- Equipment specifications including load and reach capacities
- Current qualifications, certifications, and licenses of operator(s) and rigger(s)
- For lifts involving more than one crane, the lift plan shall encompass all cranes.
- Fall Zone: The contractor shall identify the Fall Zone. The Fall Zone is the area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall. Spaces within the Fall Zone (including buildings, foot traffic, vehicle traffic, etc.) shall be barricaded to control access. The Fall Zone shall be cleared of personnel not participating in the lift.
- Wind limitations
- Ground and subsurface stability at crane and load placement locations. The contractor must ensure a qualified person evaluates the crane set-up location to ensure ground conditions are sufficient.
- Other conditions or factors that may affect the safety of the lift
- A pre-lift meeting must be completed immediately before the lift and shall include all personnel involved with the lift and a thorough review of the elements and specifics of the lift plan and personnel assignments.
- Specify distance to closest energized lines and applicable minimum approach distance of any lift component.
- Where items positioned by a crane lift are rigged at heights above easy reach height, the lift plan shall include safe attachment and de-attachment procedures and the control of exposure to fall hazards
- The contractor must provide documentation of annual and monthly inspections for the previous 3 months. 1926.1412(f) & .1412(e)

Reviewed by:_____
Review Date_____

- **Approved**
- **More Information Needed**
- **Denied**

C&D WASTE AND RECYCLING TRACKING FORM

The University requires 75% of the waste produced from each project be diverted from the landfill

Project Name & ID: _____

Name of Contractor: _____

Project Manager Name: _____

Contractor Phone #: _____

For assistance completing this form contact Adam Bensley, NCSU Waste Reduction & Recycling (919) 515-0661

Name of Person Completing Form: _____

It is required to attach weight tickets and/or invoices to this form.

Please check one: ☐ Weight tickets attached ☐ Weight tickets not attached. Provide explanation: _____

Date	Waste Hauler/Contractor Name	Material Description	Weight (lbs or tons)	Estimate Weight if no Ticket	Recycling or Landfill Facility Hauled to

Project Totals (Contractor to Calculate)

Total Weight Landfill: _____

Total Weight Diverted (Recycled + Salvaged): _____

Percent of Project Waste Diverted from Landfill
(Total Weight Diverted / Total Project Weight) x 100

Total Weight Recycled: _____

Total Project Weight (Recycled + Salvaged + Landfilled): _____

_____%

Instructions for completing this form

1. NCSU project manager to provide info.
2. Contractor to provide this information, including name of person completing this form.
3. Check a box indicating whether weight tickets are attached to this form. If they are not, provide an explanation.
4. Complete one line for each instance of hauling.
   - A. List the date material was hauled.
   - B. Provide name of waste hauler or contractor who disposed or recycled the material.
   - C. List the type of material disposed of or recycled. Ex. Mixed C&D waste, scrap metal, concrete, asphalt shingles, etc.
   - D. List the actual weight of the material, in pounds or tons, as recorded by a scale.
   - E. If material is not weighed by a scale, provide an estimate of the weight in pounds or tons (keep units consistent throughout).
   - F. List the facility the material was delivered to.
5.
   - A. Provide the total weight of all materials that went to a landfill. *Note:* For Waste Industries Raleigh View Road C&D Processing Facility *only* - 20% of each load is recycled. Multiply the weight recorded at this facility by .80 to get the weight landfilled by Waste Industries.
   - B. Provide the total weight of materials that were recycled. *Note:* For Waste Industries Raleigh View Road C&D Processing Facility *only* - 20% of each load is recycled. Multiply the weight recorded at this facility by .20 to get the weight recycled by Waste Industries.
   - C. Total weight recycled (B) plus total weight salvaged (*#8 on Salvaged Material form*).
   - D. Total weight of all material generated by the project (A+B+C).
   - E. Divide the total weight diverted by the total project weight, then multiply by 100 to get the diversion rate as a percent ((C/D) x 100).

NC STATE UNIVERSITY

C&D WASTE AND RECYCLING TRACKING FORM

The University requires 75% of the waste produced from each project be diverted from the landfill

1.
Project Name & ID: _____

Project Manager Name: _____

2.
Name of Contractor: _____

Contractor Phone #: _____

Name of Person Completing Form: _____

For assistance completing this form contact Adam Bensley, NCSU Waste Reduction & Recycling (919) 515-0661

3.
It is required to attach weight tickets and/or invoices to this form.

Please check one: ☐ Weight tickets attached ☐ Weight tickets not attached. Provide explanation: _____

4.

Date	Waste Hauler/Contractor Name	Material Description	Weight (lbs or tons)	Estimate Weight if no Ticket	Recycling or Landfill Facility Hauled to
A	B	C	D	E	F

5.
Project Totals (Contractor to Calculate)

Total Weight Landfill: _____A_____

Total Weight Recycled: _____B_____

Total Weight Diverted (Recycled + Salvaged): _____C_____

Total Project Weight (Recycled + Salvaged + Landfilled): _____D_____

Percent of Project Waste Diverted from Landfill
(Total Weight Diverted / Total Project Weight) x 100

_____E_____%

If printing this sheet, the optimal size is 11”x17”

Description Of Program: The University has established a program to salvage building materials, parts and furnishings that would otherwise be considered construction and demolition waste. Prior to the beginning of construction and renovations projects on campus, Facilities Operations and other Donees will have an opportunity to reclaim C&D materials for reuse.

Facilities Operations Trade shops will have first priority in the invitation to salvage materials from construction and renovation projects. Other donees, such as Habitat for Humanity may receive dontation of reusable materials. The following conditions and procedure must be met in order to participate in the salvaged material/ reuse program.

Criteria:

Clear understanding of the purpose of the salvaged material/ reuse program.

Tracking the salvaged materials is extremely important to protect all participants from possible liability claims or false aquisition of materials by shops or donees.

Shop or donee is responsible for removal and transportation of materials.

Shop or donee has adequate second use or storage for the materials.

Shop or donee takes responsibility for the timely and lawful surplus or disposal of materials if an adequate reuse is not identified in an appropriate amount of time.

Questions? Contact WRR at 919.515.9421 or recycling@ncsu.edu

Return completed form to Waste Reduction and Recycling. Campus Box 7516 or recycling@ncsu.edu

NC STATE UNIVERSITY

CONSTRUCTION & DEMOLITION SALVAGED MATERIAL FORM

Project Name & ID: _____

Project Manager Name: _____

For assistance completing this form contact Adam Bensley, NCSU Waste Reduction & Recycling (919) 515-0661

Date	Material Description	Quantity	Weight Each Item (lbs or tons)	Estimated Donation Value	Released By (NCSU)	Released To & Phone #

Total Salvaged Material Weight: _____

Instructions for completing this form

6. NCSU project manager to provide info.

7. Complete one line for each item salvaged for reuse.
   A. List the date salvaged material was turned over to the receiving party.
   B. Describe the material being salvaged for reuse.
   C. Quantity of a particular item was salvaged.
   D. Weight of each item, either actual or estimated.
   E. Estimate the value of the material. If you are unsure, leave this blank.
   F. List the name of the person at NCSU who is releasing the material.
   G. List the name and phone number of the person who is receiving the material.

8. Add up the total weight of material salvaged. Keep the units (tons or pounds) consistent with those used on C&D waste tracking form, as this number will be used in the diversion rate equation.

NC STATE UNIVERSITY

CONSTRUCTION & DEMOLITION SALVAGED MATERIAL FORM

6.

Project Name & ID: _____

Project Manager Name: _____

For assistance completing this form contact Adam Bensley, NCSU Waste Reduction & Recycling (919) 515-0661

7.

Date	Material Description	Quantity	Weight Each Item (lbs or tons)	Estimated Donation Value	Released By (NCSU)	Released To & Phone #
A	B	C	D	E	F	G

8. **Total Salvaged Material Weight:** _____

If printing this sheet, the optimal size is 11”x17”

SECTION 01 10 00

SUMMARY

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
1. Project Information.
2. Work covered by Contract Documents.
3. Codes and Standards.
4. Specification and drawing conventions.
5. Miscellaneous provisions.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to the Work of all Sections in the Specifications. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all.

B. Conflicts or discrepancies among the Contract Documents shall be resolved in the following order of priority:
1. The Form of Contract, as modified by Contract modifications (Change Orders). Change Orders of later date take precedence over those instruments of earlier date;
2. The General Conditions, as modified by the Supplementary General Conditions;
3. Specifications;
   a. Specifications govern Drawings for quality and performance.
4. Drawings.
   a. Drawings govern Specifications for quantity and location.
   b. In the event of a conflict between small-scale detail drawings (e.g. less detailed, 1/8”=1”-0” scale) and large-scale detail drawings (e.g. more detailed, 1-1/2” = 1’-0” scale), the largest scaled drawings take precedence.

C. In the event of ambiguity or conflicts between Specifications and Drawings, the greater quantity and the better quality shall govern.

1.3 PROJECT INFORMATION

A. Project Identification: 820937.002 - Yarbrough Field Office.
   1. Project Location: 2411 Yarbrough Drive, Raleigh, North Carolina 27695.

B. Project Directory: Refer to Specification Section 00 01 10 "Title Page / Project Directory".

C. Project Web Site: A Project Web Site administered by Contractor will be used for purposes of managing communication and documents during the construction stage.
   1. See Section 01 31 00 "Project Management and Coordination" for requirements for establishing, administering, and using the Project Web Site.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of:
   1. This project is a tenant upfit of an empty suite within the 1924 section of Yarbrough Central Utility Plant (the original turbine room). The new use of the space is a field office for general contractor operations for an adjacent project at Mann Hall planned to be under construction.

1.5 CODES AND STANDARDS

A. All references to codes, specifications and standards referred to in the Contract Documents shall mean, and are intended to be, the edition referenced in the Appendix B as noted in the Project Drawings.

B. In addition to the codes, specifications and standards referred to in the Contract Documents all work provided under this Contract shall comply with the applicable provisions of the following, where standards conflict the more stringent shall apply:
   NC State Facilities – Design and Construction Guidelines - https://facilities.ofa.ncsu.edu/resources/guidelines/construction-guidelines/

1.6 SPECIFICATION AND DRAWING CONVENTIONS

A. Specifications Format: The Specifications are organized into Divisions and Sections using CSI/CSC's "MasterFormat 2020" 50-Division numbering system.
   1. Section Identification: Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence, without all numbers included in the sequence. Consult the Table of Contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
   2. The order of articles, paragraphs, subparagraphs, and sub-subparagraphs within the text of any specification section is defined by a sequence of indentations.

a. Article, paragraph and subparagraph titles, and other identifications of subject matter in the specifications are intended as an aid in locating and recognizing various requirements in the beginning words of a sentence.
b. Specification text governs over titling and is understood to be interpreted as a whole. Where a title establishes the subject, the titles are subordinate to and do not define, limit, or otherwise restrict the specification text.

3. The captions and headings of various subdivisions of the Contract Documents are intended only as a matter of reference and convenience for describing the Work and in no way define, prescribe, or limit the scope or intent of the Contract Documents or any subdivision thereof.

B. Specification Content: The 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 specifications and other Contract Documents is abbreviated. Words and meanings are to be interpreted as appropriate. Words implied, but not stated, are to be inferred as the sense requires. Singular words are to be interpreted as plural, and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the specifications. Requirements expressed in 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 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.
   b. Contract Documents may omit modifying words such as “all” or “any,” and articles such as “the” or “an.” The absence of a modifier or article from one statement that appears in another is not intended to affect the interpretation of either statement.
3. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
4. The specifications do not:
   a. Establish trade jurisdictions or divisions of responsibility.
   b. Define subcontract scopes of work.
5. Division 01 General Requirements: Requirements of sections in Division 01 apply to the Work of all sections in the specifications.
6. Work specified in any one section is related to, and dependent upon, Work specified in other sections, whether specific reference is made to the Work of other sections or not. Cross-references in the specifications are general references intended as a matter of convenience for aiding in the location general information and are not all-inclusive.

7. Names, telephone numbers, and website addresses and other contact information listed in the Contract Documents are for convenience only, are subject to change, and are believed to be accurate and up to date as of the printing of the Contract Documents.
8. Use of the word "including," when following any general statement, is not to be construed to limit such statement to specific items or matters listed, whether or not non-limiting language (such as "without limitation," "but not limited to," or other words of similar import) is used with reference thereto; but rather, deemed to refer to all other items or matters that could reasonably fall within the broadest possible scope of such general statement.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.7 MISCELLANEOUS PROVISIONS

A. Special Insurance: Contractor's Commercial General Liability insurance shall contain no exclusion that would deny coverage for any claim arising out of or contributed to by any fungus, mildew, mold, or resulting allergens. If such exclusion exists and cannot be removed by endorsement, Contractor shall submit proof of coverage for fungus, mildew, mold, or resulting allergens under a Pollution Legal Liability or Contractor's Pollution Liability policy.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 11 16

WORK BY OWNER

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
1. Owner Furnished equipment for Contractor Installation (OFCI).
2. Owner Furnished and Owner Installed equipment (OFOI).
3. Owner performed work.

1.2 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.

1.3 INSURANCE AND SAFETY

A. Work performed by Owner and/or Owner's Contractors must abide by the Contractor's insurance and safety requirements. Owner and Contractor shall coordinate logistics and schedule to ensure the safe installation of OFOI work.

PART 2 – PRODUCTS

2.1 OWNER FURNISHED EQUPMENT FOR CONTRACTOR INSTALLATION

A. None.

2.2 OWNER FURNISHED AND OWNER INSTALLED EQUIPMENT

A. Telecommunication Systems.

B. Audio Visual Systems.

C. Security and Low Voltage Systems.

PART 3 - EXECUTION

3.1 OWNER PERFORMED WORK

A. Division 01 – General Requirements
   1. All existing valves and circuits must be operated by NC State personnel.
   2. Various fittings not included in the specifications.

B. Division 26 – Electrical
   1. High voltage power lines through the duct bank to transformer.

C. Division 27 – Telecommunications
   1. Low Voltage systems.

D. Division 28 – Security & Access Control
   1. Low Voltage systems.

END OF SECTION

SECTION 01 14 00

WORK RESTRICTIONS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section Includes:
1. Owner's Representative.
2. Employee Screening.
3. Behavior Policy.
4. Working Hours.
5. Use of Premises.
6. Utility Interruptions.
7. Fire Alarm Shutdowns.
8. Hot Work Permits
9. Miscellaneous restrictions.

B. Related Sections include the following:
1. Section 00 60 00 "Project Forms" for the Outage Request Form and Method of Procedure Form to be submitted by the Contractor when requesting Utility Interruptions.
2. Section 01 55 00 "Vehicular Access & Parking" for additional requirements on access and parking.

1.2 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.

1.3 OWNER'S REPRESENTATIVE

A. NC State has designated a Project Manager to act as the Owner's Representative in all matters pertaining to construction contracts. All official contacts, decisions, directions, problem resolution, coordination and other liaison activities required from NC State will be through the Project Manager. This requirement does not modify the responsibilities of the Designer as stated in the General Conditions of the Contract. The Project Manager for this project is listed in the Project Directory.

1.4 BEHAVIOR POLICY

A. All construction personnel shall be respectful of all members of the NC State community.

B. Any incidents of disrespect, verbal abuse, threatening statements, unwelcome comments, unwelcome interaction or any form of harassment from any construction personnel toward any member of NC State community is strictly prohibited. Any such act shall constitute sufficient cause for NC State to remove any individual permanently from the project and all NC State property.

C. Any of the Contractor(s) project personnel who ignore or refuse to take action on any requirements of the contract documents or ignore or refuse to take immediate action to correct any endangerment to the health and safety of the public (as solely determined by NC State) shall be permanently removed from the project and NC State property.

D. If in the sole determination of NC State, it is in the best interest of the project and NC State to have any of the Contractor(s) personnel removed from the project, then the Contractor shall do so upon request by NC State. Such actions taken by NC State shall not constitute grounds for a delay claim. NC State will not be responsible for any delays caused to the project due to any individual being removed from the project by NC State.

1.5 WORKING HOURS

A. The Contractor may establish a work schedule of his own choosing. There are no restrictions regarding work hours, except as noted herein. The Contractor shall submit to NC State and to the Designer his regular daily work schedule and shall notify NC State in writing one week in advance of any deviations from the schedule.

B. NC State reserves the right to limit the Contractor's activities when they conflict with NC State operations at no additional cost or delay to the project. During times in which construction operations conflict with NC State operation, NC State may require the Contractor to cease all construction activities, limit activities to on-site only, modify working hours, make accommodations for access, restrict noise-making activities, or other limitations as determined by NC State. Instances in which construction operations may conflict with NC State operations include, but are not limited to, the following:
   1. Refer to NC State University website https://studentservices.ncsu.edu/calenders/ for calendars regarding academic, exam, events and closings.
   2. Study and Examination periods;
      a. Spring 2025: Thursday thru Wednesday, April 24th – 30th.
      b. Summer Session 2025: Wednesday, June 18th; Friday, June 20th; Monday & Tuesday, July 28-29;

c. Contractor may perform "light work" on these dates, provided it does not impact adjacent classroom buildings. No deliveries should be scheduled during these dates, unless specifically approved by NC State.

3. Graduation; Saturday, May 3, 2025
4. Athletic or Special events.
5. Student move in/move out days.
6. University Holiday Schedule:

Calendar Year 2025

New Year's Day	Wednesday, Jan. 1
MLK Jr. Day	Monday, Jan. 20
Memorial Day	Monday, May 26
Independence Day	Friday, July 4
Labor Day	Monday, Sept. 1
Thanksgiving	Thursday, Nov. 27
Day after Thanksgiving	Friday, Nov. 28
Winter Break	Wednesday, Dec. 24
Winter Break	Thursday, Dec. 25
Winter Break	Friday, Dec 26
Winter Break	Monday, Dec. 29
Winter Break	Tuesday, Dec. 30
Winter Break	Wednesday, Dec. 31

1.6 USE OF PREMISES

A. Parking & Staging Areas
1. Parking is extremely limited at NC State. Parking for personal vehicles on campus is not provided by NC State and is the responsibility of the Contractor. Contractors must limit parking of company vehicles and storage of materials to within the limits of the construction site and staging area.
2. The Contractor is required to follow NC State Transportation's Contractor Parking Policies as described online at: https://transportation.ncsu.edu/construction-parking-information/.
   a. Contractor parking will be coordinated by permits through the NCSU Transportation office. These costs will be incurred by the contractor.
3. Reserved Spaces & Staging Areas must be approved in advance by NC State's Project Manager and NC State Transportation. A current logistics plan must be submitted by the Contractor to NC State in order for any reserved spaces or staging areas to be approved. Contractor staging area as shown on the Drawings includes existing employee/staff parking which will be taken offline, the cost of which will be paid by Owner.

B. Traffic Movement & Interruptions
1. The Contractor shall make requests for approval for any street, alley, driveway or any access way to be closed at least fifteen (15) workdays prior to the date for the desired closing.

a. The request shall be accompanied by a proposed traffic control plan prepared by the Contractor detailing all signage and detour routes in accordance with MUTCD current revision requirements.
b. The plan must be reviewed and approved by Designer and NC State.

2. The Contractor shall close no street, alley, driveway or access-way without prior approval by NC State. Contractor shall only install a blockage after NC State has provided written approval of the proposed blockage.
   a. All blockages and detours shall be planned, subject to approval by NC State, considering handicapped access.
3. The Contractor shall install warning signs, barricades, and detour information signs to maintain traffic flow as directed by NC State, and in accordance with MUTCD requirements. If required, flagmen provided by the Contractor shall direct traffic around the construction area or detour area.
   a. At all times, pedestrian and vehicle traffic wayfinding around the construction limits must be maintained in a clean and safe condition.
4. NC State is a handicap accessible campus. All barricades, temporary walkways, excavations, and stockpiled materials shall be placed and/or constructed in such a manner as to accommodate, adequately warn, and protect all members of the campus community, as well as the general public. Contractor shall not block accessible pathways without providing suitable alternative accessible pathways as agreed upon by Designer and NC State. Owner reserves the right to reject or modify Contractor's Site Logistics Plan as necessary to ensure handicap accessibility throughout campus.
5. No excavations shall take place prior to placing proper barricades, lighting, and other devices as shall be required.

1.7 UTILITY INTERRUPTIONS

A. The Contractor shall ensure all campus utilities and other campus services are maintained throughout the Project, except for scheduled interruptions.

B. The Project anticipates, at a minimum, the following outages to occur:
   1. Electrical: The switch serving Yarbrough will need to be opened to deenergize the existing transformer and primary conductors. This will not impact any building beyond Yarbrough.
   2. Potable Water: The Contractor should be able to complete the proposed wet tap without cutting off service to the rest of campus.
   3. Sanitary Sewer: The proposed connections in Yarbrough should be completed with minimal downtime to the existing sewer.
   4. Storm Drainage: The proposed connections in Yarbrough should be completed with minimal downtime to the existing storm.
   5. TeleComm Ductbank: The installation of the new ductbank can be completed without any downtime but unsure about the switch from the old ductbank to the new ductbank. Expected to be minimal.

C. The Contractor shall submit an Outage Request to NC State's Project Manager at least fourteen (14) calendar days in advance for minor outages and thirty (30) calendar days in advance for major outages. While the Outage Request Form provided in Section 00 60 00 "Project Forms" lists shorter durations, the durations listed herein are required so all communication, collaboration, and coordination can occur to ensure a successful Outage.
   1. No utility interruption, regardless of the advance notice given, shall be undertaken without written approval from NC State.
   2. All Outage Requests for a utility interruption must include an Outage Request Form and a Method of Procedure (MOP) describing the sequence of operations for the work to be performed by the Contractor during the outage. Incomplete Outage Requests will not be processed.
   3. Upon receipt of the Outage Request Form and MOP, NC State will notify the Contactor that the Contractor can schedule a coordination meeting with NC State's Project Manager and appropriate personnel from the NC State Zone Shop or Department, and other interested parties, to discuss the Outage Request and the MOP.
      a. No outage will be scheduled without a coordination meeting.
   4. NC State may determine the utility service cannot be interrupted for the length of time or frequency requested by the Contractor.
   5. NC State will determine if an outage is considered major or minor.
   6. Examples of major outages include, but are not limited to, outages impacting:
      a. An entire building;
      b. An entire floor of a building;
      c. All or parts of several buildings;
      d. All or parts of an area;
      e. Any high voltage outage.

D. If requested by NC State, utility outages shall be performed after hours and/or at night, or over the weekend, or during holidays. No extra payment will be made for such work. Anticipated off-hour outages on the project are as follows:
   1. Electrical: The switch serving Yarbrough will need to be opened to deenergize the existing transformer and primary conductors. This will not impact any building beyond Yarbrough.
   2. Potable Water: The Contractor should be able to complete the proposed wet tap without cutting off service to the rest of campus.
   3. Sanitary Sewer: The proposed connections in Yarbrough should be completed with minimal downtime to the existing sewer.
   4. Storm Drainage: The proposed connections in Yarbrough should be completed with minimal downtime to the existing storm.
   5. TeleComm Ductbank: The installation of the new ductbank can be completed without any downtime but unsure about the switch from the old ductbank to the new ductbank. Expected to be minimal.

E. Certain activities of utility outages must be performed by NC State and cannot be performed by the Contractor. Examples of activities to be performed by NC State include, but are not limited to:

1. Operating existing electrical switches;
2. Turning existing water, chilled water, and steam valves;
3. Placing existing building systems back in operation;
4. Operating existing fire alarm systems.

F. While NC State will provide reasonable support to the Project at no cost to the Contractor, when the Contractor requires an additional or extra outage to complete their work because of a shortage of or improper materials, shortage of labor, poor coordination, failure to finish the work during the outage scheduled length of time, the Contractor will pay all expenses incurred for NC State's services for an additional outage(s) via deductive Change Order.

G. Signs and barricades (if applicable) for utility outage notice shall be written and placed as directed by NC State seven (7) workdays prior to the outage. No outage shall take place until signs and barricades (if applicable) are in place to notify and/or protect the public. Signs and barricades (if applicable) must be maintained throughout the outage.
1. Signs shall be neat and legible, hand-made signs are not acceptable.

H. The Contractor shall include in his base bid provisions for temporary utility equipment and services for the duration of the outage(s) required to complete the Project. Anticipated equipment and services for shutdowns on the project are as follows:
1. Sewer Pump Arounds
2. Powering systems by generator
3. Temporary HVAC

1.8 FIRE ALARM SHUTDOWNS

A. The Contractor shall schedule all fire alarm shutdowns to support the Project with NC State's Project Manager at least five (5) workdays in advance. Fire Alarm shutdowns must be conducted by NC State.

B. If at any time the fire alarm system is not in operation after normal working hours then the Contractor shall be required to employ a Fire Watch for the unprotected portion of the building, using a Fire Watch company approved by NC State's Fire Marshal.

1.9 HOT WORK PERMITS

A. When the Contractor is performing work that produces heat, flame, or sparks on or in an existing building or other structure the Contractor is required to obtain a "hot work" permit from NC State Environmental Health and Public Safety, Fire Protection Department. The department's requirements for the hot work program and permit can be found at the web link on the first page of this document. The EH&PS Hot Work Policy (rev. May 1, 2022) is appended to the end of this section.

https://policies.ncsu.edu/regulation/reg-04-15-02/

1.10 MISCELLANEOUS RESTRICTIONS

A. Controlled Substances: Use of tobacco products and other controlled substances on NC State's campus is not permitted. Refer to REG 04.20.03 – Smoking Regulation for University Facilities. https://policies.ncsu.edu/regulation/reg-04-20-03/
   1. Exception: Controlled substances as prescribed by a doctor are allowable provided appropriate documentation that does not violate HIPPA requirements is available.

B. Firearms are prohibited on all university property. Refer to REG 04.20.10 - Firearms, https://policies.ncsu.edu/regulation/reg-04-20-10-firearms/

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections:
1. Section 00 60 00 “Project Forms” for the Substitution Request Form.
2. Section 00 72 00 “General Requirements” for requirements on when Substitutions are allowable.
3. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
4. Section 01 33 00 “Submittal Procedures” for administrative requirements for submittals.
5. Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

1.2 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. Requests for substitution of materials, items, or equipment shall be submitted to the Project Designer for approval or disapproval; such approval or disapproval shall be made by the designer prior to the opening of bids. Substitutions after bidding are only allowed if it can clearly be demonstrated that the substitution is for the sole benefit of the Owner, and the Designer and Owner approve of the substitution.

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, as limited to the following conditions:
a. Unavailability of product within the Contract Duration;
b. Regulatory or significant manufacturing changes that prevent the manufacture or delivery the product;

c. Net savings to the project, either in Contract Duration or Project Cost. If there is a time savings, the Contractor must also return to Owner the corresponding savings to General Conditions. Contractor is responsible for Designers time to detail the substitution, which may negate Contractors proposed savings and be a net addition to the project cost, in which case the substitution would not be allowable.

2. Substitutions for Convenience: All other changes proposed by Contractor. Substitutions for convenience are not allowed.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution requests must be submitted by the Contractor in a timely manner so the request can be reasonably evaluated so as not to impact the Project Schedule. Delays resulting from the Substitution Request process shall not relieve the Contractor from its obligation to complete the project within the duration specified in the Contract Documents.
2. Substitution Request Form: Use "Substitution Request" form provided in Section 00 60 00 "Forms."
3. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Provide Contractor Name, address, and contact information for individual responsible for the substitution request.
   b. Provide Project Name, NC State Project Number, and SCO Project Number.
   c. Provide product specified, the specification section where specified, and the drawings where the product is indicated.
   d. Provide a statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
   e. 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, necessary to accommodate proposed substitution.
   f. 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.
   g. Product Data, including drawings and descriptions of proposed products and fabrication and installation procedures.
   h. Samples, where applicable or required.
   i. Certificates and qualification data, where applicable or requested.

j. List of similar installations for completed projects with project names and addresses and names, email, and phone number, of architects and owners.
k. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
l. Research reports evidencing compliance with building code in effect for Project.
m. 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.
n. Cost information, including a proposal of change, if any, in the Contract Sum.
o. 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.
p. 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.

4. Designers Action: If necessary, Designer will request additional information or documentation for evaluation within seven (7) calendar days of receipt of a request for substitution. Designer will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) calendar days of receipt of request, or seven (7) calendar days of receipt of additional information or documentation, whichever is later. Owner is to approve all substitution requests with Designer prior to Designer notifying Contractor of acceptance.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Bulletin for minor changes in the Work.
   b. Use product specified if Designer 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.

B. In proposing items for consideration, Contractor assumes all risk, costs, and responsibility for item's final acceptance, compliance with Contract Documents, integration into the Work, and performance.

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 fifteen (15) calendar days prior to time required for preparation and review of related submittals as defined by the submittal schedule.
   1. Conditions: Designer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Designer 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; meets or exceeds level of quality of specified product, equipment, assembly or system.
      b. The Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      d. Requested substitution does not affect dimensions or functional clearances.
      e. Requested substitution has received necessary approvals of authorities having jurisdiction.
      f. Requested substitution is compatible with other portions of the Work.
      g. Requested substitution has been coordinated with other portions of the Work; including coordinated installation and changes to other work at no additional cost to the Owner.
      h. Requested substitution provides specified warranty.
      i. 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.
      j. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Substitutions for Convenience: Not allowed unless otherwise indicated by NC State.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SUBSTITUTION REQUEST FORM

(For use after Procurement phase)

TO: Perkins&Will
411 W. Chapel Hill Street Suite 200
Durham, NC 27701

From: _____

_____

_____

Substitution Request No: _____ DATE: _____

Contractor hereby requests acceptance of the following product or system as a substitution in accordance with provisions of Division 01 Section "Substitution Procedures":

PROJECT SPECIFICATION

Specification Name/Number: _____
Article, Paragraph, Page Number: _____
Item/System to be Substituted: _____

REASON FOR SUBSTITUTION REQUEST

SPECIFIED PRODUCT . . .

- ☐ Is no longer available.
- ☐ Is unable to meet project schedule.
- ☐ Is unsuitable for the designated application.
- ☐ Cannot interface with adjacent materials.
- ☐ Is not compatible with adjacent materials.
- ☐ Cannot provide the specified warranty.
- ☐ Cannot be constructed as indicated.
- ☐ Other: _____
- ☐ Cannot be obtained due to one or more of the following:
  - ☐ Strike
  - ☐ Lockout
  - ☐ Bankruptcy of manufacturer or supplier
  - ☐ Similar occurrence

PROPOSED PRODUCT . . .

- ☐ Will reduce the Contract Time by _____ days.
- ☐ Will reduce the Contract Sum by $ _____.
- ☐ Is an Owner-initiated substitution.

Explanation of each item marked above (attach documentation):

_____

_____

EFFECT OF SUBSTITUTION

Proposed substitution affects other work or trades: ☐ No ☐ Yes (if yes, explain)

_____

_____

Proposed substitution requires dimensional revisions or redesign of architectural, structural, mechanical, electrical, plumbing, life safety, or other work:

☐ No ☐ Yes (if yes, attach data explaining revisions)

PRODUCT COMPARISON

Provide side-by-side comparison between proposed substitution and specified product to facilitate review of Substitution Request:

	SPECIFIED PRODUCT:	**PROPOSED PRODUCT:**
Manufacturer:	_____	_____
Name / Brand:	_____	_____
Catalog No.:	_____	_____
Supplier:	_____	_____
Features:	_____	Variations: _____
	_____ (Attach additional sheets if necessary)	_____ (Attach additional sheets if necessary)

Local Distributor or Supplier: _____

Manufacturer's Representative: _____

Maintenance Service Available: ☐ Yes ☐ No

Spare Parts Source and Location: _____

Warranty Available is equivalent to the specified warranty: ☐ Yes ☐ No _____ Years

Describe any variation from specified warranty: _____

Product Manufacturing History ☐ New ☐ 2-5 yrs ☐ 6-10 yrs ☐ More than 10 yrs old

SUPPORTING DATA ATTACHED (REQUIRED WHERE APPLICABLE)

☐ Point-by-point comparison of performance criteria, materials, and components of specified product with proposed substitution.

☐ Drawings ☐ Specifications ☐ Product Data ☐ Samples

☐ Tests ☐ Reports ☐ LEED Compliance ☐ Warranty

REFERENCED INSTALLATIONS

Identify at least **three** similar local projects on which proposed substitution was used:

PROJECT #1:

Project: _____ Date Installed: _____

Address: _____

_____

Owner: _____

Contact: _____ Telephone: _____

Architect: _____

Contact: _____ Telephone: _____

Contractor: _____

Contact: _____ Telephone: _____

PROJECT #2:

Project: _____ Date Installed: _____

Address: _____

_____

Owner: _____

Contact: _____ Telephone: _____

Architect: _____

Contact: _____ Telephone: _____

Contractor: _____

Contact: _____ Telephone: _____

PROJECT #3:

Project: _____ Date Installed: _____

Address: _____

_____

Owner: _____

Contact: _____ Telephone: _____

Architect: _____

Contact: _____ Telephone: _____

Contractor: _____

Contact: _____ Telephone: _____

ACKNOWLEDGEMENTS: The undersigned certify that:

- **Performance**: Proposed substitution has been fully investigated and determined to be equal or superior in all respects to the specified product, including appearance, quality, performance, code compliance, and sustainability compliance.
- **Warranty:** Same warranty will be furnished for proposed substitution as for specified product.
- **LEED Compliance (LEED projects only):** Same contribution to LEED program.
- **Operations and Maintenance**: Same maintenance service and source of replacement parts, as applicable, are available locally for the proposed substitution.
- **No Adverse Effect**: Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- **No Adverse Time or Cost**: Cost data and time as stated above are complete. Contractor bears all costs for labor and materials associated with fully integrating proposed substitution into the Project. Claims for additional costs or time related to accepted substitution which may subsequently become apparent are waived.
    - Payment will be made to the Owner for changes to the project design, including Architect's and Engineer's redesign fees and engineering, detailing, special inspection, and construction costs incurred by the Owner caused by acceptance of the substitution.
    - Coordination necessary to fully integrate the proposed substitution, and any associated modifications to related or adjacent Work, have been or will be performed.
- **Dimensions and Clearances**: Proposed substitution does not affect dimensions or functional clearances.
- **Conditions of Acceptance**: The Architect's recommendation for approval, if granted, relies on data submitted and the opinion and knowledge of the Architect at the time decision is rendered. The approval is conditional in nature and subject to reevaluation and reconsideration if additional data or materials are submitted, or coordination with other work is observed to invalidate claims that substitution is equal to item originally specified.

Contractor: _____

(Name of Contractor)

Date: _____ By: _____

Subcontractor: _____

(Name of Subcontractor)

Date: _____ By: _____

Note: *Substitution requests are not part of the standard submittal process and shall not be submitted as part of Shop Drawings, Product Data, or Samples submittals. Substitution requests must be filled out completely. Unresponsive or incomplete requests will be rejected and returned without review.*

ARCHITECT'S REVIEW AND ACTION

☐ Substitution acceptance is recommended.

☐ Substitution acceptance is recommended, with the following comments: _____

_____

☐ Architect's additional services proposal attached.

☐ Resubmit Substitution Request:

- ☐ Provide the following: _____
- ☐ Provide proposal indicating amount of savings / credit to Owner.

☐ Substitution acceptance is not recommended:

- ☐ Substitution Request received too late.
- ☐ Substitution Request received directly from subcontractor or supplier.
- ☐ Substitution Request not submitted in accordance with requirements.
- ☐ Substitution Request Form is not properly executed.
- ☐ Substitution Request does not indicate what item is being proposed.
- ☐ Insufficient information submitted to facilitate proper evaluation.
- ☐ Proposed product does not appear to comply with specified requirements.
- ☐ Design Team has no experience with product / manufacturer and is therefore unable to comment on the track record of quality, performance, or reliability.
- ☐ Proposed product will require substantial revisions to Contract Documents.

PERKINS&WILL

Perkins&Will acknowledges its reliance upon information provided by the Contractor, and makes no claim as to the accuracy, completeness, or validity of such information. If an accepted substitution is later found to not comply with requirements of the Contract Documents, the Contractor shall be solely responsible for performance of the work in accordance with requirements of the Contract Documents.

By: _____ Date: _____

OWNER'S REVIEW AND ACTION

☐ Substitution is accepted; Architect to prepare Change Order.

☐ Substitution is not accepted.

By accepting this substitution, Owner agrees to compensate Perkins+Will for additional services, if any, necessary to implement the substitution.

Additional Services: $_____

By: _____ Date: _____

(Owner's Representative)

END OF FORM

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes:
1. Minor Changes in the Work
2. Owner Initiated Proposal Requests
3. Equitable Value Change Orders (General Conditions Article 19 "Method c(2)")
4. Change Order Procedures
5. Field Orders
6. Weather Delays

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 29 00 "Payment Procedures" for administrative procedures for submitting and processing payment applications.

1.2 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.

1.3 DEFINITIONS

A. Overhead: Contractors cost to perform the General Conditions of the Contract and all general requirements detailed in Division 01 of the Specifications, including, but not limited to: project management, scheduling, home office expense, engineering and layout, reproduction expenses, shop drawing processing and coordination, supervision, coordination, small tools, all vehicle expenses, temporary facilities, safety provisions, as built drawings, estimating, and general overhead.

B. Labor Burden: Actual costs of labor burden, limited to including the following. Labor Burden shall not exceed thirty percent (30%) of the actual costs of labor.
1. Actual costs of Social Security (FICA) and Medicare/Medicaid taxes;
2. Unemployment insurance;
3. Health, dental, and vision insurance premiums;
4. Paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of thirty (30) days per year;

5. Retirement contributions;
6. Worker's compensation insurance premiums;
7. Costs of general liability insurance when premiums are computed on payroll amounts.

C. Rain Day (current definition):
1. Any day that rain exceeds one tenth of one inch (0.1").

D. Weather Day (potential definitions):
1. Precipitation that prevents work on the critical path from being performed for more than four (4) hours in a given day;
2. Project Site conditions, as a result of precipitation (regardless of whether such precipitation occurred on that day or a prior day), such as mud, pooling of water, ice, standing snow, or wet building component surfaces to the extent such site conditions prevent the performance of Work activities on the critical path;
3. Wind speeds, as measured by a project site gauge, exceeding those permissible to use equipment or to perform certain tasks safely (such as not being able to safely use or operate cranes or other aerial equipment) that prevent the performance of Work on the critical path;
4. Installation of temporary protection measures and/or dismantling of equipment necessary to prepare the Project Site for extreme weather events, such as named storms and flooding; removal of temporary protections, clean-up, and restoration of Project Site that prevent the performance of critical path activities.

1.4 ACTION SUBMITTALS

A. Five Year Climatic Average: No later than fifteen (15) workdays prior to mobilization, submit a five (5) year climatic range average based on statistics kept by the National Weather Service at Raleigh-Durham International Airport.

1.5 MINOR CHANGES IN THE WORK

A. Designer may issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on "Bulletin" form included in Section 00 60 00 "Project Forms."

1.6 OWNER INITIATED PROPOSAL REQUESTS:

A. Designer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time on "Proposal Request" form included in Section 00 60 00 "Project Forms". If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Bulletins with "Designers Request for Contractor's Proposal" indicated, issued by Designer are not instructions either to stop work in progress or to execute the proposed change.

B. Within seven (7) calendar days after receipt of Bulletin, or within a duration mutually agreed upon in writing by Owner, Designer, and Contractor, the Contractor shall submit a written proposal to Owner estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

C. Owner Initiated Proposal Request Format:
   1. Use "Change Order Request" Form included in Section 00 60 00 "Project Forms" or similar form approved by Designer and Owner as a cover page for the Change Order Request.
   2. Backup to support the Change Order Request conforming to the requirements of Equitable Value Change Orders as described herein.
   3. Complete "HUB Change Order Form" included in Section 00 60 00 "Project Forms".
   4. Contractor's Schedule Update Report conforming to the requirements of Section 01 32 16 "Construction Progress Schedule". In the narrative portion of the Schedule Update Report, describe the effect of the changes requested, 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.
   5. Completed "HUB Utilization Form" as included in Section 00 21 26 "Guidelines for Recruitment and Selection of Minority Businesses for Participation in the University of North Carolina Construction Contracts".
   6. Surety Certification: In the Change Order Request, Contractor shall include a signed statement that states: "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." Contractor shall only notify Surety of change in contract value after a Change Order has been issued but shall include the statement in each Change Order Request.

1.7 CONTRACTOR INITIATED PROPOSALS:

A. If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a Change Order Request to Designer and Owner. Claims must be submitted by the Contractor to NC State and Designer within seven (7) calendar days in accordance with Article 20 of the General Conditions.
   1. Use "Change Order Request" Form included in Section 00 60 00 "Project Forms" or similar form approved by Designer and Owner as a cover page for the Change Order Request.
   2. A written description 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.
   3. Backup to support the Change Order Request conforming to the requirements of Equitable Value Change Orders as described herein.

4. Complete "HUB Change Order Form" included in Section 00 60 00 "Project Forms".
5. Contractor's Schedule Update Report conforming to the requirements of Section 01 32 16 "Construction Progress Schedule". In the narrative portion of the Schedule Update Report, describe the effect of the changes requested, 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. Completed "HUB Utilization Form" as included in Section 00 21 26 "Guidelines for Recruitment and Selection of Minority Businesses for Participation in the University of North Carolina Construction Contracts".
7. Surety Certification: In the Change Order Request, Contractor shall include a signed statement that states: "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." Contractor shall only notify Surety of change in contract value after a Change Order has been issued but shall include the statement in each Change Order Request.

1.8 EQUITABLE VALUE CHANGE ORDERS

A. When the method of determining the value of a change order is considered to be an equitable value for the work instead of being controlled by predetermined unit prices, the Contractor, Designer, and Owner shall negotiate and agree upon the equitable value of the change prior to issuance of the Change Order.

B. The change order cost breakdown shall differentiate between work performed by the General Contractor and work performed by Subcontractors.

C. The Change Order shall be organized in a manner consistent with the Schedule of Values of the contract, as detailed in Paragraph 1.5.B of Section "01 29 00" Payment Procedures".

D. The change order cost breakdown shall include the following items:
   1. Labor
      a. Number of hours worked
      b. Unburdened Labor Rate for each worker
      c. Actual cost of Labor Burden (not to exceed 30%)
      d. Overtime, or extra pay for holidays or weekends, may only be a cost item if approved by Owner.
   2. Material
      a. Quantity
      b. Unit cost of materials, including supporting invoices from material suppliers for all materials being submitted for
      c. Sales tax
   3. Tools & Equipment
      a. Quantity

b. Unit prices for rental for tools (excluding hand tools), equipment, machinery, fuel (if required) and temporary facilities required for the work, including supporting invoices from tool & equipment suppliers for all tools & equipment being submitted for.

4. Bonds, Insurance, & Permitting
   a. Actual costs of premiums for bonds, insurance, and permit fees.
5. Markups for Overhead & Profit (Additive Change Orders)
   a. All contractors (i.e. all General Contractors, Subcontractors, and tiered subcontractors) shall be allowed a maximum of ten percent (10%) on work they self-perform.
   b. The General Contractor shall be allowed a maximum of five percent (5%) on contracted work of the 1st tier Subcontractor.
   c. 1st tier Subcontractor shall be allowed a maximum of two and a half percent (2.5%) on contracted work with the 2nd tier Subcontractor.
   d. 2nd tier Subcontractor shall be allowed a maximum of two and a half percent (2.5%) on contracted work with the 3rd tier Subcontractor.
   e. 3rd tier Subcontractor shall be allowed a maximum of two and a half percent (2.5%) on contracted work with the 4th tier Subcontractor.
6. Markups for Overhead & Profit (Deductive Change Orders)
   a. In the case of deductible change orders, the Contractor shall include no less than five percent (5%) profit in the deduction, but no deduction for overhead.
7. Time
   a. In the event that the Change Order Request includes a change to the project duration, the Change Order Request shall include the revised project duration and revised dates of Final Acceptance and Final Acceptance.
   b. Not all time extensions are compensatory. Extended General Conditions for the Contractor will only be allowed in specific circumstances as described in Section 00 72 00 "General Conditions" Article 23.

E. Subcontractors pricing and backup shall conform to the "Change Order Request" Form included in Section 00 60 00 "Project Forms" or similar form approved by Designer and Owner, with the inclusion of the Subcontractors letterhead.

F. For change orders that delete any part of the work within the change order and/or contain deductive costs, the back up shall show the original material and labor for the deleted work or costs.

G. If the change order contains both adds and deducts for the same type of work then the material unit and labor unit costs shown on the back up for the deleted work and the added work shall be the same and the net difference shown.

H. Deductive change orders shall show the proper reduction in OH&P and the bond.

I. Failure by the Contractor to provide the information requested in this paragraph shall result in rejection of the change order by the designer and a request for re-submittal. Delay in the processing of the change order due to lack of proper submittal by the Contractor in accordance with this paragraph, or due to errors in the change order calculations shall not constitute grounds for a time extension or basis for a claim.

1.9 CHANGE ORDER PROCEDURES

A. Submission of Change Order Request
   1. The Contractor shall prepare a Change Order Request conforming to the requirements herein for either an Owner Requested Proposal Request or a Contractor Initiated Proposal and submit the Change Order Request to the Designer for review.

B. Review of Change Order Request
   1. The designer shall review the Change Order Request to verify correctness and determine if the Contractor's proposed costs are equitable.
   2. If the Designer determines the Change Order Request is correct and agrees to its accuracy, the Designer will forward the Change Order Request to NC State for their review.
   3. If NC State determines that the cost is equitable then NC State shall notify the Designer of their acceptance.
   4. If either the Designer or NC State determines the Change Order Request is incorrect, or the cost has not been agreed upon by the designer and NC State then the Designer shall notify the Contractor that the proposal is rejected and the proposal shall be resubmitted.

C. Interscope / Issuance of Change Order
   1. Once Change Order Requests have been reviewed and approved by the Contractor, Designer and NC State, the Designer shall initiate a Change Order in the State Construction Office (SCO) web-based Interscope program to incorporate the, or multiple, Change Order Request(s) into the Contract Documents. All Change Orders shall be processed for signatures electronically through Interscope. Directions for using Interscope shall be provided at the Preconstruction Conference.

1.10 FIELD ORDER

A. Designer may issue a Field Order on "Field Order" Form included in Section 00 60 00 "Project Forms".

B. Field Order instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Field Order 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.

C. Contractor shall maintain detailed records on a time and material basis of work required by the Field Order. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.11 WEATHER DELAYS

A. The Contractors Superintendent shall maintain Daily Weather Logs kept at the jobsite showing the effect of the weather on the progress of the critical path work and the critical path schedule, both initialed by the designer's project representative. All contract time extension requests must incorporate these work logs.

B. The Contractor may only be entitled to an extension of the contract period for the number of rain days that exceed the normal number of rain days for any given month.

C. For the purpose of determining extent of delay attributable to unusual weather, a determination shall be made by comparing the Five Year Climatic Average submittal to the Daily Weather Logs prepared by the Contractor.

D. Time extensions for weather delays do not entitle the Contractor to "extended overhead" recovery and are in all other ways non-compensable.

E. Not all rain days above the normal number of rain days will warrant a contract time extension. Justification for the request for rain related contract time extensions must also be based on the effect of the rain on critical path work activity in progress during the period of the request and additionally be predicated on the Contractor's diligent prosecution of the work.
   1. No additional rain days shall be granted for building projects after the building has been "dried-in" as determined by the designer.

F. Requests for contract time extensions based on rain days must be received by the designer on or before the 20th day of the month immediately following the month in which the rain occurred. The request must include all required documentation. All parties to this contract agree that the Contractor has no right to claim a contract time extension if the request is not received by the designer in strict accordance with the procedure set forth in this paragraph.

G. For other types of weather delays, the Contractor is granted one (1) day of contract extension for each day NC State is closed due to weather.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 26 13

REQUEST FOR INTERPRETATION (RFI)

PART 1 – GENERAL

1.1 REQUEST(S) FOR INTERPRETATION (RFI)

A. General: A Request for Interpretation (RFI) is a Contractor initiated, Owner or Designer formatted, written instrument related to the execution of the Work that is addressed to the Designer. The RFI shall be used by the Contractor as the means for it to ask questions related to the Work; subject to the conditions contained within this article.
   1. An RFI which fails to conform to the requirements stated herein, (i.e, is incomplete or contains numerous errors) shall be returned to the Contractor for its completion/rectification without benefit of the Designer's response, in addition, no adjustments for Contract Time or Contract Sum shall be granted for an RFI failing to conform to the requirements stated herein.
   2. Each RFI shall be submitted with such promptness as to cause no delay in the Contractor's own work and in that of any subcontractor. No adjustments of Contract Time or Contract Sum will be granted because of failure to have an RFI submitted with sufficient time to allow for the orderly processing of a response by the Designer.

B. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in a prompt manner to avoid delays in Contractor's work or the work of its Subcontractors.

C. Authorship:
   1. Each RFI shall originate solely from the Contractor. An RFI submitted to the Designer by an entity, or individual, other than the Contractor (i.e. a Subcontractor) shall be returned to the Contractor.

D. Prohibitions: RFIs shall not be used for the following:
   1. To solicit consideration by the Designer of a "substitution."
   2. To request an adjustment of the Contract time.
   3. To request an adjustment of the Contract sum.
   4. To solicit comment clarification(s) of any required submittal or shop drawing review that was transmitted by the Designer to the Contractor, unless the comments provided conflict with the Contract Documents.
   5. RFIs shall not be used to transfer coordination responsibility from the Contractor to the Owner or the Designer.

E. Procedure:

1. The Contractor shall submit all RFIs on the form supplied in Section 00 60 00 "Project Forms" or on a form approve by the Designer and Owner.
2. Each blank on the RFI form shall be filled in.
3. Each RFI shall be typewritten and shall be forwarded to the Designer electronically.
4. Each RFI shall address one subject.
5. Each RFI shall contain specific reference to the drawing number(s), detail number(s), schedule type(s), bulletin number(s), specification section(s) and paragraph number(s), or other related document(s) which is (are) pertinent to the Contractor's question. The date of each referenced drawing number, bulletin, specification section or other related document shall be identified. In preparing each RFI verify the applicable dimension(s), field conditions, drawing requirements (small through large scale details), and/or specification section requirements pertaining thereto. Prior to submission of the RFI coordinate the nature of the inquiry with the requirements of other sections or trades as related thereto and responses to previous RFIs. Where supplementary sketches are required to clarify an inquiry the Contractor shall attach supplementary sketches, at large scale, illustrative of the inquiry. Sketches shall include sufficient detail, materials, dimensions, thicknesses, assembly, attachments, relation to adjoining work, structural grid references, and all other pertinent data and information for the Designer to make an informed response.
    a. The Contractor is encouraged to suggest solution(s) to its inquiries, if applicable. Should the Contractor's solution(s) have an impact on Contract Sum or Contract time it shall be so stated within the RFI.
6. Each RFI shall be dated and sequentially numbered.
7. Each RFI shall be reviewed, and signed, by the RFI Manager prior to transmitting to the Designer.
8. Duration of RFI Response Upon Receipt: Seven (7) calendar days, pending complete information.
    a. If Contractor requires a response within seven (7) calendar days due to the RFI impacting work on the critical path of the project, Contractor shall make all reasonable efforts to submit the RFI in a timely manner, note on the RFI that the RFI impacts work on the critical path and identify the deadline for a response, and verbally communicate (i.e. in person, or over the phone) with the Designer that the specific RFI needs to be expedited. This exception should only be utilized as necessary to ensure the timely completion of the project. Contractor shall not frequently rely on this exception to ensure timely completion of the project.
9. RFIs rejected for incomplete information shall not be logged, or shall be logged separately and clearly identified from outstanding RFIs with complete information.
10. RFIs that contain content on the prohibitions list shall be excluded from RFI logs, and be resubmitted properly or tracked in a manner applicable to the request.

11. RFIs received by Designer after 1:00 p.m. will be considered as received the following working day.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by RFI Number. Submit RFI Log to Designer and Owner weekly. Use RFI Log Form included in Section 00 60 00 "Project Forms", or similar form approved by Designer and Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 – GENERAL

1.1 SUMMARY

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

B. Related Sections include the following:
1. Section 00 60 00 “Project Forms” for miscellaneous forms required to be submitted with each Payment Application.
2. Section 00 21 26 “UNC System MB Guidelines & Forms 2024” for HUB forms required to be submitted with Payment Applications.
3. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
4. Section 01 31 00 “Project Management & Coordination” for administrative procedures for the requirements of the Subcontractor and Vendor list.
5. Section 01 32 16 "Construction Progress Schedule" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule.
6. Section 01 32 33 “Photographic Documentation” for administrative requirements governing preparation and submittal of Construction Photographs.
7. Section 01 35 23 “NCSU Safety Requirements” for administrative requirements governing the preparation and submittal of the Monthly Safety Report.
8. Section 01 44 00 “Quality Requirements” for administrative requirements governing the Schedule of Tests and Inspections.
9. Section 01 50 00 “Temporary Facilities & Controls” for administrative requirements governing the preparation of the Site Logistics Plan, Erosion-and Sedimentation-Control Plan, Fire-Safety Program, Moisture-Protection Plan, Dust-and HVAC Control Plans, and Vibration Control Plan, as required by project scope of work.
10. Section 01 74 19 “Construction Waste Management & Disposal” for administrative requirements governing the preparation of Construction Waste Management Plan to be submitted by Contractor with Initial Application for Payment.
11. Section 01 77 00 “Closeout Procedures” for the administration requirements for Final Acceptance and the Final Payment Checklist.

1.2 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.

1.3 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 PAYMENTWORKS

A. N.C. State uses PaymentWorks, a third-party onboarding platform that eliminates the risk of business payments fraud and ensures regulatory compliance by automating the complex payee management process.

B. Prior to any payment being made from N.C. State to the Contractor, Contractor must complete the PaymentWorks supplier registration process.

1.5 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Items required to be indicated as separate activities in Contractor's Construction Schedule.
   2. Submit the Schedule of Values to Owner and Designer at earliest possible date but no later than fifteen working days before the date scheduled for submittal of initial Applications for Payment.
      a. Initial format of Schedule of Values must be approved by the Owner and Designer prior to submission of the initial Application for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. NC State Project Name and location.
      b. NC State Project Number, Code & Item, and State Construction Office Project Number.
      c. Designer's name and address.
      d. Contractor's name and address.

e. Date of submittal.

2. Schedule of Values Organization:
   a. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents.
   b. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      1) Related specification section.
      2) Description of the Work.
      3) Name of subcontractor.
      4) Name of manufacturer/fabricator.
      5) Name of supplier.
      6) Change Orders that affect value.
      7) Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
         (a) Labor.
         (b) Materials.
         (c) Equipment.
   c. Provide at least one line item for each Specification Section listed in the Table of Contents, except for Divisions 00 and 01.
      1) The following sections shall be used for Contractors Division 00 and 01 costs:
         (a) General Conditions.
         (b) Cleaning.
         (c) Temporary Facilities.
         (d) Builders Risk Insurance.
         (e) Bonding.
         (f) Insurance Programs separate from Builders Risk.
         (g) Project Closeout.
         (h) Fee.
   d. When the work of a Specification Section is to be performed by multiple Subcontractors, at least one line item for each Subcontractor shall be provided.
   e. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum.
   f. Break down principal subcontract amounts into separate labor and materials items.
   g. Breakdown of subcontractor's schedule of values must be true and accurate.
   h. For line items associated with the minority business subcontractor or supplier as identified in Contractor’s Affidavit C “Portion of the Work to be Performed by HUB Certified/Minority Businesses”.
3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

4. Schedule of Values Updating: Update and resubmit the Schedule of Values no less than seven (7) calendar days before the next Application for Payment when a Change Order(s) results in a change in the Contract Sum for either the Contractor or one of its Subcontractors. Format each change order as described throughout paragraph 1.5.B of this Section. Organize the Schedule of Values so that Change Order(s) are grouped together.
5. 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.
6. Provide separate line items in the Schedule of Values for each part of the Work where Applications for Payment may include cost of submittals.
   a. Cost for submittals shall represent true cost of submittals preparation, as evidenced by subcontractor invoices, but not to exceed 5 percent of the total value of that item of work line item.
7. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
8. 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.
9. 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.

1.6 APPLICATIONS FOR PAYMENT

A. Each Application for Payment package shall be organized as follows, with each section meeting all the requirements described in subsequent paragraphs herein:
   1. Signed cover letter on Contractor’s letterhead describing the Payment request including, but not limited to, the NC State Project Number, Code & Item, State Construction Office Project Identification Number, the date of the request, month covered in the application and the number of the application, amount of the request, and a list of included documents.
   2. Payment Application Forms.
   3. A Consent of Surety Letter that includes the surety’s consent to the progress payment and the amount of the payment.
   4. Sales Tax Forms, organized by Contractor’s summary with Subcontractor backup.
   5. Updated Schedule Report, as described in Section 01 32 16, “Construction Progress Schedule”.
   6. MBE Appendix “E” Form with accurate subcontract amounts and amounts paid.
   7. Stored Materials (if applicable), organized by Contractor’s summary with Subcontractor backup.
   8. Waivers of Mechanic’s Lien.
   9. Supplemental Information.

B. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Designer and paid for by Owner.
   1. Initial Application for Payment, and Application for Payment at time of Final Acceptance, involve additional requirements.

C. Payment Application Transmission & Times: Not later than the fifth day of the month, the Contractor shall electronically submit a signed and notarized copy of each Application for Payment to Designer, transmitted within 24 hours of signature.

D. Payment Application Forms: Use AIA Document G702 (Application & Certificate for Payment) and AIA Document G703 (Continuation Sheet) as form for Applications for Payment.

E. Application Preparation: Complete every entry on the form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Designer will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of 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 issued before the last day of construction period covered by application.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration, if any.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed.
   1. The following requirements apply for Stored Materials:
      a. Differentiate between items stored on-site and off-site.
      b. Materials must be customized or fabricated specifically for the project. No raw materials (including, but not limited to piping, conduit, CMU, metal studs and gypsum board, etc.) may be billed as stored materials.
      c. Contractor is responsible for stored materials and equipment shall remain with the Contractor regardless of ownership title.
      d. For items stored off-site, the following conditions apply.
         1) Material must be stored in an independent, licensed, and bonded warehouse approved by Designer, Owner, State Construction Office, Contractors Insurance Company, and Contractors Surety.
         2) Material stored must be clearly identified as NC State property.
         3) The warehouse shall be located as close to the project site as possible.
         4) Designer must verify that material is stored in compliance with Stored Materials requirements herein.
   2. The Stored Materials backup to be included in the Payment Application is as follows:

a. Stored Material Summary. Using the standard form provided in Section 00 60 00, provide summary documentation for stored materials indicating the following:
   1) Materials previously stored and included in previous Applications for Payment.
   2) Work completed for this Application utilizing previously stored materials.
   3) Additional materials stored with this application.
   4) Total materials remaining stored, including materials with this application.
b. Designer's verification of materials.
c. Provide description of item(s) being stored.
d. Location of the warehouse(s) where materials or equipment is stored, and warehouse approval letters from each of: Designer, Owner, State Construction Office, Contractor's Insurance Company, and Contractor's Surety.
e. Bill of sale made to Owner stating there will be no additional cost for transportation and delivery of the stored item(s).
f. Statement certifying that item, or any part thereof, will not be installed in any construction other than Work under this Contract.
g. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials (separate from consent of surety to overall payment application).
h. 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.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit notarized waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   1. Submit a current Subcontracts and Vendor List.
   2. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
   3. When an application shows completion of an item, submit final or full waivers.
   4. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   5. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   6. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. Supplemental Information: With each Application for Payment, but as separate files, submit the following reports, logs, and submittals:

1. Submittals Schedule updated the same day of the application. After 50% complete on the contract duration, include closeout submittals in a separate Closeout Submittal Schedule.
2. Construction Photographs taken within 2 days of the application for payment documenting progress in the areas under construction.
3. Change Order Log showing issued change orders and potential change orders updated the same day of the application.
4. RFI Log updated the same day of the application.
5. Daily Construction Reports for each workday during the application period.
6. Meeting minutes for meetings conducted by the Contractor during the application period.
7. Monthly Safety Report.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. Copy of executed Agreement between Owner and Contractor.
2. List of subcontractors, principal suppliers and fabricators.
3. Schedule of values.
4. Contractor’s construction schedule.
5. Products list (preliminary if not final).
6. List of Contractor's staff assignments and principal consultants.
7. Copies of permits submitted by Contractor (if any).
8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
9. Initial progress report.
10. Report of preconstruction conference.
11. Certificates of insurance and insurance policies.
12. Performance & payment bonds.
13. Preconstruction Photographs.
14. Submittal Schedule
15. Construction waste management program.
16. Site logistics & temporary security plans.
17. Erosion- and Sedimentation Control Plan (if project scope involves site work).
18. Fire-Safety Program.
19. Moisture Protection Plan.
20. Dust and HVAC Control Plan.
21. Site Specific Safety Plan.
22. Contractors Site Specific Quality Control Plan.
23. Noise & Vibration Control Plan
24. Schedule of Tests & Inspections

J. Payment Applications During Construction: Submit changes in submittals schedule, construction schedule, and other schedules with each application for payment.

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

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Final Acceptance issued previously for Owner occupancy of designated portions of the Work.

L. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Contractor's Affidavit for Release of Liens.
2. Contractor's Affidavit of Payment of Debts and Claims.
3. Consent of Surety for Final Payment.
4. Certificate of Compliance (Completed by Designer)
5. Certificate of Completion (Completed by Designer)
6. Completed Tax Statement and Form.
7. MBE Appendix "E" Form with accurate subcontract amounts and amounts paid.
8. Survey of New and Existing Sub-Surface Utilities.
9. Warranties & Guarantees required by the Contract Documents.
10. Evidence of completion of Project closeout requirements, including, but not limited to:
    a. Transmittal of required Project Record Documents to Owner.
    b. Evidence of completion of demonstration and training.
    c. Transmittal of Attic Stock.
    d. Reconciliation of Allowances.
11. Builders Risk Insurance Cancellation Notice.
12. Certificates of State Agencies required by State Law.
13. Certification all keys issued to Contractor have been returned to N.C. State Lock Shop.
14. Certification of no outstanding utility bills.
15. Final Completion Construction Photographs.

1.7 REVIEW OF APPLICATION FOR PAYMENT

A. Draft Copy: Submit draft (pencil) copy of the Application for Payment ten days prior to due date for review by Designer.

B. Draft Copy Review Meeting: The Owner, Designer and Contractor shall meet prior to payment application due date to review the draft (pencil) copy of the Application for Payment, as specified in Section 01 31 19 "Project Meetings." Questions resulting from this review shall be answered by the Contractor and clarified prior to receipt of the official copy of the Application for Payment.

C. Upon receipt of the official Application for Payment and other documentation as required by the Designer and Owner, the Designer shall review the documents received to determine if they correspond to the agreements reached during the draft copy review meeting. If necessary, the Contractor shall revise the Application for Payment to correspond to the agreements reached, execute the Certificate for Payment, and forward the executed copies to the Owner.

D. The Owner and Designer will rely on the accuracy and completeness of the information furnished by the Contractor. Issuance of a Certificate of Payment, and subsequent payment thereof will not be deemed to represent that the Owner or Designer performed audits of the supporting data and does not waive Owner's right to audit the project.

1.8 INSPECTION & AUDIT

A. Contractor's "records" shall upon reasonable notice be open to inspection and subject to audit and/or reproduction during normal business working hours. An NC State representative or an outside representative engaged by NC State may perform such audits. NC State or its designee may conduct such audits or inspections throughout the term of this contract and for a period of three years after final payment or longer if required by law.

B. Contractor's records as referred to in this contract shall include all information, materials and data of every kind and character, including without limitation the following:
   1. Records
   2. Books
   3. Documents
   4. Subscriptions
   5. Recordings
   6. Agreements
   7. Purchase Orders
   8. Leases
   9. Contracts
   10. Commitments
   11. Arrangements
   12. Notes
   13. Daily diaries
   14. Superintendent reports
   15. Drawings
   16. Receipts
   17. Vouchers and memoranda, and
   18. Any and all other agreements, sources of information and matters that may in NC State's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Document.

C. Such records shall include (hard copy, as well as computer readable data if it can be made available):
   1. written policies and procedures;
   2. time sheets;
   3. payroll registers;
   4. payroll records;
   5. cancelled payroll checks;
   6. subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.);
   7. original estimates;
   8. estimating work sheets;
   9. correspondence;
   10. change order files (including documentation covering negotiated settlements);
   11. back charge logs and supporting documentation;
   12. invoices and related payment documentation;
   13. general ledger entries detailing cash and trade discounts earned;
   14. insurance rebates and dividends; and
   15. any other Contractor records which may have a bearing on matters of interest to NC State in connection with the Contractor's dealings with NC State (all foregoing hereinafter referred to as "records") to the extent necessary to adequately permit evaluation and verification of:
      a. Contractor compliance with contract requirements,
      b. Compliance with NC State's business ethics policies, and
      c. Compliance with provisions for pricing change orders, invoices or claims submitted by the Contractor or any of his payees.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SUMMARY

A. This 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. Digital Data Files.
   5. Construction Management Software.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 01 26 13 “Requests for Information” for requirements associated with RFIs.
   2. Section 01 31 19 “Project Meetings” for requirements associated with project meetings.
   3. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule.
   4. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontractor and Vendor List: Within fifteen (15) calendar days of Notice to Proceed, prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A in Section 00 60 00 "Forms", or similar form approved by Designer and Owner. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in various 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.
4. Arrange pipes, ducts, conduits, and other overhead systems in an orderly manner when indicated to remain exposed.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

D. Conservation: Coordinate construction activities to ensure operations are carried out with consideration given to conservation of energy, water, and materials.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 ACTION SUBMITTAL - COORDINATION DRAWINGS

A. The Contractor shall submit a BIM Execution Plan and Schedule within fifteen (15) calendar days of Notice to Proceed and develop a BIM Coordination Model that satisfies the general industry definition for Level of Detail (LOD) 300.

B. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Contractor shall prepare MEPFP Coordination Drawings and submit to Designer and Owner within 45 days after initial coordination meeting.
   2. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      f. Indicate required installation sequences.
      g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Designer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

C. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
    a. Runs of vertical and horizontal conduit 1 inch (25.4 mm) in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Telecommunications Work: Show the following:
    a. Runs of vertical and horizontal conduit 1 inch (25.4 mm) in diameter and larger.
    b. Location of pull boxes and junction boxes, dimensioned from column center lines.
10. Audiovisual Work: Show the following:
    a. Runs of vertical and horizontal conduit 1 inch (25.4 mm) in diameter and larger.

b. Location of pull boxes and junction boxes, dimensioned from column center lines.

11. Security & Access Control Work: Show the following:
    a. Runs of vertical and horizontal conduit 1 inch (25.4 mm) in diameter and larger.
    b. Location of pull boxes and junction boxes, dimensioned from column center lines.
12. Architectural Work: Show the following:
    a. Any features identified in the Drawings as requiring coordination with other trades listed herein.
13. Review: Designer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Designer or Owner determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Designer will so inform Contractor, who shall make changes as directed and resubmit.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: DWG, version within two (2) years of the Notice to Proceed, operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and Portable Data File (PDF) format.
    a. Refer to Section 01 77 00 “Closeout Procedures” for additional requirements for CAD files to be included in the closeout documents.
3. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
    a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Designer.

1.6 DIGITAL DATA FILES

A. Designer will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
1. Designer makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
2. Digital Data Software Program: Drawings are available in Autodesk Revit 2023.
3. Digital data files will be provided in the software and format that is used to prepare the Contract Documents. Translations to different programs or modifications to the drawing setup will be the responsibility of the Contractor.
4. Contractor shall execute a data licensing agreement proceeding this section.

B. Digital Execution Conference: schedule and conduct a digital execution conference before starting construction, at a time convenient to Owner Architect, and Contractor.
   1. Attendees: Authorized representatives of Owner, Architect, Architect's consultants, Contractor, Contractor's 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.
   2. Agenda: Discuss items of significance that could affect the exchange of digital information, including but not limited to the following:
      a. Electronic file transfer requirements and protocols.
      b. Right of reliance on Architect’s and Architect’s Consultants digital files.
      c. Schedule of digital file transfers and periodic updates.
   3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes using PIMS.

1.7 CONSTRUCTION MANAGEMENT SOFTWARE

A. Construction Management Software is also otherwise referenced as “PIMS” throughout the specifications.

B. Provide, administer, and use a Construction Management Software (e.g. Plangrid, Procore, or similar) for purposes of hosting and managing project communication and documentation, that is mobile device compatible, until Final Acceptance. Construction Management Software shall include the following functions:
   1. Project directory.
   2. Project correspondence.
   3. Meeting minutes.
   4. Contract modifications forms and logs.
   5. Processing and tracking payment applications.
   6. RFI forms and logs.
   7. Task and issue management.
   8. Project communication tracking.
   9. Workflow planning.
   10. Photo documentation.
   11. Schedule and calendar management.
   12. Submittals forms and logs.
   13. Drawing and specification document hosting, viewing, and updating.
   14. Online document marking and collaboration.
   15. Creating and exporting editable logs.
   16. Reminder and tracking functions.
   17. Archiving functions.

C. Provide Construction Management Software user licenses for use of the Owner, Owner's Consultants, Designer, and Designer's consultants (up to 20 licenses). Provide eight hours of software training at agreed upon location for all PIMS users.

1. Provide system access privileges for Designer and their consultants to facilitate the following:
   a. A complete process for online document collaboration during submittal reviews.
   b. Preparation of reports from the entire database, including archived and closed items.

D. On completion of Project, provide one complete archive copy of Construction Management Software files to Owner and to Designer in a digital storage format acceptable to Owner. Provide data in locked format to prevent further changes.

E. Contractor, subcontractors, and other parties granted access by Contractor to Construction Management Software shall execute a data licensing agreement in the form of Agreement included in Section 00 60 00 "Project Forms".

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Electronic File Transfer Agreement (Contractor – BIM Files)

Name		**Date:**	[Publish Date]
Address		**Project Name:**	**North Carolina State University Yarbrough Field Office**
Description of Data:	Architectural BIM File	**PW Project No:**	**820937.002**

The undersigned is a contractor (the "Contractor") performing services and/or directly or indirectly providing goods and material related to the subject project (the "Project"). The undersigned hereby requests that Perkins&Will and its consultants provide electronic files prepared by Perkins&Will and its consultants for the Project in the form of an electronic model (the "Model Files"). The undersigned acknowledges and agrees that Perkins&Will has no contractual obligation, or any other obligation, to provide the Model Files to the contractor. Perkins&Will agrees to provide the Model Files in consideration for the undertakings of the undersigned. The undersigned agrees that the Contract Documents that Perkins&Will is contractually obligated to prepare and/or deliver are hardcopy drawings and specifications only. The undersigned additionally agrees that the Model Files are not Contract Documents (as that term is defined in or understood to mean in the Owner-Contractor Agreement), do not represent Contract Document modifications, and are not intended to be a substitute for or a supplement to the hardcopy drawings and specifications, or to necessarily represent actual physical conditions on the Project site.

Model Files to be furnished include work prepared by Perkins&Will and its consultant(s) only. The Model Files were prepared by Perkins&Will using the Autodesk® Revit® software platform. Model Files will be furnished in that software platform's standard format without modifications for the Contractor's convenience. One set of electronic Model Files will be furnished to the Contractor. The Contractor assumes responsibility for distributing pertinent files to the subcontractors.

The undersigned agrees that the request to provide the Model Files is purely for the convenience of the undersigned and does not constitute the rendering of professional services. Perkins&Will has prepared the Model Files to facilitate the production of the Contract Documents, which are reasonably accurate and complete to the extent of the standard of professional care. The undersigned acknowledges that Perkins&Will does not represent the furnished Model Files as being accurate or complete, as being suitable for the Contractor's purpose, or as identifying or containing any issue, anomaly, omission, or concern with reference to the Project.

The undersigned agrees and understands that the Model Files, except as expressly set forth above, are not fit for any particular purpose, including but not limited to quantity take-offs; pricing; clash detection; ascertainment of construction or installation tolerances and clearances; preparation of shop drawings, coordination drawings, or fabrication drawings; construction sequencing; or the manufacture of any building component or system. As such, the Model Files, and the information contained in them, and the information that may have been omitted from them, shall not be used as a basis for an increase in the Contract Sum or Contract Time.

The undersigned acknowledges that the Model Files have not necessarily been developed with the assistance or specific expertise of the individual subcontractors and installers, and therefore do not account for or incorporate means and methods required by individual subcontractors for their scope of the finished Work. Modifications to the information about the components included in the Model Files may be required and are the responsibility of the Contractor to ascertain, coordinate, and implement. All such modifications are part of the scope of Work of this Project and shall be provided at no additional cost to Owner.

The undersigned further acknowledges that Perkins&Will has made no representations to the undersigned that the Model Files are suitable for any purpose other than as expressly set forth above, or will be usable by the undersigned's systems, infrastructure, or software. The undersigned also understands and agrees that the Model Files may be subject to anomalies, errors, viruses, malware, or other unintended defects, and that Perkins&Will has not reviewed or determined whether such defects may be present in any electronic files. Use of these electronic files is solely at the risk of the undersigned.

The undersigned agrees to release any and all claims that they may have at any time against Perkins&Will or its consultants arising out of the use of the Model Files by the undersigned or by any other individual or entity. The undersigned agrees to hold harmless and indemnify Perkins&Will and its consultants from and against all claims, liabilities, losses, damages, and costs, including but not limited to attorney's fees arising from or in any way connected with the provision of the Model Files by Perkins&Will or the use, modification, misinterpretation, misuse, or reuse by others of the Model Files provided by Perkins&Will. The undersigned shall not use, modify, or reproduce any of the Model Files without first removing identifying information for Perkins&Will and its consultants that may be incorporated in the furnished Model Files.

The undersigned confirms that it will use the Model Files only with reference to the Project and shall not copy or distribute the Model Files, or permit the Model Files to be copied or distributed by others, except for use on this Project. The undersigned shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms and conditions of this Agreement, and to assume toward the Contractor all the obligations and responsibilities that the Contractor, by this Agreement, assumes toward the Owner and Perkins&Will. The undersigned Contractor assumes responsibility for the breach of this Agreement by any Subcontractor to whom the Contractor distributes the Model Files.

Upon return receipt of this signed Agreement, the Model Files will be transmitted to the undersigned through electronic mail, or be posted on the Perkins&Will file transfer protocol site or the Project web site.

This Agreement may be executed in counterpart, and the parties agree that the individual counterparts, taken together, shall constitute a binding agreement.

The undersigned agrees that they are authorized to bind the company indicated below to the obligations of this Agreement, and understands that Perkins&Will is relying upon this representation in agreeing to enter into this Agreement. In addition to any rights that Perkins&Will may have against the company, the undersigned agrees that Perkins&Will shall have rights personally against the undersigned if this apparent authority is questioned or disputed by the company in any way.

The undersigned agrees that any violation of this Agreement by the undersigned or the company, or any of the agents, representatives, officers, or employees of either, will result in irreparable harm to Perkins&Will that cannot be entirely compensated by money damages. Therefore, the undersigned and the company agree that Perkins&Will may seek any and all equitable remedies that may be available to Perkins&Will, including but not limited to a temporary or permanent injunction in the event of any breach or threatened breach of the terms of this Agreement.

The undersigned shall reimburse Perkins&Will for any cost or expense, including attorney's fees and all labor and expenses (including those of in-house counsel), related to the enforcement of the terms of this Agreement.

Perkins&Will	***Acknowledged and Accepted***
Signature	*Signature of Recipient*
Name	*Name*
Title	*Company*
Date	*Title*

END OF AGREEMENT

SECTION 01 31 19

PROJECT MEETINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for meetings regarding the Project including, but not limited to, the following:
   1. General Meeting Requirements
   2. Preconstruction Conference
   3. Prescheduling Conference
   4. Monthly Progress Meeting
   5. Weekly Progress Meeting
   6. Preinstallation Conferences
   7. Pay Application Review Meeting
   8. Project Closeout Conference

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 01 31 00 “Project Management and Coordination” for preparing and submitting the Subcontractor List.
   2. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule and schedule reports
   3. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   4. Section 01 77 00 "Closeout Procedures" for coordinating Contract closeout.

1.2 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.

1.3 GENERAL MEETING REQUIREMENTS

A. Schedule and physically conduct meetings at Project site or within a safe meeting space near the Project, unless otherwise indicated.
   1. Use of virtual meetings is allowable, but at least one representative from each entity invited to the meeting should be in person to facilitate discussion and item resolution.

B. Requirements herein apply to all meetings, regardless of the meeting organizer:
   1. Attendees: Meeting organizer shall inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
      a. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Meeting organizer shall prepare the meeting agenda and distribute the agenda to all invited attendees no less than three (3) working days prior to the meeting, using PIMS.
   3. Minutes: Meeting organizer shall designate a note taker for the meeting. Record significant discussions and agreements achieved. Meeting organizer shall distribute the meeting minutes to all meeting invitees within three (3) working days of the meeting, using PIMS.
   4. Notification: Inform participants three (3) working days prior to meetings not regularly scheduled.

1.4 PRECONSTRUCTION CONFERENECE

A. Designer shall schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, State Construction (if applicable) and Contractor, but no later than fifteen (15) calendar days after execution of the Agreement.
   1. Attendees:
      a. Authorized representatives of Owner
      b. Designer, and their consultants;
      c. Contractor and its superintendent;
      d. major subcontractors;
      e. manufacturers;
      f. suppliers;
      g. testing laboratory representatives;
      h. Other concerned parties shall attend the conference.
   2. Agenda: Use the State Construction Office Preconstruction Conference Agenda included in Section 00 60 00 "Project Forms" as a basis for creating the agenda for the Preconstruction Meeting. Do not change the formatting or contents of items 1 through 12 of the State Construction Office Preconstruction Conference Agenda. Beginning with new note 13, discuss items of significance from the list below that could affect progress, including the following:
      a. Review Subcontract List;
      b. Requirements in individual Specification Sections for preconstruction responsibilities;
      c. Attach a full Construction Schedule Report from the Contractor to the meeting notes;
      d. Project coordination;
      e. Site Logistics Plan;
      f. Contractors Quality Control Plan;
      g. Erosion & Sedimentation Control Plan;

h. Fire Safety Program;
i. Moisture-Protection Plan;
j. Dust and HVAC Control Plan;
k. Phasing;
l. Hazardous Material Remediation Plan;
m. Critical work sequencing and long-lead items.
n. Designation of key personnel and their duties.
o. Lines of communication.
p. Procedures for processing Requests for Interpretation (RFIs.)
q. Procedures for processing Bulletins and Architects Supplemental Instructions (ASI's) and the difference between the two.
r. Procedures for processing submittals, including electronic photography requirements and sample submittal review procedures.
s. Procedures for processing substitution requests.
t. Procedures for testing and inspecting.
u. Distribution of the Contract Documents.
v. Digital Execution Plan and associated procedures
w. Preparation of Record Documents.
x. Use of the premises.
y. Work restrictions.
z. Working hours.
aa. Owner's occupancy requirements.
bb. Responsibility for temporary facilities and controls.
cc. Procedures for moisture and mold control.
dd. Procedures for disruptions and shutdowns.
ee. Construction waste management and recycling.
ff. Parking availability.
gg. Office, work, and storage areas.
hh. Equipment deliveries and priorities.
ii. First aid.
jj. Security.
kk. Progress cleaning.

1.5 SCHEDULING CONFERENCE

A. General Contractor shall schedule and conduct a Scheduling Conference prior to mobilization to the site.

B. Attendees:
1. Contractor's Preconstruction Manager, Project Manager, and Superintendent
2. Contractor's Scheduler or Scheduling Consultant
3. Authorized Representatives of the Owner (Optional)
4. Designer, and their consultants (Optional)

C. Contractor and all its subcontractors shall include a minimum of five (5) full working days in their base bid to attend the Scheduling Conference.

D. Agenda:

1. Develop the Project Schedule that conforms to the contract time.
2. Review methods and procedures related to Contractor's Construction Schedule, including, but not limited to, the following:
    a. Review software limitations and content and format for reports.
    b. Verify availability of qualified personnel needed to develop and update schedule.
    c. Discuss constraints, including phasing work stages and interim milestones.
    d. Review delivery dates for Owner-furnished products
    e. Review schedule for work of Owner's separate contracts.
    f. Review submittal requirements and procedures.
    g. Review time required for review of submittals and resubmittals.
    h. Review requirements for tests and inspections by independent testing and inspecting agencies.
    i. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
    j. Review and finalize list of construction activities to be included in schedule.
    k. Review procedures for updating schedule.

E. At the end of the Prescheduling Conference, the Contractor shall deliver to Owner and Designer a Project Schedule, signed by the Contractor’s Project Manager and Superintendent, and each Project Manager and Superintendent for each of Contractor’s Subcontractors, as identified on the Subcontract List.
1. No application for payment will be processed until this schedule is accepted by the Designer and Owner.
2. The signed original copy of the Project Schedule resulting from the Prescheduling Conference shall be displayed at the jobsite.

1.6 MONTHLY PROGRESS MEETING

A. Designer shall conduct progress meetings at monthly intervals.
1. Attendees:
    a. Designer
    b. Designer Consultants whose discipline is under active construction or will begin within the next month
    c. Owner
    d. State Construction Monitor
    e. Contractor’s Project Manager and Superintendent
    f. The meeting is open to the following optional attendees: subcontractors, material suppliers, and any others who contribute to the progress of the project.
2. Agenda:
    a. Use Monthly Meeting Agenda included in Section 006000 “Project Forms” as a basis for the Monthly Meeting. Items should remain on the agenda until all actions associated with the note are complete.
    b. Review and correct or approve minutes of previous progress meeting.

c. 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.
d. Review Designer's Logs and discuss issues, Information, Instructions, Proposals and Modifications.
e. Review any pending change orders or field orders.
f. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

3. Reporting:
   a. Designer shall distribute minutes of the meeting to each party present and to parties who should have been present within three (3) calendar days of the meeting.
   b. Designer shall upload a copy of the meeting minutes into the State Construction Office InterSCOPE database as Package Documents.

1.7 WEEKLY PROGRESS MEETINGS

A. Contractor shall conduct progress meetings at weekly intervals.
   1. Coordinate dates of meetings with preparation of payment requests.
   2. Attendees:
      a. Representatives of Owner;
      b. Designer;
      c. Contractor's Project Manager and Superintendent;
      d. Contractor may invite their subcontractors, suppliers, and/or other entities concerned with current progress or involved in planning, coordination, or performance of future activities.
   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:
         1) 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.
         2) Review schedule for the upcoming two-week period.
         3) Discuss long-term schedule needs as necessary.
         4) Review Upcoming Work Summary report, as described in Section 01 32 16 "Construction Progress Schedule".

b. Review present and future needs of each entity present, including the following:
   1) Safety, hazards and risks.
   2) Change Order Requests and Change Orders.
   3) Request for Information.
   4) Submittals.
   5) Designer Inspection Reports.
   6) Erosion & Sedimentation Update (if applicable).
   7) Review condition of tree protection (if applicable).
   8) Progress cleaning and site cleanliness.
   9) Changes to Site Logistics or Emergency Action Plan.
   10) Sequence of operations.
   11) Resolution of BIM component conflicts.
   12) Deliveries.
   13) Off-site fabrication.
   14) Access.
   15) Site utilization.
   16) Temporary facilities and controls.
   17) Atypical work hours.
   18) Quality and work standards.
   19) Pending changes
   20) Pending claims and disputes.
   21) Documentation of information for payment requests.
   22) Testing and inspection requirements.
   23) Other business relating to the Work.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
   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.

1.8 PREINSTALLATION CONFERENCES

A. Conduct all preinstallation conferences at Project site before each construction activity that requires coordination with other construction.
   1. Attendees: Contractor, Subcontractor responsible for the work being discussed at the conference, Designer (architect at a minimum, consultant responsible for the design of the work to also be in attendance), NC State’s Project Manager, Commission Agent (if required) and other interested and/or impacted parties within NC State.

2. Agenda: Contractor shall prepare the meeting agenda and distribute the agenda to all invited attendees at least three (3) working days prior to the meeting. 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 RFI.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Possible conflicts.
   i. Compatibility requirements.
   j. Time schedules.
   k. Weather limitations.
   l. Manufacturer's written instructions.
   m. Warranty requirements.
   n. Compatibility of materials.
   o. Acceptability of substrates.
   p. Temporary facilities and controls.
   q. Space and access limitations.
   r. Regulations of authorities having jurisdiction.
   s. Testing and inspecting requirements.
   t. Installation procedures.
   u. Coordination with other work.
   v. Required performance results.
   w. Protection of adjacent work.
   x. Protection of construction and personnel.
3. Minutes: Contractor shall record significant conference discussions, agreements, and disagreements, including required corrective measures and actions. Contractor shall distribute minutes of the meeting to each party present and to other parties requiring information within three (3) working days of the meeting.
4. Notification: Conference shall occur no less than ten (10) working days prior to activity beginning.
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.

B. The following preinstallation conferences are required by NC State. Additional preinstallation conferences may be specified by the Designer within specific Specification Sections within the Contract Documents.
1. Demolition;
2. Grading, installation of construction fence, underground utility services;
3. Waterproofing, damp-proofing;

4. Face brick installation;
5. Window, Storefront, Curtain wall and other glazing installations;
6. Landscape;
7. Roofing installation;
8. Flooring installation;
9. Structural Concrete;
10. Structural Steel;
11. Casework/Fumehoods;
12. Fire Alarm-Sprinkler System;
13. Card reader/Security, Door Hardware;
14. Audio/Visual;
15. Replacement and New Installation of Transformers, Switches, etc.

1.9 PAYMENT APPLICATION MEETING

A. Contractor shall conduct a payment application meeting at monthly intervals.
   1. Meeting shall occur between submission of the pencil copy of the payment application to the Designer on the 25th day of the month and the last day of the month.
   2. Attendees:
      a. Owners Project Manager
      b. Designer;
      c. Contractor's Project Manager.
   3. Agenda: Review and correct pencil copy of payment application.

1.10 PROJECT CLOSEOUT CONFERENCE

A. Contractor shall schedule and conduct a project closeout conference, at a time convenient to Owner, State Construction, and Designer, but no later than 80% completion of the Contract Duration, or 90 days prior to the scheduled date of Final Acceptance, whichever is earlier.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees:
      a. Authorized representatives of Owner,
      b. Designer, and their consultants;
      c. Contractor and its superintendent;
      d. Major subcontractors;
      e. Suppliers;
      f. Other concerned parties shall attend the meeting.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
      a. Review Completion Schedule.
      b. Review Final Acceptance Checklist, as included in Section 00 60 00 "Project Forms".
      c. Preparation of record documents.

d. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
e. Submittal of written warranties.
f. Requirements for preparing operations and maintenance data.
g. Requirements for delivery of material samples, attic stock, and spare parts.
h. Requirements for demonstration and training.
i. Preparation of Contractor's punch list.
j. Requirements prior to the preparation of the Designer’s punch list.
k. Procedures for processing Applications for Payment at Final Acceptance and for final payment.
l. Submittal procedures for closeout documents.
m. Owner's partial occupancy requirements.
n. Installation of Owner's furniture, fixtures, and equipment.
o. Responsibility for removing temporary facilities and controls.
p. Close of PIMS and export of data to Owner and Architect.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Daily construction reports.
   2. Material location reports.
   3. Unforseen condition reports.
   4. Special reports.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 00 60 00 "Project Forms" for Daily Report and Stored Material Summary forms.

1.2 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.

1.3 REPORT SUBMISSION FREQUENCY

A. Daily Construction Reports: Submit weekly.

B. Material Location Reports: Submit at monthly intervals.

C. Site Condition Reports: Submit at time of discovery of differing conditions.

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

1.4 INFORMATION SUBMITTALS

A. Daily Report Template: Submit a copy of Contractors Daily Report Template prior to mobilization.

1.5 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at Project site:

1. Project Name, SCO Project ID #, NC State Project #
2. Report #.
3. Date & Time report was generated.
4. Weather data: overhead conditions, precipitation (if so, type & how much), temperature (high & low), impact on progress.
5. Document Daily Safety Briefing (refer to Contractor Safety Guidelines 4.0/E).
6. Report Daily Safety Inspections (refer to Contractor Safety Guidelines 4.0/E).
7. Sediment & Erosion Control.
8. Work performed (include all major trades).
9. Total number of Contractor's workers on site.
10. List of subcontractors and the number of their workers at Project site.
11. List of Owner's personnel and the nature of their business at the Project Site.
12. List of other Owner's contractors and the number of their workers at Project site.
13. Equipment at Project site.
14. Material deliveries.
15. Transmittal of salvage or attic stock to Owner, including the list of materials and name of Owner's representative taking possession of materials.
16. Difficulties encountered that may cause delay.
17. Days of no work & reason.
18. Accidents & near misses.
19. Meetings and significant decisions.
20. Unusual events (refer to special reports).
21. Stoppages, delays, shortages, and losses.
22. Report of utility shutdowns performed by Owner at Contractor's request, including, but not limited to: start time, finish time, progress of work, and personnel involved.
23. Meter readings and similar recordings.
24. Tests and inspections, including name(s) of testing and inspection agency(ies).
25. Emergency procedures.
26. Orders and requests of authorities having jurisdiction.
27. Change Orders received and implemented.
28. Field Orders received and implemented.
29. Bulletins, Architect's Supplemental Instructions, or other sketches received.
30. Services connected and disconnected.
31. Equipment or system tests and startups.
32. Substantial Completions achieved (in part or in full) and Final Acceptances authorized.

1.6 MATERIAL LOCATION REPORTS

A. 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. Indicate the following categories for stored materials:
   1. Material stored prior to previous report and remaining in storage.
   2. Material stored prior to previous report and since removed from storage and installed.
   3. Material stored following previous report and remaining in storage.

1.7 UNFORSEEN CONDITION REPORTS

A. Immediately on discovery of unforeseen conditions, prepare a detailed report using a Request for Interpretation (RFI). Include a detailed description of the differing conditions, including photos or field reports as necessary to describe and detail the unforeseen condition, together with recommendations for resolving the condition.

1.8 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day 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, 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 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Definitions.
   2. Reports.
   3. Quality Assurance.
   4. Coordination.
   5. Work Breakdown Structure Overview (WBS).

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 01 29 00 "Payment Procedures" for submitting the Schedule of Values.
   2. Section 01 31 00 "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
   4. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.
   5. Section 01 77 00 “Closeout” for administrative requirements about Contractor’s Statement of Completion with Request for Designers Inspection, Substantial Completion, and Final Acceptance.

1.2 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.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activities are activities on the critical path that must start and finish on the planned early start and finish times.

2. Predecessor Activity is an activity that must be completed before a given activity can be started.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.
1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, a separate wing, a major department, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

J. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

K. Work Breakdown Structure (WBS): A deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project, with each descending level of the WBS representing an increasingly detailed definition of the project work.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format, unless indicated otherwise:
1. Working electronic copy of schedule file in contractor's scheduling software utilized.
2. PDF electronic file.

B. Contractor's Initial Construction Schedule: Initial project construction schedule conforming to the requirements herein, submitted within fifteen (15) calendar days of Notice to Proceed. No Applications for Payment will be processed without an approved Initial Construction Schedule. Once approved, this schedule becomes the "Baseline" schedule.
   1. Submit a working electronic copy of schedule, exported to Microsoft Project (.mpp) format (regardless of the software used to generate the schedule), and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

C. Construction Finish Schedule: At 80 percent project completion (determined by duration not value of work in place), submit a schedule illustrating tasks remaining to complete the project.

D. Construction Schedule Update Report:
   1. Submit, with each Application for Payment, an electronic copy of the Construction Schedule Update Report in .pdf format containing all requirements herein as well as a working electronic copy of the schedule in Microsoft Project (.mpp) format.
   2. Cover Letter: Cover letter shall describe the contents of the report including the following:
      a. Project Name and NC State Project Number,
      b. SCO Project ID Number,
      c. Date of Report,
      d. Contents of the Report,
      e. Schedule compliance update and status of recovery schedule (if applicable)
      f. Signed by the Contractor's Project Manager.
   3. Signature Page: A signature page (or pages if necessary) must be included in the Update Report, so that in addition to the Contractor's signature representing the accuracy of the updated Schedule, the Project Manager for each Subcontractor (as identified in the Subcontract List submittal) can sign to document their agreement to the updated schedule.
      a. If a Subcontractor does not agree to the updated schedule, they shall write "Exceptions Taken" in the signature line for their company and submit to Contractor a separate written summary of their exceptions and/or inaccuracies on Subcontractors letterhead. Contractor shall include the Subcontractor's written summary, and responses to the exceptions in the Narrative section of the Schedule Update Report.
   4. Narrative: Contractor shall include, separate from the Cover Letter, a Narrative that describes what activity changes happened on the project, including the following:
      a. Summary of work completed since the last report,
      b. Missing data,
      c. Recent and upcoming changes,
      d. Documented delays,
      e. Potential delays, and

f. Other facts.

5. CPM Activity Report:
   a. Formatting:
      1) Plotted to an 11x17 page with landscape orientation,
      2) List of all activities sorted by WBS, activity number, and then early start date, or actual start date if known.
      3) Include the Gantt chart in the report, scaled so all information below and the chart fit on one page width.
   b. Each activity line in the report shall contain the following:
      1) Activity number,
      2) Activity description,
      3) Original duration,
      4) Remaining duration,
      5) Early start date,
      6) Early finish date,
      7) Late start date,
      8) Late finish date,
      9) Predecessor & Successor Activity Numbers, and
      10) Total float in working days.
6. Critical Path Report: Using the same format of the CPM Activity Report, generate a report showing only items on the Critical Path of the Project.
7. Total Float Report:
   a. Format: 8-1/2x11, portrait orientation
   b. List of all activities sorted by total float, Criticality (Critical: 0 days float, Near Critical: 1 to 10 days of float, and Not Critical: 11+ days of Float), WBS, then activity number.
   c. Each activity line in the report shall contain the following:
      1) Activity number,
      2) Activity description,
      3) Original duration,
      4) Remaining duration,
      5) Early start date,
      6) Early finish date,
      7) Total float in working days.
8. Change Report, as described in Paragraph 2.2.G. of this Section.
9. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment in tabular and chart format.

E. 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 RFI.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and Contract Time.

1.5 QUALITY ASSURANCE

A. Contractors Scheduler, or Scheduling Consultant, Qualifications: Contractor shall employ, or contract with, an experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Designer’s or Owner's request.
   1. Qualification Data: Submit the resume and/or qualifications for Contractors Scheduler or the Contractors scheduling consultant. Owner reserves the right to approve, reject, or change the Contractors Scheduler as necessary to ensure the project stays on schedule without incurring additional costs.

B. Conduct Prescheduling conference at Project site to comply with requirements in Section 01 31 19 "Project Meetings."

1.6 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 parties involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. Coordinate Contractor's construction schedule with Owner's construction schedule for Owner's own forces. Revise Contractor's construction schedule, if necessary, after a joint review and mutual agreement. The construction schedule shall then constitute the schedule to be used by Contractor, separate contractors, and Owner until subsequently revised.

1.7 WORK BREAKDOWN STRUCTURE (WBS) OVERVIEW

A. All schedules prepared by the contractor shall generally conform to the following Work Breakdown Structure (WBS). Additional details for each WBS are included in subsequent paragraphs in this Section.
   1. Milestones.
   2. Inspections & Outages.
   3. Preconstruction.
   4. Construction.
   5. Closeout.

B. Milestones
   1. Include, at a minimum, the following milestones in the schedule, within the following structure:

a. Contract Dates (if project includes multiple phases, include the following for each phase)
   1) Contract Execution
   2) Notice to Proceed
   3) 15 Days after NTP (due date for various submittals)
   4) 30 Days after NTP (due date for various submittals)
   5) 80% Duration Complete
   6) Contractor's Statement of Completion with Request for Designer's Inspection
   7) Final Acceptance
b. Coordination Effort
   1) MEPFP Coordination Drawings Ready for Review (can be multiple milestones if required by the project)
   2) Casework & Fume Hood Submittals & Shop Drawings Ready for Review, if necessary (due within 30 calendar days from Notice to Proceed)
c. SCO Monthly Meeting Dates
d. Progress Milestones
   1) Chilled Water Complete.
   2) Footings Complete.
   3) Structure Complete.
   4) Roof Complete.
   5) Envelope Complete / Dry-in.
   6) Sitework Complete.

C. Tests, Inspections & Outages
1. Contractor Tests & Inspections:
   a. Stair & Ramp Survey (if required)
   b. Moisture Testing for Flooring
   c. Contractors Pre-Final Punch List
   d. Testing, Adjusting, and Balancing
   e. Pre-Functional Testing
2. Designer Tests & Inspections:
   a. Backflow Preventer Test (if not by Contractor)
   b. Designer Punch List
   c. Designer Pre-Electrical Inspection
3. Designer and NC State Tests & Inspections:
   a. In-wall Inspections
   b. Above Ceiling Inspections
   c. Generator Load Test
   d. Fire Pump Test
   e. Fire Sprinkler Main Drain Tests
   f. Pre-Final Inspections
   g. 100% Test of the fire detection and alarm system
   h. Third Party materials testing / special inspections
   i. Piping Pressure Testing
   j. Telecom/Data Wiring Tests & As-Builts

k. Underground piping, ductbanks, and other components prior to backfill
l. Final Inspection for Project Acceptance

4. Include, at a minimum, the following tests & inspections, conducted by AHJ
   a. NFPA, DOI, and DOL Tests
   b. Final Inspections
5. Include Utility Outages on the schedule, scheduled in accordance with the requirements described in Section 01 14 00 "Work Restrictions".
6. General Requirements
   a. The Contractor should include a reasonable corrective work period after each inspection so that Contractor has time to work off deficient items identified during each inspection. However, since the duration shown for each corrective work period will be at the Contractor's discretion, and the amount of corrective work needed will be relative to Contractor's quality of work, if the corrective work period takes longer than the time identified on the schedule, it does not alleviate Contractor's requirement to achieve the Contract Milestone dates.

D. Preconstruction
1. Include, at a minimum, the following preconstruction items:
   a. Procurement & Submittals (General) - repeat for each item with a procurement duration longer than six (6) weeks.
      1) Prepare Submittal
      2) A/E Review Submittal (20 calendar days)
      3) Fabricate / Deliver Material
   b. Procurement & Submittals (Sprinkler)
      1) Prepare Submittal
      2) A/E Review Submittal (20 calendar days)
      3) North Carolina State Construction Office Review (approx. 30 calendar days)
      4) Fabricate / Deliver Material
   c. BIM Coordination
   d. Safety
      1) NCSU Review of Activities (Refer to Paragraph 4.0 of NCSU Safety Manual)
      2) NCSU Lift Plan Review (50 calendar days)

E. Construction
1. Work by Contractor – Organized at Contractor's discretion, conforming to reasonably accepted construction standards and coordinated with the Schedule of Values.
2. Work by Owner - coordinate with Section 01 11 16, "Work by Owner"
3. Acceptance Phase - Include a section that shows an Acceptance Phase showing all activities preparing for Final Acceptance.
   a. This Acceptance Phase shall include all activities by Contractor, Designer, Owner, and Inspectors required to complete the project. Coordinate activities with Section 01 77 00 "Closeout".

F. Closeout

1. Include, at a minimum, the following activities in the closeout section:
   a. Preparation of O&M's (listed by Division)
   b. Review & Approval of O&M's (listed by Division)
   c. Preparation of Warranties
   d. Review & Approval of Warranties
   e. Training & Demonstration activities
   f. Attic Stock Transfer

PART 2 PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice of Award 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.

B. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define Construction Activities so no activity is longer than fourteen (14) working days, unless specifically allowed by Owner and Designer.
   2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 30 working 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 Section 01 33 00 "Submittal Procedures" in schedule. Include selection process activities for finishes and products specified by allowances or specified to be selected during the sample review process. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
   4. Startup and Testing Time: Include not less than 15 days for startup and testing.
   5. Final Acceptance: Indicate completion in advance of date established for Final Acceptance and allow time for Designer's administrative procedures necessary for Final Acceptance.
   6. Punch List and Final Completion: Include not more than 60 days for completion of punch list items and final completion.
   7. Demonstration and Training: Training of Owner's personnel as indicated in Section 01 77 00 "Closeout Procedures."

C. 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. No constraints, aside from those specifically listed in the Contract Documents, are allowed.
   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. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 11 16 "Work by Owner". Delivery dates indicated stipulate the earliest possible delivery date.
   5. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with other construction projects.
      b. Examination periods.
      c. Graduation.
      d. Athletic Events (if applicable to the project).
      e. Student Move-in & move-out (if applicable to the project).
      f. Utility Outages.
      g. Uninterruptible services.
      h. Use of premises restrictions.
      i. Provisions for future construction.
      j. Seasonal variations or limitations.
      k. Environmental control.
   6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
      a. Subcontract awards.
      b. Submittals.
      c. Purchases.
      d. Fabrication.
      e. Sample testing.
      f. Deliveries.
      g. Installation.
      h. Tests and inspections.
      i. Adjusting.
      j. Curing.
      k. Startup and placement into final use and operation.
   7. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the milestones listed in Paragraph 1.7.B. of this Section.

D. Plan of Action and Recovery Schedule:
   1. A Plan of Action and Recovery Schedule shall be prepared by the Contractor when any of the following occur:

a. The Contractor's report indicated delays that would prevent the Contractor's ability to complete the project within the Contract Duration.
b. The updated construction schedule is thirty (30) days behind schedule.
c. The Contractor desires to make changes to the sequence of work that are, in the opinion of the Owner or Design, major in nature.

2. The Plan of Action is due from the Contractor within two (2) calendar days of Owners written demand.
3. Recovery schedules are due from the Contractor within five (5) calendar days of Owners written demand.

E. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules. Coordinate with Designer regarding which project management software will be used on the Project. Contractor to provide Owner two (2) licensed copies of the scheduling software for the duration of the Project.
1. Allowable scheduling software's include Microsoft Project, Primavera P6, or another software approved by the Owner.
2. Smartsheets, Google Sheets, Microsoft Excel, or similar products shall not be used to prepare or update the project schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Designer's approval of the schedule.
2. All activities, except for "Project Start" and "Project Finish", must have at least one predecessor activity and at least one successor activity.
3. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
4. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

5. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Purchase of materials.
      d. Delivery.
      e. Fabrication.
      f. Utility interruptions.
      g. Installation.
      h. Work by Owner that may affect or be affected by Contractor's activities.
      i. Testing.
      j. Punch list and final completion.
      k. Activities occurring following final completion.
   2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
   3. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
   4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
      a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
   1. Contractor or subcontractor and the Work or activity.
   2. Description of activity.
   3. Principal events of activity.
   4. Immediately preceding and succeeding activities.
   5. Early and late start dates.
   6. Early and late finish dates.
   7. Activity duration in workdays.
   8. Total float or slack time.

9. Average size of workforce.
10. Dollar value of activity (coordinated with the Schedule of Values).

G. Schedule Updating: Concurrent with revising the schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests, coordinate timing with progress meetings.
   a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
   b. Submit value summary printouts one week before each regularly scheduled monthly progress meeting.

PART 3 EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, or as requested by Owner, the Contractor shall update the project schedule to reflect actual construction progress and activities. Issue schedule three (3) calendar days 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 Actual Completion percentage for each activity.
4. Notify Owner and Designer a minimum of one week prior to issuance of updated schedule of all anticipated significant revisions to the Construction Schedule.

B. Distribution: Distribute copies of approved schedule to Designer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post electronic copies of the updated project schedule on the project website.
   2. Post copies in Project meeting rooms and temporary field offices.
   3. 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.
   4. Provide Owner electronic copy of updated schedule in Contractor's scheduling software format.

END OF SECTION

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Periodic construction photographs.
   3. Utility Photographs.

1.2 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.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Construction photographs may not be used for Contractor’s marketing materials or social media unless approved by Owner.

1.4 INFORMATIONAL SUBMITTALS

A. Key Plan: Fifteen (15) days after Notice to Proceed, submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.
   1. Submit photos by uploading to web-based project software site and email to Designer & NC State Project Manager. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description in web-based project software site:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Designer.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.

1.5 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time from camera.

D. File Names: Name media files with date, Project area and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

A. Photographer & Quality: Construction photographs shall be taken by a member of the Contractors Supervisory team and shall not be blurry. In the event that drone photography is to be used, Contractor shall engage with, or retain, a qualified drone operator. All drone photography must be approved in advance with N.C. State.

B. General: Take photographs with maximum depth of field and in focus.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Preconstruction Photographs: Before commencement of excavation or demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Owner or Designer.
   1. Flag excavation or demolition areas before taking construction photographs.
   2. Take a reasonably sufficient quantity of photographs to reasonably show existing conditions within and adjacent to project before starting the Work.
   3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
   4. Failure to submit preconstruction photographs may result in delayed processing of the initial payment application.

D. Post-Demolition Photographs: After completion of demolition, but before any new construction activities, take photographs of Project site and surrounding areas.

E. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
   1. Underground utilities.
   2. Underslab services.

3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

F. Periodic Construction Photographs: Take a reasonably sufficient quantity of photographs coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

G. Final Completion Construction Photographs: Take a reasonably sufficient quantity of photographs prior to Final Acceptancefor submission as Project Record Documents. Owner and Designer will inform photographer of desired vantage points.

1.7 UTILITY PHOTOGRAPHS

A. In conjunction with survey's required for as-builts, as required by Section 01 77 00 "Closeout Requirements", the following photographs need to be submitted by the Contractor to Owner within two weeks of the backfilling of utilities or completion of the associated construction task. Failure to take appropriate photographs will result in Contractor excavating the work at no addition cost to the Owner so that all photographs can be taken.

B. The following outline lists the utilities to be located and the data to be collected. Photographs shall be at a minimum resolution of 2200 x 1700. Digital photographs can be submitted in TIFF, JPG, or RAW file formats. File naming shall be all lower case text. File naming shall be as follows: bldg#_ncsu project number_util_photo#.file extention. For example: 135_201300001_util_1.jpg
1. Water Lines - (Domestic, Fire Main, Chilled, Hot Water, & Reuse Waterlines)
    a. Provide digital photographs of bends and valves.
2. Electric and Communication Duct Banks and Direct Buried Conduit
    a. Provide digital photographs of the tunnel and conduit configuration.
3. Storm and Sanitary Sewer
    a. Provide digital photographs of structures.
4. Existing Utilities
    a. Provide digital photographs of any crossings or conflict between new utilities and existing utilities.
5. Deliverables for Surveys
    a. The subsurface location data and platting shall be continuous throughout the project.
    b. All data and plats are due to NC State within two-weeks of the backfilling of utilities or completion of the associated construction task.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Submittal Schedule.
   2. Submittal Administrative Requirements
   3. Submittal Procedures regarding Submitting Shop Drawings, Product Data, Samples, and other submittals.
   4. Schedule of Required Division 01 Submittals and associated due dates.
   5. Submittals to be reviewed by Owner in addition to Designer.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Designer'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 Designer'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.

1.3 SUBMITTAL SCHEDULE

A. No less than fifteen (15) calendar days after Notice to Proceed, Contractors shall 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 Designer 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. Refer to Section 012900 "Payment Procedures" for requirements for submission of submittal schedule prior to application for payment. Minimum preliminary submittal shall 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: either Action or Informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Designer's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.
    i. Activity or event number.
5. Designer reserves the right to withhold, in addition to retainage, 10 percent of each payment request until the submittal schedule is received and accepted by the Designer.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. 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 Action and Informational submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
        a. Exception: Where samples for initial selection and samples for verification are both required, submit samples for verification after initial selection has been returned by Designer.
    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. Designer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Designer's receipt of submittal. Designer will document on submittal the date of receipt. Submittals received by Designer after 1:00 p.m. will be considered as received the following working day. 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 twenty (20) calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Designer will advise Contractor when a submittal being processed must be delayed for coordination. Delaying submittals to facilitate coordination between submittals shall not constitute a delay of the Work nor shall it be the basis for an extension of time.
   2. Sequential Review: Sequential review is a submittal that requires review by more than one design discipline. Where sequential review of submittals by Designer's consultants, Owner, or other parties is required, submittal schedule shall reflect sequential review. Sequential reviews are anticipated for, but not limited to, the following:
      a. Division 03 Sections:
         1) "Cast-in-Place Concrete."
      b. Division 04 Sections:
         1) "Unit Masonry."
      c. Division 05 Sections:
         1) "Structural Steel Framing."
         2) "Steel Decking."
         3) "Cold-Formed Metal Framing."
         4) "Metal Fabrications."
         5) Stairs and Railings of each type.
      d. Division 06 Sections:
         1) "Rough Carpentry."
         2) "Sheathing."
         3) "Interior Millwork."
      e. Division 07 Sections:
         1) "Joint Sealants."
      f. Division 08 Sections:
         1) "Aluminum Framed Entrances and Storefronts."
         2) "All-Glass Entrances and Storefronts."
         3) "Glazed Aluminum Curtain Walls."
         4) "Metal Frames Skylights."
         5) "Door Hardware."
         6) "Louvers and Vents."
      g. Division 14 Sections:
         1) "Electric Traction Elevators."
      h. Facility Services Subgroup Divisions: All Sections.
      i. Site and Infrastructure Subgroup Divisions: All Sections.
      j. Process Equipment Subgroup Divisions: All Sections.

3. If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Allow twenty (20) calendar days for review of each resubmittal.

C. Electronic Submittals: 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.
   a. Unique identifier, including revision number. Submittals shall be numbered with the Section number, followed by a dash, followed by a three-digit number, followed by a dash, and ending with a sequential submission number as indicated below. The numbering system shall be retained throughout all revisions.
      1) Section Number: Section number where submittal is specified.
      2) Three-Digit Number: Sequential number, beginning with "001," for each submittal transmitted to Designer for each Section.
      3) Submission Number: Use "00" for initial submittal, "01" for first resubmittal, "02" for second resubmittal, and so forth.
      4) Two-character Type Identifier followed by a dash:
         (a) a) CT for certificate.
         (b) b) IN for informational submittal.
         (c) c) PD for product data.
         (d) d) QL for qualification information.
         (e) e) SA for samples.
         (f) f) SD for shop drawing.
         (g) g) TR for test report.
      5) Short description of the content, using material designation indicated in the Contract Documents.
      6) Example: 084413.001.00-SD-Curtain Wall CW-1 (Section, first submission of the Section, initial submittal).
2. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Designer.
3. Scanned Copies: Legible scanned PDF files of paper originals are acceptable. Scanned submittals that are not legible will be rejected.
4. Sheet Orientation: Orient PDF sheets to a "Ready-to-Read" orientation with majority of text horizontal to the sheet with no additional adjustments or formatting required by the viewer.
5. File Security: Do not set any permissions on the file. Protected documents will not be accepted.
6. Metadata: Include the following information in the electronic submittal file metadata:
   a. Title: Project title
   b. Author: Contractor's name.
   c. Subject: Submittal type (product data, shop drawing, report, etc.)
   d. Keywords: Number and title of appropriate Specification Section; manufacturer name; product name/model number.

7. File Transmission: Through project website. Do not transmit submittal via email.

D. Options: Identify options requiring selection by Designer.

E. Deviations and Additional Information: Deviations to the requirements of the Contract Documents must follow the Substitution Requirements described in Section 01 25 00 "Substitution Requirements".

F. 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.

G. 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.

H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals.

I. The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been reviewed by Designer and returned to Contractor with Designer's action stamp.

1.5 SCHEDULE OF DIVISION 01 SUBMITTALS AND ASSOCIATED DUE DATES

A. Section 01 25 00 "Substitution Procedure"
1. Substitution Requests: As needed

B. Section 01 26 00 "Contract Modification Procedure"
1. Five Year Climatic Average: No less than Fifteen (15) Workdays prior to mobilization

C. Section 01 29 00 "Payment Procedures"
1. Schedule of Values: No less than Fifteen (15) working days prior to submission of initial Application for Payment

D. Section 01 31 00 "Project Management & Coordination"
1. Vendor & Subcontract List: due within fifteen (15) calendar days of Notice to Proceed.
2. Key Personnel Names: due within fifteen (15) working days of mobilization.
3. BIM Execution Plan and Schedule: due within fifteen (15) calendar days of Notice to Proceed.

E. Section 01 32 00 "Construction Progress Documentation"
1. Daily Construction Reports: due weekly, template due prior to mobilization
2. Material Location Reports: due monthly

3. Site Condition Reports: due within five (5) calendar days of discovery of differing conditions.
4. Special Reports: due within five (5) calendar days of unusual event.

F. Section 01 32 16 "Construction Progress Schedule"
1. Contractor's Initial Construction Schedule: due within fifteen (15) calendar days of Notice to Proceed.
2. Construction Finish Schedule: due at 80% project completion
3. Construction Schedule Update Report: due monthly

G. Section 01 32 33 "Photographic Documentation"
1. Key Plan: due within fifteen (15) calendar days of Notice to Proceed.
2. Digital Photographs: due within three (3) calendar days of taking photographs.

H. Section 01 33 00 "Submittal Procedures"
1. Submittal Schedule: due within fifteen (15) calendar days of Notice to Proceed.

I. Section 01 35 23 "NCSU Safety Requirements"
1. Site Specific Safety Plan: due no fewer than fifteen (15) working days prior to mobilization.
2. Crane Plan: due no fewer than fifty (50) working days prior to the crane mobilizing.
3. Safety Reports: due monthly.

J. Section 01 40 00 "Quality Requirements"
1. Contractor's Site-Specific Quality Program: due not less than five (5) working days prior to preconstruction conference.
2. Schedule of Tests & Inspections: submit prior to initial payment application.

K. Section 01 50 00 "Temporary Facilities & Controls"
1. Site Logistics Plan: due not less than five (5) working days prior to preconstruction conference. Updated not less than monthly during construction.
2. Fire-Safety Plan: due not less than five (5) working days prior to preconstruction conference.

L. Section 01 51 00 "Temporary Utilities"
1. Implementation and Termination Schedule: due prior to mobilization.

M. Section 01 57 00 "Temporary Controls"
1. Erosion & Sedimentation Control Reports: due weekly while Erosion & Sedimentation Control Plan in the Project Documents is active.
2. Moisture & Mold Prevention Plan: due not less than five (5) working days prior to preconstruction conference.
3. Dust & HVAC Control Plan: due not less than five (5) working days prior to preconstruction conference.
4. Noise & Vibration Control Plan: due not less than five (5) working days prior to preconstruction conference

N. Section 01 74 19 "Construction Waste Management & Disposal"
   1. Waste Management Plan: Due within thirty (30) calendar days of Notice to Proceed.

O. Section 01 77 00 "Closeout"
   1. Closeout Submittal Log: Due at 50% completion, as determined by the project schedule.
   2. Contractor's Statement of Completion with Request for Designer's Inspection: Due no later than ten (10) working days prior to Request for Designer's Pre-Final Inspection.

P. Section 01 78 46 "Maintenance Materials"
   1. Schedule of Maintenance Material Items: Due within five (5) working days prior to requesting an inspection for Substantial Completion.
   2. Maintenance Material Transmittal: Due at Substantial Completion.

1.6 SUBMITTALS TO BE REVIEWED BY NC STATE IN ADDITION TO DESIGNER

A. N.C. State reserves the right to review the following submittals:
   1. Lift Plan (if applicable)
   2. Safety Plan
   3. Training/Warranty
   4. Masonry
   5. Office Case/Mill Work
   6. Roofs
   7. Hardware (Keying)
   8. Colors (Outdoors)
   9. Indoor Signs (Schedule)
   10. Fire Sprinkler System (SCO must also approve)
   11. Air Compressors
   12. Boilers
   13. Water Meters
   14. Valves
   15. Air Handler Units
   16. Chiller Water Chemicals
   17. Chillers
   18. Controls
   19. Mechanical Pumps
   20. Electrical Panels
   21. Power Meters
   22. Switch Gear/ Transformers
   23. Emergency Generator
   24. Audio Visual Systems
   25. Fire Alarm System
   26. Card Readers
   27. Security Infrastructure
   28. Telecommunications

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. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project. Do not post zipped files.
      a. Designer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   2. Action Submittals: Submit electronic copies of each submittal, unless otherwise indicated. Designer will electronically return electronic copies. Mark up and retain one returned copy as a Project Record Document.
   3. Informational Submittals: Submit electronic copies of each submittal, unless otherwise indicated. Designer will not return copies.
   4. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
   5. 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.
   6. Systems Submittals: Identify submittals for systems such as fire alarms and fire protection systems, on the transmittal and act upon the system singularly as a combined submittal. If resubmission is required, resubmit entire system submittal,

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's written recommendations.
      c. Manufacturer's product specifications.
      d. Standard color charts.
      e. Mill reports.
      f. Standard product operating and maintenance manuals.
      g. Compliance with recognized trade association standards.
      h. Compliance with recognized testing agency standards.
      i. Application of testing agency labels and seals.
      j. Notation of coordination requirements.

k. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. PDF electronic file.

C. Shop Drawings: Prepare and submit Project-specific information, drawn accurately to scale. Do not reproduce, digitally or otherwise, the Contract Documents and submit as Shop Drawings. Do not use, copy or reproduce title blocks, dimensions, notes, keynotes, symbols schedules or details from Contract Drawings, digital or otherwise. Use of the Contract Drawings shall be limited to reproduction, digitally or otherwise, of the exterior wall layout, interior partition layout, grid lines, doors, and windows. Do not base Shop Drawings on standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Fabrication and installation drawings.
      c. Roughing-in and setting diagrams.
      d. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
      e. Shopwork manufacturing instructions.
      f. Templates and patterns.
      g. Schedules.
      h. Design calculations.
      i. Compliance with specified standards.
      j. Notation of coordination requirements.
      k. Notation of dimensions established by field measurement.
      l. Relationship and attachment to adjoining construction clearly indicated.
      m. Seal and signature of professional engineer if specified.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (279.4 mm), but no larger than size of Contract Drawings.
   3. Submit Shop Drawings in the following format:
      a. PDF electronic file.
   4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
      a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
      b. Refer to Section 01 31 00 "Project Management and Coordination" for requirements for coordination drawings.

D. Samples: Submit physical units of materials or products 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. Prior to transmission of any samples, coordinate with Designer for determination of submittal review location, where samples are better reviewed on site in contractor's construction field office. Coordinate arrival of samples no less than weekly with Designer to provide advance notice of sample arrival for the following week.
   2. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   3. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
   4. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
      e. Specification paragraph number and generic name of each item.
   5. Electronic Sample Submittal Requirements: Submit corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record. Submittals without digital photos, not submitted under the contractor's submittal, and without contractor's review stamp shall be returned without review. Criteria for acceptable photography:
      a. Clear photo of material label. Clearly written labels or manufacturer's labels shall be acceptable.
      b. Clear photo of label appended by the general contractor indicated for which material the product is being submitted. Utilize labels as found in the drawings on the finish legend wherever available. Utilize adhesive type labels that will not become lose with handling onsite, labeling with a marker or other easily read lettering when photographed.
      c. Clear photos in well lit conditions without shading on the material to show visual characteristics. Where multiple corners, sides or transitions occur, provide additional photos showing different conditions.
      d. Materials to be install on the exterior of the building shall be photographed in natural sunlight to show visual characteristics. Labeling is not required to be photographed in natural light.
      e. Sample photography for guidance will be provided by the Designer upon request.

6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. This sample shall be held at the contractor's trailer on site, clearly labeled with the transmittal and stamped submittal, clarifying the use of the material in the project. Samples shall be required to be sorted and stored in a manner to be easily produced upon in person request. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
7. 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 one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line.
    b. Designer will return submittal with options selected.
    c. Refer to Electronic Submittal Requirements for associated photography requirements for all samples.
    d. Refer to Disposition for on site storage and labeling requirements of all samples.
8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the 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:
        1) Submit two sets of Samples.
        2) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        3) Submit at least three sets of paired units that show approximate limits of variations if variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample.
        4) Refer to Electronic Submittal Requirements for associated photography requirements for all samples.
        5) Refer to Disposition for on site storage and labeling requirements of all samples.

b. Designer will retain one Sample set; remainder will be returned. Mark up and retain one returned physically periodically, as feasible. The primary documentation shall be the contractor's electronic submittal, with the contractor's photograph, which will be returned electronically, unless specifically requested by the Contractor. Contractor to retain one returned sample set as a Project record sample, readily available and clearly labeled for use on site.

9. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Designer's sample where so indicated. Attach label on unexposed side that includes the following:
   a. Generic description of Sample.
   b. Product name or name of manufacturer.
   c. Sample source.
10. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
    a. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
    b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    c. Refer to Electronic Submittal Requirements for associated photography requirements for all samples.
    d. Refer to Disposition for on site storage and labeling requirements of all samples.

E. Product Schedule or List: Prepare and submit a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:
   a. PDF electronic file.

F. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."

G. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

H. Subcontract List: Prepare and submit a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Submit on the form included in Document 00 60 00 "Forms," "Subcontractors and Major Material Suppliers List."
   1. Submit subcontract list in the following format:
      a. PDF electronic file.

I. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation" for action required.

J. Construction Photographs: Comply with requirements in Section 01 32 16 "Construction Progress Schedule."

K. Daily Construction Reports: Comply with requirements specified in Section 01 32 33 "Photographic Documentation".

L. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

M. Certified Surveys: Comply with requirements specified in Section 01 73 00 "Execution."

N. Closeout Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

O. Operation and Maintenance Data: Submit written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

P. Qualification Data: Submit written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of Designers and owners, and other information specified.

Q. Welding Certificates: Prepare and submit written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

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

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

T. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements.

U. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements.

V. 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.

W. Product Test Reports: Submit written reports indicating that 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.

X. 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. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

Y. Preconstruction Test Reports: Prepare and 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.

Z. Compatibility Test Reports: Prepare and 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.

AA. Field Test Reports: Prepare and submit reports, written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

BB. Manufacturer's Field Reports: Prepare and submit written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

CC. Manufacturer's Instructions: Submit written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

DD. Insurance Certificates and Bonds: Prepare and submit written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

EE. Material Maintenance Submittals: Comply with requirements specified in individual Sections for quantity and disposition of delivery of extra stock.

FF. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Refer to Section 01 35 73 “Delegated Design Requirements” for requirements regarding Delegated Design.

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 Designer.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Section 01 77 00 "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, coordinated, checked, and approved for compliance with the Contract Documents.

3.2 DESIGNER'S ACTION

A. General: Designer will not review submittals that have not been properly transmitted, reviewed by Contractor, or do not bear Contractor's approval stamp and will return them without action.
   1. Submittals are reviewed for conformance with the design concept expressed in the Contract Documents. Review is not for the purpose of confirming or approving:
      a. Deviation from the Contract Documents, including but not limited to deviation with reference to material, quantity, location, quality, dimension, or orientation (except as expressly annotated in writing by the Architect herein).
      b. Means, methods, sequences, or techniques of construction (unless expressly called for in the Contract Documents and herein expressly highlighted for review and approval by the Architect).
      c. Safety of the Contractor(s) work, work plan, procedures, workers or of the site.
      d. Any clarification of a patent or latent ambiguity or defect in the Contract Documents.
      e. Procurement or request for any labor, materials, or other expense of the contractor(s) which is in addition to that previously approved by the Owner.

B. Action Submittals: Designer will review submittal, make marks to indicate corrections or revisions required, and return it to Contractor. Designer will stamp each submittal with an action stamp as illustrated and will mark stamp appropriately to indicate action, as follows:
   1. Final Unrestricted Release: When the Designer marks a submittal:
      a. A – NO EXCEPTIONS
      b. The Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
   2. Final-But-Restricted Release: When the Designer marks a submittal:
      a. B – EXCEPTIONS AS NOTED
      b. The Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal of requirements of the Contract Documents. Final payment depends on that compliance. Resubmittal is not required for this action.

3. Returned for Resubmittal: When the Designer marks a submittal:
   a. C – REVISE AND RESUBMIT
   b. Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
   c. Do not use or allow others to use, submittals marked "C – REVISE AND RESUBMIT" at the Project Site or elsewhere where Work is in progress.
4. Returned as Rejected: When the Designer marks a submittal:
   a. D – REJECTED
   b. Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. The submittal does not conform to the design concept or meet requirement of the Contract Documents.
   c. Do not use or allow others to use, submittals marked "D – REJECTED" at the Project Site or elsewhere where Work is in progress.
5. Returned as received for Information Only: When the Designer marks a submittal:
   a. E – FOR INFORMATION ONLY
   b. Proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. The submittal is acceptable, but the Designer's affirmative action is not required.
6. Returned as Not Reviewed: When the Designer marks a submittal:
   a. F – NOT REVIEWED
   b. Submittal is not required by the Contract Documents.

C. Contractor will remain responsible for the following:
   1. Compliance with the Contract Documents.
   2. Coordination of the Work.
   3. Performing the Work in a safe and satisfactory manner.
   4. Confirming and correlating quantity and dimensions.
   5. Construction Schedule.

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

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

F. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

G. Submittals not required by the Contract Documents will not be reviewed and may be discarded or returned marked "NOT REVIEWED."

H. Substitution items received as product data, shop drawing, or sample submittals required by individual Sections will be returned to Contractor without review. Comply with requirements in Section 01 25 00 "Substitution Procedures" for submission of substitution request.

END OF SECTION

SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Special procedures for alteration work including the following:
   1. Products and installation for patching and extending Work within construction areas of existing facilities.
   2. Providing transition and adjustments.
   3. Repair of damaged surfaces and finishes.

1.2 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 OCCUPANCY, ACCESS, AND PROTECTION

A. Entire facility will be occupied during progress of construction for conduct of normal operations.

B. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage. Perform work not to interfere with operations of occupied areas.

C. Existing facilities will remain in full operation during execution of this Work. Exercise every precaution to ensure safety and protection for existing facilities, occupants, merchandise, pedestrians, and vehicles.
1. Maintain safe access and egress at all times for occupants, pedestrians, and vehicles.
2. Maintain exiting from facilities to provide safe passage complying with applicable codes.

1.4 COORDINATION

A. Make arrangements with Owner and schedule Work to avoid interference with normal operations of occupied areas. Submit schedule and summary of applicable Work within occupied areas and obtain Owner approval not less than two days prior to commencement of such Work.
1. Requests for use of certain existing loading docks, passageways, and other similar spaces within areas outside limits of construction operations will be limited to day-by-day basis and must be approved in advance by Owner.

B. Coordinate access and scheduling of Work within tenant areas with Owner.
1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:
   a. Owner's continuing occupancy of portions of existing building.
   b. Owner's partial occupancy of completed Work.
   c. Other known work in progress.
   d. Tests and inspections.
3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs.

6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

1.5 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.
   1. Attendees: In addition to representatives of Owner, Architect, and Contractor shall be represented at the meeting.
   2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
      a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
      b. Fire-prevention plan.
      c. Governing regulations.
      d. Areas where existing construction is to remain and the required protection.
      e. Hauling routes.
      f. Sequence of alteration work operations.
      g. Storage, protection, and accounting for salvaged and specially fabricated items.
      h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
      i. Qualifications of personnel assigned to alteration work and assigned duties.
      j. Requirements for extent and quality of work, tolerances, and required clearances.
      k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.
   3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner,Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
    a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
    b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:
        1) Interface requirements of alteration work with other Project Work.
        2) Status of submittals for alteration work.
        3) Access to alteration work locations.
        4) Effectiveness of fire-prevention plan.
        5) Quality and work standards of alteration work.
        6) Change Orders for alteration work.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.
    1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed.
    2. Salvage and store for future reuse all commemorative plaques affixed to the building.

1.7 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:
   1. Submit alteration work subschedule within seven days of date established for commencement of alteration work.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

C. Alteration Work Program: Submit 30 days before work begins.

D. Fire-Prevention Plan: Submit 30 days before work begins.

1.8 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.
   1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.
   1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
   2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.9 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:
1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:
1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, and photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F (3 deg C) or more above the dew point.

E. Storage Space:
1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space includes security and climate control for stored material.
2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.10 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of measured drawings and preconstruction photographs.

1. Comply with requirements specified in Section 01 32 33 - Photographic Documentation.

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

1.11 KEYS

A. When necessary to perform Work, Owner will issue keys to existing mechanical/electrical equipment spaces.

B. Return keys at end of each work day; request keys on succeeding days, if necessary.

PART 2 PRODUCTS

2.1 MATERIALS

A. Type and Quality of Existing Products: Use products or types of construction that exist in structure, as needed to patch, extend, or match existing Work.
1. Generally, Contract Documents do not define products or standards of workmanship present in existing construction.
2. Determine by inspecting and testing products where necessary, referring to existing work as quality standard.

B. New Materials: Comply with Specifications for each product involved.
1. Match existing products and work for patching existing work.

C. Materials for Temporary Fire-Rated Partitions: Comply with provisions of Section 01 50 00 - Temporary Facilities and Controls.

PART 3 EXECUTION

3.1 EXAMINATION

A. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
1. Prior to commencing work, carefully compare and check Contract Documents for discrepancies in locations or elevations of work to be executed.
2. Refer discrepancies among Drawings and existing conditions to Architect for adjustment before work affected is performed.

3. Existing conditions concealed behind accessible ceilings which are contrary to anticipated or proposed conditions, shall not be used as a basis for change order requests. Existing conditions behind in-accessible ceilings may be used as a basis for change order requests, provided it can be documented that there was no way conditions could be verified.

3.2 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
   1. Use only proven protection methods, appropriate to each area and surface being protected.
   2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
   3. Erect temporary barriers to form and maintain fire-egress routes.
   4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
   5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
   6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
   7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
   8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:
   1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
   2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:
   1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
   2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
   3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
   1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
   2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

F. Existing Roofing: Prior to the start of work in an area, install roofing protection, as indicated on Drawings.

3.3 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:
   1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
   2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
      a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
   1. Obtain Owner's approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
   2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
   3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
   4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
   5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.

6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
   a. Train each fire watch in the proper operation of fire-control equipment and alarms.
   b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
   c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
   d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
   e. Maintain fire-watch personnel at each area of Project site until 60 minutes after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
   1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.4 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.5 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings. Comply with requirements in Section 01 32 33 - Photographic Documentation.

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
   1. Do not proceed with the work in question until directed by Architect.

3.6 INSTALLATION

A. Coordinate Work of alterations and renovations to expedite completion and to accommodate Owner occupancy.

B. Remove, cut, and patch Work in manner to minimize damage and to provide means of restoring products and finishes to specified condition.
   1. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes.

C. Install products as specified in individual Specification sections.

D. Where new Work abuts or aligns with existing, perform smooth and even transition to match existing adjacent surface in texture and appearance.
   1. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and request instructions from Architect as to method of making transition.

3.7 FINISHES

A. Finish new surfaces as specified in individual Specification sections.

B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.8 ADJUSTMENTS

A. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to provide smooth plane without breaks, steps, or soffits.

B. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

C. Fit Work at penetrations of surfaces as specified in Section 01 73 00 - Execution.

3.9 CLEANING

A. Comply with Section 01 73 00 - Execution. Thoroughly clean areas and spaces affected by Work. Completely remove paint, mortar, oils, putty and items of similar nature.

B. Clean Owner-occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

END OF SECTION

NC State University Design and Construction Guidelines

Division 01 Contractor Safety Requirements

[The designer shall incorporate this document into the specification in its entirety.]

1.0 Purpose

A. The purpose of this guideline is to define NC State contractor safety requirements. This guideline is intended to be a supplement to the General Conditions of the contract.

B. The Designer or Construction Manager shall incorporate this document into the Project Manual in its entirety.

C. Contractors and subcontractors are responsible for the safety of their employees and all persons on and around a work site. Contractors are solely responsible for the development and implementation of their safety programs. This document does not relieve the duty and responsibility of contractors, subcontractors, their agents, employees, and other persons performing portions of the work on a project to comply with federal, state, and/or local laws or regulations that relate to work site safety.

2.0 Scope

A. This document provides contractors with the University's specific requirements that must be incorporated into the contractor's Site-Specific Safety Plan. This document is not designed or intended to replace the contractor's safety program, nor to address every possible safety, environmental, or health hazard associated with the contractor's work. In the event that the contractor's safety program includes a requirement or practice that is more stringent than set forth herein, the more stringent shall be followed. This document does not relieve the contractor of this obligation to: (1) control the means and methods by which its employees and any subcontractors perform work, and (2) independently ascertain what health and safety practices are necessary for the performance of the work.

B. No specific requirements herein shall be construed to limit, replace, or supersede applicable provisions of federal, state, or local laws or regulations. Occupational Safety and Health Administration (OSHA) Regulations; Standard Number 29 CFR 1926 are the foundation of these Guidelines.

C. Deliverables

1. Competent Person Designation (see attached form) (4.0/C)
2. Verification of OSHA 30 or OSHA 10 compliance, based on project requirements. (4.0/D/1/b)
3. Contractor Site Specific Safety Plan (SSSP). (4.0/I)
4. Summary of the Daily Safety Inspections documented as part of regular project

meeting minutes. For projects bid through Construction Services summaries of Daily Safety Inspections will be documented as agreed upon at the pre-construction meeting. (4.0/F/1)

5. Regular (min. monthly) Safety Reports. (4.0/F/2)
6. Traffic Control Plans (when impact exists) (4.0/QQ/1)

3.0 Reference Materials

A. The following reference materials are required to be available upon request at every job site:

1. OSHA Regulations published by NC Department of Labor (DOL) (Available at (800) NC-LABOR, http://www.nclabor.com/pubs.htm).
2. Safety Data Sheets (SDS) for all chemical products the contractor has brought to the worksite.
3. The written Safety Plan of the Contractor or Subcontractor.
4. Site inspection documentation.
5. Worksite employee training records.
6. Mishap reports and investigations.

4.0 General Responsibilities

A. The contractor must notify the NC State Project Manager in writing at least 10 days prior to:

1. Utilizing powder-actuated tools
2. Starting operations that will produce excessive odor, dust, and noise affecting occupied buildings or work near air intakes
3. Using a combustion engine indoors
4. Using a mobile crane or tower crane (50-day notice is required)
5. Breaking ground for an excavation or trench
6. Using a laser
7. Using any source of radioactive material
8. Working with lead or asbestos-containing materials
9. Performing energized electrical work
10. Working on or near active underground utility infrastructure (steam, chilled water, natural gas, water, etc.)
11. Entering electrical distribution assets

Violation of any safety, security, or environmental requirement may result in the permanent removal of the contractor or their employees from the NC State premises.

Division 01 Contractor Safety Requirements

Division 01 Contractor Safety Requirements

B. Construction Management

1. The contractor is responsible for compliance with all federal, state, and local laws, regulations, standards, executive orders, etc. applicable in part or whole pertaining to the scope of work.
2. Contractors are responsible for compliance with all applicable NC State safety practices, procedures, policies, standards, and requirements.
3. Contractors are responsible for providing qualified and competent personnel to perform activities under the scope of work. Contractors must provide documentation of training prior to beginning work on-site.
4. Contractors are responsible for ensuring that subcontractors, their agents, employees, visitors, and other persons performing portions of the work on a project comply with federal, state, and/or local laws or regulations that relate to work site safety.
5. Contractors are responsible for ensuring that subcontractors are informed of and comply with all applicable requirements within the scope of work.

C. Competent Person Designation

1. Contractors shall designate a competent person for activities as specified in OSHA 29 CFR 1926. Such activities include, but are not limited to, the following activities, as applicable to the job:
    a. general provisions
    b. ionizing/non-ionizing radiation
    c. gases, vapors, fumes, mists, dust
    d. ventilation
    e. hazard communication
    f. lead
    g. asbestos
    h. personal protective equipment
    i. hearing conservation
    j. respiratory protection
    k. rigging and material handling equipment
    l. welding, cutting, brazing
    m. electrical
    n. scaffold
    o. fall protection
    p. cranes (overhead and mobile)
    q. motor vehicles and equipment
    r. excavations
    s. concrete and masonry
    t. steel erection
    u. demolition

v. stairways and ladders
w. toxic and hazardous substances.

2. OSHA 29 CFR 1926.32(f) “Competent person" means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

D. Contractor Safety Personnel
   1. Safety Representative
      a. For all projects contractors must designate a Safety Representative prior to the start of the project. The Safety Representative may be the Project Superintendent and is responsible for all safety concerns related to the construction operations.
      b. For formally contracted projects (>$500k), the Safety Representative must have completed, at a minimum, an OSHA 30-hour Construction Safety Course. For informally contracted projects (<$500k), the Safety Representative must have completed, at a minimum, an OSHA 10-hour Construction Safety Course.
      c. The Safety Representative must actively monitor the job site for safety issues on a daily basis. The Safety Representative may have additional site duties outside the scope of safety; when the safety representative is not on the project site, a competent designee must be assigned to monitor safety on the site.
   2. Safety Professional
      a. When appropriate, the contractor shall provide a full-time safety professional assigned to the project. The duties of the full-time safety professional must be strictly limited to safety-related activities, with no additional job site duties.
      b. Safety professionals must have one or more of the following credentials: a professional certification (beyond an OSHA 30-hour course), a college or professional degree related to safety and health, or significant previous experience and skills necessary to thoroughly understand the health and safety hazard and controls relevant to the project. The designation and adequacy of qualifications of the full-time safety professional shall be reviewed and accepted by the University prior to the commencement of the work.
      c. Project-specific requirements for a full-time safety professional will be addressed in the contract documents and discussed during the Pre-Bid Meeting.

E. Daily Pre-Job Meetings
   1. A pre-job meeting (i.e. “Tailgate” or “toolbox” meeting) shall be held at the

beginning of each work period (normally in the morning before leaving the yard or work staging area). The pre-job meeting should include a discussion of the scope of work to be completed, associated hazards, and means and methods to mitigate the hazards. The pre-job meeting must be led by the supervisor or other competent person.

F. Safety Inspections
    1. Daily Inspections: The Contractor shall perform daily job inspections and correct any unsafe conditions or actions. A summary of these inspections will be reviewed as a portion of and captured in the minutes of the weekly Owner, Designer, and Contractor job meetings.
    2. Monthly Inspections: For projects with a duration of more than one calendar month (4 weeks), the safety inspection must be documented and include, at a minimum, the name of the person performing the inspection, the date, a checklist of items observed, any identified safety concerns, and actions taken to address identified concerns.
    3. University Project Visits: The NC State Project Manager, or another owner representative, may perform unscheduled visits to project sites to address adherence to the Contractor Safety Requirements or Site-Specific Safety Plans. Any safety concerns identified will be reported to the responsible contractor for prompt mitigation.

G. Mishap Reporting: All mishaps occurring on the project site must be investigated to determine causes and actions must be taken to prevent recurrence. Mishaps resulting in a recordable injury requiring medical treatment or damage to NC State property must be reported in writing to the NC State Project Manager as soon as possible but no later than 24 hours from occurrence; the Project Manager shall be notified immediately of mishaps resulting in life-threatening injury.

H. The Contractor shall address safety concerns at regularly scheduled meetings with subcontractors.
    1. Contractor Site-Specific Safety Plan (SSSP) - The Contractor must develop and implement an SSSP. The SSSP is a comprehensive safety plan for his or her employees, which covers all aspects of onsite construction operations and activities associated with the contract. This plan must comply with all applicable health and safety regulations and any project-specific requirements. The SSSP must be submitted to, reviewed, and accepted by NC State before beginning any on-site work activities.
    2. As applicable to the project, these items must be included in the SSSP:
        a. Scope of Work
        b. Emergency Procedures
        c. 24-hour emergency points of contact

d. Identification of Designated Competent On-Site Personnel (per OSHA requirements)
e. Designated On-Site Safety Personnel
f. Safety orientation program
g. Site logistics Plan: address public (student, faculty, staff, visitor) safety, traffic plan, equipment and lay-down areas, site security, dust containment, etc.
h. Minimum PPE requirements
i. Hazard Assessment (for defined project tasks) - include hazard identification and mitigation
j. Mishap reporting and investigation procedures
k. Safety inspection/audit procedures
l. Sub-contractor requirements

5.0 General Requirements

A. Asbestos - If asbestos-containing materials are uncovered during construction, NC State must be notified immediately. Do not attempt to remove the material. Contractors shall comply with provisions of the State Construction Office Asbestos Abatement Guidelines and Policies and the NC State Asbestos Management Plan.

1. If asbestos-containing material is present in any building material and is in good condition (i.e. non-friable) and will not be disturbed during construction, the material may be left in place. If asbestos-containing material is disturbed during construction activities, then it shall be removed; removal shall be performed by appropriately qualified and accredited personnel and in accordance with federal, state, and local regulations.

B. Compressed Gas Cylinders

1. Compressed gas cylinders shall be properly used, stored, and maintained as per federal, state, and local requirements.
2. Cylinders shall not be stored in a location in which they are subject to mobile equipment traffic (including vehicles) unless adequately protected.

C. Confined Space Entry

1. Contractors required to enter a confined space at NC State must have and implement a written confined space entry program in accordance with OSHA 1926 Subpart AA Confined Spaces in Construction or OSHA 1910.146 permit required confined spaces, as applicable.
2. Controlling contractors (those with overall responsibility for construction at the work site) must ensure space entry coordination when more than one entity enters the space.
3. Each contractor must have a competent person who will identify confined spaces associated with the scope of their work. Before entry into a permit-required confined space, contractors must obtain the following information from the controlling contractor (when there is no controlling contractor, the contractor will obtain the information from the NC State Project Manager):

a. The location of each known permit space associated with the project scope;
b. The known hazards or potential hazards that make it a permit space;
c. Any precautions needed to be taken based on the known hazards or potential hazards.

4. Each contractor performing work in a permit space must perform a hazard assessment specific to the work to be performed and establish corresponding hazard controls.
5. A competent person from each contractor performing work in a permit space must complete and sign Appendix F to the NC State Confined Space Entry Program.

D. Contaminated Soil - If soil or any materials appear to be contaminated, the NC State Project Manager must be notified immediately. The NC State Project Manager will contact NC State EHS for assistance at (919) 515-7915.

E. Electrical Power Lines (Overhead) - The contractor shall have a trained and knowledgeable observer (signal person) within sight of the operator and the overhead lines that will effectively provide guidance and clearance information to the operator as the equipment may approach the minimum approach distances. Advising the operator shall be the signal person's one and only task. When conducting any work with a crane, derrick, or hoist in the vicinity of any overhead electric power transmission or distribution line, the contractor shall observe all clearance requirements dictated by all applicable OSHA rules, as specifically contained within 29 CFR 1910 - Standards for General Industry, CFR 1926 - Standards for Construction, IEEE C2 - NEC, NFPA 70 - NEC, the NCSBC, ANSI standards, and other applicable NC State safety guidelines and requirements. Further, no crane, derrick, or hoist operator or contractor shall conduct any operation at any distance closer than 20 feet to any electric power line lower than 200 kV or closer than 35 feet to any electric power transmission line at voltages higher than 200 kV and lower than 250 kV, unless the requirements of OSHA 1926 Sub CC for preventing encroachment/electrocution are strictly followed.

F. Elevators/Material Hoists

1. Any persons operating elevators/hoists must be trained to do so. Documentation shall be kept onsite.
2. No elevator/hoist with a defect shall be used.
3. Elevator/hoist safety devices shall not be overridden or made inoperable.

G. Emergency Equipment- The following shall not be moved, blocked, disabled, or rendered inaccessible unless authorized by NC State:

1. Fire equipment
2. First aid equipment, fire blankets, stretchers, eyewash fountains, and safety showers
3. Fire protection, hydrants, and detection systems

H. Emergency Medical Treatment - To receive immediate assistance for emergency medical treatment call 911.

I. Environmental and Chemical Requirements

1. Contractors must provide NC State with a list of all chemicals to be used on NC State property and maintain a copy on-site of the SDS for each chemical prior to being brought on-site. Each chemical container must be labeled clearly with the identity of the chemical and any associated hazards in accordance with the OSHA Hazard Communication Standard (1910.1200).
2. Contractors must follow the safety procedures recommended by the manufacturer or seller of any chemicals, tools, equipment, or other materials. Contractors are to remove all empty containers, excess chemicals, and chemical waste from NC State property.
3. For all chemical incidents, contractors shall call 911 and also notify the NC State Project Manager.

J. Excavation and Trenches - Before doing any excavation work, the Contractor must locate all utilities by calling the local utility locator service and NC State.

K. Excavations

1. Underground Facilities Locate. Contractors shall ensure underground installations and facilities are identified by calling 811 (Call Before You Dig) before performing any excavating activity. Note: excavation includes movement or removal of earth, rock, or other materials in or on the ground by use of manual or mechanized equipment. This is required for any project with earth-moving activities before you dig so that underground facilities can be identified and avoided. Detailed instructions and requirements can be found at nc811.org.
2. Competent Person. Trench and excavation work must be performed under the direction of a competent person. Responsibilities include: classifying soil, inspecting protective systems, monitoring water removal, and conducting site inspections.
3. Cave-In Protective Systems. A protective system is required by OSHA-1926 Subpart P for trenches and excavations that are 5 feet or more in-depth OR if the competent person has examined the ground and finds an indication of a potential cave-in. Protective systems typically include sloping/benching, shoring, or shielding. To determine what protective systems are appropriate, the competent person must first determine the soil type: Stable Rock, Type A, Type B, or Type C soil. Type C soil is the least cohesive and therefore, the least stable. No work shall be permitted in excavations where water has accumulated unless the integrity of the excavation has been protected.
4. Excavations >20 feet in depth or that cannot comply with OSHA requirements require written approval by a Registered Professional Engineer (RPE).
5. A ladder, stairway, ramp, or other means of access must be provided within the excavation when excavations are >4 feet in depth.
6. Barricades (stop-logs) shall be provided where vehicles or mobile equipment are used near or adjacent to excavations.
7. Spoil piles must be placed a minimum of 2 feet from the edge of the excavation.
8. Air monitoring must be performed if the excavation is >4 feet in depth and there is a potential for a hazardous atmosphere to exist.

L. Exit Routes

1. Exit routes must be maintained at all times during construction.
2. Lighting and marking must be adequate and appropriate.
3. Exit routes must be kept free of explosive or highly flammable furnishings.
4. Exit routes must be free and unobstructed. No materials or equipment may be placed, either permanently or temporarily, within the exit route. The exit access must not go through a room that can be locked, such as a bathroom, to reach an exit or exit discharge, nor may it lead into a dead-end corridor. Stairs or a ramp must be provided where the exit route is not substantially level. No materials shall be stored in a stairwell.

M. Explosives: Blasting on university property is prohibited.

N. Fall Prevention. A fall hazard is any condition on a walking-working surface that exposes an employee to a risk of a fall on the same level or to a lower level. Examples of fall hazards include, but are not limited to: floor openings, hoist areas, roofs, leading edges, scaffolding, ramps, etc.

1. Preventing or protecting falls from height may be necessary at any height given the circumstances, but is required when an employee is at a height of 6 feet or more above a lower level.
2. Contractor work generally falls within construction industry applications, where acceptable methods depend on the type of work being performed: unprotected sides or edges, roof work, leading edge, etc. In all cases, contractors shall comply with the respective OSHA standards.
3. Contractors shall ensure that every employee required to work at unprotected heights (greater than 6 feet) is trained in fall hazard recognition and prevention.
4. **Guardrail System**. A guardrail system provides the highest level of protection and is always preferred. The system must be capable of supporting 200 lbs. in any direction and still maintain its integrity. The individual heights of the components must conform to the following minimum standards:
    a. The top rail of the system must be at a height of 42” (+ or – 3”);
    b. the mid rail must be at a height of 21” with a 3” variation possible;
    c. the toe board must have a minimum vertical height of 3.5”.

    Note: The building code has more stringent requirements for permanent installations.
5. **Personal Fall Protection Systems**. At times, it is necessary to work in areas where guardrails cannot be constructed; in these instances, a personal fall protection system must be used. Personal Fall Protection Systems are systems (including all components) that provide protection from falling or that safely arrest a fall. Examples include travel restraint and personal fall arrest. All components of this system shall meet the applicable design requirements as specified in OSHA 1910, 1926, or ANSI Z359. All components shall be inspected by the wearer prior to each use and at least annually by a competent person. No employee may use a personal fall protection system without proper training and an understanding of proper use and safe application of the system.
    a. **Travel Restraint System**. A travel restraint system is a combination of an anchorage, anchorage connector, lanyard (or other means of connection),

and body support that the wearer uses to eliminate the possibility of going over the edge of a walking-working surface. Anchorages for travel restraint systems shall have a strength capable of sustaining static loads of at least 1,000 lbs. (per person) or two times the foreseeable forces for certified anchorages. Anchorage connectors, lanyards (or other means of connection), and body support devices shall be used in accordance with the manufacturer's requirements. The system shall be installed so that a fall cannot occur; therefore, a rescue plan is not required.

b. **Personal Fall Arrest System**. A personal fall arrest system is a system used to safely arrest a user in a fall from a walking-working surface. It includes an anchorage, anchorage connector, and a full-body harness. The means of connection may include a lanyard, deceleration device, lifeline, or a suitable combination of these. Equipment must be worn and used in accordance with the manufacturer's requirements. Anchorages for personal fall arrest systems shall have a strength capable of sustaining static loads of at least 5,000 lbs. (per person) or two times the maximum arresting force for certified anchorages. The system shall be installed so that should a fall occur, the wearer will not contact the lower level or any other obstruction. Since there is a potential for a fall to occur, a rescue plan written by a qualified person is required.

c. **Warning Line System**. A warning line may be used for construction roofing work when closer to the fall hazard than 15ft, but no closer than 6ft and in conjunction with one of the following: a guardrail system, a safety net system, a personal fall protection system, or a safety monitoring system. A warning line system shall conform to regulatory requirements and enclose all authorized employees conducting work protected by the Warning Line System. Refer to OSHA 1926.502(f).

O. Fire Protection and Prevention

1. The contractor shall be responsible for the development and maintenance of an effective fire protection and prevention program at the job site throughout all phases of the construction. Contractors shall perform inspections on fire extinguishers monthly. Contractors shall immediately replace fire extinguishers that do not pass inspection.
2. Fire cutoffs shall be retained in buildings undergoing alterations or demolition until operations necessitate their removal.
3. If work requires the disabling of Fire Protection Devices, then the Contractor must request a Fire Alarm Disconnect; through the appropriate NC State process; beginning with the Project Manager. No alarm shall be disabled at any time by the Contractor.

P. Hand and Power Tools

1. All hand and power tools and similar equipment, whether furnished by the employer or the employee, shall be maintained in a safe condition. Any tool found not in proper working order, or that develops a defect during use, shall be immediately removed from service and not used until properly repaired.
2. All tools shall be used, operated, and maintained in accordance with OSHA and manufacturer requirements.

Division 01 Contractor Safety Requirements

Q. Hot Work Permits - A Hot Work Permit is required when any indoor or outdoor work will involve hot work, defined as operations including cutting, welding, thermite welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of torch-applied roof systems or other similar activities. Requirements for Contractors performing this work are contained in the NC State Hot Work Permit Program which is a part of the specifications package and can also be found in the Hot Work Permit Form.

R. Housekeeping

1. The Contractor must maintain a clean and orderly project job site. The Contractor shall maintain NC State's pathways free of rocks, mud, and other miscellaneous construction debris. The Contractor shall prevent the accumulation of dirt, dust, and/or other debris on NC State's roadways. The Contractor shall clean the travelways on a daily basis. (Refer to project specifications for requirements.)
2. Waste material and debris must be removed from the work and access areas at least once a day. Waste material and debris should not be thrown from one level to another but should be carried down, lowered in containers, or deposited in a disposal chute.
3. Materials must be neatly piled, stacked, or otherwise stored to prevent tipping or collapsing. Materials must be carefully stacked and located so they do not block aisles, doors, fire extinguishers, safety showers, eyewash stations, fixed ladders, or stairways.
4. Material to be lifted by crane or other hoisting devices must not be stored under overhead power lines.
5. No materials may be stored on penthouses, roofs, or other areas until a specific area is assigned by NC State for a specific project.
6. Adverse Weather: If NC State becomes aware of an adverse weather event, the NC State Project Manager shall notify the construction superintendent, and the contractor shall perform a job site review to ensure any debris or construction materials are secured and protected from the elements.

S. Illumination - Construction areas, ramps, runways, corridors, offices, shops, and storage areas shall be lit to not less than the minimum illumination intensities required by OSHA.

T. Ladders - All ladders must meet OSHA requirements.

U. Lasers

1. Lasers must comply with the OSHA Construction Industry Standards.
2. Lasers must be low-power (<5mw) devices with visible beams. Lasers to be used must bear a label indicating this maximum power output. Lasers that do not bear this label shall not be used.
3. "Laser in use" signs shall be posted according to OSHA requirements.
4. Lasers must be used in a manner that will not risk exposure to others.

V. Lead

1. Lead may be found in certain painted surfaces. A check for lead presence should be conducted prior to certain activities such as grinding, sanding, or burning over

painted surfaces. If lead-containing paint is disturbed or a material is questionable the NC State Project Manager must be notified immediately. Do not attempt to remove the material.

2. Hot Work over lead-painted surfaces is generally not permitted.

W. Lock Out/Tag Out

1. All contractors that work on energized equipment with any hazardous energy source are required to have a hazardous energy control (i.e. lockout tagout) program. The program shall specify policies and procedures for de-energizing, verifying de-energizing, and securing the source potential using energy isolating devices and applying locks/tags or implementing other forms of hazardous energy control as specified in OSHA standards. Types of potential energy sources include, but are not limited to:
    a. Electrical (refer to the section of these requirements titled “Electrical”)
    b. Pneumatic
    c. Hydraulic
    d. Thermal
    e. Kinetic (motion)
    f. Hazardous gas, liquid, air
    g. Radiation
    h. Lasers
2. When multiple contractors are performing work on the same project, hazardous energy control procedures shall be coordinated by the controlling entity which includes establishing device standardization.
3. Contractors shall ensure site personnel are trained on the hazardous energy control program.
4. Central Utility Plant (CUP) - Lockout Tagout Procedure
    a. Contractors with the need to perform LOTO operations within the operating CUP shall be trained in accordance with the procedure and comply with applicable sections of the procedure. The contractor is responsible for providing this training; a copy of this procedure will be provided to the contractor.
    b. Contractor management shall ensure that authorized personnel are assigned to perform work in which they are qualified.
    c. Contractor management shall comply with applicable sections of the procedure.

X. Mobile Cranes, Tower Cranes, etc. (Reference OSHA 1926 Subpart CC).

1. Prior to the setup or operation of any crane on university property, the NC State Project Manager (or another point of contact) shall be notified; notification must be made with as much lead time as possible, but no fewer than fifty (50) working days
2. Cranes shall be set up and operated in compliance with the manufacturer and applicable OSHA requirements.
3. Contractors are responsible for ensuring ground conditions are capable of

supporting the equipment and load, which will include performing underground facilities/utilities location (i.e. 811 calls) as well as factual confirmation of necessary compaction capacities. This confirmation is to be by third-party inspection services, at the expense of the contractor.

4. No lifts may occur over occupied spaces unless a registered structural engineer evaluates and certifies that the building can withstand the impact of a load being dropped on the building as a worst-case scenario. If it is determined that the building cannot withstand the impact without compromising the structure, areas of the building within the load fall zone must be evacuated during the duration of the lift. This evacuation process must be a part of the lift plan and managed by the contractor.
5. The crane contractor shall provide equipment documentation, including the annual inspection and the last monthly inspection. Documentation must be signed.
6. Crane operators shall be certified by an Accredited Crane Operator Certification Agency for the type of equipment operated. Examples of such agencies, include, but are not limited to:
    a. National Commission for the Certification of Crane Operators (NCCCO)
    b. National Center for Construction Education and Research (NCCER)
    c. Operating Engineers Certification Program (OECP)
    d. Electrical Industry Certifications Association (EICA)

    Additionally, the crane operator's employer must attest that the operator was evaluated to verify the operator demonstrates skills and knowledge to safely operate the equipment as well as the ability to recognize and avert risk, as required under 29 CFR1926.1427 (f).
7. All rigging personnel and signal persons shall be qualified in accordance with OSHA 1926 Subpart CC.
8. Crane Lift Plan. A lift plan is required for any lift in a location not under the exclusive control of the contractor, including lifts affecting NC State property, structures, employees, students, or visitors. Each lift plan must be developed by a qualified person and include at least the following:
    a. The identity of the controlling entity, meaning the employer with the overall responsibility for construction operations associated with the crane lift.
    b. Identify a lift director (i.e. primary signal person) and method of communication (hand signals, radio, etc.).
    c. Contractors conducting crane operations are required to obtain required FAA permits according to 14 CFR Part 77; to be submitted with the lift plan.
    d. Equipment positioning locations, including load staging and movement and paths to and from the working position.
    e. Equipment specifications including load and reach capacities.
    f. Current qualifications, certifications, and licenses of operators and

riggers.

g. For lifts involving more than one crane, the lift plan shall encompass all cranes.

h. Fall Zone: The contractor shall identify the Fall Zone. The Fall Zone is the area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall. Spaces within the Fall Zone (including buildings, foot traffic, vehicle traffic, etc.) shall be barricaded to control access. The Fall Zone shall be cleared of personnel not participating in the lift.

i. Wind limitations.

j. Ground and subsurface stability at crane and load placement locations. The contractor must ensure a qualified person evaluates the crane set-up location to ensure ground conditions are sufficient. (See X., 3. above).

k. Other conditions or factors that may affect the safety of the lift.

l. A pre-lift meeting must be completed immediately before the lift and shall include all personnel involved with the lift and a thorough review of the elements and specifics of the lift plan and personnel assignments.

m. Specify the distance to the closest energized lines and the applicable minimum approach distance of any lift component.

n. Where items positioned by a crane lift are rigged at heights above easy reach height, the lift plan shall include safe attachment and de-attachment procedures and the control of exposure to fall hazards.

o. The contractor must provide documentation of annual and monthly inspections for the previous 3 months. 1926.1412(f) & .1412(e).

Y. Electrical

1. Electrical Contractor shall ensure that their personnel using electrically powered equipment are trained to recognize electrical hazards, inspect and maintain electrically powered equipment, and on safe work procedures to prevent exposure to electric shock.
2. Premises Electrical Equipment. All electrical installations must comply with the National Electrical Code® (NEC®). Work associated with electrical equipment installed in accordance with the NEC® will be conducted in accordance with the NFPA 70E® Standard for Electrical Safety in the Workplace. NC State's goal is to minimize exposure to shock and arc flash hazards during the installation, repair, maintenance, and operation of electrical equipment, components, and systems.
    a. Electrical power sources shall be de-energized, verified, and locked out prior to working on electrical equipment except when de-energization creates a greater hazard and a properly executed Energized Electrical Work Permit (EWP) has been completed.
    b. Contractors performing electrical work must have their own energized electrical work program that includes a permit process.
3. Power Generation & Distribution: Work by Qualified Persons and Unqualified Persons working on or near power generation or distribution equipment is

addressed in OSHA 29CFR1910.269. It includes work on or directly associated with installations used for the generation, control, transformation, transmission, and distribution of electricity. Any work involving the NC State distribution system shall be coordinated by the NC State Project Manager (or other university contact person) in collaboration with the Facilities Division Power Systems group.

a. Work involving the NC State electrical distribution system shall only be performed after authorization by the Facilities Division Power Systems group in accordance with the Power Systems Switching Procedure.
b. System Check-In/Out: Prior to entering any primary enclosure (substation, transformer, manhole, switch, switching station, etc.) of the NC State Power System the NC State Project Manager or other designated person shall send a text or email to group-powersystementry@ncsu.edu with the work location and brief description of the tasks to be performed (photos are welcomed). When exiting the enclosure, check out with NC State Power Systems using the same method. This is only for unescorted access. For example, if you're with a member of the Power Systems team there's no need to check in/out, but if that team member has to leave your work site, you're expected to check in and check out.

4. The contractor will follow all requirements as noted in NFPA 70E.

Z. Mobile Elevating Work Platforms (MEWPs)

1. General Requirements.
   a. MEWPs shall be operated in accordance with the manufacturer’s requirements and specifications.
   b. Employees must always stand firmly on the floor of the MEWP and must not sit or climb on the edge of guardrails, or use planks, ladders, or other devices for a work position. The guardrail system of the platform must not be used to support materials, other work platforms, or employees.
   c. A personal fall arrest/restraint system shall be used in accordance with the manufacturer’s requirements. A scissor lift with approved guardrails may be used without a personal fall arrest system when specified by the manufacturer, however, if there are designated anchor points, the use of a fall arrest/restraint system is required.
   d. The MEWP must be used only in accordance with the manufacturer’s operating instructions and safety rules.
   e. The designed rated capacity for a given angle of elevation must not be exceeded.
   f. At least 10 ft distance must be maintained away from overhead power lines with a nominal voltage of 50kV or less; 20 ft for power lines over 50kV (or if the voltage is unknown). Note: qualified workers using appropriately insulated MEWPs may approach closer than 10 ft when following provisions specified in OSHA 1910.268, 1910.269, and 1926 Subpart V, as applicable.
   g. The manufacturer’s rated load capacity must not be exceeded. The load and its distribution on the platform must be in accordance with the

manufacturer's specifications. The rated load capacity must not be exceeded when loads are transferred to the platform at elevated heights. Only employees, their tools, and necessary materials must be on or in the platform.

h. A trained spotter with no other job duties is required when a MEWP is driven; the spotter will assess conditions that could pose a hazard to the operation (for example, drop-offs, holes, slopes, inadequate surface and support, obstructions, pedestrians, vehicles, debris, electric lines, etc.) and stop operations and alert the operator. The operator shall halt operations until hazards are adequately controlled.

2. Training
    a. Only personnel who have received training to operate the specific type(s) of MEWPs are authorized to operate them on NC State property.
    b. Training must include inspection, application, and operation of MEWPs (including recognition and avoiding hazards associated with their operation). Operators are only authorized to use MEWPs of the specific model for which they are trained and evaluated.
    c. Training must be provided by a person who has knowledge regarding the laws, regulations, safe use practices, manufacturer's requirements, and recognition and avoidance of hazards, and is familiar with the specific type(s) of MEWPs. Note: Personnel may not operate rented equipment unless qualified to operate the specific equipment; the rental provider or other authorized evaluator must provide familiarization training to satisfy this requirement.
3. Inspection, Maintenance, and Testing
    a. Each MEWP must be inspected, maintained, repaired, and kept in proper working condition in accordance with the manufacturer's operating or maintenance and repair manual or manuals. Maintenance inspections shall be completed at intervals no less frequent than annually.
    b. Before use, visual equipment inspections and a functional check must be performed before each shift in accordance with the manufacturer's operating manual. Any MEWP found not to be in a safe operating condition must be removed from service until repaired. All repairs must be made by an authorized person in accordance with the manufacturer's operating or maintenance and repair manual or manuals.
    c. Before and during use, visual worksite inspections must be performed and include workplace risk assessment. The workplace risk assessment includes identifying and evaluating hazards (for example, drop-offs, holes, slopes, inadequate surface and support, obstructions, pedestrians, vehicles, debris, electric lines, etc.) and establishing effective control measures. Uncontrolled hazardous situations must be corrected prior to the initial or continued use of the MEWP.

AA. Noise/Vibration

1. Noise-producing equipment, such as power drills, jackhammers, welders, etc., can create sound levels of 80dB(A) or greater in and around a construction area.

Notify the NC State Project Manager in advance to determine the appropriate times to operate high noise/vibration equipment for that project's location.

2. Appropriate personal protective equipment shall be used when working around high-noise/vibration equipment.

BB. Overhead Work

1. Work must not be performed above other personnel, including other contractor employees. Affected areas must be roped off or barricaded and marked to prohibit traffic.
2. Contractors must not climb on the heating and air-conditioning ductwork, plumbing steam piping, sprinkler piping, electrical cable trays, fixtures, or furniture or use as work platforms.
3. Contractors are expected to comply with OSHA fall protection requirements.

CC. Paints and Solvents - Contractors must provide the following safeguards:

1. Adequate ventilation must be maintained at all times when paints or solvents are being used. Refer to NC State Odor Prevention and Dust Control in Occupied Buildings for additional information.
2. Contractor personnel must use proper respiratory protection and protective clothing when the toxicity of the material requires such protection.
3. Flammable solvents and materials must be used with extreme caution when possible sources of ignition exist.
4. Flammable paints and solvents must be stored in an approved flammable liquid storage cabinet when storage is required inside buildings. Acids and flammables must never be stored together. If an approved flammable liquid storage cabinet is not available, flammable paints and solvents must be removed from the building.
5. Flammable liquids must be dispensed in a safety can with a flash screen bearing a Factory Mutual or Underwriters Laboratory (UL) approval.

DD. Personal Protective Clothing and Equipment - The contractor shall determine this minimum level of protective equipment to be worn on the job site (example: hard hat, eye protection, safety vest, gloves, and safety shoes); NC State expects contractors to conform to industry accepted minimum PPE standards, for example, hard hats, safety glasses, and protective toe footwear. Any additional safety equipment required by a specific activity shall also be worn and shall meet or exceed OSHA standards. This applies to ALL persons entering the job site.

EE. Powder-Actuated Tools

1. Powder-actuated tools are not to be used on NC State property unless specific approval is obtained from NC State prior to usage.
2. If approved, powder-actuated tools must be used in accordance with OSHA and manufacturer regulations.

FF. Power Vehicle Equipment

1. Only trained operators are allowed to use power vehicles on NC State property. Contractor management will be expected to provide proof of training if requested.
2. Generally, LP gas-powered trucks are not to be used inside NC State buildings. Prior approval from NC State is required.

3. The design of the LP gas-fueled industrial truck for use within NC State buildings must comply with the following:
    a. LP gas-fueled industrial trucks must comply with NFPA 505-1982.
    b. If trucks are in continuous use in a populated area, they must be equipped with a catalytic converter.
    c. LP gas containers must not exceed the nominal 45 pounds of LP gas.
4. The following conditions and requirements will govern the use of LP gas-fueled vehicles inside the confines of NC State buildings and structures:
    a. LP gas-fueled trucks must be removed from the building and parked at the end of each workday and not left unattended while in use. When the job requiring the vehicle is complete, the vehicle must be removed from the job site.
    b. Trucks and tanks must not be refueled inside buildings.
    c. All areas where LP gas-fueled trucks are used must be well ventilated.
5. All LP cylinders must be stored outside and secured by a chain in an upright position.

GG. Roof Safety

1. The contractor shall request authorization from NC State prior to accessing a roof.
2. During all rooftop operations, the contractor must provide fall protection measures in accordance with OSHA.
3. A Hot Work Permit and at least two appropriate fire extinguishers of the correct ABC type are required when performing hot work on roofs. Other persons acting as a Fire Watch shall be in place on the roof and on the floor(s) directly below the operation.

HH. Sanitation

1. Drinking Water - An adequate supply of water, meeting the U.S. Public Health Service Drinking Water Standards, shall be provided.
2. Washing Facilities
    a. The contractor shall provide adequate washing facilities for employees engaged in the application of paints, coating, herbicides, or insecticides, or in other operations where contaminants may be harmful to the employees. Such facilities shall be close to the work site and shall be so equipped as to enable employees to remove such substances.
    b. Hand soap or similar cleansing agents shall be provided.
    c. Individual hand towels, cloth or paper, warm air blowers, or clean individual sections of continuous cloth toweling, shall be provided.
3. Toilet facilities shall be provided for employees according to OSHA requirements.

II. Scaffolding

1. The contractor shall erect, use, and dismantle scaffolding in accordance with OSHA and manufacturer regulations.
2. Competent Person. Scaffolds must be erected and dismantled under the

direction of a competent person. Responsibilities include, but are not limited to:

a. Supervise and direct scaffold erection, moving, dismantling, or alteration.
b. Determine the feasibility and safety of providing fall protection for employees erecting or dismantling supported scaffolds. Employers are required to provide fall protection for employees erecting or dismantling supported scaffolds where the installation and use of such protection is feasible and does not create a greater hazard.
c. Inspect scaffold and scaffold components for visible defects before each work shift and after any occurrence that could affect a scaffold's structural integrity and ensure identified deficiencies are corrected,
d. Determine if it is safe for employees to work on scaffolds during storms or high winds.

3. Access. When scaffold platforms are more than 2 feet (0.6 m) above or below a point of access, portable ladders, hook-on ladders, attachable ladders, stair towers (scaffold stairways/towers), stairway-type ladders (such as ladder stands), ramps, walkways, integral prefabricated scaffold access, or direct access from another scaffold, structure, personnel hoist, or similar surface shall be used. Cross Braces shall not be used as a means of access.
4. Fall Protection. Each employee on a scaffold more than 10 feet (3.1 m) above a lower level shall be protected from falling to that lower level; each employee on a suspended scaffold shall be protected by a personal fall arrest system attached to an independent anchorage.
5. Falling Object Protection. Where the potential for tools, materials, or other equipment could fall from a scaffold, the area below must be barricaded, and personnel not permitted to enter the area OR effective means shall be implemented to prevent objects from falling.

JJ. Signs, Tags, and Barricades (references 1926 Sub G and ANSI Z535)

1. Signs and Tags: Each sign and tag must include a signal word, symbol, and text.
   a. Signal words:
      (1) DANGER = the hazard will most likely result in serious injury or death;
      (2) WARNING = the hazard could result in serious injury or death;
      (3) CAUTION = the hazard would not likely result in serious injury or death;
      (4) NOTICE = indicates important information, but is not directly hazard-related;
      Symbols or graphics are used to bridge language barriers and draw attention to the message.
   b. Text is used to convey the safety message in a clear, concise manner.
2. Barricades. Barricades must be installed for situations where a physical obstruction is necessary to deter the passage of people, vehicles, or equipment. When used, barricades must be installed at all points of access.
   a. Barricades associated with traffic control in a public roadway must comply with the Federal Manual of Uniform Traffic Control Devices and the North Carolina Supplement. Coordinate with the NC State Transportation

Office.

b. Barricades may take many forms on construction sites, but when used, they must clearly indicate the intent of the barricade. All barricades are required to include a sign that includes the name of the person responsible for the barricaded area, method for contacting the responsible person (ex. phone number), and clear and concise text describing the purpose of the barricade.

(1) CAUTION Tape Barricades should be used when the hazardous condition is not likely to cause serious physical harm but could result in injury. Standard CAUTION Tape must be used, which includes yellow tape with the word “CAUTION” in black letters. Personnel may enter the barricaded area only when implementing precautions to address the identified hazard.

(2) DANGER Tape Barricades are used when a serious or imminent danger may exist. Standard DANGER Tape must be used, which includes red tape with the word “DANGER’ in black letters. Only personnel specifically authorized by the person responsible for the barricaded area may enter the barricaded area.

KK. Silica (Respirable Crystalline Silica) – The following requirements apply to all operations involving exposure to respirable crystalline silica. Examples of such operations include: cutting, grinding, drilling, or crushing brick, block, concrete, stone, rock, mortar, and other materials that contain crystalline silica.

1. Contractors shall comply with OSHA standard 29 CFR 1926.1153 including taking all necessary steps to comply with the established exposure limits.
2. Contractors must have a written Exposure Control Plan specific to their operations in accordance with 29 CFR 1926.1153 that includes specific details for controlling exposure to NC State personnel and the public. A copy of this plan shall be made available to NC State EHS and/or the university Project Manager upon request.
3. Tasks performed indoors or in an enclosed area shall have effective exhaust ventilation to minimize the accumulation of visible airborne dust. In situations where ventilation is exhausted in an area with the potential to expose people to dust must incorporate effective HEPA filtration; such areas include but are not limited to, inside a building or outside where people may be present.
4. When a building ventilation system services an area where work with the potential for generating respirable crystalline silica exists, the building air returns shall be blanked or closed while such work is in progress. Contractors must coordinate this with the university project manager.
5. Contractors must establish a “Temporary Restricted Area” for tasks that require the use of respiratory protection in accordance with 29 CFR 1926.1153.
    a. A *Temporary Restricted Area* is an area demarcated by the employer where an employee is required to wear respiratory protection.
    b. *Temporary Restricted Areas* must be designated with signs, barriers, or other effective means that will ensure unauthorized persons do not enter.

    If such work is performed in *occupied* buildings, dust barriers shall be

installed as necessary to isolate the restricted area. Refer to NC State Odor Prevention and Dust Control in Occupied Buildings for additional information.

LL. Smoking and Open Flames

1. Smoking is not allowed in any NC State buildings, including roofs, penthouses, electrical/mechanical rooms, and basements or within 25 feet of any building entrance or exit.
2. The use of open flames is strictly prohibited in areas where flammable liquids, gases, or highly combustible materials are stored, handled, or processed.
3. The use of open flames, where allowed, requires a Hot Work Permit.

MM. Tarpaulins - When tarpaulins are required for the deflection of hot slag, dust, paint drippings, etc., or as a security barrier, they must be flame resistant and in good condition, free of holes and worn edges.

NN. Tar Pots (tar kettles) - Tar Pots are not allowed on roofs. The contractor must notify the NC State Project Manager prior to using tar pots and obtain a Hot Work permit.

OO. Temporary Heating - When heaters are used in confined spaces, special care shall be taken to provide sufficient ventilation to ensure proper combustion, maintain the health and safety of workmen, and limit temperature rise in the area.

PP. Temporary Lighting - The contractor shall submit a lighting plan for night work, underground work, and any other worksites without adequate lighting.

QQ. Temporary Traffic Control

1. All traffic control shall be approved by NC State and meet the Institute for Transportation Research and Education (ITRE) Work Zone Safety Guidelines for Construction, Maintenance, and Utility Operations. A traffic control plan shall be provided by the contractor and approved prior to commencement.
2. The contractor shall provide warning signs, barriers, barricades, etc., in accordance with the construction plans and specifications or whenever such protection is needed.
3. Where signs and barricades do not provide adequate protection, particularly along a road, walkway, or main aisle, flagmen shall be used.
4. Review with the crew, each person's responsibility regarding the traffic control set-up (e.g. sign installation, lane closure setup, etc.).
5. Review traffic control devices to be used at the site. Assure that traffic control set-up is properly installed. The installer shall document what traffic control set-up was used (including the sign types and sign locations) and how it was installed.

RR. Vehicle Operation

1. All equipment shall have operational backup alarms. Equipment shall not be utilized until such device is functioning properly.
2. All vehicles shall be operated in accordance with OSHA and manufacturer regulations.

SS. Vertical Lifts - All contractors' platforms or vertical lifts must meet OSHA and manufacturer requirements.

SECTION 01 35 73

DELEGATED DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for portions of the Work the design of which is delegated to the Contractor.

1.2 REFERENCES

A. Abbreviations and Acronyms:
   1. AHJ: Authority Having Jurisdiction.
   2. SCO: State Construction Office

B. Definitions:
   1. Delegated: Means transferred by the Designer to the Contractor.
   2. Design: Means the complete planning, arrangement, and coordination of a discrete portion of the work, along with its graphic and written communication, including determination and engineering of its organization and structure in response to aesthetic requirements, functional requirements, dimensional and geometric limits, and the arrangement, performance, and other criterion indicated in the Contract Documents.
   3. Engineering Services: Means structural engineering services performed for the design, fabrication, and installation of systems, assemblies, and components similar in material, design, complexity and extent to that indicated for the delegated design portion of the Work.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Portions of the Contract Documents may delegate the design of discrete portions of the Work to the Contractor, or may otherwise specify "delegated design requirements" in individual specification Sections. Part 3 of this Section describes the portions of work that have been delegated to the Contractor.

B. The Contractor is professionally liable for delegated design work, including design, engineering, and conformance to specified performance requirements.

C. Drawings of delegated design portions of the Work are diagrammatic; they do not identify or imply solutions to engineering aspects of the portions of the Work that are required to be designed by the Contractor, and are intended to only indicate:
   1. The design intent of final profiles, shapes and forms of the specified materials;

2. Relationships between adjacent components of the Work;
3. Location, identification, dimension and size of components, assemblies, accessories, and other components of the Work; and
4. Schematic joining and attachment details and diagrams of fasteners and connections.

D. Specifications for delegated design portions of the Work are performance based, and establish the minimum qualities and performance criteria for materials, fabrications, products, systems, assemblies, and methods of execution.

E. Architect will review informational submittals specified herein to determine whether or not the delegated component, assembly or system design complies with the following:
1. Contractor’s engineering shows substantiation of the specified performance criteria;
2. Conforms to the design intent of the delegated design portion of the Work being reviewed;
3. Conforms to the specified graphic and specification requirements, including subsequent modifications; and
4. Is appropriately integrated into the adjacent components of the Work and, where applicable, the overall design of the project.
5. Review by the Architect does not relieve the Contractor from compliance with the requirements of the delegated component.

F. In the event of a dispute regarding the Contractor's proposed delegated design solutions and the design intent of the Contract Documents, the decision of the Designer is final.

1.4 PROCEDURAL REQUIREMENTS

A. Design Requirements: Proposed delegated design solutions are to demonstrate conformance to the original design intent of the Contract Documents, as determined by the Designer.
1. Unless otherwise defined by the Contract Documents, the appearance of exposed elements, including member sizes, profiles, and alignment of components shall be within the dimensional limits and section profiles indicated, and consistent throughout the Project where the delegated design component of the Work is to be installed.
2. Deviation from the profiles, layouts, dimensional locations, or arrangements indicated is not permitted without prior written consent from the Designer.
3. Deviations from the specifications are not permitted without prior written consent from the Designer.
4. Contractor-proposed delegated design solutions that exactly follow the details indicated on the Drawings do not relieve the Contractor from liability for the design, fabrication, and performance of the delegated design portions of the Work.

B. Engineering Requirements: Engineer delegated design portions of the Work shall;

1. Meet or exceed the specified performanceand quality requirements;
2. Conform to the dimensional and graphic requirements of the Drawings;
3. Satisfy the requirements of the AHJ; and
4. Provide structurally sound, leak-proof, non-corroding, and weather tight applicable, the minimum specified in-service loads, and thermal, seismic, and wind sway, or other types of movement, without incipient or catastrophic failure.

C. Additional Requirements:
1. Fabricate, assemble and install delegated design portions of the Work to accommodate the full range of manufacturing, operating and field installation tolerances of adjacent work specified in other Sections.
2. If required by the authorities having jurisdiction, submit shop drawings, specifications, calculations and other supporting data necessary for obtaining jurisdiction approval after they have been reviewed by the Architect and prior to beginning installation. Pay fees incurred.

D. Regulatory Requirements: Delegated design items shall be engineered in conformance with the North Carolina State Building Code and the City of Raleigh.

E. SCO Review: Once a Designer has approved the Delegated Design Submittal conforms with the overall design intent, the Designer shall upload the Delegated Design Submittal into Interscope for SCO review and comment. All SCO Comments must be incorporated into the submittal. SCO approval of the submittals must occur prior to starting any work associated with the Delegated Design Submittal on the project.

1.5 INFORMATIONAL SUBMITTALS

A. General: Coordinate and process submittals for delegated design portions of Work in same manner as for other portions of Work.

B. Professional Engineer's qualifications.

C. Design Data: Submit structural engineering calculations demonstrating conformance to the requirements of the Contract Documents and of the AHJ.
1. Calculations must be legible and incorporate sufficient cross-references to shop drawings to make calculations readily understandable and reviewable.
2. At a minimum, structural calculations must contain:
   a. An analysis of framing members;
   b. Section property computations for framing members;
   c. An analysis of anchors, including anchors embedded in concrete;
   d. The signature and seal of the professional structural engineer, licensed in the state of North Carolina, and responsible for their preparation.
3. Test reports are not an acceptable substitute for calculations.

D. Furnish appropriate certification from licensed fabricator shop or complete detailed inspection reports signed by each inspector performing unlicensed shop inspection to the Architect before the Work affected by these inspections is delivered to the site.

1.6 QUALITY ASSURANCE

A. Professional Structural Engineer's Qualifications:
   1. Must be legally licensed or otherwise qualified to practice in the state of North Carolina, and experienced in and having a minimum of 10 consecutive years providing the type of engineering services indicated in the Contract Documents..
   2. Engineering services are defined as those performed for the design, fabrication and installation of components and assemblies similar in material, design, complexity and extent to those indicated in the Contract Documents for this Project.

B. Fabricator/Installer Qualifications: Firm with a minimum of 10 consecutive years' experience in the design, testing, fabrication, assembly, installation and coordination of specified components, assemblies, and systems on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance. Submit evidence demonstrating the following:
   1. Ability to coordinate and work with a qualified testing agency for testing exterior building envelope assemblies utilizing the recognized test standards of the industry on projects similar in material, design, complexity and extent of this Project.
   2. Experience in managing, scheduling, coordinating, and maintaining on-time performance in conjunction with the successful projects and for the proposed project.
   3. An in-place, comprehensive quality assurance and quality control program and procedures that demonstrates how it is being applied on the project. Describe and demonstrate how the proposed comprehensive quality assurance and quality control program has been successful on other projects.
   4. Current resources, including currently employed personnel, to produce the Work to the specified requirements.
   5. Ability to produce proposal drawings, accommodate plant visits, organization plans, project management plans and proposed schedules in conjunction with the bidding for this Project.
   6. Ability to warranty curtain wall systems for 5 years and the curtain wall finishes for 20 years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials, fabrications, products, components, and accessories required for a complete installation, whether or not such items are indicated on the Drawings or in the Specifications.

B. Provide anchors, attachments, inserts, fasteners, clips, bracing, framework, and similar items as required to meet specified design and performance requirements, and to securely attach delegated design Work to adjacent supports, or to adjoining work, whether or not such items are indicated on the Drawings or in the Specifications.

PART 3 - EXECUTION

3.1 DESIGN

A. Unless otherwise indicated or specified, maintain the design intent and conform to the performance requirements indicated on the Drawings and in the Specifications, as determined by the Designer.
   1. In the interest of fabrication or erection methods, minor dimensional changes and detailing adjustments to the original design communicated in the Contract Documents may become necessary.
   2. Obtain written approval from the Designer for proposed changes and adjustments before procurement, fabrication, manufacture, assembly, or installation, as applicable.

B. Engage a qualified professional structural engineer to design connection details and determine fastener types and sizes.
   1. Fasteners or connections may neither conflict with nor require revision to the finish profiles indicated for the supporting work.
   2. Connections may not impose eccentric loading, nor induce twisting or warping to the supporting structure.
   3. Connections must be designed to accommodate potential and actual misalignment of adjacent work within tolerances specified in other Sections.

3.2 DELEGATED DESIGN SCHEDULE

A. The following sections have been preapproved as being allowed by the State Construction Office for delegated design and are included in this project:
   1. None in this submission.

B. The following sections have received written approval from the State Construction Office for delegated design and are included in this project:

1. None in this submission.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-control services required by Designer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.

C. Related Sections:
   1. Section 01 31 00 “Project Management & Coordination” for requirements on the Construction Management Software that the Contractor will be utilizing to implement the Site-Specific Quality Program.
   2. Section 01 73 00 "Execution" for repair and restoration of construction disturbed by testing and inspecting activities.
   3. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.2 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.

1.3 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Designer.

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

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. 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(s).

I. 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.

J. Professional Engineer: Engineer currently licensed to practice in the State of North Carolina.

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 Designer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Designer for a decision before proceeding.

1.5 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Site-Specific Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
   1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections..
   2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

E. 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.

F. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.
   5. Number of tests and inspections required.
   6. Time schedule or time span for tests and inspections.
   7. Entity responsible for performing tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

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

H. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

I. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

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

1.7 CONTRACTOR'S SITE-SPECIFIC QUALITY PROGRAM

A. General:
   1. Submit Contractors Site-Specific Quality Program including all components herein not less than five days prior to preconstruction conference. Submit in format acceptable to Designer and Owner. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
   2. Contractors Site-Specific Quality Program must be specifically tailored to the work of the project. While a corporate Quality Manual may be submitted to supplement, or as a reference to, the Site-Specific Quality Program, the submission of a corporate Quality Manual without specific tailoring to the needs of the project will be rejected.

B. Quality Assurance:
   1. Goals & Objectives, including key milestones for the project.
   2. Roles & Responsibilities of Project Personnel, including an Organization Chart and Resumes of individuals.
   3. Description of the Project Management / Document Control Software / Quality Control Software(s) to be utilized on the project.
   4. Define the Projects Definable Features of Work (DFOW).
      a. Existing commemorative plaques to be extracted and delivered to Owner..
      b. Contractor is encouraged to define additional DFOW’s as they see fit to ensure that the quality requirements of the Project Documents is successfully delivered.
   5. Describe the BIM coordination process to be followed.
   6. Describe the Preconstruction / Bidding process.

7. Describe procedures for ensuring compliance with requirements through review and management of submittal process.

C. Quality Control:
1. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
2. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements. Inspections & Testing: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
   a. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include the following:
      1) Tests and inspections required in the Contract Documents.
      2) Contractor-elected tests and inspections (i.e. first-in-kind installations, material delivery inspections, weekly jobsite walks, etc.)
   b. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
   c. Owner-performed tests and inspections indicated in the Contract Documents.
3. Describe the process for Correction of Deficiencies.
4. Submit Documentation Templates to be used by the Contractor during the Project to ensure quality requirements are being met. Include at a minimum, the following:
   a. Daily Reports Template.
   b. Inspection & Testing Report Forms.
   c. Inspection checklist templates.
   d. Material receiving reports.
5. Describe the process for the control of Quality Records.
   a. Maintain testing and inspection reports including log of approved and rejected results. Include work Designer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.
6. Describe the startup process for equipment, include relevant forms to ensure work is complete prior to attempting startup.

D. Closeout & Project Acceptance:
1. Describe the process for completing the following items as part of the Closeout & Project Acceptance Phase. Provide draft checklists as applicable.
   a. Contractors Completion List
   b. Designer & Owner Punch List
   c. Owner’s Training

d. O&M Manuals
e. Attic Stock
f. NC State Final Acceptance Checklist
g. SCO Final Inspection Checklist
h. Warranty Phase

1.8 QUALITY ASSURANCE

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

B. 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.

C. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

D. Testing Agency Qualifications: An NRTL, an NVLAP-accredited, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.

3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. 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. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
7. Provide quality assurance and control services required due to changes in the Work proposed by or made by the Contractor.
8. Provide quality control services for Work done contrary to the Contract Documents, without prior notice, when so specified, or without proper supervision.
9. Overtime expenses and schedule delays accruing as a result of executing quality control services shall be the Contactor's responsibility and shall not be charged to the Owner.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents. Designer retains the right to require the use of a different testing agency for retesting and reinspecting.

D. Testing Agency Responsibilities: Cooperate with Designer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Designer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.
7. Attend Project progress meetings as requested by Designer.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies or arranging for pick-up of test samples after normal business hours.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency
7. Security and protection for samples and for testing and inspecting equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit schedule concurrently with Contractor's Construction Schedule as specified in Section 01 32 00 "Construction Progress Documentation."
1. Distribution: Distribute schedule to Owner, Designer, , testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in Statement of Special Inspections, and as follows:
1. Notifying Designer and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

2. Submitting a certified written report of each test, inspection, and similar quality-control service to Designer, with copy to Contractor and to authorities having jurisdiction.
3. Submitting a final report of special tests and inspections prior to Final Acceptance, which includes a list of unresolved deficiencies.
4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Retesting and reinspecting corrected work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: 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 Designer.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Designer's and authorities having jurisdiction reference during normal working hours.
   1. Submit log at Project closeout as part of Project Record Documents.

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 Section 01 73 00 "Execution."
   2. Protect construction exposed by or for quality-control service activities.
   3. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 42 00

REFERENCES

PART 1 GENERAL

1.1 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, without any implied meaning extending the Architect's responsibility into the Contractor's area of Contractor coordination, supervision, or means and methods of construction as outlined in the Conditions of the Contract.
   1. In no situation will an approval by Architect release Contractor from responsibility to fulfill requirements of the Contract Documents.

C. "Authorities Having Jurisdiction" (AHJ): Means the agencies, either individually or collectively, charged by statute with administration and enforcement of the requirements of building codes and other regulations at the Project location.

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

E. "General Requirements":
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions (if any) and other Division 01 General Requirement Sections, apply to all sections of the work.
   2. The provisions or requirements of Division 01 Sections apply to entire Work of the Contract and where so indicated, to other elements which are included in the Project.

F. "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."

G. "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.

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

I. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

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

K. "Installer": Means the Contractor or other entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor to perform a particular construction operation at the Project site, including preparation, erection, installation, application, construction, re-installation, and similar operations required for execution of the Work.
   1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
   2. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

L. "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.

1.2 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.

1.3 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 Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 33

CODE REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Administrative and procedural requirements for special inspections required by the International Building Code.

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. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to substantiate that the construction is in compliance with the code prescribed special inspections, procedures and requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to substantiate that actual products incorporated into the Work and completed construction comply with the code requirements. Services do not include contract enforcement activities performed by Architect.

C. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

D. Field Special Inspections: Tests and inspections that are performed on-site to demonstrate required documentation for code compliance of Chapter 17 of the IBC International Building Code, with amendments. Edition/ release that is consistent with the requirements of the project.

E. Testing Agency: An entity engaged to perform special inspections, tests, inspections. Testing laboratory shall mean the same as testing agency.

F. 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(s).

1.3 CONFLICTING REQUIREMENTS

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

1.4 INFORMATIONAL SUBMITTALS

A. Special Inspector Qualifications: Prior to the start of construction, the approved agencies shall provide written documentation to the building official demonstrating the competence and relevant experience or training of the special inspectors who will perform the special inspection and tests during construction. Experience or training shall be considered relevant where the documented experience or training is related in complexity to the same type of special inspection or testing activities for projects of similar complexity and material quantities. These qualifications are in addition to qualifications specified in other sections of the code.

B. The approved agency and their personnel shall act as the required special inspectors for the work required by ICC (IBC) Chapter 17.

C. 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.

1.5 REPORTS AND DOCUMENTS

A. Inspection and Test Reports: Prepare and submit certified written reports as required by the code to achieve compliance the required special inspection requirements.
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.

7. Complete test or inspection data.
8. Test and inspection results and an interpretation of test results.
9. Comments or professional opinion attesting that the tested or inspected Work complies with the Code requirements.
10. Name and signature of laboratory inspector.
11. Recommendations on retesting and re-inspecting.

B. At completion of construction, the Testing Agency shall provide a final report sealed by its Professional Engineer in responsible charge, along with standard AHJ form(s) as required by the building official.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required.

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

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located, serving as the special inspections engineer of record in responsible charge of the project. The engineer shall be experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for inspections of the installations of systems, assemblies, or product that are similar in material, design, and extent to those indicated for this Project.

D. Specialists: Specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

E. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to the code requirements; and with additional qualifications specified in any related individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

1.7 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional special inspections and code required quality-control activities required to verify that the Work complies with the Code requirements, whether specified or not.
   1. Engage a qualified testing agency to perform these quality-control services.
   2. Notify testing agencies at least 24 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. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

D. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.

E. Coordination: Coordinate sequence of activities to accommodate required special inspection services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner or Design Professional, as indicated in Statement of Special Inspections attached to this Section, and as follows:

B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and in Statement of Special Inspections attached to this Section, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to authorities having jurisdiction, with a copy to the Contractor, Owner and Architect.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and re-inspecting corrected work.

IBC Sections	Type of Special Inspections and Extent	Applicable	Non-Applicable	Continuous	Periodic
1705.1.1	Special cases		X		
1705.2	Steel Construction	X			X
1705.3	Concrete construction	X			X
1705.4	Masonry construction	X			X
1705.10	Fabricated items		X		
1705.17	Fire-resistant penetrations and joints		X		

1705.18	Testing for smoke control		X		

7. Refer to Structural Drawings for additional special inspection requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: 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 revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections 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 Section 01 73 00 "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.

Appendix: Statement of Special Inspections.

END OF SECTION

Statement of Special Inspections

Project:
Location:
Owner's Representative:
Owner's Address:

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the 2012 North Carolina State Building Code. It includes a Schedule of Special Inspection Services applicable to this project as well as the name of the Special Inspector and the identity of other approved agencies intended to be retained for conducting these inspections. This Statement of Special Inspections was prepared by the following Designers of Record:

Structural			
	(Type or print name)	(Signature)	(Date)
Architectural			
	(Type or print name)	(Signature)	(Date)
Mechanical			
	(Type or print name)	(Signature)	(Date)
Other			
	(Type or print name)	(Signature)	(Date)

The Special Inspector shall keep records of all inspections and shall furnish inspection reports to the State Construction Office and the Designers of Record. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the State Construction Office and the Designers of Record. The Special Inspections program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the State Construction Office, Owner, and the Designers of Record.

Interim Report Frequency: Monthly

A Final Report of Special Inspections documenting completion of all required Special Inspections and correction of any discrepancies should be submitted prior to issuance of a Certificate of Use and Occupancy.

Job Site safety and means and methods of construction are solely the responsibility of the Contractor.

Owner's Authorization

Signature Date

Accepted for the SCO by:

Signature Date

Schedule of Special Inspection Services

The following sheets comprise the required schedule of special inspections for this project. The construction divisions which require special inspections for this project are as follows.

- ☐ Structural Steel
- ☐ Cold-Formed Steel Framing
- ☐ Concrete Construction
- ☐ Masonry – Level 1[a]
- ☐ Wood Construction
- ☐ Soils
- ☐ Driven Deep Foundations
- ☐ Cast-in-Place Deep Foundations
- ☐ Helical Pile Foundations
- ☐ Sprayed Fire Resistant Material
- ☐ Intumescent Fire-Resistant Coatings
- ☐ Exterior Insulation & Finish System
- ☐ Smoke Control
- ☐ Retaining Walls Exceeding 5 Feet
- ☐ Wind-Resisting Components (1705.4)[b]
- ☐ Wind Requirements (1706)[c]
- ☐ Seismic Resistance[d]

a. Occupancy Category IV structures, as defined by 1604.5 of the North Carolina Building Code, may require Level 2 inspection of masonry construction. The SER shall review Code sections 1704.5.1 and 1704.5.3 and adjust the Schedule of Special Inspection Services as needed.
b. Special inspections for Wind Resistance are applicable to those areas defined by 1705.4 of the North Carolina Building Code. Wind Resistance Special Inspections are only effective if the 1704.1.2 base triggers apply.
c. Special Inspections for Wind Requirements are applicable to those areas defined by 1706.1 of the North Carolina Building Code. Wind Requirements are effective even if the 1704.1.2 base triggers do not apply.
d. Special Inspections for Seismic Resistance are applicable to those structures defined by 1707.1 of the North Carolina Building Code. Seismic Requirements are only effective if the 1704.1.2 base triggers apply.

Inspection Agents	Qualifications	Address
1. Special Inspector	SI	
2. Structural Engineer of Record	SER	
3. Testing Laboratory	ITL	
4. Other		

Note: The inspection and testing agent shall be engaged by the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the State Construction Office, prior to commencing work.

Seismic Design Category: ☐ A ☐ B ☐ C ☐ D

Basic Wind Speed: ☐ 90-109mph ☐ 110-119mph ☐ ≥120mph

Wind Exposure Category: ☐ B ☐ C ☐ D

Schedule of Special Inspection Services
Structural Steel

Item	Qualifications	Scope
1. Fabricator Certification/Quality Control Procedures	SI SER / SI	• Ensure fabricator meets the requirements of NCSBC 1704.2.2 • Collect certificate of compliance from fabricator at completion of fabrication
2. Welding	SI	• Continuous inspection of complete and partial joint penetration welds, multipass fillet welds, plug and slot welds, and single-pass fillet welds > 5/16” in accordance with NCSBC Table 1704.3 • Periodic inspection of single-pass fillet welds ≤ 5/16” • Collect certificate of compliance for weld filler material • Identify use of approved filler material and in accordance with AWS D1.1
3. Metal Deck	SI SER / SI	• Collect material data sheets for decking and connectors or fasteners • Periodic inspection of welds and / or mechanical fasteners
4. Structural Details	SER / SI	• Periodic inspection of steel framing and joint details
5. Bolting	SI SI SER / SI	• Collect material data sheets for bolts, nuts, and washers • Collect certificate of compliance from bolt supplier • Periodic inspection of snug-tight, pretensioned, and slip critical joints in accordance with NCSBC Table 1704.3 • Continuous inspection of pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation
6. Material Certification	SI	• Collect certified mill test reports

Schedule of Special Inspection Services
Cold-Formed Steel Framing

Item	Qualifications	Scope
1. Plant Certification/ Quality Control Procedures for Pre-Engineered Wall Panels Assembled Off-Job Site	SI SER / SI	• Ensure wall panel fabricator meets the requirements of NCSBC 1704.2.2 • Collect certificate of compliance from wall panel fabricator at completion of fabrication
2. Mechanical Connections	SER / SI	• Periodic inspection of all field connections including anchorage to the structural frame
3. Welding	SER / SI	• Periodic inspection of all field connections including anchorage to the structural frame
4. Framing Details	SER / SI	• Periodic inspection framing and details
5. Cold-formed Steel Trusses	SER / SI	• For trusses clear spanning 60 feet or more, verify that both temporary and permanent restraints and braces are installed in accordance with the approved truss submittal package.

Schedule of Special Inspection Services
Concrete Construction

Item	Qualifications	Scope
1. Mix Design/Material Certifications	SER / SI	• Collect mix designs and verify appropriate mix use during specific installation
2. Reinforcement Installation	SER / SI SI SI	• Periodic inspection of reinforcing steel, including prestressing tendons and welded wire fabric • Collection of certified mill test reports • Continuous inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5b
3. Concrete Placement/Monitoring Fresh Concrete, Sampling & prep of test samples	SI SI / ITL SER / SI SI / ITL SI SI	• Continuous inspection of cast-in-place concrete placement • Continuous monitoring of sampling of fresh concrete, slump test, air content test, temperature of concrete and creation of strength test specimens • Periodic inspection of formwork • Periodic verification of concrete strength prior to removal of shores and forms from beams and structural slabs • Continuous inspection of bolts to be installed in concrete prior to and during placement • Periodic inspection of anchors installed in hardened concrete
4. Curing & Protection	SI	• Periodic inspections of curing techniques
5. Structural Precast Concrete Members	SER / SI	• Periodic inspection of attachment of precast members
6. Post-Tensioned Concrete Members	SI / ITL SI SI	• Periodic verification of posttensioned concrete strength (f'ci) prior to force transfer • Continuous inspection of force application to prestressing tendons • Continuous inspection of grouting procedures at bonded prestressing tendons included in the lateral force resisting system

Schedule of Special Inspection Services
Masonry

Item	Qualifications	Scope
1. Material Certification	SI SI SI	• Collect mix design for mortar • Collect mix design for grout • Certificates of Compliance for masonry constituents
2. Mixing of Mortar & Grout	SI SI	• Periodic inspection of site prepared mortar, site-prepared grout, and grout for bonded tendons • Continuous verification of slump flow and VSI as self-consolidating grout is delivered to the site
3. Installation of Masonry	SI SER / SI	• Periodic inspection of construction of mortar joints, prior to beginning masonry construction and during construction • Periodically verify the type, size, and location of anchors and their attachment to the structure • Periodically verify size and location of structural elements
4. Reinforcement Installation	SER / SI SI SER / SI SER / SI SI	• Verify location of reinforcement and connections to structure as construction begins • Continuous inspection of reinforcing steel welding in accordance with Table 1704.3, Item 5b • Prior to grouting periodically verify size, grade, and placement of reinforcement and connection of masonry to structural frame • Periodically verify prestressing technique • During construction, continuously monitor the application and measurement of prestressing force
5. Grouting Operations	SI SI SI	• Prior to grouting, periodically verify conforming cleanliness of grout space and placement of the reinforcement and connectors • Continuous observation of the placement of all grout • Continuously observe the grouting of prestressing bonded tendons
6. Weather Protection	SI	• Periodically verify protection techniques for construction of masonry below 40ºF and above 90ºF
7. Observation of the Evaluation of Masonry Strength	SI / ITL	• Periodic observation of the preparation of grout specimens, mortar specimens and or prisms.

Schedule of Special Inspection Services
Wood

Item	Qualifications	Scope
1. Inspection of Fabricators	SI	• Ensure fabricator meets the requirements of NCSBC 1704.2 verifying adequate quality control procedures for prefabricated wood structural elements and assemblies are in place
2. High-load diaphragms	SER / SI	• Periodic inspection of Table 2306.2.1(2) high-load diaphragm sheathing panels, fasteners, and framing members at adjoining panel edges.
3. Wood Trusses	SER / SI	• For trusses clear spanning 60 feet or more, verify that both temporary and permanent restraints and braces are installed in accordance with the approved truss submittal package.

Schedule of Special Inspection Services
Soils

Item	**Qualifications**	**Scope**
1.Site Preparation	SI	• Determine that the subgrade has been prepared in accordance with the approved soils report and the construction document
2. Fill Placement	SI	• Periodic classification and testing of compacted fill materials • Continuous observation of materials used, densities, and lift thickness ensuring compliance with the approved soils report and the construction documents
3. Evaluation	SI / ITL	• Determine that the materials below shallow foundations are adequate to achieve the design bearing capacity

Schedule of Special Inspection Services
Driven Deep Foundations [a] [b]

Item	Qualifications	Scope
1. Material Verification	SI	• Continuously verify pile materials, sizes, and lengths comply with the construction documents
2. Pile Testing	SI	• Continuously observe pile load tests and determine capacities of test elements ensuring compliance with the construction documents
3. Installation	SI SI SI	• Continuous observation of the driving operations • Continuously observe pile placement, location, plumbness, blow count, penetration, tip and butt elevations, and anomalies • Maintain complete and accurate records

a. For steel elements, perform additional inspections in accordance with Section 1704.3 of the North Carolina Building Code and the companion Schedules included herein

b. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1704.4 of the North Carolina Building Code and the companion Schedules included herein

Schedule of Special Inspection Services
Cast-in-Place Deep Foundations [a]

Item	Qualifications	Scope
1. Material Verification	SI	• Continuously verify pile materials comply with the construction documents
2. Pile Testing	SI	• Continuously observe pile load tests and determine capacities of test elements ensuring compliance with the construction documents
3. Installation	SI SI SI	• Continuous observation of the drilling operations • Continuously verify pile placement, location, plumbness, diameters, lengths, rock embedment, end-bearing strata capacity, concrete or grout volumes, and anomalies • Maintain complete and accurate records

a. For concrete elements and concrete-filled elements, perform additional inspections in accordance with Section 1704.4 of the North Carolina Building Code and the companion Schedules included herein

Schedule of Special Inspection Services
Helical Pile Foundations

Item	Qualifications	Scope
1. Quality Control Procedures	SI	• Collect Certificate of Compliance from fabricator
2. Installation of Helical Piles	SI	• Continuously observe the installation equipment used, pile placement, location. tip elevations, final depth, and final installation torque

Schedule of Special Inspection Services
Sprayed On Fire Resistant Materials

Item	Qualification	Scope
1. Preparation	SI / ITL	• Periodically inspect preparation of substrate prior to installation in accordance with approved fire resistance design and approved manufacturer's written instructions
2. Application	SI / ITL	• Periodically inspect that substrate has minimum ambient temperature before and after application as specified by the fire resistance design and approved manufacturer's written instructions • Test thickness of sprayed on material per the instruction of Section 1704.12.4, the fire resistance design, and the approved manufacturer's written instructions • Periodically test Density of sprayed on material per fire resistance design and approved manufacturer's written instructions • Periodically test bond Strength to ensure a value greater than 150 pounds per square foot.

Schedule of Special Inspection Services
Mastic and Intumescent Fire-Resistant Coatings

Item	Qualification	Scope
1. Preparation	SI / ITL	• Periodically inspect preparation of substrate prior to installation in accordance with approved fire resistance design, approved manufacturer's written instructions, and the requirements of AWCI 12-B
1. Application	SI / ITL	• Periodically observe application of fire-resistant coatings ensuring compliance with approved fire resistance design, approved manufacturer's written instructions, and the requirements of AWCI 12-B

Schedule of Special Inspection Services
Retaining Walls Exceeding 5 Feet

Item	Qualification	Scope
1.Retaining Systems	SI / ITL / SER	• All retaining walls exceeding 5 feet in height require special inspections. Refer to the applicable material schedules for explicit requirements
1. Application	SI / ITL	• Periodic examination of backfill materials for compliance with the approved specifications • Confirm that all subsoil drainage piping is undamaged, drains freely to the designated outlet or structure, and has been installed per the approved engineered design

Schedule of Special Inspection Services
Exterior Insulation and Finish Systems (EIFS)

Item	Qualifications	Scope
1. Application	SI	• Verify that EIFS is installed in conformance with project specifications • For EIFS incorporating drainage over a water-resistive barrier, periodically confirm that the water-barrier and drainage strip are installed in conformance with project specifications

Schedule of Special Inspection Services
Smoke Control

Item	Qualifications	Scope
1. Smoke Evacuation System	SI / Independent Inspector	• During erection of ductwork and prior to concealment leak test and record locations of devices • Upon completion of smoke control system perform pressure difference testing, flow measurements and detection and control verification

Schedule of Special Inspection Services
Wind-Resisting Components

Item	**Qualifications**	**Scope**
1. Contractor Statement of Responsibility	SI	• Prior to any work taking place, each contractor responsible for the construction of a wind-resisting material, system, or component shall submit a written statement of responsibility to the Special Inspector for distribution to the Building Official and Owner
2. Wind-resisting components	SER / SI	• Inspect the wind-resisting materials, systems, components, and connections listed below ensuring all items are installed in conformance with the project documents

Main Wind-Force Resisting System(s):

Wind-Resisting Components Subject to Continuous Special Inspections:

Wind-Resisting Components Subject to Periodic Special Inspections:

Schedule of Special Inspection Services
Special Inspections for Wind Requirements

Item	**Qualifications**	**Scope**
1. Structural Wood	SER / SI SER / SI	• Continuously observe field gluing operations pertinent to the main wind force-resisting system • Periodically inspect all nailing, anchoring, and fastening of components within the main windforce-resisting system
2. Cold-Formed Steel Light-Frame Construction	SER / SI SER / SI	• Periodically inspect welding operations at elements of the main windforce-resisting system • Periodically inspect all screw attachment, bolting, anchoring, and fastening of components within the main windforce-resisting system
3. Wind-resisting components	SER / SI	• Periodically inspect the roof cladding and wall cladding components and connections listed below ensuring all items are installed in conformance with the project documents

Structural Wood and Cold-Formed Steel Light-Frame Construction Main Wind-Force Resisting System(s) Subject to Special Inspections:

Roof Cladding Components Subject to Periodic Special Inspections:

Wall Cladding Components Subject to Periodic Special Inspections:

Schedule of Special Inspection Services
Special Inspections for Seismic Resistance[a]

Item	Qualifications	Scope
1. Contractor Statement of Responsibility	SI	• Prior to any work taking place, each contractor responsible for the construction of a seismic-resisting material, system, or component shall submit a written statement of responsibility to the Special Inspector for distribution to the Building Official and Owner
3. Mechanical and electrical components	SI	• Collect manufacturer certificates and verify compliance with ASCE7 requirements for nonstructural components • Periodic inspection during the anchorage of electrical equipment used for emergency power systems • Periodic inspection of piping systems intended to carry flammable, combustible, or highly toxic contents and their associated mechanical units. • Periodic inspection during the installation of vibration isolation systems accommodating nominal clearances of ¼ inch or less • Periodic inspection of HVAC ductwork that will contain hazardous materials
4. Seismic isolation system	SI	• Periodic inspection of isolator units and energy dissipation devices during fabrication and installation • Oversee testing program per ASCE7 requirements
5. Structural Steel	SI / ITL	• Testing and inspection program per AISC 341 - Seismic Provisions for Structural Steel Buildings

a. The Special Inspections listed reflect North Carolina code requirements for Seismic Design Category C. The SER shall review Code sections 1705 and 1707 and adjust the Schedule of Special Inspection Services for structures of greater seismic hazard.

Main Wind-Force Resisting System(s):

Seismic-Resisting Components Subject to Continuous Special Inspections:

Seismic-Resisting Components Subject to Periodic Special Inspections:

SECTION 01 50 00

TEMPORARY FACILITES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for support facilities, and security and protection facilities.
   1. Provide and maintain all temporary facilities and controls necessary for the performance of the Work. Locate and install all facilities and controls where acceptable to the local authorities having jurisdiction and utility owner and remove same and terminate, in a manner suitable to the utility owner, at completion of the Work or when otherwise directed. Pay all costs associated with the provision and maintenance of temporary facilities and controls including power, water, and fuel (if any) consumed until Final Acceptance.
   2. Notwithstanding these specifications for Temporary Facilities and Controls, the incorporation of all temporary facilities and controls into the Project shall be subject to the Owner's approval.

B. Related Sections include the following:
   1. Section 01 33 00 "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
   2. Section 01 51 00 “Temporary Utilities” for requirements associated with temporary utilities: HVAC Equipment, Air-Filtration Units, Electrical Outlets, and Power Distribution System Circuits.
   3. Section 01 57 00 “Temporary Controls” for Pest Control requirements.
   4. Section 01 73 00 "Execution" for progress cleaning requirements.
   5. Section 01 74 19 "Construction Waste Management and Disposal" for waste management requirements.
   6. Section 01 77 00 “Closeout Procedures” for closeout requirements.
   7. Divisions 02 through 49 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.2 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.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Designer, includes as a minimum, the following:
   1. Permanent or temporary roofing is complete, insulated, and weathertight, including parapets and roof edge terminations.
      a. Roof insulation is fully protected from getting wet.
      b. Roof drains are fully functional.
   2. Exterior walls are insulated, weathertight, and UV-resistant.
   3. All openings are closed with permanent construction or substantial weathertight temporary closures.
   4. Permanent enclosure envelope shall be capable of retaining controlled interior temperature and humidity levels.

1.4 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities are not chargeable to Owner or Designer and 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, the following:
   1. Owner's personnel.
   2. Owner’s construction forces.
   3. Designers.
   4. Testing agencies.
   5. Personnel of authorities having jurisdiction.

1.5 INFORMATIONAL SUBMITTALS

A. Site Logistics Plan: Using the Site Plan from the Drawings as a base, prepare and maintain a detailed logistics plan showing, at a minimum: temporary facilities, fencing, signage, utility hookups, staging areas, and parking areas for construction personnel. Additional sheets, including markup on interior sheets, or sheets wholly prepared by the Contractor, may be required to reasonably convey the current logistics plan for the project.
   1. Submit initial Site Logistics Plan not less than five (5) working days prior to preconstruction conference.
   2. Update Site Logistics Plan as site conditions evolve during progress of the work, but not less than monthly.
   3. Implementation and Termination Schedule: Within 15 days of date established from commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1. Submit Fire Safety Program not less than five (5) working days prior to preconstruction conference.

1.6 QUALITY ASSURANCE

A. 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. Conditions of Use: The following conditions apply to use of temporary facilities by all parties engaged in the Work:
   1. Keep temporary facilities clean and neat.
   2. Relocate temporary facilities as required by progress of the Work.

B. 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. General: Provide materials suitable for use intended.

B. Lumber and Plywood: Comply with requirements in Section 06 10 53 "Miscellaneous Rough Carpentry."

C. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219.2 mm) wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

E. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mil (0.254 mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

F. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

G. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (1524 mm).

H. Water: Potable.

2.2 TEMPORARY FACILITIES

A. Field Offices: Contractor to use existing space(s) as temporary field offices in Owner approved facility. Refer to Drawings for location.

B. Storage and Fabrication Spaces: Contractor to use existing space(s) as temporary storage at Owner approved facility. This includes space for staging, laydown area and temporary self-contained toilet units. Refer to Drawings for locations.
   1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Hand carried, portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.

D. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degrees Fahrenheit (12.78 degrees Celsius).

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner’s property.

3.2 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.
   1. Locate facilities to limit site disturbance as specified in Section 01 14 00 "Work Restrictions."

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (914.4 cm) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   2. Maintain support facilities until Designer schedules Final Inspection. Remove before Final Acceptance. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Field Office
   1. Provide an insulated, weather tight temporary field office for use by Contractor, Designer, and Owner. Field office shall have not less than two office spaces, a conference room, and toilet facilities with running water.
      a. Provide each office space with a desk, desk chair, and two side chairs.
      b. Provide each conference room with a conference table, seating for not less than 12 people, and appropriate audiovisual technology to support virtual and or hybrid meetings.
      c. Furnish, maintain, and pay for light, power, phone, internet, wi-fi and other field office services.
      d. For the Owner's exclusive use during the project, provide one (1) 12" wi-fi only Apple iPad Pro tablet computers of the latest model with a minimum 128gb memory, including protective cases with keyboard and stylus with each, with the Contractor's tracking and punchlist software installed.
      e. Provide Owner with two (2) office adjacent temporary parking spaces for Owner personnel.

C. Electronic Communication Service: Provide temporary electronic communication service in common-use facilities.
   1. Provide broadband in primary field office.
   2. Provide for connection of communication devices by Owner, Architect, and Contractor by Wi-Fi, or wired connections.

D. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

E. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

F. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Final Acceptance, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
   1. Do not load elevators beyond their rated weight capacity.
   2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

G. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
   1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that 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 Section 01 14 00 "Work Restrictions."

C. Barricades, Warning Signs, and Lights: Comply with authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting. Paint with appropriate colors and graphics to inform personnel and public of possible hazard.

D. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.

F. Temporary Partitions: Provide and maintain floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (457.2 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219.2 mm) between doors. Maintain water-dampened foot mats in vestibule
3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

G. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction area.
2. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
    a. Field Offices: Class A stored-pressure water-type extinguishers.
    b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.

c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.

3. Store combustible materials in containers in fire-safe locations.
4. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting.
5. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
6. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities. Protect fire protection system from damage due to construction activities and environmental conditions.
7. Develop and supervise an overall fire-prevention and first-aid fire-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.
8. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

H. 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 Final Acceptance. Perform control operations lawfully, using environmentally safe materials.

3.5 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. Protect from damage caused by freezing temperatures and similar elements.
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.
2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Final Acceptance.

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, orprior to Final Acceptance. 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.
   1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification and directional signs.
   2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. Prior to Final Acceptance, repair, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 51 00

TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary utilities.
   1. Provide and maintain all temporary utilities necessary for the performance of the Work. Locate and install all utilities where acceptable to the local authorities having jurisdiction and utility owner and remove same and terminate, in a manner suitable to the utility owner, at completion of the Work or when otherwise directed. Pay all costs associated with the provision and maintenance of temporary facilities and controls including power, water, and fuel (if any) consumed until Final Acceptance.
   2. Notwithstanding these specifications for Temporary Utilities, the incorporation of all temporary utilities into the Project shall be subject to the Owner's approval.

B. Related Sections include the following:
   1. Section 01 33 00 "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
   2. Section 01 50 00 “Temporary Facilities” for requirements associated with temporary facilities.
   3. Section 01 73 00 "Execution" for progress cleaning requirements.
   4. Section 01 74 19 "Construction Waste Management and Disposal" for waste management requirements.
   5. Section 01 77 00 “Closeout Procedures” for closeout requirements.
   6. Divisions 02 through 49 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.2 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.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities are not chargeable to Owner or Designer and shall be included in the Contract Sum, unless otherwise indicated. Allow other entities to use temporary services without cost, including, but not limited to, the following:

1. Owner's personnel.
2. Owner’s construction forces.
3. Designers.
4. Testing agencies.
5. Personnel of authorities having jurisdiction.

B. Sewer Service: No sewer service use charge by Contractor, paid for by Owner. Contractor responsible for hookup and disconnect.

C. Water Service: No water service use charge by Contractor, paid for by Owner. Contractor responsible for hookup and disconnect.

D. Electric Power Service: No electric power service use charge by Contractor, paid for by Owner. Contractor responsible for hookup and disconnect.

E. Internet Service: Owner does not allow Contractor to connect to university internet service. Contractor is responsible for providing internet service in all temporary facilities.

1.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
   1. 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.

1.5 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
   1. Temporary Use of Permanent Utilities: Installer of each permanent service shall 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.

B. Conditions of Use: The following conditions apply to use of temporary services by all parties engaged in the Work:
   1. Keep temporary services clean and neat.
   2. Relocate temporary services as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials suitable for use intended.

2.2 EQUIPMENT

A. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

B. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

C. Temporary HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

D. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction after dust generating activities in areas serviced by the system are complete, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."
   1. Warranty period for the HVAC system begins at Final Acceptance, not the date in which the unit was started up.
   2. Contractor is responsible for a full duct cleaning and filter changes prior to Final Acceptance.

E. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.

B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
   1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
   2. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
   3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
   4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water for use of construction personnel. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
   2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.
      a. Drinking-Water Facilities: Provide bottled-water or drinking-water units. Ensure dispensed water temperature is between 45 to 55 degrees Fahrenheit (12.78 degrees Celsius).

E. Heating and Cooling: Refer to Section 01 57 00 – Temporary Controls.

F. Ventilation and Humidity Control: Refer to Section 01 57 00 – Temporary Controls.

G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
   1. Install electric power service underground, unless overhead service must be used.
   2. Install power distribution wiring overhead and rise vertically where least exposed to damage.

H. 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.

END OF SECTION

SECTION 01 55 00

VEHICULAR ACCESS AND PARKING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for vehicular access and parking.

B. Related Sections include the following:
1. Section 01 50 00 “Temporary Facilities” for requirements associated with temporary facilities.

1.2 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.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SUPPORT FACILITIES INSTALLATION

A. Temporary Use of Permanent Roads and Paved Areas: Maintain existing roads and paved areas to adequately support loads and to withstand exposure to traffic during the construction period.

B. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. 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.

C. Pedestrian Detours: Sidewalks shall remain open and accessible during construction. Should sidewalks require closure, an accessible and safe temporary (concrete, asphalt or plywood) pedestrian path around construction shall be required if an alternative accessible route is not close by. Temporary paths are shown on the contract documents clearly showing path and type of construction.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel. Refer to NC State Transportation Guidelines for Parking, Traffic Control and Road Closures. Refer to Drawings for approved parking locations.
   1. NC State Transportation Guidelines:
      https://transportation.ncsu.edu/construction-parking-information/
   2. Parking permits may be obtained here:
      https://transportation.ncsu.edu/specialty-permits/
   3. Make provision for shuttling personnel to and from remote parking decks.

END OF SECTION

SECTION 01 57 00

TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for support facilities and protection of facilities.
   1. Provide and maintain all temporary facilities and controls necessary for the performance of the Work. Locate and install all facilities and controls where acceptable to the local authorities having jurisdiction and utility owner and remove same and terminate, in a manner suitable to the utility owner, at completion of the Work or when otherwise directed. Pay all costs associated with the provision and maintenance of temporary facilities and controls including power, water, and fuel (if any) consumed until Final Acceptance.
   2. Notwithstanding these specifications for Temporary Facilities and Controls, the incorporation of all temporary facilities and controls into the Project shall be subject to the Owner's approval.

B. Related Sections include the following:
   1. Section 01 33 00 "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
   2. Section 01 51 00 “Temporary Utilities” for requirements associated with temporary utilities.

1.2 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.

1.3 INFORMATIONAL SUBMITTALS

A. Moisture-Protection Plan: Not less than five (5) working days prior to preconstruction conference, Contractor shall submit a Moisture Protection plan Describing procedures and controls for protecting materials and construction from water absorption and damage.
   1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
   2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, bathroom waterproofing testing, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

B. Dust- and HVAC-Control Plan: Not less than five (5) working days prior to preconstruction conference, submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

C. Noise & Vibration Control Plan: Not less than five (5) working days prior to preconstruction conference, submit a Noise & Vibration Control Plan describing procedures and controls for protecting adjacent classrooms, laboratories, dormitories, common areas, and food service areas from excess noise and vibration. Pay special attention to exam and graduation periods. Include a description of how the Contractor will mitigate the following:
1. Vibration resulting from site preparation activities that could impact active experiments or student learning.
2. Concrete cutting method(s) to be used.
3. Saw cutting and grinding activities.
4. Equipment noise.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.

b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

B. 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 from that specified that will not have a harmful effect on completed installations or elements being installed.
1. Maintain a minimum temperature of 50 degrees Fahrenheit (10 degrees Celsius) in permanently enclosed portions of building for normal construction activities, and 65 degrees Fahrenheit (18.33 degrees Celsius) for finishing activities and areas where finished Work has been installed.

C. 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.

3.2 PEST CONTROL:

A. Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Final Acceptance. Perform control operations lawfully, using environmentally safe materials.

3.3 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.

3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Designer.
    c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

END OF SECTION

SECTION 01 58 00

PROJECT IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for project identification.

B. Related Sections include the following:
1. Section 01 50 00 "Temporary Facilities" for requirements associated with temporary utilities.

1.2 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.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PROJECT SIGNS

A. Project Signs: Project sign(s) secured to perimeter fence is permitted following approval of location and content by Owner. Directional signs for material deliveries are allowed within the construction area, if required, and shall be 4' wide x 2' high maximum, black and white only. The NCSU Project Manager shall approve the design of the sign and the sign text.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 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. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
   1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.3 ACTION SUBMITTALS

A. Comparable Product 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. Identification of basis-of-design product, fabrication, or installation method to be replaced, including Specification Section number and title, and Drawing numbers and titles.

B. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

C. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 - Submittal Procedures. Show compliance with requirements.

D. Substitution: Refer to Section 01 25 00 - Substitution Procedures for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

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

1.5 COORDINATION

A. Coordinate affected Work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft 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. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Provide a secure location and enclosure at Project site, at location approved by Owner for storage of materials and equipment.
   2. Store products to allow for inspection and measurement of quantity or counting of units.
   3. Store materials in a manner that will not endanger Project structure.
   4. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   5. Store cementitious products and materials on elevated platforms.
   6. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   7. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   8. Protect stored products from damage and liquids from freezing.
   9. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: 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. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 - Closeout Procedures.

1.8 PROHIBITION ON INCORPORATION OF HAZARDOUS MATERIALS

A. Contractor is responsible for ascertaining that materials within the existing facility, which will be disturbed as part of the work, are free of asbestos containing materials and for performing surveys and/or providing certifications attesting regarding this.

B. Architect and its consultants have not knowingly specified for incorporation into the work, materials or products containing hazardous materials or toxic substances (including asbestos).

C. Contractor (including its subcontractors, sub-subcontractors, and material suppliers/fabricators under its control) is prohibited from incorporating any material or products into the work containing hazardous materials or toxic substances.

D. As part of completed materials and products list required herein, Contractor shall assemble, for the Owner’s records, the Material Safety Data Sheets (MSDS) for all materials and products incorporated into the work. These MSD sheets shall be updated upon final completion of the work to incorporate changes which have occurred during the course of the work due to approved substitution requests and other modifications. Architect will not review, nor approve, the MSD sheets. The Contractor, also as a pre-requisite to achieving final completion, shall provide a certificate to the Owner indicating that no hazardous or toxic materials or products were incorporated into the work.

E. Architect and its consultants are not responsible for the presence of hazardous materials or toxic substances in or around the work, nor the exposure to persons who construct or subsequently occupy the work. The Architect will not provide certifications regarding the presence or absence of such materials or substances.

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. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Substitutions may be considered, unless otherwise indicated, when submitted in accordance with provisions of Section 01 25 00 - Substitution Procedures.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Substitutions may be considered, unless otherwise indicated, when submitted in accordance with provisions of Section 01 25 00 - Substitution Procedures.
   3. Products:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
   1) Substitutions may be considered, unless otherwise indicated, when submitted in accordance with provisions of Section 01 25 00 - Substitution Procedures.

4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
      1) Substitutions may be considered, unless otherwise indicated, when submitted in accordance with provisions of Section 01 25 00 - Substitution Procedures.
5. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
6. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer.
   a. Submitted in accordance with provisions of Section 01 25 00 - Substitution Procedures.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
   a. Substitutions may be considered, unless otherwise indicated, when submitted in accordance with provisions of Section 01 25 00 - Substitution Procedures.

C. 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 Section 01 25 00 - Substitution Procedures for proposal of product.

D. 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.
   1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
   2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
   3. Full Industry Range: Where Specifications include the phrase "full industry range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from any listed manufacturer's product line that includes both standard and premium items.
   4. "Custom Color as selected by Architect" or "to match color on file in Architect's office", "match Architect's sample" means that the color selected is custom and requires custom formulations and submissions of color to obtain Architect's approval prior to application.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Submitted in accordance with provisions of Section 01 25 00 - Substitution Procedures.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Installation of the Work.
   2. Cutting and patching.
   3. Coordination of Owner-installed products.
   4. Progress cleaning.
   5. Starting and adjusting.
   6. Protection of installed construction.

1.2 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.

B. Section 02 41 19 - Selective Demolition for demolition and removal of selected portions of the building.

C. Section 07 84 13 - Penetration Firestopping for patching penetrations in fire-rated construction.

D. Reference Section 01 74 19 "Construction Waste Management and Disposal" for required submittals.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

C. Cutting and patching is performed for coordination of the Work, to uncover Work for access or inspection, to obtain samples for testing, to permit alterations to be performed or for other similar purposes.

D. Restoring or removing and replacing non-complying work is specified separately from cutting-and-patching but may require cutting-and-patching operations as specified herein.

1.4 INFORMATIONAL SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

B. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Coordinate with Owner if Cutting and Patching Plan will be required.
   2. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   3. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   4. Products: List products to be used for patching and firms or entities that will perform patching work.
   5. Dates: Indicate when cutting and patching will be performed.
   6. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
   7. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

1.5 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.
   1. Coordinate with Owner if Cutting and Patching Conference will be required.
   2. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
      a. Contractor's superintendent.
      b. Trade supervisor responsible for cutting operations.
      c. Trade supervisor(s) responsible for patching of each type of substrate.
      d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
   3. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.6 QUALITY ASSURANCE

A. 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 Designer of locations and details of cutting and await directions from Designer before proceeding. Shore, brace, and support structural elements 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. Other construction elements include but are not limited to the following:
      a. Water, moisture, or vapor barriers.
      b. Membranes and flashings.
      c. Exterior curtain-wall construction.
      d. Sprayed fire-resistive material.
      e. Equipment supports.
      f. Piping, ductwork, vessels, and equipment.
      g. 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 Designer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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

1.7 WARRANTY

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

PART 2 PRODUCTS

2.1 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 Designer for the visual and functional performance of in-place materials.

C. Materials to be cut and patched include those damaged by the performance of the Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examination of the Site and Records of Existing Construction and Conditions: Examine the site, the records of existing construction, and the conditions under which the Work is to be performed. Notify the Architect immediately if existing conditions discovered will affect the Work as shown on the Contract Documents.

B. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
   1. Before beginning construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping,underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Existing Conditions Depicted in the Contract Documents: The Contract Documents are based upon the information furnished to the Architect by the Owner. Such information is available from the Owner. The records are furnished for information only and may not represent all conditions that will be encountered. The records of existing construction represent conditions known to the Owner. Other construction, of which no records are available, may be encountered. Dimensions of existing construction are based on information provided to the Architect by the Owner. The Contractor and each subcontractor shall field verify dimensions of existing conditions.

D. 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. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

E. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

F. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility 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 Contractor, submit a request for interpretation to Designer according to Section 01 26 13 "Request for Interpretation."

3.3 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. Where indicated to remain exposed, arrange overhead systems in an orderly manner.
4. Maintain minimum headroom clearance of 96 inches (2438.4 mm) in occupied spaces and 90 inches (2286 mm) in unoccupied spaces.

B. Precautions Against Movement or Settlement: The Contractor shall take precautions, including bracing, shoring, underpinning, or other retaining structures, to guard against movement or settlement of existing or new construction. Assume responsibility for the design, safety, and support of such construction, and for movement, settlement, damage, or injury resulting from the construction.

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

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

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. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

G. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.

H. 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.

I. 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 Designer.
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.

J. 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.

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

L. Protect adjacent property and adjoining work, including sealant bond surfaces, from spillage or blow-over of coatings, paints, sprayed fire-resistive material, and other spray-applied products. Cover adjoining and nearby surfaces, including live plants and grass, if there is possibility of spray-applied products being deposited on surfaces.

3.4 EXAMINATION

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

3.5 PREPARATION

A. 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.

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

E. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.6 PERFORMANCE

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.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots 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. Avoid cutting steel reinforcement.
      a. Locate steel reinforcement using Ground Penetrating Radar or Ferroscan prior to cutting or drilling reinforced concrete and masonry. If existing steel reinforcement is in proposed cut or hole location, contact Designer before proceeding with the Work.
   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.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable, as judged by Architect. 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. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Ceramic Tile: Provide ceramic tile and grout to match existing. Remove and replace tile damaged as a result of Work of this Contract. Comply with TCNA's "Handbook for Ceramic Tile Installation" for installation method to match existing. Lay tile in grid pattern to match existing. Make joints between existing and new tile same width so patches are not apparent in finished work.
6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

D. Fire Rated Construction: At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 13 - Penetration Firestopping, to full thickness of the penetrated element.

E. 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 forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
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 forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces 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. Coordinate progress cleaning for joint-use areas where more than one installer is working concurrently. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees Fahrenheit (26.67 degrees Celsius).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

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

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted. Comply with Section 01 74 19 "Construction Waste Management and Disposal."

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

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

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

3.9 STARTING AND ADJUSTING

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

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

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

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 01 40 00 "Quality Requirements."

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 Acceptance.

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

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging and Disposal of nonhazardous demolition and construction waste.
   2. Handling and disposing of hazardous demolition and construction waste.

1.2 RELATED SECTIONS

1. Section 00 60 00 "Project Forms" for the Designer Waste Information Form for the project and Non-Hazardous Waste Tracking Forms.
2. Section 02 41 19 - Selective Demolition for disposition of waste resulting from partial demolition of buildings, structures, and site improvement

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 and waste materials (i.e. brick, concrete, asphalt, and aggregate).

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

C. Special Waste: Solid wastes that require special handling and management.

D. Hazardous Waste: Any solid waste that is ignitable, corrosive, reactive, or toxic; a listed hazardous material or containing a listed hazardous material per Title 40 Code of Federal Regulations Parts 260-270.

E. Universal Waste: Hazardous wastes that have been provided specific exemptions (((40 CFR 273))) to encourage recycling. Universal wastes are limited to recalled or cancelled pesticides and intact batteries, lamps, and mercury containing devices. State regulations prohibit the crushing of fluorescent lamps.

F. 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.

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

H. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

I. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

J. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable and reusable material.

K. Waste Management Plan: A project-related plan for the collection, transportation and disposal of waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material becoming landfill.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For waste management coordinator.

1.6 CLOSEOUT SUBMITTALS

A. Hazardous Waste Disposal Certificates: Contractor shall provide NC State with a copy of all hazardous, universal, and special waste disposal certifications and/or manifest for all waste shipped.

B. Construction & Demolition Waste and Recycling Tracking Forms: All reuse, recycling, and landfilled materials are to be tracked and complied on NC State's "Construction & Demolition Waste & Recycling Tracking Form", which is included in Section 00 60 00 "Project Forms".

C. Construction & Demolition Salvaged Material Form: All salvaged materials are to be tracked and compiled on NC State's "Construction & Demolition Salvaged Material Form" which is included in Section 00 60 00 "Project Forms".

D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 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 Section 01 31 00 "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 including responsibilities of waste management coordinator.
   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.

1.8 WASTE MANAGEMENT PLAN

A. General: The plan shall include details on how the hazardous and non-hazardous generated waste will be managed in accordance with local, state, and federal regulations. Contractor must also provide all materials, personnel, and protective equipment necessary to remove and store wastes in accordance with the plan. The Contractor must coordinate salvage or reuse efforts identified on the Designer Waste Information Form with NC State and/or the non-profit entity.

B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
   1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with Section 02 41 19 - Selective Demolition.
   2. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
   3. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
   4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

D. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

E. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
   1. Total quantity of waste.
   2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
   3. Total cost of disposal (with no waste management).
   4. Revenue from salvaged materials.
   5. Revenue from recycled materials.
   6. Savings in transportation and tipping fees by donating materials.
   7. Savings in transportation and tipping fees that are avoided.
   8. Handling and transportation costs. Include cost of collection containers for each type of waste.
   9. Net additional cost or net savings from waste management plan.

1.9 PERFORMANCE GOALS & REQUIREMENTS

A. All hazardous and non-hazardous generated waste shall be managed in accordance with local, state, and federal regulations.

B. Seventy-five percent (75%) of a project's non-hazardous waste must be diverted from landfill disposal through reuse and recycling.
   1. Exclude excavated soil, land-clearing debris from calculations. Include materials destined for alternative daily cover (ADC) in the calculations as waste (not diversion). Include wood waste converted to fuel (bio-fuel) in the calculations; other types of waste-to-energy are not considered diversion for this credit.
   2. Divert at least four material waste streams.
   3. The waste-sorting facility provides a waste diversion percentage specific to the project's waste based on measurement of each component waste material.

C. The Designer must complete the Designer Waste Information Form (http://go.ncsu.edu/wasteinfoform) and identify regulated wastes, as well as materials, fixtures, and equipment that are to be salvaged for reuse or recycled. The location of the staging area as well as the responsible party for removal, delivery, and/or pick up must also be included.
   1. The completed Designer Waste Information Form has been included in Section 00 60 00 "Project Forms".

1.10 PROJECT MEETINGS

A. Waste management plans and implementation shall be discussed at the following meetings:
   1. Pre-demolition meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.

4. Subcontractor toolbox meetings.

1.11 MANAGEMENT OF HAZARDOUS, UNIVERSAL, AND SPECIAL WASTES

A. Hazardous, universal, and special wastes must be managed separately from other C&D wastes.

B. Disposal must be coordinated with NC State Environmental Health & Safety.

C. Special wastes include:
1. Paints, varnish, solvents, sealers, thinners, resins, roofing cement, adhesives, lubricants, and caulk, or drums and containers that once held these materials.
2. Treated wood including lumber, posts, ties, decks, and utility poles (creosote, arsenic, chromium, pentachlorophenol).
3. Asbestos, PCBs, mercury, or lead containing materials
4. Used oil
5. Lead acid batteries
6. Medical wastes

D. Waste disposal responsibility falls to one of two parties: the Contractor or NC State, as defined in the NC State Environmental Health and Safety's document: Management of Building Demolition Debris available at: http://go.ncsu.edu/demodebris
1. Containers used for waste storage must be United States Department of Transportation approved. The Contractor must supply bins, tanks or tank trucks. Containers must remain closed at all times except when material is being added. NC State will provide containers for items collected by NC State.
2. Hazardous waste containers must have labels that clearly identify waste streams. Different waste streams cannot be combined in a shared container. The Contractor must identify the initial accumulation date on the hazardous waste label when waste is first placed in the container.
3. Waste containers must be stored in a secured, covered, and well identified area of the construction site. Hazardous waste cannot be stored for more than 90 days. Any waste stored for more than six days must be inspected, and the inspection documented, weekly.
4. Spill response supplies must be on-site and adequate to contain 110% of any accumulated waste. Portable fire extinguishers must also be readily available. If a spill occurs, Contractor must contact NC State immediately and proceed with spill containment and clean up.
5. The Contractor must provide NC State with a copy of all hazardous, universal, and special waste disposal certifications and/or manifests for all waste shipped.

1.12 MANAGEMENT OF NON-HAZARDOUS WASTE

A. Priority 1 - Salvage of Construction and Demolition Waste for Reuse

1. Salvaged materials should first be evaluated for use in University construction projects. NC State Surplus Property Services should be considered if there are reusable materials that have resale value and are no longer needed by the University. Contact Waste Reduction and Recycling (recycle@ncsu.edu) for assistance with disposition. Examples of Salvageable material include:
    a. Furniture and electronics
    b. Cabinets and shelves that are not built-in
    c. Sinks and water fountains
    d. Paper towel dispensers
    e. Newer light fixtures
    f. Dry erase boards, chalkboards, and cork boards
    g. Solid wood panel doors
    h. Brick pavers
2. Contact vendors about take-back programs to recycle materials their company provides. These materials include, but are not limited to ceiling tiles, carpet tiles, and cubicle walls.
3. Coordinate with the Project Manager to utilize the NC State Construction Shop for the careful removal of salvageable items prior to contractor demolition. An estimate for the Construction Shop's work must be received during design and must be initiated prior to the project going out to bid.

B. Priority 2 - Recycling of Construction and Demolition Waste
1. If materials are not salvageable for reuse, they must be source separated to the greatest extent possible and recycled.
2. Common source separated materials for recycling include:
    a. Cardboard
    b. Bottles and cans
    c. Scrap metal and wire
    d. Rigid plastics
    e. Untreated/unpainted dimensional lumber
    f. Gypsum board (unpainted)
    g. Concrete
    h. Asphalt (pavement and shingles)
    i. Aggregate
    j. Brick and CMU
    k. Carpet and Pad
3. 100% of the following materials must be recycled:
    a. Paper
    b. Cardboard
    c. Bottles and cans
    d. Scrap metal and wire
    e. Concrete
    f. Asphalt (pavement and shingles)
    g. Aggregate
    h. Brick and CMU
    i. Plastic sheet and film
    j. Polystyrene packaging

k. Wood crates
l. Wood pallets
m. Plastic pails

C. Priority 3 - Disposal of Construction and Demolition Waste
1. If material/s cannot be salvaged for reuse or source separated and recycled, they must be sent to a C&D recycling and reclamation facility. Materials are not to be sent directly to a landfill or a facility that does not sort and recycle.
2. Regardless of salvage/recycle goal indicated in "General" paragraph above, salvage or recycle 100% of the following construction office waste materials:
a. Paper
b. Aluminum cans
c. Glass containers

D. All solid waste management facilities must be permitted to operate by NCDEQ in accordance with 15A NCAC 13B .0201.

1.13 DUMPSTER SERVICES

A. Contractor is responsible for providing the dumpster for the project.

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 operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. 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 salvaged, recycled, reused, donated, and sold.

2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area on-site.
   5. Protect items from damage during transport and storage.

C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

E. Plumbing Fixtures: Separate by type and size.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND 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. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
2. Inspect containers and bins for contamination and remove contaminated materials if found.
3. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
4. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
5. Store components off the ground and protect from the weather.
6. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
   1. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

H. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

I. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
   1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

J. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

L. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 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.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION

SECTION 01 77 00

CLOSEOUT

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
   1. Final Acceptance / Beneficial Occupancy procedures.
   2. Final completion procedures.
   3. Final cleaning.
   4. Repair of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 00 60 00 "Project Forms" for Completion Checklists and Project Acceptance forms.
   2. Section 01 29 00 "Payment Procedures" for Payment at Final Acceptance .
   3. Section 01 31 00 "Project Management & Coordination" for information regarding the Project Website used for the Punch List(s).
   4. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   5. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   6. Section 01 78 46 "Maintenance Materials" for submitting maintenance materials requirements.
   7. Section 01 79 00 "Demonstration & Training" for completing training and submitting documentation of completed training.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents used during Final Clean.

B. Contractor's Pre-Final Punch List: Submitted no later than thirty (30) calendar days prior to Final Acceptance.

C. Final Inspection Punch List: Submitted at Final Acceptance. All work must be complete within thirty (30) calendar days of the Final Inspection.

1.4 CLOSEOUT SUBMITTALS

A. As listed in the checklists referenced in Paragraph 1.5 of this Section, and as itemized in the various Specification Sections of this Project Manual.

B. Certificates of Release: From authorities having jurisdiction.

C. Certificate of Insurance: For continuing coverage.

D. Closeout Submittal Log: Contractor shall, at 50% complete, as determined by the project schedule, submit to Designer a log of schedule of all Closeout Submittals required by the Project Documents.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 FINAL ACCEPTANCE PROCEDURES

A. The checklists and timelines listed herein are organized in a manner to prepare the Project Team for SCO's Inspection for Beneficial Occupancy (if applicable) and SCO's Final Inspection for Final Acceptance. The checklists provided herein are required to be completed in the timelines provided herein in their entirety, but the checklists do not replace the SCO Forms for Beneficial Occupancy and Final Acceptance, both of which are included in Section 006000 "Project Forms" and will be uploaded by the Designer to Interscope after the milestone is achieved.

B. Request for Designers Pre-Final Inspection: No less than ten (10) working days prior to Designer's Pre-Final Inspection, Contractor shall submit to Designer, in an organized .zip folder, the items shown on the Request for Designers Pre-Final Inspection Checklist, as included in Section 006000 "Project Forms".

C. Request for Final Inspection: No less than ten (10) working days prior to the SCO Final Inspection, Contractor shall submit to Designer, in an organized .zip folder, the items shown on the Request for Final Inspection Checklist, as included in Section 006000 "Project Forms".
   1. If the project has a phase that requires Beneficial Occupancy, as noted in Article 23 of the Supplemental General Conditions, use the Request for Final Inspection Checklist to prepare for Beneficial Occupancy.

D. Final Inspection: To achieve Final Acceptance, all items on the Final Acceptance Checklist must be complete. Contractor shall submit to Designer, in an organized .zip folder, all items shown on the Final Acceptance Checklist. Once all items on the Final Acceptance Checklist are complete, the Project has achieved Final Acceptance.

E. Project Closeout: Prior to Final Payment, Contractor must submit all items on the Project Closeout Checklist as included in Section 006000 "Project Forms".

1.7 LIST OF INCOMPLETE ITEMS (CONTRACTORS COMPLETION / DESIGNER PUNCH LIST)

A. Preparation: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, proceeding from lowest floor to highest floor.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. NC State Project Name and location.
      b. NC State Project Number, Code & Item, and State Construction Office Project Number.
      c. Date.
      d. Name of Designer.
      e. Name of Contractor.
      f. Page number.

B. Submit list of incomplete items using Web-based Project Information Management Systems,. Designer will utilize agreed upon electronic tracking system (Project Website). Access shall be provided by the contractor.
   1. Required Functions of Web-based Project Information Management Systems:
      a. Ability to download and sync tasks with Apple iPad over non-persistent wireless internet connection.
      b. Drawing markup and viewing, for location identification of incomplete items.
      c. Authorship tracking of each comment and subsequent action, including timestamps.
      d. Sortable, filterable, itemized listing of incomplete items, by at a minimum unique issue number, date, location, issue author and responsible party.
      e. Ability to append photos and markups on photos for the purpose of identifying incomplete items and demonstrating completeness of items.
      f. Ability to incorporate Designer's provided list of pre-generated comments.

C. Designer will direct all incomplete items to the attention of the Contractor, who shall identify responsible subcontractors.

D. Contractor shall verify all items for completion prior to forwarding to Designer for action. To the maximum extent feasible, items shall be documented for closeout with clear photographs in the software, taken with context to identify the specific issue is resolved.

1.8 PROJECT RECORD DOCUMENTS

A. Provide Project Record Documents as specified in Section 01 78 39 "Project Record Documentation".

1.9 OPERATION AND MAINTENANCE MANUALS

A. Assemble and provide complete set of operation and maintenance data as specified in Section 01 78 23 "Operation & Maintenance Data".

B. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
   1. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

1.10 SUBMITTAL OF PROJECT WARRANTIES

A. Submit written warranties as specified in Section 01 78 23 "Operation & Maintenance Data".

PART 2 PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the 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 comply with Green Seal's 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: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

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

1. Complete the following cleaning operations before requesting Designers Pre-Final Inspection:
    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including plenums, shafts, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces. Remove labels that are not meant to be permanent.
    k. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

n. Clean ducts, blowers, and coils if units were operated without filters during construction.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in lighting fixtures to comply with requirements for new fixtures.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Final Acceptance.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
b. Do not paint over labels for fire resistive joints.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency procedures manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

1.2 RELATED DOCUMENTS

A. Section 00 60 00 "Project Forms" for forms preparing for Final Acceptance.

B. Section 01 33 00 "Submittal Procedures" for requirements associated with the submission and approval of Submittals.

C. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 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. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

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 Acceptance and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Print one set of hard copies of the Operation and Maintenance Manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.5 COORDINATION

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

PART 2 PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.3 EMERGENCY PROCEDURES MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.4 OPERATION AND MAINTENANCE MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Noise and vibration adjustments.
10. Precautions against improper use.
11. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves, and effective energy utilization.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

2.5 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. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Maintenance record forms.
   6. Repair instructions.

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

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. 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 (NOT USED)

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for submitting as-builts, record Drawings, record Specifications, and record Product Data.

1.2 RELATED DOCUMENTS

A. Section 01 77 00 “Closeout Procedures” for administrative and procedural requirements for contract closeout.

B. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 DEFINITIONS

A. As-Builts: Drawings and Specifications maintained and updated by Contractor during construction.

B. Record Drawings: Drawings maintained and updated by Architect during construction utilizing Contractor’s As-Builts.

C. Record Specifications: Specifications maintained and updated by Architect during construction utilizing Contractor’s As-Builts.

1.4 CLOSEOUT SUBMITTALS

A. As-Builts: Comply with the following:
   1. Initial Submittal:
      a. Submit consolidated PDF electronic files of most current marked-up Drawings and Specifications.
      b. Owner and Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
   2. Final Submittal:
      a. Submit PDF electronic files of As-Builts.

B. Record Product Data: Submit annotated PDF electronic files and directories of each submittal. Record Product Data shall include Architect’s final review and acceptance of each submittal.

1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.5 AS-BUILT DRAWINGS AND SPECIFICATIONS

A. General: As-builts are required to show all changes in the work relative to the original contract documents; and show additional information of value to Owner's records, but not indicated in original contract documents.

B. Maintenance of As-Built Drawings During Construction: During progress of the work, maintain a set of contract drawings along with specifications and shop drawings. Update these drawings weekly, at a minimum, with markup of actual installations, which vary from the work as originally shown.
1. Mark whatever drawing is most capable of showing actual physical condition, fully and accurately, and reference all other appearances of this work to the sheet, which was updated. Include cross-reference to the official change number on the updated sheet and all additional sheets where the work is shown.
2. Give particular attention to information on work concealed, which would be difficult to identify or measure and record at a later date.
3. Note alternative numbers, change order numbers and similar identification for any change.
4. Maintain and have available for review in conjunction with the regular project meetings, a current set of the as- built drawings and specifications marked with "as constructed" information. Availability for review, and acceptability, of both the format and the content is a prerequisite condition for certification of monthly pay requests by the Owner and Architect. Comply with Requirements in Section 01 29 00 “Payment Procedures”.

C. Supplemental Drawings: Where marked-up shop drawings are intended for inclusion in the record set, mark cross-reference on contract drawings at corresponding location. Use of shop drawings as supplements to the record as-builts is encouraged for all items which require the larger scale employed on the shop drawings in order to show the work in sufficient detail to be of future use to the Owner.
1. The supplemental document shall be identified as a "Supplementary As-Built Drawing" and shall be numbered with an extension to the contract drawing it supplements in a manner acceptable to the Owner.

D. Record/Final As-Builts: Before inspection for Certificate of Final Acceptance, submit As-Built Drawings and Specifications to Architect and Owner for review. Comply with requirements in Section 01 77 00 "Closeout Procedures".
   1. Format: Annotated PDF Electronic file with comment function enabled.
   2. Following the Architect and Owner's review of the As-Built files, and upon authorization by the Architect based on their belief that the marked-up information is accurate and complete, the Architect shall proceed with preparation of Record Drawings and Specifications.

1.6 PROJECT RECORD DOCUMENTS

A. General: Store Record Documents and As-Builts in the field office apart from the Contract Documents used for construction. Do not use Record Documents and As-Builts for construction purposes. Maintain Record Documents and As-Builts in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents and As-Builts for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of electronic Portable Document Format (.pdf) prints of Contract Drawings and Shop Drawings incorporating all modifications and changes made in As-Built Drawings.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Clearly mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Note related Change Orders, Record Drawings, and Product Data, where applicable.

D. Record Product Data:
   1. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
   2. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
      a. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
      b. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
      c. Note related Change Orders, Record Drawings, where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections such as tests and inspections, and inspections by authorities having jurisdiction. Electronically bind in Portable Document Format (.pdf) and bookmark miscellaneous records and identify each, ready for continued use and reference.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 78 46

MAINTENANCE MATERIALS AND ATTIC STOCK

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for maintenance materials (commonly referred to as "attic stock").

1.2 RELATED DOCUMENTS

A. Section 01 77 00 "Closeout" for closeout requirements.

B. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

C. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 CLOSEOUT SUBMITTALS

A. Schedule of Maintenance Material and Attic Stock Items: For maintenance material submittal items listed below and as specified in other Sections. Contractor shall submit the following a minimum of 5 days prior to requesting an inspection for determining date of Final Acceptance for the Work or a designated portion thereof.

1. Prepare and submit schedule of maintenance material submittal items, including tools, spare parts, extra materials, and similar items including name and quantity of each item and name and number of related Specification Section. Label with manufacturer's name and model number where applicable. Obtain Designer's signature for receipt of submittal.

B. Maintenance Material and Attic Stock Transmittal: Prior to Final Acceptance, Contractor shall turn over all items on the Schedule of Maintenance Material Items to N.C. State. Contractor shall obtain N.C. State's recipients signature for each item received by each recipient.

PART 2 PRODUCTS

2.1 MATERIALS

A. None.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Instruction in operation and maintenance of systems, subsystems, and equipment.
   2. Demonstration and training video recordings.
   3. Descriptions and responsibilities for commissioning demonstration and training requirements.

1.2 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.

B. The following sections provide additional demonstration and training requirements:
   1. 23 05 13 - Electrical Motors for HVAC Equipment
   2. 23 09 13 - Instrumentation and Control Devices for HVAC
   3. 23 09 23 - Extension of Existing Direct Digital Control System for HVAC
   4. 23 34 16 - Centrifugal HVAC Fans
   5. 23 62 00 - Packaged Condensing Units
   6. 23 73 11 - Blower-Coil Air-Handling Units, Indoor or Outdoor

1.3 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. Indicated proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two (2) copies within seven (7) working days of the end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Designer.
      d. Name of Contractor.
      e. Date of video recording.
   2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
   3. At completion of training, submit complete training manual(s) for Owner's use prepared in same paper and PDF file format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance based test.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A competent videographer who is experienced photographing demonstration and training events similar to those required. If Contractor is to have their personnel perform the videography, Contractor must send a sample of audio and video quality to Owner and Designer for approval prior to the training being scheduled. Sample audio and video must be representative of the camera and microphone that will be used during the training.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Designer and Owner.

1.7 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. Systems and equipment operation manuals.
      c. Systems and equipment maintenance manuals.
      d. Product maintenance manuals.

e. Project Record Documents.
f. Identification systems.
g. Warranties and bonds.
h. 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.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and 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.

1.8 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Designer will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum recording quality of UHD 4k at 30 fps with vibration reduction technology. Use an external directional microphone (Rode VideoMic GO, or equivalent) to capture audio.
   1. Submit video recordings on thumb drive.
   2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
   3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
   4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
      a. Name of Contractor/Installer.
      b. Business address.
      c. Business phone number.
      d. Point of contact.
      e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
   1. Film training session(s) in segments not to exceed 15 minutes.
      a. Produce segments to present a single significant piece of equipment per segment.
      b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
      c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
   1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

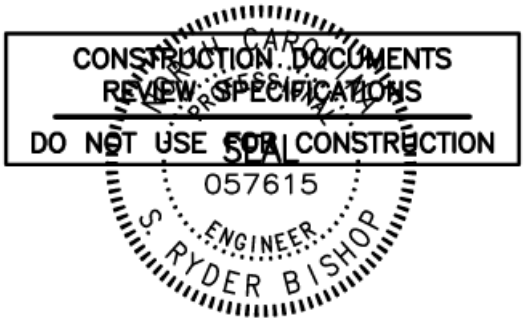
PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 019913 - GENERAL REQUIREMENTS FOR DIVISIONS 21-28 WORK

The "Engineer of Record" for the work defined by Division 01 Sections: 019913, 019916, 019926 is Salas O'Brien, 702 Oberlin Road, Suite 300, Raleigh, NC 27605. The term "engineer," "architect-engineer," "engineer-architect," "A-E," "E-A," etc., when used in these Sections shall reference Salas O'Brien.



The "Engineer of Record" for the work defined by Divisions 21-28 is Salas O'Brien., 702 Oberlin Road, Suite 300, Raleigh, NC 27605. The term "engineer," "architect-engineer," "engineer-architect," "A-E," "E-A," etc., when used in Divisions 21-28 Drawings and Specifications shall reference Salas O'Brien.

PART 1 - GENERAL

RELATED DOCUMENTS

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

The requirements specified herein shall govern all Sections in Divisions 21-28, whether stated therein or not.

Where items specified in the other sections of this Division conflict with requirements of this Section, the former shall govern.

REVIEW OF CONTRACT DOCUMENTS

The Contract Documents may represent imperfect data and may contain errors, omissions, conflicts, inconsistencies, code violations and improper use of materials. Such deficiencies will be corrected by the A-E when identified. The Contractor shall carefully study and compare the individual Contract Documents with each other and report at once in writing to the A-E any deficiencies the Contractor may discover. The Contractor shall require each subcontractor to likewise study the documents and report at once any deficiencies discovered. The Contractor shall resolve all reported deficiencies with the A-E prior to starting any work. **Any work performed prior to receipt of instructions from the A-E will be done at the Contractor's risk.** If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency, or omission in the Contract Documents without such notice to the A-E, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

The Contractor shall be responsible for maintaining habitable structures under this Contract rainproof, and for making equipment and utility installations properly perform the intended function. If he is prevented from so doing by any limitations of the drawings or specifications, the Contractor shall immediately notify the A-E in writing of such limitations before proceeding with construction in the area where the problem or limitation exists.

DEFINITIONS

Mechanical Work: Work required by this Contract as defined by specification Division 21 (Fire Protection), Division 22 (Plumbing), and Division 23 (Heating, Ventilating, and Air-Conditioning).

Electrical Work: Work required by this Contract as defined by specification Divisions 26-28.

Labeled: Appliances, equipment, materials or products to which has been attached a label, symbol, or other identifying mark of an organization acceptable to the North Carolina Building Code Council and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with identified standards or has been tested and found suitable for a specified purpose.

Listed: Appliances, equipment, materials or products included in a list published by an organization acceptable to the North Carolina Building Code Council and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets appropriate designated standards or has been tested and found suitable for a specified purpose.

Concealed: Work within or behind various construction elements or in crawl spaces or trenches that is not exposed to view when the project is complete.

Exposed: Not "concealed" as defined above, or anything exposed to view when the project is complete.

Wiring: Cable, raceways, fittings, mechanical supports, wire, junction boxes, device boxes, outlet boxes, switches, cutouts, and related items.

CODES, LAWS, REGULATIONS, AND STANDARDS

Work on and for the project shall conform to requirements of each applicable volume of the *North Carolina Building Code*; shall comply with the regulations of the N.C. Department of Labor, including the latest revisions and interpretations of the *Occupational Safety and Health Act of North Carolina;* and be in accordance with all other codes, laws, rules and regulations that apply to this project.

"Confined spaces" and "permit-requiring confined spaces", as defined by U.S. Occupational Safety and Health Administration (USOSHA) may exist in the work area or may be created by the construction of this Project. The Contractor shall be responsible for identification of any permit-requiring confined spaces and for establishing all required procedures for meeting the requirements of USOSHA relative to these spaces, including written confined space entry program(s).

Codes, laws, regulations, and/or industry standards referenced in the Specification or on the Drawings shall be considered to be part of the Project requirements. Applicable edition of the referenced volume is the edition that is/was in effect at the time the construction permit was issued or at the time of approval of the Contract Documents by the Authority Having Jurisdiction.

INTENT AND WORKMANSHIP

The words "furnish," "furnish and install," "install," and "provide" or words with similar meaning shall be interpreted, unless otherwise specifically stated, to mean "furnish and install complete in-place and ready for service."

The work of all trades under this Contract shall be coordinated in such a manner as to obtain the best workmanship possible.

Miscellaneous items and accessories that are not specifically shown on the drawings or specified herein, but which are essential to produce a complete and properly operating installation, or usable structure or plant, providing the indicated function, shall be furnished and installed without change in the Contract price. Such miscellaneous items and accessories shall be of the same quality standards, including material, style, finish, strength, class, weight and other applicable characteristics, as specific for the major component of which the miscellaneous item or accessory is an essential part. The above requirement, however, is not intended to include major components not covered by or inferable from the drawings and specifications.

WELDER QUALIFICATION

Where welding is required on vessels or piping with an ASME P- or S- stamp, qualify welders for welding procedures complying with ASME *Boiler and Pressure Vessel Code*, Section IX. Submit *Welder's Performance Qualification Record* required by the ASME *Boiler and Pressure Vessel Code*.

For piping and structural supports welding, qualify welders in accordance with AWS QC7 *Standard for AWS Certified Welders* for welding procedures complying with ASME B31.1 or ASME B31.9, as applicable. Submit *Welder's Performance Qualification Record* required by ASME B31.1 or B31.9 and a copy of the most recent *Maintenance of Welder Certification* form submitted to AWS.

In addition, submit each welder's assigned number, letter, or symbol used to identify the work of the welder. This symbol shall be stamped in or adjacent to each completed weld.

QUALITY ASSURANCE

The Contract Drawings indicate the extent and general arrangement of the Work. The Contractor shall coordinate the Work under his Contract so as to avoid conflicts between his work and the work of other trades. He shall carefully examine the Drawings and shall be responsible for the proper fitting of materials and equipment into the space provided. 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 A-E for his review. No such departures shall be made without this review and written clarification or change order.

If manufacturer recommended details or installation instructions differ from the contract drawings or specifications, then the contractor shall notify the A-E immediately of any discrepancies.

The Drawings and Specifications shall be considered supplementary, one to the other, so that materials and/or labor indicated, called for, or implied by one and not the other shall be provided as though specifically called for in both.

Firestop Materials Codes and Standards: Comply with ASTM Standard E814 and applicable categories of UL's current *Fire Resistance Directory*, Vol. I and II, for compliance with ANSI/UL Standard 1479.

Access Doors Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide Listed and Labeled units.

OBSERVATION

All work shall be done by skilled technicians, continuously supervised by the Contractor and subject to observation and final acceptance by the A-E. Such final acceptance shall in no way relieve the Contractor from responsibility for defects in either workmanship or material that may subsequently develop.

SUBMITTALS

Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Material and equipment schedules, catalog cuts, manufacturers' data and shop drawings, and field working drawings as required by individual Sections shall be provided.

Shop drawings, technical data and other such submittals required by individual Sections of the Divisions listed above shall be provided.

Equipment drawings, manufacturer's installation instructions as shipped with the equipment, field working and location drawings, wiring diagrams, and coordination drawings shall be provided by the Contractor for items of equipment, sleeves, foundations, curbs, wiring, ductwork, piping, etc., as necessary for information and coordination of all trades. These drawings shall be provided sufficiently in advance of installation to avoid delays and removal and reworking of installed work, and so as to provide information to other trades when and as required. No work shall be done until these drawings have been coordinated by the Contractor.

Submittals shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with Contract requirement. **All submittals shall be accompanied by the "Submittal Cover Form" provided at the end of this Section, signed by Contractor**.

Contractor shall submit complete lists or schedules of all proposed sub-contractors and material suppliers, and of all proposed construction materials and equipment. Materials and equipment lists shall be complete with trade names and/or catalog numbers of each item. Processing of the second and subsequent Certificate for Payment will be withheld until substantial portions of these lists have been submitted.

Products furnished shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer.

Products proposed by the Contractor shall be new except where specifically noted otherwise. Contractor(s) shall provide products only from manufacturers who have published data showing compliance with specified requirements or who certify in writing to such compliance (including laboratory and/or in-place testing, if applicable). All electrical products shall be both labeled and listed, as defined above. **Prior to purchase of major materials, equipment or systems, submit manufacturer's data to the A-E for review as hereinafter specified.**

Products of the specified type and for the specified application offered by the Contractor(s) for use on this Project shall comply with the following requirements:

Product shall have had satisfactory performance in applications of similar character to that specified for a period of at least three (3) years.

Product shall be from an established national or regional manufacturer. The A-E's experience with the manufacturer on prior projects relative to product performance, technical support, etc. may be taken into account to establish suitability of the offered product for this Project.

Product shall be provided through an authorized representative of the manufacturer. The representative shall be capable of providing technical support relative to the installation, operation, and maintenance of the product. The A-E's experience with the representative on prior projects relative to product performance, technical support, etc. may be taken into account to establish suitability of the offered product for this Project.

Repair parts and service for the product shall be available within twenty-four (24) hours of notice.

The manufacturer and his authorized representative shall furnish satisfactory evidence in support of these conditions when requested. The A-E's decision relative to the suitability and acceptability of any product is final and acceptance of this limitation is implicitly acknowledged by the contractor and the manufacturer and/or his representative offering the product for use on this Project.

Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the specifications the submittal shall clearly indicate such deviations by being marked "**NON-COMPLYING FEATURE**." This indication shall be applied to the submittals at the appropriate location in a color contrasting with the remainder of the submittal. Additional information that might assist the Engineer in product evaluation may be included with the submittal. This information should indicate how a specific non-complying feature is believed by the Contractor to meet the intent of the specification.

> **It is the Contractor's responsibility to demonstrate compliance with the specifications and to clearly indicate any features that do not meet the specifications. It is not the Engineer's responsibility to identify non-compliance.** Substantial non-compliance, as determined by the Engineer, is grounds for rejection of the submittal. Discovery of non-complying features that have not been properly identified as such on submittals may require, at any stage of construction, the removal and replacement of the non-complying item(s).

The A-E will review shop drawings, manufacturer's data, and samples with reasonable promptness. This review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. Contractor is responsible for dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of his or her Work with that of all other trades; and for performing all work in a safe and satisfactory manner. The Contractor is responsible for any delay caused by his failure to observe submittals requirements and the time for completion of his Contract will not be extended because of such delays.

The A-E's submittals review stamp categories shall be interpreted as follows:

> Reviewed: Fabrication and installation or erection may be undertaken.
>
> Exceptions indicated, revise and proceed: Fabrication and installation of erection may be undertaken. However, Contractor shall comply with all notes or corrections indicated.
>
> Exceptions indicated, revise and re-submit: Neither fabrication, installation, nor erection shall be undertaken. Re-submit corrected copies for review. Corrections shall be limited to items marked, except that changes required in order to coordinate the corrections indicated shall be made. All changes, other than those indicated, shall be called specifically to the A-E's attention.
>
> Rejected, re-submit: Neither fabrication, installation, nor erection shall be undertaken. Revise entire submission to comply with information given in the Contract Documents and re-submit.

Submittals returned to the Contractor with the A-E's "reviewed" or "exceptions indicated, revise and proceed" stamp need not be resubmitted, except that corrected copies of "exceptions indicated, revise and proceed" submittals shall be furnished for record when requested.

Submittals returned to the Contractor with the A-E's "revise and re-submit" or "rejected, re-submit" stamp shall be corrected to comply with Contract requirements and re-submitted to the A-E for review. The Contractor shall direct specific attention, in writing or on re-submitted shop drawings, product data or samples, to revisions other than those requested by the A-E on previous submittals.

Shop drawings of work that involves more than one subcontractor shall be coordinated by the Contractor and submitted to A-E under one cover. No items shall be fabricated, nor any portion thereof shipped to site, prior to receipt by the Contractor of all applicable submittals, including manufacturer's data, samples and shop drawings bearing the A-E's "reviewed" or "exceptions indicated" stamp only.

Manufacturer's data submitted as required by the technical specifications sections or requested by A-E shall consist of four (4) copies of certificates, schedules, catalog cuts, manufacturer's specifications and installation instructions for each type of product or material. Include maintenance recommendations, fire ratings and other reports when applicable to show compliance with the Specifications. When catalog cuts are submitted, the specific item to be considered shall be identified. Items that are not so identified will be returned to the Contractor without action.

Firestop Systems: Submit data on products. Provide manufacturer's certification of UL classification(s) required, including copies of UL systems listings and schedule defining each UL system proposed and the applicable type of penetration.

Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.

Contractor shall submit for review any samples required by the technical specification sections or that may be requested by the A-E.

With each electrical testing and compliance submittal, Contractor shall submit evidence of compliance that each manufactured item or component of electrically-operated equipment and that each fabricated assembly of electrically operated equipment furnished complies with the testing requirements.

FIRE RATINGS

Fire rating of walls and floors, as indicated on the Drawings, are for reference only. Refer to Architectural Drawings for exact construction and fire ratings.

Where fire resistive insulation or other coverings have been applied to a structural element to obtain a fire rating and this insulation or covering is removed or otherwise disturbed, the Contractor shall be responsible for restoring the material to a condition that matches the original fire protective ability.

USE OF BRAND NAMES

Brand names, where scheduled as “basis of design,” are to be considered for information purposes and are not intended to be a product specification.

Where the Contractor proposes to use an item of equipment other than that indicated as basis of design that may require redesign of the structure, partitions, foundations, piping, wiring, or any other part of the mechanical, electrical, or architectural layout, all such redesign and all new drawings and detailing required shall be prepared by the Contractor at his own expense and submitted for review by the A-E.

Where such deviation requires a different quantity and arrangement of ductwork, piping, wiring, raceway, or equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and raceway, and any other additional equipment required by the system, at no additional cost.

Brand names, where used as a product specification, are intended to denote the standard of quality required for the particular material or product.

Where the term “equal” or “equivalent” is present, such specification does not restrict the Contractor to a specific brand and equivalent products by other manufacturers may be acceptable. The term "equal" or "equivalent" shall be interpreted to mean a material or product that is similar and equal in type, quality, size, capacity, composition, finish, color, and other performance characteristics to the material or product specified by brand name, and that, **in the opinion of the A-E**, is suitable for the same use and capable of performing the same function as the material or product specified. **Proposed equivalent items must be reviewed by the A-E before they are purchased or incorporated into the work**.

EQUIPMENT SUBSTITUTIONS AND CHANGES/EXTRA COSTS FOR CHANGES IN BUILDING SERVICES

Where the Contractor proposes to use an item of equipment other than that specified or detailed on the Drawings, requiring any redesign of the structure, partitions, foundations, piping, wiring, or any other part of the mechanical, electrical, or architectural layout, all such redesign and all new drawings and detailing required shall be prepared by the Contractor at his own expense and submitted for review by the A-E.

Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, raceway, or equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and raceway, and any other additional equipment required by the system, at no additional cost.

It is the responsibility of the Contractor to notify the A-E in all cases where the requirements of proposed equipment differ from the requirements specified, shown, or implied on the Drawings or within the Specifications. **Failure of the Contractor to notify the A-E shall not relieve the Contractor of the responsibility of providing compatible equipment at no additional cost as described above**.

OPERATION AND MAINTENANCE DATA

For each Division of the Work, provide four (4) copies of Operating Manuals, Maintenance Manuals, and Test Reports, bound in suitable covers, to the A-E at least two (2) weeks **prior** to the final inspection of the project.

Each manual shall include a cover sheet listing the following:

Project name and location.

Division of Work covered by the manual.
Contractor data, including name, address, phone and fax numbers, and service contact information (24-hour number, email address, etc.)

Date of project completion.

Each manual shall include a table of contents.

Operating manual: Provide all relevant information needed for day-to-day operation and management of the building systems. Include the following for each system:

System Description: Identify the areas of the building the system serves, the locations of performance checkpoints, the expected performance readings at the design load conditions and, where applicable, at part-load conditions. The system's operation during the day, night, and weekend, as well as seasonal start-up and shutdown, safety devices and their function, control devices and their function, pollution control devices, etc., also shall be described. The function of the controls for individual systems shall be described alongside the description of the system function.

Operating Routines and Procedures: Identify activities associated with the normal operation of systems and equipment. Operating checklists and operating logs shall be provided for each system and all performance standards shall be identified.

Seasonal Start-Up and Shutdown: List seasonal start-up and shutdown procedures, including any "mothballing" procedures required.

Special Procedures: Special procedures related to environmental control, health and safety, productive work environment, etc., shall be codified.

Troubleshooting Procedures: This section shall include questionnaires and diagnostics to allow users to isolate probable causes of operating problems in an efficient manner.

Maintenance manual: The maintenance manual shall be divided into two parts:

Part I shall contain information related to the equipment data sheets, nameplate data, operating data, etc. Include the original purchase order number; date of purchase; name, address, and phone number of vendor; and warranty information.

Part II shall support a maintenance program. The manual shall contain information prepared by the equipment manufacturers, but shall be supplemented by information provided by the Contractor. Each item of equipment shall be identified and an individual "Equipment Maintenance Sheet" shall be prepared for each, with the following information:

Description each system and system component, consisting of easily read schematic drawings showing all components, identified to match Part I data, that requires maintenance.

Recommended preventative and predictive maintenance procedures and their recommended frequency of application for each system component.

Recommended list of spare parts with part numbers and place(s) they can be obtained.

Copy of manufacturer's Installation instructions for each component.

Any other information requested by the A/E to support the operation and maintenance of the equipment.

Test reports: Provide copies of the test protocols used in the construction and commissioning of the systems. Arrange data so as to allow the results of ensuing tests to be easily added.

PART 2 - PRODUCTS

MACHINERY DRIVES

V-Belt Drives: Provide ANSI/Rubber Manufacturers Association (RMA) standard or raw edge cogged V-belts with properly-selected motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

The drive shall be rated for the motor horsepower indicated on the Drawings, plus the recommended ANSI/RMA service factor (but, not less than 20%), in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.

Drives 1 horsepower and smaller may be provided with single standard V-belt. Drives 1-1/2 horsepower and larger shall be provided with raw edge cogged V-belts, the number of belts necessary to transmit the required power with 95% minimum efficiency, but in no case less than 2.

Exception: **Belt drives for fans utilized as part of smoke control and/or smoke venting systems shall be rated for the motor horsepower indicated on the Drawings, plus 50% additional service factor, in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact, and shall have at least 2 belts.**

Multiple belts shall be matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

Sheaves and pulleys shall be fixed pitch type, statically and dynamically balanced, and constructed as follows:

Construction of pressed steel or close grained cast iron.
Bore shall be fixed or bushing type for securing to shaft with keys.

Groove spacing for driving and driven pulleys shall be the same.

Maximum belt speed shall not exceed 5000 feet per minute.

Minimum motor sheave diameter shall comply with ANSI/RMA recommendations as follows:

Shaft Couplings: Shaft couplings for direct drive equipment driven by polyphase motors shall be flexible type capable of absorbing vibration, rated for the motor horsepower indicated on the Drawings plus an additional 50% service factor. Couplings shall be drop-out type to allow disassembly and removal without removing equipment shaft or motor.

Drive Guards: Drive guards shall be provided for belt drives and shaft couplings.

Belt guards shall comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

Coupling guards shall be constructed steel and comply with ANSI B15.1, Section 8, and OSHA 1910.219. Guards shall be easily removable for access and service and provided with openings for speed checks, etc. without removal.

FIRESTOPPING SYSTEMS

Firestop systems shall be used in locations including, but not limited to, the following:

Penetrations through fire resistance rated floor assemblies and roof assemblies (where required by code) including both empty openings and openings containing penetrants.

Penetrations through fire resistance rated wall assemblies including both empty openings and openings containing penetrants.

Membrane penetrations in fire resistance rated wall assemblies where items penetrate one side of the barrier.

Membrane penetrations in fire resistance rated ceiling assemblies.

Systems or devices must be listed in the UL Fire Resistance Directory and must conform to construction type, penetrant type, annular space requirements and fire rating involved in each separate instance. System must be symmetrical for wall applications.

Systems or devices must be asbestos-free and all products must be from a single manufacturer.

Products must withstand the passage of cold smoke, either as an inherent property of the system or by the use of a separate product included as part of the UL system or device, and designed to perform this function.

Cracks, Voids, or Holes Up to 4" Diameter: Putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, Listed, and capable of expanding 10 times when exposed to flame or heat.

Openings 4" or Greater: Sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350 deg. F (121 to 177 deg. C), Listed.
Wall Boxes:

Metallic boxes used in fire-rated walls or floors must be listed in the UL Fire Resistance Directory under category CEYY.

Listed single and double gang metallic device and outlet boxes with metallic or nonmetallic cover plates may be used in bearing and nonbearing wood stud and steel stud walls with ratings not exceeding 2 hours. The metallic outlet or switch boxes shall be securely fastened to the studs and the opening in the wallboard facing shall be cut so that the clearance between the box and the wallboard does not exceed 1/8 in. The surface area of individual metallic outlet or switch boxes shall not exceed 16 sq. in. The aggregate surface area of the boxes shall not exceed 100 sq. in. per 100 sq. ft. of wall surface.

Metallic boxes located on opposite sides of walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between metallic boxes may be reduced when “Wall Opening Protective Materials” listed in the UL Fire Resistance Directory under category CLIV are installed according to the requirements of the Classification.

Metallic boxes shall not be installed on opposite sides of walls or partitions of staggered stud construction unless “Wall Opening Protective Materials” are installed with the metallic boxes in accordance with Classification requirements for the protective materials.

WALL AND FLOOR ACCESS DOORS

Where floors, walls and ceilings must be penetrated for access to engineering work, provide types of access doors indicated, including floor doors if any. Furnish sizes indicated or, where not otherwise indicated, furnish 24" x 24" panels. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.

Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth, 16-gage frames and 14-gage flush panel doors, 175 deg. swing with concealed spring hinges, flush screw-driver-operated cam locks, factory-applied rust-inhibitive prime-coat paint finish.

Provide rated access doors where installed in fire resistance rated floor and wall assemblies to meet fire rating.

PART 3 – EXECUTION

GENERAL

Comply with NFPA 241, *Standard for Safeguarding Construction, Alterations, and Demolition Operations*; ANSI A10 Series standards for *Safety Requirements for Construction and Demolition*; and Chapter 14 of the *North Carolina State Building Code: Fire Code*.

FIRE PROTECTION DURING CONSTRUCTION

Building contents and all elements of new and/or existing construction must be thoroughly protected from construction procedures that produce sparks, flames, or excessive heat. Such procedures include, but are not limited to, welding, soldering, flame-cutting, using grinders or metal cutting saws, and heating of work spaces. Contractor shall maintain fire watch and/or portable fire-suppression devices, as required, during these operations.

The Contractor shall develop, provide, and post a written plan in compliance with NFPA 241 and Chapter 14 of the *North Carolina State Building Code: Fire Code*.

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 required to prevent fires and how to deal with them if they occur.

Provide and maintain portable, UL rated fire extinguishers with class and extinguishing agent as required by locations and classes of fire exposures. Comply with NFPA 10 *Standard for Portable Fire Extinguishers.* Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor or area at or near each usable stairwell.

SECURITY AND SAFETY DURING CONSTRUCTION

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

Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

MOISTURE AND MOLD CONTROL DURING CONSTRUCTION

Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

Protect porous materials from water damage.
Protect stored and installed material from flowing or standing water.

Keep porous and organic materials from coming into prolonged contact with concrete.

Keep roof, wall, and/or openings covered or dammed.

Partially Enclosed Construction Phase: After installation of weather barriers, but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

Do not load or install porous materials or components, or items with high organic content, into partially enclosed building.

Keep interior spaces reasonably clean and protected from water damage.

Periodically collect and remove waste containing cellulose or other organic matter.

Discard or replace water-damaged material.

Do not install material that is wet.

Discard, replace, or clean stored or installed material that begins to grow mold.

Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

Controlled Construction Phase of Construction: After completing and sealing of the building enclosure, maintain as follows:

Control moisture and humidity inside building by maintaining effective dry-in conditions.

Use **temporary** HVAC units or system to control humidity.

Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

Hygroscopic materials that may support mold growth that become wet during the course of construction and remain wet for 48 hours are considered defective and must be replaced.

DUST AND CONTAMINATION CONTROL DURING CONSTRUCTION

Prevent dust, fumes, and odors from entering occupied areas or areas in which construction work is more advanced

Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

Maintain negative air pressure within the work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

Use vacuum collection attachments on dust-producing equipment. Isolate limited work areas using portable dust-containment devices.

Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

Coordinate general construction activities with the work of Divisions 21-28 to avoid contamination and/or degradation of building engineered systems by dust, over-spray of insulation or paint, etc. **Costs for the cleaning and/or component replacement of engineered systems required by contamination and/or degradation by general construction activities shall be assigned to the General Contractor.**

TEMPORARY HVAC SYSTEMS USE DURING CONSTRUCTION

The use of permanent HVAC systems to support construction activities is prohibited. The need for heating, cooling, dehumidification, and/or ventilation during construction shall be met via use of temporary HVAC units or systems as follows:

Heating: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

Cooling: Provide modular, portable stand-alone direct expansion cooling units with condensers vented to the outdoors.

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.

COOPERATION WITH OTHER TRADES

The Contractor shall give full cooperation to other trades and shall furnish any and all information necessary to permit the work of other trades. Information to be provided by the Contractor includes, but is not limited to templates, patterns, setting plans, and shop details as may be necessary for the proper installation of work and for the purpose of coordinating adjacent work. Information required by other trades shall be provided in a timely manner and shall be sufficient to allow the work of such other trades to proceed with the least possible interference or delay.

Where the work of the Contractor will be installed in close proximity to, or may interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. **If the Contractor installs his work before coordination with other trades, he shall make the necessary changes in his work to correct the condition without extra charge.**

MISCELLANEOUS CONCRETE AND STEEL SUPPORTS

All concrete curbs, bases, etc., required for mechanical or electrical equipment and components shall be provided under the Division requiring them except where specifically indicated and/or specified to be provided under a different Division.

"Housekeeping pads", constructed of 3000 psi concrete doweled to floor slab, shall be provided for each floor-mounted component. Pads for air-handling units shall, unless indicated otherwise on the drawings, be 6" high, while pads for all other equipment shall be 4" high. Pads shall be finished smooth with chamfered top edges and corners. Equipment and other floor-mounted elements shall be installed and shall be anchored and grouted to housekeeping pads.

Miscellaneous steel for equipment, pipe, duct, raceway, etc. installation required by the work in any Division shall be provided and placed under that Division except where specifically indicated and/or specified to be provided under a different Division.

Anchors, inserts, supports, attachments, etc., required and but not indicated on the Drawings shall be provided under this Contract.

FIRESTOPPING

Installer should be experienced in installing or applying similar systems, plus: be acceptable to or licensed by manufacturer, state or local authority where applicable; have at least five years experience; and have successfully completed at least five comparable projects using this system.

Firestop systems or devices installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.

Install only after substrate penetrations and supporting brackets have been installed. Do not install firestopping when ambient or substrate temperatures are outside limits permitted by manufacturers or when substrates are wet. Where floor openings without penetrating items are more than 4 inches wide and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor. Protect materials on surfaces subject to traffic.

SMOKE-RESISTIVE SYSTEMS

The space around items penetrating non-fire rated walls and floors shall be filled with an approved material to limit the free passage of smoke, heat and flame in locations including, but not limited to, the following:

Penetrations through non-rated floors including both empty openings and openings containing penetrants.

Penetrations through non-rated smoke partitions and wall assemblies including both empty openings and openings containing penetrants.

WALL AND FLOOR ACCESS DOORS

Comply with manufacturer's instructions for installation of access doors, floor doors, and removable access plates.

Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

Adjust hardware and panels after installation for proper operation.

Remove or replace panels or frames that are warped, bowed, or otherwise damaged.

PATCHING

Repair, patching, and finishing of walls, floors, and/or ceilings affected by demolition, cutting after installation of new work, etc. shall be done by technicians skilled in the applicable trades and shall match surrounding or adjoining materials in composition, texture, color, and finish.

CONTRACTOR AS-BUILT DRAWINGS

Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

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.

Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

Accurately record information in an acceptable drawing technique.

Record data as soon as possible after obtaining it.

Record and check the markup before enclosing concealed installations.

Cross-reference record prints to corresponding archive photographic documentation.

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

Dimensional changes.

Revisions to details.

Locations and depths of underground utilities.

Revisions to routing of piping and conduits.

Revisions to electrical circuitry.

Actual equipment locations.

Duct size and routing.

Locations of concealed internal utilities.

Additional information that was either shown schematically or omitted from original Drawings.

Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

Submit Contractor As-built Drawings to A/E for review **at least two (2) weeks prior to Project final inspection**.

END SECTION 019913

SUBMITTAL COVER FORM

PROJECT: Yarbrough Field Office
North Carolina State University

PROJECT NO.: 2023-01769

TO: SALAS O'BRIEN
1620 Midtown Place
Raleigh, NC 27609

FROM: _____

_____

_____

_____

_____ CONTRACTOR _____ SUBCONTRACTOR

We submit for your consideration the following product for the above project:

SPECIFICATION SECTION	SPECIFICATION PARAGRAPH	DESCRIPTION

TYPE OF SUBMITTAL:

_____ Specified Brand Product
_____ Proposed Equivalent Product to Specified Brand
_____ Product Meeting Performance Specification (No Brand Specified)

We warrant the following:

a. We have personally investigated the proposed product, and determined that it is equal in all respects to that specified and/or performance specification requirements;

b. We will provide the specified guarantee for this product;

c. We will coordinate installation of this product into the work, making such changes as may be required for the work to be complete in all respects;

d. We have clearly indicated by marking as "Non-Complying Feature" each and every requirement of the Specifications that this product does not meet;

e. And, we waive all claims for additional costs related to this product which subsequently become apparent.

Attached hereto are complete technical data, including applicable laboratory reports, to demonstrate compliance with project requirements.

SUBMITTED BY:

_____ _____
SIGNATURE DATE

SUBMITTAL REVIEW

(SAMPLE FORM - ORIGINAL WITH COMMENTS WILL BE ATTACHED TO SUBMITTAL BY A/E)

PROJECT:

PROJECT #:

SUBMITTAL ID#:

SPECIFICATION PARAGRAPH:

DESCRIPTION:

Submittal has been reviewed only for conformance with design intent of the contract documents. See Section 019913 "GENERAL REQUIREMENTS FOR ENGINEERED WORK" for complete definition of Submittal Review.

- ☐ Reviewed
- ☐ Exceptions Noted - Revise & Proceed
- ☐ Exceptions Noted - Revise & Resubmit
- ☐ Rejected

DATE:

BY:

REVIEW COMMENTS:

THESE COMMENTS SHALL NOT BE REMOVED FROM THIS DOCUMENT

SECTION 019916 - DIVISIONS 21-28 WORK IN EXISTING BUILDINGS

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

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

The requirements specified herein shall govern all Sections in Divisions 21-28, whether stated therein or not.

Where items specified in the other sections of this Division conflict with requirements of this Section, the former shall govern.

SUBMITTALS

Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Submit a written description of each roof covering system to be disturbed and/or repaired. Description shall include each type of roofing material that will be required for repair, including but not limited to decking, membrane, insulation, substrate and flashing, and a repair sequence for each. Submit Manufacturer's warranty for each type of material to be used for repair of each roof covering system. Submit letter of qualification for each roofing contractor.

Submit data for each distinct lay-in ceiling suspension system and acoustical unit type indicated. Submit the following samples:

Acoustical ceiling units: 12-inch-square samples of each type required.

Exposed suspension and trim elements: 12-inch-long samples of each type and finish required.

For steel stud framing:

Submit product information and installation instructions from manufacturers for each item of cold-formed metal framing and accessories.

Submit shop drawings, including placing drawings for framing members showing size and gauge designations, number, type, location, and spacing. Indicate supplemental strapping, bracing, splices, bridging, accessories, and details required for proper installation.

Submit samples of brick and concrete masonry units for owner/engineer approval.

Submit manufacturer's technical data sheets for replacement carpet floor tile required. Submit sample of each type and/or color of floor covering required, along with samples of *adjacent existing floor covering.*

Submit manufacturer's technical data sheets for each paint coating, material analysis including vehicle type and percentage by weight and by volume of vehicle, resin, and pigment. Application instructions including mixing, surface preparation, compatible primers and topcoats, recommended wet and dry film thickness, recommended application methods. Submit documented evidence that paints and coatings are low V.O.C. types.

Provide for each paint coating system, color, and texture and applied to representative substrate samples.

Provide color selection board for paint and any other finishes. Prepare samples to show bare, prepared surface, and each successive coat. Label each sample with coating name and color.

Submit manufacturer's technical data sheets for each vinyl wall covering, complete with material analysis. Provide samples of each proposed wall covering, along with samples of *adjacent existing wall covering.*

DEFINITIONS

Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

MATERIALS OWNERSHIP

Unless otherwise indicated, demolition waste becomes property of Contractor. Materials removed during demolition shall be accumulated in the demolition area for examination by the Owner. The Owner may choose to retain selected items. Items not selected to be retained by the Owner become the property of the Contractor and shall be removed from the site in a timely manner. All disposal fees and/or permits shall be the responsibility of the Contractor.

QUALITY ASSURANCE

Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved Section 608 certification program.

FIELD CONDITIONS

Existing facilities shall remain in use during all phases of construction under this Contract. **All and any of existing building safeties such as exit signage, exit lights, fire alarm, fire sprinkler etc., must remain operational CONTINUOUSLY in order to retain building occupancy status. All required exits and exit signs must be kept available and free of obstruction at all times.** The Contractor shall cooperate with the Owner in every way possible to keep interruption of, and interference with, normal functions, activities, and operations to a minimum.

Where construction or attendant work interrupts normal functions in any area, a schedule of work shall be submitted for approval of the Owner and after approval, strictly followed. Modification to existing work shall be done as required. All work shall be performed in such a manner as to prevent any interruption of any service or utility. Where it is necessary to interrupt service for demolition, cut-in, or changeover, the work shall be scheduled well in advance of the interruption and the interruption approved by the Owner. As required by the Owner, such work shall be done during night, weekends, holidays, or other off peak period as approved.

Existing piping, ductwork, raceway and wiring, etc., shall be modified as indicated on the Drawings and/or as required by new and modified construction. Existing piping, ductwork, raceway and wiring, etc., shall be modified as required and put in first class operating condition. No equipment shall be disconnected without approval of the Owner's Representative. Temporary relocation of equipment and temporary piping, ductwork, wiring and raceway, etc., required for continued operation of the facility shall be provided as required.

ASBESTOS WARNING

Asbestos and asbestos containing materials are often encountered during the process of renovations or in the performance of site work in or in the vicinity of existing structures. Under no circumstances will the Contractor disturb asbestos or asbestos containing material.

Suspect Materials - Contractor to Notify: It is the Contractor's responsibility to notify the Owner and the A/E immediately should suspect materials be encountered during construction activities. In the event suspect asbestos or asbestos containing materials are encountered, the Contractor shall immediately cease all work in the area and secure the involved area to prevent inadvertent contamination or exposure. The Owner or the Owner's agent will conduct testing of suspect materials and notify the Contractor in writing when work in the affected area may resume.

Contractor Responsible for Contamination: The Contractor is enjoined to use extreme caution in the performance of construction activities in the vicinity of asbestos or asbestos containing materials. The Contractor shall bear the total and complete expense, including expenses incurred for decontamination, fines, penalties and incidental expense due to loss of use of the facility resulting from any improper work involving asbestos or asbestos containing materials.

LEAD BASED PAINT WARNING

Lead based paint and/or other lead containing materials are often encountered during the process of renovations or in the performance of site work in or in the vicinity of existing structures. The Contractor may be required to work with these materials during the normal course of the construction process.

OSHA Compliance is Contractor's Responsibility: It is the Contractor's responsibility to comply with all OSHA requirements during the construction process. Specific attention is drawn to OSHA Standard 1926.62, Subpart D, titled "LEAD" (29 CFR 1910) during work with all lead-containing materials.

Testing by Contractor: The Contractor is hereby notified that lead based paint testing may be necessary to comply with OSHA requirements.

The determination of the need for testing and the cost associated with such testing as necessary to comply with OSHA requirements is a construction activity and shall be provided by the Contactor at no additional cost to the Owner.

Contractor Responsible for Contamination: The Contractor is enjoined to **use extreme caution** in the performance of construction activities in the vicinity of lead-based paint, lead-containing paint, or lead-containing materials. The Contractor shall bear the total and complete expense, including expenses incurred for decontamination, fines, penalties and incidental expense due to loss of use of the facility resulting from any improper work involving lead or lead containing materials.

ROOFING WARRANTIES

Existing Warranty: *Remove, replace, patch, and repair materials and surfaces during roofing repairs by methods and with materials so as not to void existing roofing system warranty*. Notify warrantor before proceeding. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

New Warranty: All new roofing work shall be guaranteed for five (5) years.

PART 2 - PRODUCTS

ROOF COVERING SYSTEMS

Roof repair areas include all new rooftop penetrations, fixtures and locations indicated on the Drawings. New roofing, including type, membrane, insulation, flashings, trim, etc. shall match adjacent existing roofing system.

Roofing removal, replacement, patching, and repair shall be done is compliance with National Roofing Contactors Association's *The NRCA Roofing and Waterproofing Manual* or, as applicable, *Roof Repair Manual for Low-Slope Membrane Roof Systems.*

Exceptions:

Roofs for metal buildings and architectural sloped metal roofs shall be in accordance with the latest edition of *Structural Considerations for Metal Roofing*, U.S. Army Corps of Engineers, Technical Instructions TI-809-29.

For low slope roofs:

Use only insulation materials that do not absorb water or whose thermal performance does not degrade as a function of moisture content such as cellular glass or polyisocyanurate.

Do not include a vapor retarder unless it is clearly needed as indicated by a dewpoint temperature analysis, as follows:

A built-up roof application does not require a vapor retarder.

If a single-ply roof application requires a vapor retarder, it shall be located between the insulation and roofing membrane.

If a single-ply roof application is installed over an existing built-up roof, a vapor retarder is not required.

Prior to commencement of new work, the Contractor shall review each existing roof covering system that is to be disturbed or repaired. The Contractor is to identify and record any and all roof covering materials found to be damaged in the area of new work. The contractor is to identify and record all roof covering materials that will be required to repair areas that will be disturbed by new work.

The Contractor shall contact the appropriate Owner’s representative to obtain information regarding existing roof covering systems that will be disturbed by new work. If any such system is still under a Manufacturer’s warranty, the Contractor shall obtain a copy of that warranty.

Roofing membrane, flashings, adhesives, and associated materials for repairs shall be by an A/E-approved manufacturer. All such materials shall be totally compatible with existing roofing materials to be repaired.

Substrate materials vary. The Contractor is to review and identify each type of substrate in areas of new work.

Substrate shall be protected and undisturbed to greatest extent possible except where otherwise required by new work.

Manufacturer's required/recommended tools and equipment, and/or industry standard recommended tools and equipment, and as required for acceptable application of materials for watertight repair.

Flashings shall comply with *Architectural Sheet Metal Manual*, Sheet Metal and Air Conditioning Contractors National Association (SMACNA). *Galvanized steel flashing, unless hot-dipped galvanized after fabrication, are prohibited*. Minimum ASTM requirements for flashing metals are as follows:

Copper: ASTM B 370, temper H00 (cold rolled), 20 oz when not fully supported. All joints are formed mechanical joints or are soldered.

Lead-Coated Copper: 20 oz copper as above with minimum 1.92-oz lead coating (total weight of lead on both sides).

Sheet Aluminum: ASTM B 209; alloy 3003, temper H14, 0.050 in thickness, with mechanically formed joints, designed to allow for thermal movement, but be watertight.

Sheet Lead: ASTM B 749, type L51121, minimum 4 lb/ft^2 (0.0625-in. thick), with all joints soldered.

Flexible Sheet Membrane: 60 mil thickness with all joints lapped and fusion-welded, complying with the following:

Shore A Hardness:	ASTM D 2240, 50 to 70
Tensile Strength:	ASTM D 412, 1200 psi
Tear Resistance:	ASTM D 624 Die C, 20 lb per linear in.
Ultimate Elongation:	ASTM D 412, 250%
Low Temperature Brittleness:	ASTM D 746, -30 °F
Resistance to Ozone Aging:	ASTM D 1149
Resistance to Heat Aging:	ASTM D 573

GYPSUM WALLBOARD

Interior gypsum wallboard walls or ceilings affected by demolition or new work shall be repaired or patched to match adjacent materials, in compliance with the following:

Gypsum Board: Comply with ASTM C 840 and GA-216.

Joint Treatment Materials: Comply with ASTM C 475.

Joint Tape: Fiberglass.

Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

Pre-filling: At open joints, beveled panel edges**,** and damaged surface areas, use setting-type taping compound.

Embedding and First Coat: For embedding tape and first coat on joints, flanges of trim accessories, and fasteners, use setting-type taping compound.

Fill Coat: For second coat, use drying-type, all-purpose compound.

Finish Coat: For third coat, use drying-type, all-purpose compound.

Where indicated, new GWB walls, partitions, and/or ceilings shall be provided, framed with the following material(s) to match adjacent existing:

Wood framing:

All lumber shall be graded to comply with the rules of applicable grading agencies. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated. Factory mark each piece of lumber with grade stamp of grading agency.

Where nominal sizes are indicated, provide actual sizes for moisture content not to exceed 15 percent. Provide dressed lumber, S4S, unless otherwise indicated.

Provide engineered wood products, as indicated, acceptable to authorities having jurisdiction.

Pressure-treated wood:

Comply with AWPA U1. Use Category UC2 for interior construction not in contact with the ground.

Preservative chemicals shall be acceptable to authorities having jurisdiction and containing no arsenic, inorganic boron, or chromium.

Kiln-dry lumber after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

Fasteners:

Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

Provide fasteners in compliance with the following:

Nails, Brads, and Staples: ASTM F 1667.

Power-Driven Fasteners: NES NER-272.

Wood Screws: ASME B18.6.1.

Lag Bolts: ASME B18.2.1.

Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

Expansion Anchors: Anchor bolt and sleeve assembly of stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

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Metal framing anchors:

Interior Anchors: Fabricate from hot-dip, heavy-galvanized steel sheet complying with ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
Anchors For Use In Wood-Preservative-Treated Lumber: Stainless-steel sheet complying with ASTM A 666, Type 304 for used in indoor treated lumber and Type 316 for use in outdoor treated lumber in coastal regions.
Use for exterior locations and where indicated.

Miscellaneous materials:

Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spun-bonded polyolefin to produce an overall thickness of not less than 0.025 inch.

Metal framing members:

Provide light gauge metal framing shall consist of pre-formed galvanized steel studs and tracks conforming to ASTM C 645 for non-structural steel framing members or to ASTM C 955 for load-bearing steel framing.

Metal framing members shall be manufacturers' standard load-bearing steel studs and joists of type, size, shape, and gauge as indicated. With each type of metal framing required, provide manufacturer's standard steel runners (tracks), blocking, lintels, reinforcements, shoes, clip angles, fasteners, and accessories for applications indicated, as needed to provide a complete metal framing system.

Materials and finishes:

For 16 gauge and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 40,000 psi, ASTM A 446 Grade C.

For 18 and 20 gauge units, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi, ASTM A 446 Grade A.

Provide galvanized finish to metal framing components complying with ASTM A 525 for minimum G 60 coating.

Finish of installation accessories to match that of main framing components, unless otherwise indicated.

Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.

Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

Framing components may be prefabricated into assemblies before erection.

Fabricate panels plumb, square, true-to-line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.

Fabricate units in jig templates to hold members in proper alignment and position and to assure consistent component placement.

INTERIOR PAINTING

Where required, provide new interior paint systems to match existing type, thickness, color, and pattern.

Contractor shall verify compatibility of new paint systems which are to be applied over existing systems prior to commencing work. All paints and coatings shall be low VOC types. All color(s) shall match adjacent existing color(s) unless otherwise directed by the A/E.

Work includes painting and finishing of exposed interior items and surfaces, including but not limited to the following:

Building surfaces left exposed after installation or removal of conduit, panels, piping, ductwork, equipment, etc. Any work associated with project work.

Areas of patched/repaired walls, ceilings, and structure.

All coating materials required by this section shall be provided by a single manufacturer, unless otherwise required or approved. Subject to compliance with requirements, provide products by one of the following:

Benjamin Moore & Co.
Duron, Inc.
ICI Paints.
Sherwin-Williams Company (The).

For each individual paint system, provide primer and other undercoat paint produced by the same manufacturer as finish coat.

Painting shall be provided by a firm with not less than 5 years of successful experience in painting work similar in scope to work of this project. Maintain throughout duration of the work a crew of painters who are fully qualified to satisfy requirements of the specifications.

Paint products shall comply with MPI standards indicated below and listed in MPI *Approved Products List*.

Material Compatibility: Provide materials for use within each paint system that are compatible with one another and substrates, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

Paints and primers shall comply with the following:

Metal Primers:

Rust-Inhibitive Primer (water-based): MPI #107.
VOC Content: E Range of E1.
Environmental Performance Rating: EPR 1.

Waterborne Galvanized-Metal Primer: MPI #134.
VOC Content: E Range of E1.
Environmental Performance Rating: EPR 1.

Latex Paints:

Latex Primer/Sealer: MPI #50.
VOC Content: E Range of E1.
Environmental Performance Rating: EPR 1.

Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).
VOC Content: E Range of E3.
Environmental Performance Rating: EPR 4.5.

Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).
VOC Content: E Range of E3.
Environmental Performance Rating: EPR 3.

VINYL WALL COVERING

Provide rolls of each type of wall covering from same print run or dye lot.

Provide mildew-resistant products complying with CFFA-W-101-D for Type III, Heavy-Duty products.

Match adjacent existing wall covering types, colors, textures, and patterns.

ACOUSTICAL LAY-IN CEILING MATERIALS

Where required, provide new lay-in acoustical tile ceilings to match existing type, size, thickness, color, and pattern, in compliance with ASTM E 1264 for Class A materials.

Fire Performance Characteristics:

Surface burning characteristics: Provide products having the following characteristics when tested in accordance with ASTM E 84:

Maximum flame spread: 25
Maximum smoke developed: 50

Fire-resistant (time-rated) assemblies: Provide acoustical ceiling products and installation accessories labeled and listed by Underwriters Laboratories Inc. for assemblies indicated, by reference to the Fire Resistance Directory design numbers.

Ceiling Suspension Systems-General:

Provide galvanized steel suspension systems conforming to specified requirements and to requirements of ASTM C 635.

Colors: Match existing.

Finishes: Baked-on painted finish over galvanized steel.

Attachment Devices for Suspension System:

Anchors and intermediate support members shall be capable of sustaining 5 times the load-carrying capabilities shown in ASTM C 635, Table 1, "Direct Hung" column.

The use of powder-actuated fasteners is prohibited.

Hanger wire: Galvanized carbon steel wire, ASTM A 641, soft temper, with Class 1 coating, minimum 12 gauge.

Edge Moldings and Trim:

Extruded plastic or metal; provide molding for edges and ceiling penetrations indicated. Provide profiles suited to edge profiles of acoustical units and suspension members.
Molding and trim for reveal edge lay-in panels: Provide stepped edge molding sized to create reveal with width approximately equal to 1/2 the width of exposed grid member flange, and with depth approximately equal to vertical dimension between recessed grid member flange and bottom face of panel.

Special-purpose moldings: Fabricate the following from extruded aluminum; profiles as required.

Circular ceiling penetrations: Provide edge moldings which precisely fit penetrations.

FLOOR TILE

Where required, provide new floor tiles to match existing type, size, thickness, color, pattern, and seaming method in compliance with the following:

Solid Vinyl Floor Tile: Comply with ASTM F1700, Class 1, Type A.

Rubber Floor Tile:

Comply with ASTM F 1344, Class 1, Type A or B to match existing.

Hardness: Not less than 85 as required by ASTM F 1344, measured using Shore, Type A durometer per ASTM D 2240.

Vinyl Composition Floor Tile (VCT): Comply with ASTM F 1066, Class 1 or Class 2 to match existing.

Installation Materials:

Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

Vinyl tile and VCT Adhesives: Not more than 50 g/L.

Rubber Floor Tile Adhesives: Not more than 60 g/L.

Floor Polish: Provide protective liquid floor polish products as recommended by tile manufacturer.

CARPET

Carpet: Unless indicated otherwise on the Drawings, match adjacent existing carpet tiles or sheet carpeting in type, color, pattern, quality, padding, etc.

Installation Accessories:

Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

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.

Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

MASONRY AND MORTAR MATERIALS

Where required, provide new brick and concrete masonry units to match existing type, size, thickness, color, pattern, etc.

Mortar shall be a pre-mixed, pre-colored cement-lime based mixture formulated to comply with the requirements of ASTM C-270, of type to match existing mortar.

PART 3 - EXECUTION

PERFORMANCE REQUIREMENTS

Comply with governing EPA notification regulations before beginning selective demolition.

Comply with hauling and disposal regulations of authorities having jurisdiction.

EXISTING FACILITY ACCESS

Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

Do not load elevators beyond their rated weight capacity.

Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

Existing Stair Use: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

EXAMINATION AND PREPARATION

Verify that utilities have been disconnected and capped, valved off, or otherwise secured before starting demolition.

Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the A/E.

Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain. As necessary, provide dust barriers, noise control, etc. to minimize impact of demolition on adjacent occupied areas.

Provide protection to ensure safe passage of people around demolition area and to and from occupied portions of building.

Provide temporary weather protection, during interval between demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

Provide heating, cooling, dehumidification, and ventilation as necessary to protect the existing building materials and finishes during the demolition period.

Where existing plumbing, fire protection, HVAC, or electrical services in demolition areas must be shutdown, temporary plumbing, fire protection, heating, cooling, dehumidification, ventilation, lighting, and electrical power shall be provided as needed to maintain use of adjacent occupied areas that are negatively impacted by the shutdown.

Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

Cover and protect furniture, furnishings, and equipment that have not been removed.

Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

GENERAL CONSTRUCTION DEMOLITION

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:

Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and/or portable fire-suppression devices, as required, during flame-cutting operations.

Maintain adequate ventilation when using cutting torches.

Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

Dispose of demolished items and materials promptly.

Protect construction indicated to remain against damage and soiling during demolition.

MECHANICAL DEMOLITION

Remove or relocate all mechanical elements (devices, fixtures, controls, etc.) from walls or floors indicated as being demolished.

Thermostats and sensors containing mercury shall be disposed in accordance with EPA Resource Conservation and Recovery Act (RCRA). Contractor shall refer to EPA web site for handling procedures for disposal and spill management of projects containing mercury.

Extend or relocate any existing piping and or ductwork serving existing equipment to remain or other items where such circuits are disrupted due to demolition.
Remove all abandoned piping back to the point of supply or back to the point where other remaining piping is connected. For existing piping imbedded existing walls or floors that are not to be demolished, remove piping to behind finish surface, cap, and patch wall or floor as specified hereinafter.

Existing HVAC systems serving both occupied areas and construction areas shall be modified as required to isolate the construction area. Ducts shall be sealed by closing dampers, disconnecting ducts and sealing openings with 6-mil polyvinyl sheeting, etc.

HVAC equipment in construction areas that is required to be reused shall be de-energized and protected from construction dust and debris with 6-mil polyvinyl sheeting during construction. HVAC systems that are modified during renovation shall be sealed until modifications are made and then resealed until start-up is required. After unsealing of equipment, coils and drain pans of air-handling equipment shall be cleaned.

Recover and recycle refrigerants from existing equipment to be demolished. All demolition work of existing systems containing refrigerant must be conducted in accordance with Section 608 of EPA Clean Air Act under supervision of an EPA certified technician. Provide documentation with types, quantities and dates for the engineers and owners record.

Control or monitoring systems that protect equipment and/or occupants must be maintained until associated equipment is removed.

ELECTRICAL DEMOLITION

Coordinate all electrical outages with the Owner to facilitate reworking of existing system. No service, feeder, or branch circuit may be de-energized unless specific approval has been obtained from the Owner's representative.

Dispose of Removed Equipment and Material: Materials removed and not indicated by Drawings to be reinstalled, stored, or retained by the Owner, shall be removed from the site in a timely manner at the Contractor's expense.

> The Owner may choose to retain selected items or equipment. The Contractor shall remove and deliver such items and/or equipment to a location on site as requested by the Owner.

Thoroughly inspect electrical systems in reworked areas and bring to the attention of the A-E all defective or unserviceable material not scheduled for removal or replacement.

Remove all abandoned wiring, both exposed and concealed.

Remove all abandoned raceway and any related items, both exposed and concealed. Where existing raceway is concealed in concrete or masonry, remove wiring as required above and abandon in place. Cut abandoned raceway off ½" into wall, ceiling, or floor to allow patching to completely cover cut off end of raceway.

Repair surfaces and finishes to match existing surrounding surfaces or finish in all areas where items are removed. After repairs are made no evidence of previous use of surfaces shall be visible.

Provide touch-up painting as required where new items are installed adjacent to existing items to remain.

Clean new, damaged, and/or disturbed areas and apply primer, intermediate, and finish coats at each location.

Surface preparation and timing of application of successive coats of paint shall be in accordance with paint manufacturer's instructions.

Use zinc-rich paint to repair damage to galvanized finishes. Follow written instructions of paint manufacturer.

Repair paint finishes for other items, surfaces, or equipment as necessary. Follow written instructions of paint manufacturer.

Provide blank cover plates to match device plates used in the adjoining areas where outlet, device, junction, or other boxes are to remain,

Perform the electrical demolition as described below:

Remove all electrical raceway, cable, wiring, devices, junction boxes, fittings, and related items from all locations indicated on the Drawings as being renovated. Existing raceway, junction boxes, fittings, and similar items may only be reused for the present project where explicitly indicated on the Drawings, provided:

The existing item is in good condition and is suitable for reuse.

The existing items meets the requirements of the Specifications for similar items which might be provided new in other locations on the project. Additional support and/or fire stopping may be required to meet this condition.

The existing item is located in the same position as required in the new configuration as shown on the Drawings.

Extend or relocate all existing circuits and related items serving existing utilization or other equipment where such circuits or items are disrupted due to demolition activities of any division of the Contract Documents. Relocate all existing junction boxes or similar items that will be rendered inaccessible by new construction furnished under any division of the Contract Documents. Provide any and all temporary electrical supply (supplies) as needed to meet this requirement.

Remove all abandoned circuits back to the point of supply or back to the point where other remaining loads are connected. Label any unused overcurrent devices as "SPARE". Circuits supplying equipment which is removed or demolished by any division of the Contract Documents is considered as "abandoned" for purposes of this requirement.

Revise existing panel directories to reflect modifications made as a part of the project. All directory revisions shall be typed.

LIGHT FIXTURE DISPOSAL

Lighting fixtures shall be expected to contain ballasts containing Polychlorinated Biphenyls (PCB's). The Contractor shall dispose of these ballasts by collecting them in metal drums, and shall transport these drums to an approved disposal site. The Contractor's responsibility shall be to properly collect the ballasts and turn them over to a hazmat disposal facility.

On all fixtures to be demolished the Contractor shall open the wiring compartments of the lighting fixture and determine if the lighting fixture contains ballast(s) with Polychlorinated Biphenyls (PCB's.) Non PCB-containing ballasts will have printed on their labels "NO PCB's". If the ballast label is missing, illegible, or not explicitly labeled "NO PCBs," the ballast shall be considered to contain PCBs. Ballasts explicitly stating "NO PCBs" shall be disposed of by the Contractor as a part of the normal demolition of material in the project. All other ballasts (missing labels, illegible labels, or those ballasts not explicitly marked "NO PCBs") shall have their wires cut close to the ballasts and be removed from the lighting fixtures.

In addition, Contractor shall expect that all lamps contain mercury. The Contractor shall dispose of these lamps by collecting them in a manner that keeps the lamps intact and turn them over to a properly permitted light recycler.

ROOF COVERING SYSTEM PATCHING AND REPAIR

The Contractor shall remove existing roof covering systems, including but not limited to membrane and insulation, to accommodate new rooftop penetrations and equipment. *Existing roofing shall not be cut, and shall not be left open, during periods of precipitation. Roofing operations shall not be started in the event there is a probability of precipitation during work.*

The Contractor shall repair all roof covering assemblies disturbed by new work. The repaired assemblies shall ensure watertight conditions, in accordance with industry standards, the manufacturer's published requirements, and this project manual.

The Contractor shall ensure the existing substrate and insulation remain dry.

The application of any roof covering system shall be accomplished by a primary roofing contractor, his roofing foreman, and sufficient applicator technicians who all have been trained and approved by the Manufacturer of the roof covering system. Contractor shall submit letter of qualifications from the repair material Manufacturer.

Only as much of the new roofing work shall be started as can be made weather tight before the end of each day or before unexpected precipitation.

All surfaces to be bonded/adhered shall be prepared and cleaned before each roofing repair application.

The Contractor shall protect the existing roof covering systems during all rooftop work. Roofing materials damaged during the work shall be repaired immediately by the Contractor. Any and all roofing materials that have not been previously identified as being damaged shall be repaired by the Contractor at no expense to the Owner.
Substrate Preparation:

Verify that the substrate is dry, clean, smooth, and free of loose material, oil, grease, or other foreign matter. *Beginning installation work signifies Contractor acceptance of existing conditions.*

Where damaged/deteriorated insulation, nailers, metal flashing and other existing roof covering system materials are determined to be an unacceptable substrate for roof covering/flashing repair, the Engineer shall be notified, and acceptable repairs shall be made to the substrate.

The roof covering and flashing repairs shall be installed over the properly prepared substrate. The repair area shall be cleaned at least 3 inches beyond the repair area.

Scrub roof covering surface with detergent and water or other industry accepted method pre-cleaner.

Apply splice wash to remove residue from roof covering using natural fiber, white cloth.

Prime roof covering surface using manufacturer's approved primer.

Apply splice adhesive to all surfaces that do not have self adhesive surface. Apply using a solvent resistant paint brush, minimum 3 inch wide, or as required by manufacturer.

General Roof Covering Repair:

Inspect for wet insulation or other damage before installing new roofing.

Remove roof covering and flashing materials, old roof covering patch material, etc. around roof penetration or other area of repair as required to install repair material.

Where wet insulation exists, the Contractor shall notify the A/E immediately. All insulation shall be assumed to be dry unless otherwise identified by the Contractor before initiating work.

Clean and prepare roof covering and substrate.

Prime roof covering contact surfaces.

Apply splice adhesive to roof covering contact surfaces as required.

Install new roof covering material and flashing/gravel stop as required.

Fasten roof covering and flashing/gravel stop where required.

Apply lap sealant as required.

Contractor shall ensure the water tightness of all roof covering system repair work.

Remove all debris and excess material from the roof area. Pick up all loose fasteners and sheet metal scraps.

The Contractor shall protect all roof surfaces from damage from other trades.

GYPSUM WALL BOARD INSTALLATION

Framing for new GWB walls, partitions, and/or ceilings:

Wood framing:

Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction. Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

Install engineered wood products to comply with manufacturer's written instructions.

Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Where required, install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.]

Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

Do not splice structural members between supports unless otherwise indicated.

Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal-thickness.

Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.

Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

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.

Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

Use inorganic boron for items that are continuously protected from liquid water.

Use copper naphthenate for items not continuously protected from liquid water.

Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
Wood sleeper, blocking, and nailer Installation:

Install where required for attaching other work. Form to shapes and cut as required for true line and level of attached work. Coordinate locations with other work involved.

Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

Wall and partition framing installation:

Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.

Provide wood studs sized to match adjacent existing, spaced 16 inches o.c. unless otherwise indicated.

Provide continuous horizontal blocking at mid-height of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth required the *North Carolina State Building Code: Building Code*.

Floor joist framing installation:

Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:

Where supported on wood members, by using metal framing anchors.

Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.

Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.
Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.

Provide solid blocking between joists under jamb studs for openings.

Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

Provide steel bridging installed to comply with bridging manufacturer's written instructions, at intervals of 96 inches o.c., between joists.

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Ceiling Joist Framing Installation: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

Metal framing:

Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Do not field weld units of 20 gauge or lighter. **Wire tying of framing members is prohibited**.

Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting weld work.

Locate mechanical fasteners and install according to cold-formed metal framing manufacturer’s instructions.

Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

Cut framing members by sawing or shearing; **do not torch cut**.

Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

Load-bearing walls:

Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and to match stud spacing. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs 16 inches o.c.

Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.
Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.

Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches deep.

Joist installation:

Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacing indicated on Shop Drawings. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.

Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

Space joists not more than 2 inches from abutting walls and joist spacing shall not exceed 16 inches o.c.

Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

Install web stiffeners to transfer axial loads of walls above.

Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

Bridging shall be a combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

Masonry wall applications: Install wood furring for GWB attachment as follows:

Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c. anchored to masonry with Type 304 stainless steel fasteners.

Provide GWB panels in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated. Provide thickness that will allow surface of patch to align with adjacent existing surfaces.

Apply gypsum panels to supports with steel drill screw fasteners, spaced maximum of 6 inches o.c.

Stagger abutting panel end joints not less than one framing member in alternate courses of board.

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.

Pre-fill open joints and damaged surface areas.

Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

Apply finish treatment to match that of surrounding ceiling area.

INTERIOR PAINTING

Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

Maintain containers in clean condition, free of foreign materials and residue.

Remove rags and waste from storage areas daily.

Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

Examine substrates and conditions for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry. *Beginning coating application signifies Contractor acceptance of substrates and their conditions.*

Preparation:

Comply with manufacturer's written installation instructions and recommendations in MPI *Architectural Painting Specification Manual* applicable to substrates indicated.

Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

Apply paints according to manufacturer's written instructions.

Use applicators and techniques suited for paint and substrate indicated.

Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

Cleaning and Protection:

At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

Interior Painting Schedule:

Substrate	Paint System	Prime Coat	Intermediate Coat	Topcoat
Concrete/ Masonry (Non-Traffic Surfaces)	Institutional Low-Odor/VOC Latex: MPI INT 3.1M	Institutional low-odor/VOC interior latex matching topcoat	Institutional low-odor/VOC interior latex matching topcoat	Institutional low-odor/VOC interior latex (flat) (eggshell)
Black Steel	Institutional Low-Odor/VOC Latex: MPI INT 5.1S	Rust-inhibitive primer (water based)	Institutional low-odor/VOC interior latex matching topcoat	Institutional low-odor/VOC interior latex (semigloss)
Galvanized Steel	Institutional Low-Odor/VOC Latex: MPI INT 5.3N	Waterborne galvanized-metal primer.	Institutional low-odor/VOC interior latex matching topcoat	Institutional low-odor/VOC interior latex (semigloss)
Gypsum Wall Board	Institutional Low-Odor/VOC Latex: MPI INT 9.2M	Interior latex primer/sealer	Institutional low-odor/VOC interior latex matching topcoat	Institutional low-odor/VOC interior latex (eggshell)

Painting Completion: After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

VINYL WALL COVERING INSTALLATION

Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated except where more stringent requirements apply.

Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

Install strips in same order as cut from roll.
Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

Retain first paragraph below for patterns that require matching; revise to suit Project.

Match pattern 72 inches above the finish floor.

Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

ACOUSTICAL LAY-IN CEILING REPLACEMENT AND REPAIR

Prepare and distribute to affected installers, data necessary for coordination with related work. Include setting diagrams showing placement of attachment devices for acoustical ceiling hangers.

Coordinate ceiling system installation with work of other sections as required, including the following:

- Light fixtures.
- HVAC equipment.
- Partitions.

Within each space to receive specified products, do not begin installation until the following conditions are met:

- Work above ceilings has been finished, tested, and approved.
- Space to receive ceiling system is properly enclosed and protected from weather.
- Any wet work within the space is dry.

Do not begin installation of ceiling system until building's normal operating temperature and humidity levels have been reached and will be maintained.

Examine substrates and conditions under which products of this section are to be installed and verify that the work properly may commence.

Position ceiling components to maximize use of full-sized acoustical units and to provide border units which are equal in size and shape at opposing ceiling edges. Use of acoustical units which are smaller than 1/2 full-width is prohibited at ceiling perimeters. Conform to reflected ceiling plans to greatest extent possible.

Suspension System Installation:

- Conform to the requirements of ASTM C 636, manufacturer's installation instructions, and governing regulations.
- Install hangers plumb and supported solely by building structure or carrying channels. Do not allow hangers to contact any objects or materials in ceiling plenum which are not actual components of ceiling system.

Splay hangers only where necessary to avoid obstacles. Provide counter-splaying, bracing, or other acceptable devices to compensate for lateral stresses caused by splayed hangers.

Install splay hangers or other means of seismic restraint as required to meet the requirements of ASTM E 580.

Do not attach hangers to piping, conduit, or duct. Provide carrying channel trapeze support where obstruction cannot be avoided by splaying hanger 45 degrees from vertical or less.

Space hangers at not more than 48 inches on center and within 6 inches of ends of each direct-hung runner or carrying channel, unless indicated otherwise.

Loop and tie wire hangers securely to building's structural members; to attachment devices indicated; or, where not indicated, to devices suitable for substrate and capable of permanently supporting ceiling weight without failure or deterioration.

Level ceiling suspension system to tolerance of 1/8 inch in 12 feet, with cumulative tolerance not to exceed 1/4 inch. Bending or kinking of hangers is not allowed.

Install grid members square, with ends of members securely interlocked. Remove and replace dented, bent, or kinked members.

Trim Installation:

Install edge moldings and trim units at acoustical ceiling borders, at locations indicated, and where required to cover acoustical unit edges.

Space screws not more than 16 inches on center and within 3 inches of ends of each trim-piece being installed. Install moldings and trim level with suspension system and within tolerance specified for suspension system.

Miter corners and align butt joints carefully to form tight hairline joints.

Face-riveting of trim and moldings is not allowed.

Lay-In Panel Installation: Install acoustical panels for accurate fit with suspension system and trim members. Scribe and cut panels at ceiling perimeter and at obstructions to provide neat, precise fit. Provide installation with panel edges which are hidden from view, by suspension members or trim.

Adjust and Clean:

Use ceiling manufacturer's recommended methods and materials to clean and touch-up exposed components of ceiling system.

Replace existing ceiling system components which are discolored or damaged in any way, in a manner which results in the ceiling system showing no evidence of replacement work.

FLOOR TILE REPLACEMENT AND REPAIR

Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft.

Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

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.

Do not install floor tiles until they are same temperature as space where they are to be installed.

Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

Comply with manufacturer's written instructions for installing floor tile.

Lay tiles to conform to existing pattern. 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. Lay tiles with grain running in pattern to match existing.

Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

Perform the following operations immediately after completing floor tile installation:

Remove adhesive and other blemishes from exposed surfaces.

Sweep and vacuum surfaces thoroughly.

Damp-mop surfaces to remove marks and soil.

Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

For VCT and vinyl tile, remove soil, visible adhesive, and surface blemishes from floor tile surfaces apply two coats of liquid floor polish, buffed to high gloss.

CARPET INSTALLATION

Preparation:

General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive carpet or carpet tile installation.

Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

Remove coatings, including curing compounds, and other substances on substrates 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.

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.

Broom and vacuum clean substrates to be covered immediately before installing carpet.

Installation:

Match adjacent existing carpet installation methods.

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.

Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

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.

Install pattern parallel to walls and borders.

Cleaning and Protection:

Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.

Remove yarns that protrude from carpet tile surface.

Vacuum carpet using commercial machine with face-beater element.

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.

MASONRY UNIT CONSTRUCTION

Only skilled masons who are familiar and experienced with the materials and methods specified shall be used for masonry repair. One skilled mason shall be present at all times during masonry repair and shall personally direct the work.

Deliver materials to site in manufacturer's original unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

Deliver and store material in manufacturer's original, unopened containers with the grade, batch and production data shown on the container or packaging.

Protect materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.

Protect grout, mortar and other materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing.

Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

Comply with the manufacturer's written specifications and recommendations for mixing, application, and curing of grouts and patching materials.

Protect persons and building contents from injury or damage resulting from masonry restoration work.

Clean masonry surfaces only when air temperatures are above 40 degrees F and will remain so until masonry has dried out, but for not less than 7 days after completion of cleaning.

Cover partially completed work when work is not in progress.

Protect sills, ledges, projections and surrounding surfaces from mortar droppings.

New Masonry Construction:

Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

Tolerances:

For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.

For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.

For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

Lines and Levels:

For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.

Joints:

For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (, with a maximum thickness limited to 1/2 inch.

For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.

For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thickness and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry to match adjacent bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

Built-in Work: As construction progresses, build in items indicated on the Drawings. Fill in solidly with masonry around built-in items.

Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
Lay hollow CMUs as follows:

With face shells fully bedded in mortar and with head joints of depth equal to bed joints.

With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

With webs fully bedded in mortar in grouted masonry, including starting course on footings.

With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.

Allow cleaned surfaces to dry before setting.

Reinforcement: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcement not more than 16 inches o.c.

Control and Expansion Joints: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

Lintels: Provide concrete or steel lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

Patching/Repairing Existing Masonry Construction:

Existing Masonry Unit Removal:

Carefully remove by hand masonry units. Cut out full units from joint to joint and in manner to permit replacement with full size units.

Support and protect masonry to remain that surrounds removal area.

Clean remaining masonry at edges of removal areas by removing mortar, dust, and loose debris in preparation for rebuilding.

Masonry Unit Rebuilding:

Match existing coursing, bonding, color and texture.

Fit replacement units into bonding and coursing pattern of existing. If cutting is required, use motor driven saw designed to cut masonry with clean, sharp unchipped edges.

Lay replacement masonry with completely filled bed, head and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Do not wet concrete masonry units. Maintain joint width for replacement units to match existing.

Tool exposed mortar joints in repaired area to match joints of surrounding existing masonry.

Repoint new mortar joints in repaired area to match existing mortar joints.

END OF SECTION 019916

SECTION 019926 - OWNER INSTRUCTION AND TRAINING FOR DIVISIONS 21-28 WORK

PART 1 - GENERAL

RELATED DOCUMENTS

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

The requirements specified herein shall govern all Sections in Divisions 21-28, whether stated therein or not.

Where items specified in the other sections of this Division conflict with requirements of this Section, the former shall govern.

QUALITY ASSURANCE

The Owner instruction and training program shall be developed and coordinated by a firm or individual experienced in training or educating maintenance personnel.

Contractor personnel experienced in the systems and components incorporated in this Project, along with factory-authorized service representatives, shall perform the instruction.

COORDINATION

Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

Coordinate content of training modules with content of manufacturers' recommended emergency, operation, and maintenance procedures.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Instructional Program and Instructional Materials: Submit detailed description of instructional program structure, training modules, and instructional materials.

Instructor Qualifications: Submit curriculum vitae for each instructor, specifically defining the experience of each instructor and the training modules for which he or she shall be responsible.

PART 2 - PRODUCTS

INSTRUCTION PROGRAM

General: **The Contractor(s) for each of Divisions 21-28, as applicable, is responsible for instructing Owner's personnel relative to each Division's work**, including the following:

Instruction in the operation of systems, subsystems, and equipment.
Training in maintenance of systems, subsystems, and equipment.

Program Structure: Develop an instruction and training program that includes individual training modules for each Division 21-28 system, subsystem, and equipment item, including both classroom instruction and "hands-on" demonstrations.

Training Modules: Develop a learning objective and teaching outline for each instruction and training module, taking into consideration the level of proficiency of Owner's maintenance staff. Include a description of specific skills and knowledge that each participant is expected to master.

For each instruction and training module, include instruction for the following, as applicable to the system, subsystem, equipment, or component:

Documentation: Review the following items in detail:

Operations manuals.

Maintenance manuals.

Project record documents.

Warranties, bonds, and guarantees.

Maintenance service agreements and similar continuing commitments.

Emergencies: Include the following, as applicable:

Instructions on meaning of warnings, trouble indications, and error messages.

Shutdown instructions for each type of emergency.

Operating instructions for conditions outside of normal operating limits.

Sequences for electric or electronic control systems.

Special operating instructions and procedures.

Operations: Include the following, as applicable:

Startup procedures.

Equipment or system break-in procedures.

Routine and normal operating instructions.

Regulation and control procedures.

Control sequences.

Safety procedures.

Normal start-up and shutdown instructions.

Operating procedures for emergencies.

Operating procedures for system, subsystem, or equipment failure.

Required sequences for electric or electronic control systems.

Special operating instructions and procedures.

Adjustments: Include the following:

Alignments.

Routine adjustments, tightening, etc.

Noise and vibration adjustments.

Economy and efficiency adjustments.

Maintenance: Demonstrate the following:

Inspection procedures.

Preventative maintenance requirements, consisting of the following:

Routine maintenance, which consists of specific procedures that are performed on a regular schedule and are designed to detect, preclude, or mitigate degradation of a system or its components.

Predictive maintenance, which uses routine inspection and evaluation, testing, and analysis to augment routine maintenance procedures by detecting the onset of component degradation and to address problems as they are identified.

Instruction on use of special tools.

Repairs: Include the following:

Troubleshooting and diagnostic instructions.

Test and inspection procedures.

Repair instructions.

Disassembly; component removal, repair, and replacement; and reassembly instructions.

Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

Owner will furnish an instructor to describe Owner's operational philosophy.

Owner will furnish Contractor with names and positions of participants to attend instruction and training, not to exceed 10 individuals.

Confirm Topics and Agenda with owner prior to scheduling.

Provide instruction at mutually agreed on times scheduled at least four (4) weeks in advance through the A/E. For systems, subsystem, and/or equipment that requires seasonal operation, provide required instruction at start of each season.

Conduct training on-site in the completed and fully operational facility in classroom/conference space provided by the Owner and using the actual systems, subsystems, and equipment installed.

Conduct training using final operation and maintenance data submittals as the training reference material. If additional training materials are utilized, they shall be incorporated as an appendix to the operation and maintenance data submittals.

Provide documentation that Owner instruction and training has taken place. Provide record of dates, topics, and duration of each training session, the names of Owner's staff who participated, and a signed review form by each participant.

END OF SECTION 019926

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Demolition and removal of selected portions of building or structure.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

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

1.4 PREINSTALLATION MEETINGS

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

6. Review areas where existing construction is to remain and requires protection.

1.5 SUBMITTALS

A. Informational Submittals:
   1. Qualification Data: For refrigerant recovery technician.
   2. Engineering Survey: Submit engineering survey of condition of building.
   3. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, dust control, and noise control. Indicate proposed locations and construction of barriers.
   4. Schedule of Selective Demolition Activities: Indicate the following:
      a. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
      b. Interruption of utility services. Indicate how long utility services will be interrupted.
      c. Coordination for shutoff, capping, and continuation of utility services.
      d. Use of elevator and stairs.
      e. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
   5. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 - Photographic Documentation. Submit before Work begins.
   6. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
   7. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 QUALITY ASSURANCE

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

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. 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: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

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.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.9 COORDINATION

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

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs or video, and templates.
   1. Comply with requirements specified in Section 01 32 33 - Photographic Documentation.

3.2 PREPARATION

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

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. Notify the Architect immediately if the removal of fire-suppression, plumbing HVAC, electrical, communications, and safety and security systems or components will adversely affect the operation of those systems outside the limits of demolition.

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

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
    1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
    2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
    3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
    4. Cover and protect furniture, furnishings, and equipment that have not been removed.
    5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 - Temporary Facilities and Controls.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
    1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   5. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
   6. Maintain adequate ventilation when using cutting torches.
   7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

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

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

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.8 CLEANING

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

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete masonry units.

B. Mortar and grout.

C. Steel reinforcing bars.

D. Masonry-joint reinforcement.

E. Miscellaneous masonry accessories.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
   2. Shop Drawings: For the following:
      a. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
      b. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

B. Informational Submittals:
   1. Qualification Data: For testing agency.
   2. Material Certificates: For each type and size of the following:
      a. Masonry units.
         1) Include material test reports substantiating compliance with requirements.

b. Cementitious materials. Include name of manufacturer, brand name, and type.
c. Mortar admixtures.
d. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
e. Grout mixes. Include description of type and proportions of ingredients.
f. Reinforcing bars.
g. Joint reinforcement.

3. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   a. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C 1506 for water retention, and ASTM C91/C91M for air content.
   b. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
4. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 402/602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet (6 m) vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
   1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
   2. Density Classification: Lightweight.
   3. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.
   4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
   4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

E. Aggregate for Grout: ASTM C404.

F. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM C615/C615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Heckmann Building Products, Inc.; #374: Steel-Wich.
      b. Hohmann & Barnard, Inc.; RB Rebar Positioner.
      c. Wire-Bond, Figure 8 Rebar Positioners.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
   1. Interior Walls: Hot-dip galvanized carbon steel.
   2. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
   3. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
   4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

2.6 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions; 202 New Masonry Detergent.
      b. EaCo Chem, Inc.; NMD 80.
      c. PROSOCO, Inc.; Sure Klean 600.

2.7 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For reinforced masonry, use Type N.
   2. For interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
   3. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 402/602 /ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C476 Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
   3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C143/C143M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Verify that substrates are free of substances that impair mortar bond.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build masonry wall construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).

3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:
1. For bed joints, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, and remove loose masonry units and mortar.

D. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

E. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
   3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 - Joint Firestopping.

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:
   1. Bed face shells in mortar and make head joints of depth equal to bed joints.
   2. Bed webs in mortar in grouted masonry.
   3. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
   1. Space reinforcement not more than 16 inches (406 mm) o.c.

3.7 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.8 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.9 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/602/ACI 530/ASCE 5.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140/C140M for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

H. Prism Test: For each type of construction provided, according to ASTM C1314 at 7 days and at 28 days.

3.10 REPAIRING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   4. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
   5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.11 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste.
   3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:
1. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 ACTION SUBMITTALS

A. Product Data:
1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Threaded rods.
4. Shop primer.
5. Galvanized-steel primer.
6. Galvanized repair paint.
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.
5. Identify members not to be shop primed.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer and fabricator.

B. Welding certificates.

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. Source quality-control reports.

F. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified 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 (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.6 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 label intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate 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.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
1. Option 1: Connection designs have been completed and connections indicated on the Drawings.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

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.

2.4 RODS

A. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
1. Finish: Plain.

B. Threaded Rods: ASTM A36/A36M

1. Nuts: ASTM A63 (ASTM A563M) heavy-hex carbon steel.

2. Washers: ASTM A36/A36M carbon steel.

3. Finish: Plain.

2.5 PRIMER

A. Steel Primer:
1. Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
2. SSPC-Paint 23, latex primer.

3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, 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. Mark and match-mark materials for field assembly.

2. 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, mechanically thermal cut, 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. 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.

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.

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 lintels attached to structural-steel frame and located in exterior walls.

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 unless indicated to be painted.
   6. Surfaces enclosed in interior construction.

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.
   3. SSPC-SP 7 (WAB)/NACE WAB-4.
   4. SSPC-SP 6 (WAB)/NACE WAB-3.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.

D. 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.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
   1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
   2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
   3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      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 accepted.
c. Ultrasonic Inspection: ASTM E164.
d. Radiographic Inspection: ASTM E94/E94M.

4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M.
5. Prepare test and inspection reports.

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.

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. Baseplates 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. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

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. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3. 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 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting:

1. 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.
a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in Section 099123 "Interior Painting."

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Bolted Connections: Inspect 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.
      a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
         1) Liquid Penetrant Inspection: ASTM E165/E165M.
         2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
         3) Ultrasonic Inspection: ASTM E164.
         4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Load-bearing wall framing.
2. Interior non-load-bearing wall framing.
3. Floor joist framing.

B. Related Requirements:
1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Vertical deflection clips.
4. Single deflection track.
5. Drift clips.
6. Floor joist framing.
7. Post-installed anchors.
8. Power-actuated anchors.

B. Shop Drawings:
1. Include layout, spacings, sizes, thicknesses, and types of cold-formed 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.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product certificates: For each type of code-compliance certification for studs and tracks.

D. Product test reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Research Reports:

1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
   b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).

c. Floor Joist Framing: Vertical deflection of 1/360 for live loads and 1/240 for total loads of the span.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: As required by structural performance.
2. Coating: G90 or equivalent.

B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
2. Coating: G60.

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Minimum Flange Width: 1-5/8 inches (41 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Minimum Flange Width: 1-5/8 inches (41 mm).

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Minimum Flange Width: 1-5/8 inches (41 mm).

D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Minimum Flange Width: 1-5/8 inches (41 mm).

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
2. Flange Width: 1-3/8 inches (35 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
2. Flange Width: 1-1/4 inches (32 mm).

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
   2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, unpunched with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0677 inch (1.72 mm).
   2. Flange Width: 2 inches (51 mm) minimum.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
   2. Flange Width: 1-1/2 inches (38 mm) minimum.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips.
   5. End clips.
   6. Foundation clips.
   7. Gusset plates.
   8. Stud kickers and knee braces.
   9. Joist hangers and end closures.
   10. Hole-reinforcing plates.
   11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC308 as appropriate for the substrate.
   1. Uses: Securing cold-formed steel framing to structure.
   2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
   3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M.

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing 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. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners, install according to Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
   1. Anchor Spacing: As indicated on Drawings.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track.
   1. Fasten both flanges of studs to top and bottom tracks.
   2. Space studs as follows:
      a. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
   1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
   2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
   1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on Drawings. Fasten at each stud intersection.

   1. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.

   2. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single deep-leg deflection tracks and anchor to building structure.
   2. Connect vertical deflection clips to infill studs and anchor to building structure.
   3. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows as indicated on Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   2. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
   1. Install solid blocking at centers indicated on Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
   1. Joist Spacing: As indicated on Drawings.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
   1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Drawings. Fasten bridging at each joist intersection as follows:
   1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
   2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 REPAIRS

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 43 00

SLOTTED CHANNEL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Slotted channel framing forequipment.

B. Slotted channel framing for mechanical and electrical equipment.

C. Slotted channel framing for applications where framing and supports are not specified in other Sections.

1.2 COORDINATION

A. Coordinate installation of slotted channel framing that is anchored to or that will receive other work. 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.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product indicated.
   2. Shop Drawings: Indicate plan layout, typical elevations, details and anchoring methods.

B. Informational Submittals
   1. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, within the State of the Project, responsible for their preparation.
   2. Submit following:
      a. Certificates verifying AWS qualifications within previous 12 months for each welder employed for Work.
      b. Manufacturer’s certification that products furnished for Project meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Engineer Qualifications: Registered professional engineer licensed to practice structural engineering in jurisdiction where Project is located, with minimum of five years experience in design of equipment support systems.

B. Manufacturer Qualifications: Company specializing in manufacturing, fabricating, and installing Products specified in this Section with minimum five years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 60 00 - Product Requirements.
   1. Deliver components of system required to be installed by other trades in sufficient time not to delay work of project.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Requirements: Drawings are diagrammatic and are intended to establish basic dimension of units, sight lines, ceiling heights, and profiles of units.

B. Manufacturer: Responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
   1. Employ registered professional engineer, licensed to practice structural engineering in jurisdiction where Project is located, to engineer each component of equipment support systems.

C. Attachment Considerations: Account for site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening and fracturing connection between units and building structure or between components themselves.
   1. Make modifications only to meet field conditioned and ensure fitting of system components.
   2. Obtain Architect's approval of modifications and for connections to building elements at locations other than indicated on Drawings.

D. Support Structure: Locate support members in order to maintain scheduled ceiling planes indicated on Drawings. Make possible attachment of equipment support rails at any point along support system without drilling or welding into system.
   1. Ceiling Anchorage: For framing scheduled to be mounted to ceilings, attach to ceiling by means of imbedded concrete inserts, through bolts or direct attachment to structural framing.
   2. Rigidly fix and brace support structure against sway.

E. Loading: Design support structure to support vertical load, maximum eccentricity of vertical load from support point, transverse force acting on longitudinal rail, longitudinal force acting on longitudinal rail, and deflection criteria established for each piece of supported equipment.
   1. If loads are not defined for piece of supported equipment assume concentrated load of 1500 pounds at any point along equipment rails. Concentrated load is maximum encountered by positioning of equipment at extremities of its travel (maximum load configuration).
   2. Safety Factor: Design support structure for minimum safety factor of three based on ultimate strength under static loading conditions. Structure shall not deflect more than 1/720 span vertically or horizontally when maximum loading conditions of equipment operation are applied on either rail.

F. Interface with Adjacent Systems: Integrate design and connections with adjacent construction.
   1. Accommodate allowable tolerances and deflections for structural members in installation.
   2. Coordinate with reflected ceiling plan and other items indicated to be placed in or above ceiling to ensure support system does not interfere with or dislocate other items.

2.2 MANUFACTURERS

A. Slotted Channel Framing:
   1. Cooper B-Line, Inc.
   2. Flex-Strut, Inc. Metal Framing Products
   3. Hilti, Inc., "Hilti Strut MQ."
   4. Tyco Fire Suppression & Building Products "Unistrut" Metal Framing

2.3 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.

2.4 SLOTTED CHANNEL FRAMING

A. Framing Members: Cold-formed metal channels with continuous slot complying with MFMA-3, and as follows:
   1. Cold-formed metal channels with flange edges returned toward web with 9/16 inch wide slotted holes in webs at 2 inches on center.
   2. Width, Depth, Thickness: As required by design to meet structural performance.

B. Materials:
   1. Steel Sheet Structural Quality: ASTM A 570, Grade 33.

2. Zinc-Coated Steel Sheet: ASTM A653/A653M, Quality SQ, Grade 33, G90.
3. Hot-Rolled Steel Bar: ASTM A 575.
4. Hot-Rolled Steel Sheet and Strip: ASTM A 569.
5. Fasteners and Anchors: Concrete inserts, bolts or direct attachment to structural framing.

C. Finishes:
1. System components: Manufacturer's standard corrosion resistant factory-painted acrylic enamel finish.
2. Hardware: Electro-galvanized.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01 73 00 - Execution.

3.2 INSTALLATION

A. Support Systems: Install in accordance with approved Shop Drawings and manufacturer's installation instructions and recommendations.

B. Structural Assembly: Install supporting framework plumb and true. Tolerances:
1. Mount surfaces of support structure horizontal within tolerance of 1/32 inch in 24 inches and within 1/16 inch in 18 foot length.
2. Elevation of one rail mounting surface to other shall be within 1/16 inch in any 24 inches length of rails.

3.3 PROTECTION

A. Protect finished installation under provisions of Section 01 73 00 - Execution.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ladders.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For the following:
      a. Nonslip aggregates and nonslip-aggregate surface finishes.
      b. Fasteners.
      c. Shop primers.
      d. Shrinkage-resisting grout.
      e. Manufactured metal ladders.
   2. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
      a. Metal ladders.
   3. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, within the State of the Project, responsible for their preparation.

B. Informational Submittals:
   1. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
   2. Welding certificates.
   3. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
   4. Research Reports: For post-installed anchors.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 - Quality Requirements, using performance requirements and design criteria indicated.
   1. Design Calculations: Submit design calculations for the following:
      a. Ladders

B. Structural Performance of Ladders: Laddersshall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

2.2 METALS

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.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A ASTM A568/A568M, Property Class 4.6); with hex nuts, ASTM A563/A563M; and, where indicated, flat washers.

B. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 3, heavy-hex steel structural bolts; ASTM A563/A563M, Grade DH3, (ASTM A563/A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).

2.4 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 (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. 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 and contour of welded surface matches that of adjacent surface.

F. 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.

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.

2.5 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3 unless otherwise indicated.

B. Steel Ladders:
   1. Space siderails 24 inches (457 mm) apart unless otherwise indicated.
   2. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
   3. Rungs: 1-inch- (25-mm-) diameter, steel bars.
   4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
   6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
      a. Manufacturers:
         1) Harsco Industrial IKG, a division of Harsco Corporation.
         2) Ross Technology Corp.
         3) W.S. Molnar Company.
   7. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
   8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.'
      a. Siderail Top Extension: 42 inches above landing surface.
      b. Bottom Rung Offset: 14 inches maximum above finish floor surface.
   9. Prime interior ladders, including brackets and fasteners, unless noted otherwise.

2.6 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.7 STEEL AND IRON FINISHES

A. 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 unless zinc-rich primer is indicated.

B. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

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.

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.
   1. Coordinate in-wall blocking for anchorage of ladder to substrate per Section 06 10 53 - Miscellaneous Rough Carpentry.

3.2 REPAIRS

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
      a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

END OF SECTION

SECTION 05 53 13

BAR GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal bar gratings.
2. Grating frames and supports.

1.2 ACTION SUBMITTALS

A. Product Data for each type of product.

B. Shop Drawings: Include Plans, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates

1. Welding Certificates

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

a. AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Gratings to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft.
2. Limit deflection to L/360 or 1/4 inch (6.4 mm), whichever is less.

2.2 METAL BAR GRATINGS

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531.

B. Welded Steel Grating

1. Bearing Bar Spacking: 1-3/16 inches o.c.
2. Bearing Bar Depth: 1-1/2 inches.
3. Bearing Bar Thickness: 3/16 inch.
4. Crossbar Spacing: 4 inches o.c.
5. Traffic Surface: Serrated.

C. Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for permeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.

D. Galvanize steel frames and supports in the following locations:

1. Exterior
2. Interior, where indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 301 stainless steel fasteners for exterior use and zink plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade and class required.

B. Post-Installed Anchors: Torque-controlled expansion or chemical 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 in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M

B. Steel Bars for Bar Gratings: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.

C. Wire Rod for Bar Grating Crossbars: ASTM A510/A510M.

D. Uncoated Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30 (Grade 205).

E. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.

2.6 FABRICATION

A. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Fit exposed connections accurately together to form hairline joints.

2.7 STEEL FINISHES

A. Finish gratings, frames, and supports after assembly

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

C. Shop prime gratings, frames, and supports not indicated to be galvanized unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

B. Fit exposed connections accurately together to form hairline joints.

1. 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 the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

3.2 INSTALLATION OF METAL BAR GRATINGS

A. Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 REPAIR

A. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on prime-painted gratings immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rooftop equipment bases and support curbs.

B. Wood blocking, cants, and nailers.

C. Wood furring and grounds.

D. Plywood backing panels.

E. In wall blocking for wall mounting equipment and accessories.

F. Interior plywood for flooring service access over finished ceilings.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
      a. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
      b. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
      c. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

d. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
e. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Informational Submittals:
1. Evaluation Reports: For the following, from ICC-ES:
a. Preservative-treated wood.
b. Fire-retardant-treated wood.
c. Metal framing anchors.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: 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. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

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.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 mm) beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

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. Cants.
   5. Furring.
   6. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
   1. Hem-fir (north); NLGA.
   2. Mixed southern pine or southern pine; SPIB.
   3. Spruce-pine-fir; NLGA.
   4. Hem-fir; WCLIB or WWPA.
   5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
   6. Western woods; WCLIB or WWPA.
   7. Northern species; NLGA.
   8. Eastern softwoods; NeLMA.

C. Concealed Boards: 19 percent maximum moisture content of any of the following species and grades:
   1. Mixed southern pine or southern pine, No. 3 grade; SPIB.
   2. Hem-fir or hem-fir (north), Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
   3. Spruce-pine-fir (south) or spruce-pine-fir, Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD FLOORING PANELS

A. Floor Substrate and Finish Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged (Substrate), and A-B Exterior (Finish Floor Panels) in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667/F1667M.

C. Screws for Fastening to Metal Framing: ASTM C954, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

2.8 METAL FRAMING ANCHORS

A. Manufacturers:
   1. Cleveland Steel Specialty Co.
   2. KC Metals Products, Inc.
   3. Phoenix Metal Products, Inc.
   4. Simpson Strong-Tie Co., Inc.
   5. USP Structural Connectors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
   1. Use for interior locations unless otherwise indicated.

C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
   1. Use for wood-preservative-treated lumber and where indicated.

2.9 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
   1. Adhesives shall have a VOC content of 70 g/L or less.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

C. Do not splice structural members between supports unless otherwise indicated.

D. 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 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.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.2 WOOD GROUND, SLEEPER, BLOCKING AND NAILER, OR METAL STRAPPING INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. At Contractor's option, provide metal backing plates or fire treated wood blocking to support loads imposed at wall-mounted and wall-hung items that require backing plates, include, without limitation, the following:
1. Fire protection specialties.
2. Millwork.
3. Wood trim.

D. Fire-treated wood blocking is required at the following locations:
1. Wall-mounted door stops.
2. Upper wall casework units.

E. Where indicated or where wood blocking is not allowed by code, utilize galvanized sheet metal backing plates. Plating shall be long enough to span across a minimum of 3 studs, unless otherwise indicated, and may be one of the following:
1. Galvanized steel plate 0.053-inch (1.34-mm) thick minimum by4-inches (102-mm) wide.
2. 3-5/8 inches (92.1 mm) un-punched wide flange steel stud of 0.053 inch (1.34-mm) thick. Notch studs so that backing plate will be flush with exterior face of stud.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
1. Fire block furred spaces of walls, at each floor level and at ceiling, with wood blocking or noncombustible materials accurately fitted to close furred spaces.

B. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

3.4 PANEL PRODUCT INSTALLATION

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. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

D. Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
   1. Comply with "Code Plus" provisions in above-referenced guide.

3.5 PLYWOOD BACKING PANELS

A. Provide fire retardant-treated 3/4-inch (19-mm) thick plywood panels to each wall scheduled to receive electrical, telephone, communications, data, or similar equipment.
   1. Do not install panels within 2 feet (610 mm) of the floor nor within 2 feet (610 mm) of a door frame.

B. Refer to Section 09 91 00 - Painting for field painting. Do not paint over at least one fire-retardant-treated label per panel.

END OF SECTION

SECTION 07 01 53

ROOF MODIFICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cutting in of new penetrations through existing roof system, and flashing with new materials into existing roofing system.

B. Protection of existing roofing system that is not to be modified or disturbed.

1.2 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to 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.

B. Existing Membrane Roofing System: EPDM roofing membrane, surfacing, and components and accessories between deck and roofing membrane.

C. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.

D. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.4 SYSTEM DESCRIPTION

A. Designated Roof Areas: Remove existing ballast (if any), perimeter flashings, base flashings, counter flashings, vent stack flashings, roofing membrane, insulation, and other system components as required for roofing work.

B. Remove or relocate designated roof mounted mechanical and electrical equipment as required for roofing work.

C. Provide products required by manufacturers to be fully compatible with each other and with indicated substrates, or provide separation materials as required to eliminate contact between incompatible materials.

D. Provide new roof membrane, insulation, and flashing to accommodate roof mounted equipment removal or relocation, and penetrations.

E. Performance Requirements: Prevent water infiltration through roof membrane penetrations or modifications resulting from work described in Contract Documents.

F. Industry Standards: Conform to NRCA - Roofing and Waterproofing Manual, except where more stringent requirements are indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product specified.
   1. Include list of materials and data sheets describing physical characteristics and performance criteria for materials proposed for use as well as applicable standards met by each product.

B. Shop Drawings: Submit details for this specific project indicating construction at penetrations, terminations, flashings, drains, and tie-in to existing roof.

1.6 INFORMATIONAL SUBMITTALS

A. Certifications specified in Quality Assurance article.

B. Qualification Data: For Installer, including certificate that Installer is approved by warrantor of existing roofing system.

C. Manufacturer's Installation Instructions: Submit manufacturer’s printed installation instructions for each product.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 01.

B. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roof installation.

C. Warranty: Submit specified warranty in accordance with Sections 01 60 00 - Product Requirements, and 01 77 00 - Closeout Procedures.

1.8 QUALITY ASSURANCE

A. Applicator Qualifications: Approved by manufacturer for making modifications and repairs to existing warranted roofing prior to execution of this Contract.
   1. Minimum of 5 years documented experience in roofing repairs of this type of roof.
   2. Include list of completed projects having similar scope of work identified by name, location, date, reference name, and phone number.

B. Materials Removal Firm: Company specializing in performing the work of this Section with minimum 5 years documented experience.

C. Certifications:
1. Submit manufacturer's certification stating materials ordered and supplied are compatible with existing roofing system and will not void existing warranty.
2. Submit manufacturer's project registration form indicating that manufacturer has reviewed Project and will issue or extend existing warranty to cover repairs warranty upon successful completion of installation.
3. Submit manufacturer's approval of applicator.
4. Certify materials shipped to Project site meet roof manufacturer's published performance standards and requirements of this Specification.

D. Roofing Modifications Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer including project manager, superintendent, and foreman; and installers whose work interfaces with or affects roof modification work, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to preparations for roof modifications, including membrane roofing system manufacturer's written instructions.
3. Review temporary protection requirements for existing roofing system that is to remain, during and after installation.
4. Review roof drainage during each stage of roofing modification work and review roof drain plugging and plug removal procedures.
5. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
6. Review structural loading limitations of deck during roofing work.
7. Review base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect roof modifications.
8. Review HVAC shutdown and sealing of air intakes.
9. Review shutdown of fire-suppression, -protection, and -alarm and -detection systems.
10. Review procedures for asbestos removal or unexpected discovery of asbestos-containing materials.
11. Review governing regulations and requirements for insurance and certificates if applicable.
12. Review existing conditions that may require notification of Architect before proceeding.

1.9 PROJECT CONDITIONS

A. Protect building where roofing is scheduled to be modified, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from modification operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

C. Owner assumes no responsibility for condition of areas to be modified.
   1. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.

D. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

E. Weather Limitations: Proceed with roofing modification work only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.
   1. Emergency Equipment: Maintain on-site equipment necessary to apply emergency temporary edge seal in the event of sudden storms or inclement weather.
   2. Maintain continuous temporary protection prior to and during installation of new roofing system.

F. Hazardous Materials: It is not expected that hazardous materials such as asbestos-containing materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

1.10 SEQUENCING AND SCHEDULING

A. Schedule work to coincide with commencement of installation of new roofing system.

B. Remove only existing roofing materials that can be replaced with new materials the same day.

C. Coordinate the work with other affected mechanical and electrical work associated with roof penetrations.

1.11 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during roof modification work, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.

1. Notify warrantor of existing roofing system on completion of roofing modifications, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

B. If roofing system manufacturer's warranty is no longer in effect on the existing roof system, upon completion of Work and prior to final payment, furnish written warranty signed by installer and Contractor stating that for 2 year period from date of Final Acceptance of Building repairs and maintenance will be made to maintain roofing and flashings in watertight condition.

PART 2 PRODUCTS

2.1 INFILL AND PATCHING MATERIALS

A. Use infill and patching materials, including sheet and adhesive materials, flashings, roof surfacing, fasteners, adhesives, and accessories, matching existing membrane roofing system materials, unless otherwise indicated.

2.2 AUXILIARY MATERIALS

A. General: Auxiliary preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing membrane roofing system

B. Insulation: Type used in original roof construction in thickness necessary to achieve satisfactory repair of membrane with no ponded water.

C. Wood Blocking and Nailers: As specified in Section 06 10 53.

D. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

E. Mechanical Fasteners and Disks: Appropriate for purpose intended and approved by UL or FM; length required for thickness of materials, fluoropolymer finish complete with disks; manufacturer as required by membrane manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing modifications will be performed with Installer present for compliance with requirements.

B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

C. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

E. Do not apply roofing materials to damp, frozen, dirty, dusty or other surface conditions which are unacceptable to manufacturer or applicator.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prepare roof surfaces as recommended by manufacturer of original installation.

C. Protect existing membrane roofing system that is indicated not to be modified.
1. Limit traffic and material storage to areas of existing roofing membrane that have been protected.
2. Maintain temporary protection and leave in place until replacement roofing has been completed.

D. Coordinate with Owner to shut down air intake equipment in the vicinity of the Work. Cover air intake louvers before proceeding with roof modification work that could affect indoor air quality or activate smoke detectors in the ductwork.

E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
1. If roof drains will be temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing membrane roofing system components that are to remain.

F. Verify that rooftop utilities and service piping have been shut off before commencing Work.

3.3 FLASHING AND REPAIR WORK

A. General: Perform work in accordance with instructions and recommendations of manufacturer of original installation materials.

B. Clean substrate of contaminants such as dirt, debris, oil, and grease that can affect adhesion of roof patching materials.

C. Cut holes for penetrations neatly and in accordance with Division 01 Section "Cutting and Patching."

D. Where continuity of existing fastener pattern has been interrupted by cutting and patching work, provide additional uplift securement for existing roofing system with new screws and plates applied to each roof zone to comply with same wind uplift requirements as specified for new roofing work.

E. Lay base flashing and seal down to membrane and penetration.

F. Strip in flashing with multiple layers of felt and bitumen on built-up systems and with one layer of sheet material on single-ply systems.

G. Counterflash as required to make watertight.

H. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish.

3.4 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect and Owner 48 hours in advance of the date and time of inspection.

B. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.5 DISPOSAL

A. Collect and place demolished materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
   1. Storage or sale of demolished items or materials on-site will not be permitted.

B. Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed low-slope roof sheet metal fabrications.

B. Formed equipment support flashing.

C. Formed mechanical piping cover/hood.

1.2 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
   3. Review requirements for insurance and certificates if applicable.
   4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
      a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
   2. Shop Drawings: For sheet metal flashing and trim.
      a. Include plans, elevations, sections, and attachment details.

b. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
c. Include identification of material, thickness, weight, and finish for each item and location in Project.
d. Include details for forming, including profiles, shapes, seams, and dimensions.
e. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
f. Include details of termination points and assemblies.
g. Include details of roof-penetration flashing.
h. Include details of special conditions.
i. Include details of connections to adjoining work.
j. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

B. Informational Submittals:
1. Qualification Data: For fabricator.
2. Product Test Reports: For each product, for tests performed by a qualified testing agency.
3. Sample Warranty: For special warranty.

C. Closeout Submittals:
1. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: 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.

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 extent necessary for period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel 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 Final Acceptance.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies 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.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
   1. Finish: 4 (polished directional satin).

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).
3. Products:
   a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
   c. Henry Company; Blueskin PE200 HT.
   d. Metal-Fab Manufacturing, LLC; MetShield.
   e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
   1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
      a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   2. Obtain field measurements for accurate fit before shop fabrication.
   3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

H. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch (0.48 mm) thick.

B. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch (0.48 mm) thick.

C. Flashing Receivers: Fabricate from the following materials:
   1. Stainless Steel: 0.016 inch (0.40 mm) thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch (0.48 mm) thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.019 inch (0.48 mm) thick.

B. Formed Mechanical Piping Cover/Hood: Fabricate from the following materials:
   1. Stainless Steel: 14 gauge, 0.078 inch (2.0 mm) thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, 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.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
   5. Torch cutting of sheet metal flashing and trim is not permitted.
   6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
   1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. 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. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 - Joint Sealants.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm). Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Formed Mechanical Piping Cover/Hood: Coordinate installation of hood and cover with mechanical piping penetration through existing masonry wall assembly. Fabricate all bends, forms, and flanges in the shop to the greatest extent possible prior to installation. Provide anchors and sealant compatible with substrates.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 62 10

FLEXIBLE FLASHINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible concealed flashing used within wall assemblies to protect and shed incidental water to the exterior.

1.2 COORDINATION

A. Coordinate flashing layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate flashing installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.
   1. Review flashing observation and repair procedures after flashing installation.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
      a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
   2. Shop Drawings: Show fabrication and installation layouts of flashing, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
   3. Samples: For each type of flexible flashing and accessory required.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store flashing materials in contact with other materials that might cause staining, denting, or other surface damage. Store flashing materials away from uncured concrete and masonry.

B. Protect flashing from exposure to sunlight and high humidity, except to extent necessary for period of flashing installation.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Flashing and trim assemblies as indicated shall withstand 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.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 FLEXIBLE FLASHING

A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing. Provide primer according to written recommendations of underlayment manufacturer if needed.
   1. Products:
      a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
      b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
      c. Henry Company; Blueskin PE200 HT.
      d. Metal-Fab Manufacturing, LLC; MetShield.
      e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
   2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
   3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of sealants, and other miscellaneous items as required for complete flashing installation and as recommended by manufacturer, unless otherwise indicated.

B. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, 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 FLEXIBLE FLASHING INSTALLATION

A. General: Install flexible flashing to intercept and exclude penetrating moisture, otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
   1. Install as indicated on Drawings and per Manufacturer’s recommendations.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

C. Locations:
   1. As indicated on Drawings for miscellaneous flashings and penetrations.

3.3 CLEANING AND PROTECTION

A. Replace flashing that have been damaged or that have deteriorated beyond successful repair.

END OF SECTION

SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Penetrations in fire-resistance-rated walls.

B. Penetrations in horizontal assemblies.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Include the following participants:
      a. Contractor.
      b. Architect.
      c. Installers.
      d. 3rd party inspectors.
      e. Firestopping manufacturer.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
   2. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
      a. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

B. Informational Submittals:
   1. Qualification Data: For Installer.
   2. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

C. Closeout Submittals:

1. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. For systems that utilize a pre-formed firestop device, Installer shall be trained directly from manufacturer.
   2. For systems that require sealants, putties, or sprays a firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors", or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements" is required.

B. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
        1) UL in its "Fire Resistance Directory."
        2) Intertek Group in its "Directory of Listed Building Products."
        3) FM Global in its "Building Materials Approval Guide."

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
1. Manufacturers:
    a. 3M Fire Protection Products.
    b. Hilti, Inc.
    c. RectorSeal.
    d. Specified Technologies, Inc.
    e. Tremco, Inc.

B. Source Limitations:
1. Obtain joint and penetration firestopping primary materials through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing principle materials described in this Section.

C. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

D. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

E. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of less than or equal to 1 determined by ASTM G21.

F. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
1. Sealant shall have a VOC content of 250 g/L or less.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
   1. Permanent forming/damming/backing materials.
   2. Substrate primers.
   3. Collars.
   4. Sleeves.

2.3 FILL MATERIALS

A. Firestop Sealants: Single-component formulations that do not re-emulsify after cure during exposure to moisture.
   1. Acceptable Products:
      a. FS-ONE MAX Intumescent Firestop Sealant by Hilti.
      b. CP 606 Flexible Firestop Sealant by Hilti.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
   1. Acceptable Products:
      a. CP 643 N and CP 644 Firestop Collar by Hilti.
      b. CFS-CC Firestop Cable Collar by Hilti.

C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
   1. Acceptable Products:
      a. CFS-COS Firestop Composite Sheet by Hilti.

D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
   1. Acceptable Products:
      a. CFS-D Firestop Putty Disc, CP 617 Putty Pad, CP 618 Putty Stick, and CP 619 T Putty Roll by Hilti, Inc.
      b. TREMstop Putty Pads by Tremco TREMstop Firestopping.
      c. SpecSeal Series SSP Firestop Putty by Specified Technologies, Inc. (STI).

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
   1. Acceptable Products:
      a. CP 648 Firestop Wrap Strip, by Hilti, Inc.
      b. TREMstop Super Strips by Tremco TREMstop Firestopping.
      c. SpecSeal Series RED2 or BLU2 Wrap Strip by Specified Technologies, Inc. (STI).

F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

1. Acceptable Products:
    a. CP 637 Firestop Mortar by Hilti, Inc.
    b. TREMstop Fire Mortar by Tremco TREMstop Firestopping.
    c. SpecSeal Series SSM Firestop Mortar by Specified Technologies, Inc. (STI).

G. Blocks: Intumescent flexible block. Non-curing, reusable solution for medium to large openings. No compression required.
1. Acceptable Product:
    a. CFS-BL Firestop Block by Hilti, Inc.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
1. Acceptable Product:
    a. Flamesafe Pillow by Rectorseal.
    b. SpecSeal Series SSB Firestop Pillows by Specified Technologies, Inc. (STI).

I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions and Spray mastic formulation for use with a power sprayer. For use in top-of-wall joints, curtain wall/edge of slab, expansion joints.
2. Acceptable Products:
    a. CFS-S SIL SL (self-leveling), CFS-S SIL GG (gun grade), and CFS-SP SIL (spray mastic) by Hilti, Inc.
    b. TREMstop Fyre-Sil (self-leveling/gun grade) by Tremco TREMstop Firestopping.
    c. SpecSeal SIL300 Silicone Firestop Sealant or SIL300 SL Self-Leveling Silicone Firestop Sealant by Specified Technologies, Inc. (STI).

J. Firestop Sleeve Device: Factory assembled sleeves formed from galvanized steel and lined with intumescent material designed to handle 0 to 100 percent visual cable fill.
1. Acceptable Products:
    a. CP653 Speed Sleeve by Hilti.
    b. EZ-PATH™ Fire Rated Pathway by Specified Technologies Inc. (STI).

K. Polyurethane Firestop Foam: Two component polyurethane foam created through chemical reaction of polyol, water and polyisocyanate, plus flame retardants and other additives (all included in the polyol component). Foam cures within one minute at room temperature to produce non-shrinking smoketight firestopping system and does not require additional firestop coating.
1. Acceptable Product: CP620 Fire Foam by Hilti.

2.4 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words similar to "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Final Acceptance. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
   1. Equivalent approved systems by the following are acceptable:
      a. Intertek Group-listed systems designs in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."
      b. FM Global-approved systems designs listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

B. Penetration Firestopping Systems with No Penetrating Items. Comply with the following:
   1. Acceptable UL-Classified Systems with CAJ/CBJ/FA 0000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
      a. Or an Engineered Judgments by one of the listed manufacturer’s meeting the required rating.
   2. Type of Fill Materials: One or more of the following:
      a. Latex sealant.
      b. Silicone sealant.
      c. Acrylic sealant.
      d. Intumescent putty.
      e. Mortar.
      f. Preformed intumescent blocks/plugs.
      g. Pillows/Bags

C. Firestop Systems for pipes, plastic or metal, conduit in vertical runs, installed through firestop devices. Comply with the following:
   1. Acceptable UL-Classified Systems with FA 1000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
      a. Or an Engineered Judgments by one of the listed manufacturer’s meeting the required rating.
   2. Type of Firestop Device:
      a. Cast-in Firestop Devices.
      b. Drop-In Devices.

D. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing. Comply with the following:

1. Acceptable UL-Classified Systems with CAJ/CBJ/FA 1000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.
2. Type of Fill Materials: One or more of the following:
    a. Latex sealant.
    b. Silicone sealant.
    c. Acrylic sealant.
    d. Intumescent putty.
    e. Mortar.
    f. Polyurethane firestop foam.

E. Penetration Firestopping Systems for Nonmetallic Pipe, Conduit, or Tubing. Comply with the following:
1. Acceptable UL-Classified Systems with CAJ/CBJ/WL 2000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.
2. Type of Fill Materials: One or more of the following:
    a. Intumescent sealant.
    b. Intumescent putty.
    c. Intumescent wrap strips.
    d. Firestop device.
    e. Firestop sleeve device.
    f. Latex sealant.

F. Penetration Firestopping Systems for Electrical Cables. Comply with the following:
1. Acceptable UL-Classified Systems with CAJ/CBJ/WL 3000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.
2. Type of Fill Materials: One or more of the following:
    a. Intumescent sealant.
    b. Latex Sealant
    c. Pillows/bags
    d. Intumescent putty.
    e. Silicone foam.

G. Penetration Firestopping Systems for Cable Trays with Electric Cables. Comply with the following:
1. Acceptable UL-Classified Systems with CAJ/CBJ/WL 4000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
    a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.

2. Type of Fill Materials: One or more of the following:
   a. Intumescent sealant.
   b. Latex Sealant
   c. Pillows/bags
   d. Intumescent putty.
   e. Silicone foam.

H. Penetration Firestopping Systems for Insulated Pipes. Comply with the following:
1. Acceptable UL-Classified Systems with CAJ/CBJ/WL 5000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
   a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.
2. Type of Fill Materials: One or more of the following:
   a. Intumescent sealant.
   b. Silicone foam.
   c. Intumescent wrap strips.
   d. Pre-formed intumescent blocks.
   e. Latex sealant.

I. Penetration Firestopping Systems for Miscellaneous Electrical Penetrants. Comply with the following:
1. Acceptable UL-Classified Systems with CAJ/CBJ/WL 6000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
   a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.
2. Type of Fill Materials: One or more of the following:
   a. Intumescent sealant.
   b. Latex sealant
   c. Intumescent putty.
   d. Mortar.

J. Penetration Firestopping Systems for Miscellaneous Mechanical Penetrants. Comply with the following:
1. Acceptable UL-Classified Systems with CAJ/CBJ/WL 7000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
   a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.
2. Type of Fill Materials: One or both of the following:
   a. Intumescent sealant.
   b. Latex sealant.
   c. Mortar.
   d. Acrylic sealant.
   e. Silicone sealant.

K. Penetration Firestopping Systems for Groupings of Penetrants. Comply with the following:
   1. Acceptable UL-Classified Systems with CAJ/CBJ/WL 8000 Series or other Systems meeting the fire and smoke ratings specified or as indicated on Drawings.
      a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.
   2. Type of Fill Materials: One or more of the following:
      a. Latex sealant.
      b. Mortar.
      c. Intumescent wrap strips.
      d. Firestop device.
      e. Intumescent composite sheet.
      f. Pre-formed intumescent blocks.
      g. Polyurethane firestop foam.

END OF SECTION

SECTION 07 84 43

JOINT FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Joints in or between fire-resistance-rated constructions.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Include the following participants:
      a. Contractor.
      b. Architect.
      c. Installers.
      d. 3rd party inspectors.
      e. Firestopping manufacturer.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
   2. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
      a. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

B. Informational Submittals:
   1. Qualification Data: For Installer.
   2. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

C. Closeout Submittals:
   1. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. For systems that utilize a pre-formed firestop device, Installer shall be trained directly from manufacturer.
   2. For systems that require sealants, putties, or sprays a firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors", or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements" is required.

B. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

1) UL in its "Fire Resistance Directory."
2) Intertek Group in its "Directory of Listed Building Products."

2.2 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Basis-of-Design Products: The design for each fire-resistive joint system is based on products named in Part 2 articles. Subject to compliance with requirements, provide either the named products or comparable products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. RectorSeal.
      d. Specified Technologies, Inc.
      e. Tremco, Inc.

B. Source Limitations:
   1. Obtain joint and penetration firestopping primary materials through one source from a single manufacturer with not less than ten years of successful experience in manufacturing principle materials described in this Section.

2.3 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
   1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints at Intersection between Rated Wall Assemblies and Nonrated Horizontal Assemblies: Provide joint firestopping systems with ratings determined by ASTM E 2837.

D. Mold Resistance: Provide joint firestopping with mold and mildew resistance rating less than or equal to 1 as determined by ASTM G21.

E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
   1. Sealant shall have a VOC content of 250 g/L or less.

F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

2.4 FILL MATERIALS

A. Pre-Formed Top of Wall Firestopping:
   1. Acceptable Products:
      a. CFS-TTS Firestop Top Track Seal by Hilti.
      b. CFS-TTS MD Firestop Top Track Seal for Metal Deck by Hilti.

B. Pre-Formed Bottom of Wall Firestopping:
   1. Acceptable Products:
      a. CFS-BTS Bottom Track Seal by Hilti.

C. Pre-Formed edge of Slab Firestopping:
   1. Acceptable Products:
      a. CFS-EOS QS Edge of Slab QuickSeal by Hilti.

D. Firestop Sealants: Single-Component formulations that do not re-emulsify after cure during exposure to Moisture.
   1. Acceptable Products:
      a. CP 606 Flexible Firestop Sealant by Hilti.

E. Firestop Water Based Spray: A sprayable water-based fire-rated mastic for construction joints. For use in top-of-wall joints and expansion joints.
   1. Acceptable Products:
      a. CFS-CP WB Water-Based Acrylic Sealant Spray by Hilti.

F. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions and Spray mastic formulation for use with a power sprayer. For use in top-of-wall joints and expansion joints.
   2. Acceptable Products:
      a. CFS-S SIL SL (self-leveling), CFS-S SIL GG (gun grade), and CFS-SP SIL (spray mastic) by Hilti, Inc.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.

2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words similar to "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Final Acceptance. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
   1. Equivalent approved systems by the following are acceptable:
      a. Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under product category Expansion/Seismic Joints or Firestop Systems.

B. Floor-to-Floor, Joint Firestopping Systems. Comply with the following:
   1. UL-Classified Systems: FF-D/S Systems or other System meeting the fire and smoke ratings specified or as indicated on Drawings.
      a. Or an Engineered Judgments by one of the listed manufacturer’s meeting the required rating.
   2. Assembly Rating: As indicated on Drawings.
   3. Nominal Joint Width: As indicated on Drawings
   4. Movement Capabilities: Class II compression, extension, or horizontal shear.

C. Wall-to-Wall, Joint Firestopping Systems. Comply with the following:
   1. UL-Classified Systems: WW-D/S Systems or other System meeting the fire and smoke ratings specified or as indicated on Drawings.
      a. Or an Engineered Judgments by one of the listed manufacturer’s meeting the required rating.
   2. Assembly Rating: As indicated on Drawings.
   3. Nominal Joint Width: As indicated on Drawings
   4. Movement Capabilities: Class II compression or extension.

D. Floor-to-Wall, Joint Firestopping Systems. Comply with the following:
   1. UL-Classified Systems: FW-D/S Systems or other System meeting the fire and smoke ratings specified or as indicated on Drawings.
      a. Or an Engineered Judgments by one of the listed manufacturer’s meeting the required rating.
   2. Assembly Rating: As indicated on Drawings.
   3. Nominal Joint Width: As indicated on Drawings
   4. Movement Capabilities: Class II compression, extension, or horizontal shear.

E. Head-of-Wall, Fire-Resistive Joint Firestopping Systems. Comply with the following:
   1. UL-Classified Systems: HW-D/S Systems or other System meeting the fire and smoke ratings specified or as indicated on Drawings.
      a. Or an Engineered Judgments by one of the listed manufacturer’s meeting the required rating.
   2. Assembly Rating: As indicated on Drawings.
   3. Nominal Joint Width: As indicated on Drawings
   4. Movement Capabilities: Class II compression or extension.

F. Bottom-of-Wall, Joint Firestopping Systems. Comply with the following:

1. UL-Classified Systems: BW-D/S Systems or other System meeting the fire and smoke ratings specified or as indicated on Drawings.
   a. Or an Engineered Judgments by one of the listed manufacturer's meeting the required rating.
2. Assembly Rating: As indicated on Drawings.
3. Nominal Joint Width: As indicated on Drawings
4. Movement Capabilities: Class II compression or extension.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonstaining silicone joint sealants.

B. Interior horizontal traffic urethane joint sealants.

C. Interior vertical and horizontal nontraffic joint sealants

D. Butyl joint sealants.

E. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Joint sealants.
      b. Joint sealant backing materials.
   2. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
   3. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants 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.
   4. Joint-Sealant Schedule: Include the following information:
      a. Joint-sealant application, joint location, and designation.
      b. Joint-sealant manufacturer and product name.
      c. Joint-sealant formulation.
      d. Joint-sealant color.

B. Informational Submittals:
   1. Field Quality-Control Submittals:
      a. Field-Adhesion-Test Reports: For each sealant application tested.
   2. Sample warranties.

C. Closeout Submittals:
   1. Warranty Documentation:
      a. Manufacturers' special warranties.
      b. Installer's special warranties.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Installers: Authorized representative who is trained and approved by manufacturer.
   2. Testing Agency: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.5 FIELD 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 (5 deg C).
   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.

1.6 WARRANTY

A. Special Installer's Warranty: 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 years from date of Final Acceptance.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Final Acceptance.
   2. Silicone Sealants Warranty Period: 20 years from date of Final Acceptance.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, 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: Verify sealants and sealant primers comply with the following:
   1. Architectural sealants have a VOC content of 250 g/L or less.
   2. Sealants and sealant primers for nonporous substrates have a VOC content of 250 g/L or less.
   3. Sealants and sealant primers for porous substrates have a VOC content of 775 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 NONSTAINING SILICONE JOINT SEALANTS (**DESIGNATION S-SP**)

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
   1. Manufacturers:
      a. Dow Corning Corporation; 790.
      b. Pecora Corporation; 890 NST.
      c. Tremco Incorporated; Spectrum 1.
      d. Sika Corporation; Sil 290 NB

C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
   1. Manufacturers:
      a. Dow Corning Corporation; 795.
      b. GE Construction Sealants; Momentive Performance Materials Inc.; SilPruf NB
      c. Pecora Corporation: 895NST.

d. Tremco Incorporated: Spectrum 2.
e. Sika Corporation; Sil 295 FPS NB

2.4 INTERIOR HORIZONTAL TRAFFIC URETHANE JOINT SEALANTS (**DESIGNATION U-TI**)

A. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
1. Manufacturers:
a. Master Builders Solutions; MasterSeal-SL-1.
b. Pecora Corporation; NR-201.
c. Sherwin-Williams Company (The); Stampede 1SL.
d. Tremco Construction Products Vulkem 45SSL

2.5 INTERIOR VERTICAL AND HORIZONTAL NONTRAFFIC JOINT SEALANTS (**DESIGNATION U-SC**)

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
1. Manufacturers:
a. Bostik, Inc.; Chem-Calk 915
b. Master Builders Solutions; MasterSeal-TX-1.
c. Pecora Corporation; Dynatrol I-XL.
d. Sherwin-Williams Company (The); Loxon-TX.
e. Sika Corporation; Silkaflex Textured Sealant.
f. Tremco Incorporated; Dymonic 100.

2.6 BUTYL JOINT SEALANTS (**DESIGNATION BU**).

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
1. Manufacturers:
a. Pecora Corporation; BC-158.
b. Tremco Incorporated; Butyl.
c. Sherwin-Williams Company (The); White Lightning Butyl Rubber Caulk.

2.7 LATEX JOINT SEALANTS (**DESIGNATION L-GP**).

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
1. Manufacturers:
a. Master Builders Solutions; MasterSeal-NP 520.
b. Pecora Corporation; AC-20.
c. Sherwin-Williams Company (The); 950A.
d. Sika Corporation; Sil A 700.

e. Tremco Incorporated; Tremflex 834.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) for all sealants, except silicone and horizontal joints. Type O (open-cell material) for silicone sealants. Provide size and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Backings shall be approximately 25% larger than joint.

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.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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.
   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.

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 C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 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.

3.5 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 Final Acceptance. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Exterior joints in vertical surfaces and horizontal nontraffic surfaces (**Designation S-SP**):
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints in exterior insulation and finish systems.
      d. Joints between metal panels.
      e. Joints between different materials listed above.
      f. Perimeter joints between materials listed above and frames of doors, windows and louvers.
      g. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, S, NS, 100/50 or 50, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Interior joints in horizontal traffic surfaces **(Designation U-TI**):
   1. Joint Locations:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Where open gaps / joints occur between base and floor finishes.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Urethane, S, P/NS, 25, T, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Interior joints in vertical surfaces and horizontal nontraffic surfaces (**Designation U-SC**):
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Vertical joints on exposed surfaces of unit masonry, concrete, walls and partitions.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Urethane, S, P/NS, 25, T, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Concealed mastics (**Designation BU**):
   1. Joint Locations:
      a. Aluminum thresholds.
      b. Sill plates.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Butyl-rubber based.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement (**Designation L-GP**):
   1. Joint Locations:
      a. Control joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
      c. Joints between interior wall surfaces and countertops and millwork.
      d. Other joints as indicated on Drawings.
   2. Joint Sealant: Acrylic latex.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 08 12 13

HOLLOW METAL FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior standard steel frames.

B. Borrowed lites.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
      a. Include construction details, material descriptions, fire-resistance ratings, and finishes.
   2. Shop Drawings: Include the following:
      a. Elevations of each frame type.
      b. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
      c. Locations of reinforcement and preparations for hardware.
      d. Details of each different wall opening condition.

e. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
f. Details of anchorages, joints, field splices, and connections.
g. Details of accessories.
h. Details of moldings, removable stops, and glazing.

3. Product Schedule: For hollow-metal 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.

B. Informational Submittals:
1. Product Test Reports: For each type of fire-rated hollow-metal frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Mesker Door Inc.
4. Pioneer Industries, Inc.
5. Republic Doors and Frames.
6. Steelcraft; an Ingersoll-Rand company.

B. Source Limitations:
1. Obtain interior hollow-metal work from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Smoke- and Draft-Control Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Metal labels, bearing the name of the labeling agency, shipped on items located as follows:
   1. Door Frames: Placed on the rabbet between the two upper hinge locations as to be concealed when doors are shut.

2.3 STANDARD STEEL FRAMES

A. Construct hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Interior Frames: SDI A250.8.
   1. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
   2. Construction: Full profile welded.
   3. Exposed Finish: Prime.

2.4 BORROWED LITES

A. Fabricate of uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

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 (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) 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 (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

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. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

D. 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.

E. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

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. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted hairline joints.
   1. Provide fixed frame moldings on public/non-secure side of interior frames. Provide loose stops and moldings on inside of hollow-metal frames.
   2. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   3. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

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 SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

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 frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with SDI A250.11.

B. 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.
   1. 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.
   2. Install frames with removable stops located on secure side of opening.

C. Fire-Rated Openings: Install frames according to NFPA 80.

D. Floor Anchors: Secure with postinstalled expansion anchors.
   1. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

E. Solidly pack mineral-fiber insulation inside frames.

F. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

G. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

H. Glazing: Comply with installation requirements in Section 08 80 00 - Glazing and with hollow-metal manufacturer's written instructions.

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.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Five-ply flush wood veneer-faced doors for transparent finish.

B. Factory finishing flush wood doors.

C. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Action Submittals:
1. Product Data: For each type of product, including the following:
    a. Door core materials and construction.
    b. Door edge construction
    c. Door face type and characteristics.
    d. Factory-machining criteria.
    e. Factory-finishing specifications.
2. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
    a. Door schedule indicating door location, type, size, fire protection rating, and swing.
    b. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
    c. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
    d. Dimensions and locations of blocking for hardware attachment.
    e. Dimensions and locations of mortises and holes for hardware.
    f. Clearances and undercuts.
    g. Requirements for veneer matching.
    h. Doors to be factory finished and application requirements.
3. Samples for Verification:

a. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

B. Informational Submittals:
1. Qualification Data: For door inspector.
a. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
b. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
c. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.
2. Field quality-control reports.
3. Sample Warranty: For special warranty.

C. Closeout Submittals:
1. Special warranties.
2. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.4 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

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 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, 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 remainder of construction period.

1.7 WARRANTY

A. Special Warranty: 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. Delamination of veneer.
      b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
      c. 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 Period for Solid-Core Interior Doors: Life of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.
   1. Temperature-Rise Limit: Where indicated on Drawings, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards." and ANSI/WDMA I.S. 1A, whichever is stricter.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:
1. Manufacturers:
a. Eggers Industries.
b. Forte Opening Solutions (Formerly Masonite Architectural).
c. Mohawk, (Masonite).
d. VT Industries Inc.
2. Performance Grade:
a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated.
b. ANSI/WDMA I.S. 1A Extra Heavy Duty: assembly spaces, exits, and where indicated on Drawings.
3. Architectural Woodwork Standards or ANSI/WDMA I.S. 1A Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick.
a. Species: Red oak.
b. Cut: Rotary cut.
c. Match between Veneer Leaves: Book match.
d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
e. Pair and Set Match: Provide for doors hung in same opening.
f. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
5. Exposed Vertical Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.
a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
b. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
1) Finish steel edges and astragals to match door hardware (locksets or exit devices).
c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
1) Screw-Holding Capability: 475 lbf (2110 N) in accordance with WDMA T.M. 10.
6. Core for Non-Fire-Rated Doors:

a. ANSI A208.1, Grade LD-2 particleboard, made with binder containing no urea-formaldehyde resin.
   1) Blocking: Provide wood blocking in particleboard-core doors as follows:
      (a) 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
      (b) 5-inch (125-mm) bottom-rail blocking, in doors indicated to have kick, mop, or armor plates.
   2) Provide doors with WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 00 "Door Hardware."

b. WDMA I.S. 10 structural composite lumber.
   1) Screw Withdrawal, Door Face: 550 lbf (2440 N).
   2) Screw Withdrawal, Vertical Door Edge: 475 lbf (2110 N).

c. Either ANSI A208.1, Grade LD-2 particleboard or WDMA I.S. 10 structural composite lumber.

7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
   a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as follows:
      1) 5-inch (125-mm) top-rail blocking.
      2) 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
      3) 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
      4) 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
   4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

2.6 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.
   3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:
   1. Architectural Woodwork Standards or ANSI/WDMA I.S. 1A Grade: Premium.
   2. Finish: Architectural Woodwork Standards System-5, Varnish, Conversion.
   3. Staining: As selected by Architect from manufacturer's full range, to match existing building standard.
   4. Effect: Open-grain finish.
   5. Sheen: Satin.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed 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 Section 08 71 00 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
   1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
   2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finish hardware required to adequately trim, hang, and operate all doors, as is hereinafter specified and listed in the Hardware Schedule.
   1. Provide hardware for doors and frames of unusual profile or shape or other special conditions.
   2. Provide all necessary standard and special fasteners, screws, bolts, expansion shields or anchors to properly secure hardware to its intended door, frame, or other surface.

1.2 RELATED REQUIREMENTS

A. Section 08 12 13 - Hollow Metal Frames.

B. Section 08 14 16 - Flush Wood Doors.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section:
   1. Permanent cores to be installed by Owner.

1.3 REFERENCE STANDARDS

A. The following reference standards and model code documents shall be used in estimating and detailing door hardware, and shall considered as a standard of quality, function, and performance, as applicable:
   1. IBC 2000 Edition.
   2. NFPA-80 Fire Doors & Windows (current year adopted).
   3. NFPA-101 Life Safety Code (current year adopted).
   4. NFPA-105 Smoke Control Door Assembly. (current year adopted)
   5. ANSI-117.1 1992 Edition Providing Accessibility and Usability for Physically Handicapped People.
   6. ADAAG Americans with Disabilities Act Accessibility Guidelines.

1.4 SUBMITTALS

A. Action Submittals:

1. General: Submit the following in accordance with Section 01 31 00 - Project Management and Coordination.
2. Product Data: Provide a catalog cut sheet, clearly marked and identified, illustrating and describing each product included in the Hardware Schedule.
    a. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
    b. Formulate catalog cut sheets into sets and include a set with each copy of the Hardware Schedule submitted.
3. Door Hardware Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
    b. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
    c. Content: Include the following information:
        1) Type, style, function, size, label, hand, and finish of each door hardware item.
        2) Complete designations of every item required for each door or opening including name and manufacturer.
        3) Fastenings and other pertinent information.
        4) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule. Use same scheduling sequence and format and use same door numbers and hardware set numbers as in the Contract Documents.
        5) Explanation of abbreviations, symbols, and codes contained in schedule.
        6) Mounting locations for door hardware.
        7) Door and frame sizes and materials.
        8) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
    d. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other Work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

4. Wiring Diagrams: For electrified hardware items specified for this Project, Provide complete wiring diagrams along with riser drawings and elevations, showing locations where such material is to be installed. Wiring Diagrams shall be submitted with Hardware Schedule. Verify and coordinate with the electrical systems installer. Integration shall take effect into central system as specified by Owner.
    a. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
    b. Sequence of Operation: Include description of component functions that occur in the following situations:
        1) authorized person wants to enter;
        2) authorized person wants to exit;
        3) unauthorized person wants to enter;
        4) unauthorized person wants to exit.
5. Samples for Verification: If so requested by the Architect, provide a sample of any product or item requested, properly marked and tagged, for the opening for which it is intended.
6. Keying: Provide a keying schedule, listing the levels of keying, (GGMK, GKD, MKD or KA) as well as an explanation of the key system's function, the key symbols used and the numbers of the doors controlled. Provide in conjunction with the Door Index/Keying Schedule (which lists the door number, schedule heading, lock type and individual key symbol and remarks or special instructions) mentioned in above. Project shall be Masterkeyed and/or Grand Masterkeyed and provide two (2) keys per lockset or cylinder.

B. Operation and Maintenance Data: For each type of door hardware to include in maintenance manuals. Provide latest, revised and updated schedule of finish hardware, complete with catalog cuts and keying schedule. In addition, furnish one (1) copy of maintenance and parts manuals for those items for which they are readily available and normally provided.
    a. Submit in accordance with provisions of Section 01 78 23 - Operation and Maintenance Data.

1.5 QUALITY ASSURANCE

A. Substitutions: Request for substitutions for alternative hardware items will not be accepted on this Project unless specifically indicated. Specification indicates one (1) specified product, listed hereinafter in the Hardware Schedule, and two (2) acceptable alternative manufacturers for that product. If any specified product is listed as a "No Substitution" product, only that specified product shall be provided as indicated.

B. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. The hardware supplier shall be engaged regularly in the furnishing, delivery and servicing of contract builder's hardware and must be experienced and knowledgeable in all phases of estimating, detailing, scheduling, masterkeying, shipping and installation practices.
   2. When electro-mechanical or electronic hardware is supplied, a qualified individual with a minimum five- (5) year's experience shall be available for assistance.

D. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

E. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

F. Regulatory Requirements: Comply with provisions of the following:
   1. Provide hardware that complies with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1.

G. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 - Project Management and Coordination. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
   1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   2. Preliminary key system schematic diagram.
   3. Requirements for key control system.
   4. Address for delivery of keys.
   5. Location of Key Cabinet.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Marking and Packaging: All items of hardware shall be delivered to the site in manufacturer's original cartons or boxes. Each item of hardware shall be marked with the abbreviation set forth on the Shop Drawings to ensure that the product reaches its installation destination without needing specific hardware product number knowledge.

B. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

C. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system, as applicable.

1.8 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: If there are any products listed hereinafter that normally require a maintenance or service contract, provide the Owner and Architect with details and costs of standard maintenance or service contract.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Hardware Schedule" Article.

B. Product manufacturers listed with an asterisk (*) denote the specified manufacturers listed in the Hardware Schedule. The remaining two (2) listed manufacturers will be acceptable substitutions. If only one manufacturer is listed this shall be considered a "No Substitution" specification as set forth in "Quality Assurance" Article, for that particular item.

2.2 MATERIALS

A. Screws and Fasteners: Provide all screws and fasteners of the proper size and type to properly anchor or attach the item of hardware scheduled. Provide all fasteners with Phillips heads, unless security type screws (spanner-head or torx-head) are hereinafter specified.

B. Hinges: Provide as follows:
1. Where regular ball bearing hinges are listed for other doors, provide one hinge for each 30-inch of door height.
2. The width of the hinges shall be sufficient to clear all trim that is mounted to the doorframe.
3. Hinges shall be guaranteed for life of opening if installed per manufacturer's recommendations.
4. Acceptable Manufacturers:
   a. Hager.
   b. Stanley.
   c. McKinney.

C. Locks: All locks shall incorporate a seven pin tumbler system and be keyed to a GRANDMASTER SYSTEM as not to breach security of system in place. Keying system must be guaranteed of no duplication of existing change keys, master keys or grandmaster keys located in this Project. All keying shall be coordinated with Owner. Locks shall be Grade 1 mortise and/or cylindrical as hereinafter listed in the Hardware Schedule.
1. Acceptable Manufacturers:
   a. Best.
   b. Schlage.

D. Lock Trim: Cylindrical/mortise locks are to be furnished with lever handle trim, with levers having a return to within 1/2 inch of the door face, as is hereinafter listed in the Hardware Schedule.

E. Exit Devices: Exit Devices shall be rim, mortise or vertical rod type as called for in the Hardware Schedule. Devices shall be of the touch-pad type as is hereinafter specified in the Hardware Schedule. Exit devices shall be constructed to allow cylinder to be removed and rekeyed without removing the device from the door either by removable core cylinders or construction of exit device. Exit devices shall be constructed to allow the conversion from one function to another simply within lock stile case and selecting proper outside trim as specified hereinafter in the Hardware Schedule. Devices shall be furnished with outside trim lever handles matching locks.
   1. Acceptable Manufacturers:
      a. Von Duprin.

F. Door Closers: Door closers shall be of cast iron and rectangular design, furnished with a full cover. Provide complete with backcheck, delayed action and hold-open as indicated. Closers shall be mounted out of the line of sight wherever possible (i.e., room side of corridor doors, etc.) with parallel arm mounting on out-swinging doors. Mount closers to jamb or on brackets and/or drop plates, where special conditions require.
   1. Acceptable Manufacturers:
      a. LCN.

G. Protective Plates: Protective plates shall be mop (6”), kick (10”) or armor (34”) and shall be minimum .050 thick brass, bronze, or stainless steel, with three (3) beveled edges, drilled and countersunk for screws. Plates shall be mounted to avoid louvers and/or glass kits.
   1. Acceptable Manufacturers:
      a. Ives.
      b. Trimco.
      c. Hager.

H. Door Stops and Holders: Where a door strikes a wall at approximately 90 degrees, a suitable door stop shall be provided, either a wall bumper or floor stop. Where doors are undercut, provide floor stops with adequate height to properly stop the door. If door would not otherwise strike a wall, an overhead stop shall be provided. In-wall blocking for wall bumpers at stud walls shall be provided in accordance with Section 06 10 53 - Miscellaneous Rough Carpentry. Provide reinforcing in frame and door for overhead stops.
   1. Acceptable Manufacturers:
      a. Ives.
      b. Hager.
      c. Glynn-Johnson.

I. Wall Magnets: Magnets shall be fail safe and hold until the current is interrupted. Current input shall be factory selected to be 24V AC/DC or 120V AC and be protected against voltage surges up to 600 volts. If voltage less than 120 VAC is indicated, provide transformers as required to accommodate power supply on specified magnets. Maximum holding force shall be forty (40) pounds. Magnet covers shall be of metal composite. Plastic covers will not be accepted.

1. Acceptable Manufacturers:
   a. LCN.
   b. ABH.
   c. Dorma.

J. Electromagnetic Locks (Access Control): Electromagnetic lock shall have a 1500 lb. holding force containing a built in passive infrared (PIR) sensor to energize the magnetic lock when a person enters its field of view. Lock shall contain a built-in lighted emergency exit button as a redundant means of de-energizing lock. An access control system shall be integral to the lock with keypads/readers easily wired directly to the lock.
   1. Acceptable Manufacturers:
      a. Locknetics.

K. Power Supply: Designed and fabricated to interface with all designated electrical security components with no additional hardware. Power supplies shall be Underwriter Laboratories (UL) listed for general-purpose use tested to meet UL 1012 specifications. Power supplies shall have 12/24VDC field selectable output voltage. Output current shall be 1 Amp at 12VDC and 1 Amp at 24VDC. When required, interfacing to an emergency alarm system shall terminate power supply output. Power supply output voltage shall be filtered and regulated.
   1. Power supply shall be housed in a standard NEMA 1 enclosure with additional space for a minimum of four (4) 4 Amp/hour batteries providing battery back up when required. An integral battery charging circuit shall be standard. Provide key locking cover to prevent tampering.
   2. Basis of Design Product:
      a. Locknetics Security Engineering Model 510

L. Intumescent Seal: Intumescent seal shall comply with door and frame manufacturers for positive pressure tests for fire and smoke. (UBC 7-2, Parts 1 & 2/UL10C).
   1. Acceptable Manufacturers:
      a. Pemko.
      b. Reese.
      c. NGP.

2.3 FINISHES

A. Hardware finishes shall match and be maintained to BHMA symbols, as indicated in the Hardware Schedule. Strict adherence to base metals and finish is required.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.4 KEYING

A. Keying of locks and cylinders throughout project shall be scheduled through a key meeting with Architect, Owner, and hardware supplier. Key schedule shall be prepared and submitted to the Owner for approval. Copies of final key schedule with the bitting instructions shall be submitted as part of the Project Record Documents.

2.5 KEY CONTROL

A. Provide key cabinet(s) manufactured by of sufficient capacity to handle all keys, plus 50 percent expansion. Provide key control cross-reference chart and accountability (sign-out) tags.
   1. Acceptable Manufacturers:
      a. Telkee.
      b. Lund.
      c. Key Control Systems.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107 or ANSI A250.6, whichever is more stringent.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Installation shall be by a qualified installer with a minimum five (5) year's experience in the installation of commercial grade hardware. Manufacturer's instructions shall dictate templating and installation.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

D. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect prior to installation.

3.4 FIELD QUALITY CONTROL

A. Perform final inspection with hardware installer and hardware supplier present to ensure correct installation and operation, and check for any damaged or defective items. Observe and inspect that all hardware has been installed to its correct destination in proper working order.

B. Independent Architectural Hardware Consultant: Owner reserves the right to engage a qualified independent Architectural Hardware Consultant to perform a separate independent inspection and to prepare an inspection report.

3.5 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.
   1. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. At completion of the installation and prior to Final Acceptance, make final adjustments to door closures and other items of hardware. Leave all hardware clean and fully operable. Should any item be found to be defective, it shall be repaired or replaced as directed.

C. Occupancy Adjustment: Approximately three months after date of Final Acceptance, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Final Acceptance.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 MANUFACTURER'S ABBREVIATIONS

A. Abbreviations that could be used within Door Hardware Schedule.
1. ABH Architectural Builders Hardware
2. ADA Adams Rite
3. BES Best
4. HAG Haggar
5. IVE Ives
6. LCN LCN
7. LOC Locknetics
8. MCK McKinney
9. NGP National Guard Products
10. PEM Pemko
11. ROC Rockwood
12. ROT Roton
13. SAR Sargent
14. SCH Schlage
15. SDC Security Door Controls

16. SEC Securitron
17. SEL Select
18. STA Stanley
19. TRI Trimco
20. UNK Unknown
21. VON Von Duprin

3.9 HARDWARE SCHEDULE

Group 11

3 HINGES	TA2714 4 1/2 x 4 1/2	26D	MCK
1 LOCKSET	35H 7E 3H	626	BES
1 WALL BUMPER	409	US32D	ROC
3 DOOR SILENCER	GJ64	GRAY	GL

Group 16

Kerfed Frame

6 HINGES	T4A3786 4 1/2 X 4 1/2	26D	MCK
2 EXIT DEVICE	9547L-BE-F X LP373L-BE LBR 03	US26D	VON
2 CLOSER	4111 EDA	AL	LCN
2 PROTECTION PLATE	K1050 10" X 34"	US32D	ROC
2 MAGNETIC HOLDER	2120 24VAC/DC, 120 VAC	US28	ABH

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Interior borrowed lites.
   2. Glazing accessories.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
   2. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square.
      a. Insulating glass.
   3. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

B. Informational Submittals:
   1. Qualification Data: For Installer.
   2. Product Certificates: For glass.

3. Product Test Reports: For insulating glass, for tests performed by a qualified testing agency.
4. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: 10 years from date of Final Acceptance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. IGMA Publication for Insulating Glass: IGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
   1. Minimum Glass Thickness for Interior Lites up to 48-inches tall: 1/4-inch (6 mm).
   2. Minimum Glass Thickness for Interior Lites up to 96-inches tall: 3/8-inch (10 mm).
      a. Provide load charts or calculation to determine maximum allowable width of each lite.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Primary Float Glass (**GL-1 FL**)
   1. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
   2. Minimum Thickness: 6 mm.
      a. Products:
         1) AGC, clear float glass.
         2) Guardian, clear glass.
         3) Pilkington Libbey-Owens-Ford (LOF), clear glass
         4) Vitro Architectural Glass, clear glass.

B. Heat-Treated Clear Float Glass (**GL-1 HS, and GL-1 FT**)
   1. Heat Treated Float Glass: ASTM C1048, Condition A (uncoated); Quality-Q3 and as follows:
      a. Class: 1 (clear).
      b. Minimum Thickness: 6 mm.
      c. Kind: HS (heat strengthened).
      d. Kind: FT (fully tempered).
   2. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   3. For clear or low-iron glass 1/4 to 3/8-inch thick without ceramic frit or ink, maximum + or – 100 mD (millidiopter) over 95 percent of the glass surface.
   4. Maximum peak to valley rollerwave 0.003” (0.08mm) in the central area and 0.008-inches (0.20mm) within 10.5-inches (267mm) of the leading and trailing edge

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.
   1. Sealing System: Dual seal, with manufacturer's standard primary and silicone sealant complying with ASTM C1249 for secondary seal.
   2. Sealed Insulating Glass Units to be double sealed with a primary seal of polyisobutylene and a secondary seal of silicone complying with ASTM C1249.
      a. Minimum thickness of the secondary seal shall be 1/16-inch (1.59mm).
      b. Target width of the primary seal shall be 5/32-inch (3.97mm).
      c. No voids or skips in the primary seal allowed.

d. Up to a maximum of 3/32-inch of the air spacer may be visible above the primary polyisobutylene sealant.
e. Gaps or skips between primary and secondary sealant are permitted to a maximum width of 1/16-inch (1.59mm) by maximum length of 2-inches (51mm) with gaps separated by at least 18-inches (457mm). Continuous contact between the primary seal and the secondary seal is desired.

3. Spacer: Manufacturer's standard spacer material and construction .
4. Desiccant: Molecular sieve or silica gel, or a blend of both.

B. Basis of Design Products:
1. Glass (**Type GL-3**): Clear insulating glass.
a. Overall Unit Thickness: 1-inch (25 mm).
b. Thickness of Outer Glass Lite: 1/4-inch (6.0 mm).
1) Outdoor Lite: Clear, heat strengthened float, fully tempered where required or indicated (GL-1 FL or GL-1 HS)
c. Interspace Content: Air.
d. Thickness of Inner Glass Lite: 1/4-inch (6.0 mm).
1) Indoor Lite: Clear Heat strengthened float glass (GL-1 FL or GL-1 HS), fully tempered where required or indicated.
e. Provide safety glazing where required.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of 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).

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Grind smooth and polish exposed glass edges and corners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Minimum required face and edge clearances.
   3. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. 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.

D. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

E. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   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.

F. 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.

G. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

H. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

I. 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.

J. 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 (INTERIOR USE ONLY)

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant where indicated on Drawings.

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.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Final Acceptance. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

SECTION 08 87 33

GLAZING SURFACE FILMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Film products applied to glass surfaces to impart the following characteristics:
   1. Glazing surface films.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data: Submit for each product specified indicating:
      a. Performance properties.
      b. Preparation and installation instructions and recommendations.
      c. Storage and handling recommendations.
   2. Samples: For each type of film specified, 12 inches square.
   3. Qualification Data: Submit documentation indicating qualifications of film manufacturer.
   4. Operation and Maintenance Data: Submit for film to include in maintenance manuals.
   5. Warranty: Submit sample special warranty specified in this section.

B. Informational Submittals:
   1. Qualification Data: Submit documentation indicating qualifications of film manufacturer.
   2. Operation and Maintenance Data: Submit for film to include in maintenance manuals.
   3. Warranty: Submit sample special warranty specified in this section.

C. Closeout Submittals:
   1. Maintenance Data: For each type of films to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that has a minimum of (5) five years of documented experience manufacturing films similar to that used for this project.

B. Installer Qualifications: A firm that is authorized by film manufacturer to install film in accordance with guidelines set forth by the manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials in manufacturer's protective packaging.

B. Store and protect materials according to manufacturer's written recommendations to prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install films 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.

1.6 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to replace films that deteriorate within specified warranty period. Deterioration of film is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning film contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass.
   1. Warranty Period: 10 years from date of Final Acceptance.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Scratch Resistance: Decorative films shall average less than 12 percent increase in haze when tested according to ASTM D1044 using a Teledyne Taber Abrader using CS10F Type III wheels each loaded to 0.5 kg for 100 cycles in a 70 percent vacuum.
   1. Scratch resistance testing shall be performed by an independent third party agency.

B. Peel Strength: >2720 (>6) grams/inch of width when tested in accordance with ASTM D3330.

C. Surface Burning Characteristics: Provide films that have Flame Spread Index of 0 and Smoke Developed Index of 30 or less when tested in accordance with ASTM E84 ASTM E84.

D. Provide decorative films that do not have a masking sheet.

2.2 MANUFACTURERS

A. LLumar Films.

B. Solar Gard Window Films.

C. 3M Window Films.

D. Vista Window Films

E. Source Limitations: Obtain each type of film from same manufacturer.

2.3 GLAZING SURFACE FILMS

A. Decorative Film: Dimensionally stable, cast PVC film, 2-mil- (0.05-mm-) minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.
   1. Basis of Design Product: Refer to Finish Plan General Notes on Drawings.

2.4 GLAZING FILM ACCESSORIES

A. General: Provide accessories either manufactured by or acceptable to film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Pressure Sensitive Adhesive: This adhesive is activated by pressure and water. It is characterized by its permanently tacky nature and its installation ease.

C. Cleaners, Primers, and Sealers: Types recommended by film manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements and for conditions affecting performance of film including glass that is broken, chipped, cracked, abraded, or damaged in any way.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer’s written instructions for surface preparation.

B. Clean substrates thoroughly prior to installation.

C. Prepare substrates using methods recommended by film manufacturer to achieve the best results for the substrate under project conditions.

D. Protect window frames and surrounding surfaces to prevent damage during installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Install film continuously, but not necessarily in one continuous length. Install with no gaps or overlaps.

C. If seamed, make seams non-overlapping.

D. Do not remove release liner from film until just before each piece of film is cut and ready for installation.

E. Custom cut to the glass with neat, square corners and edges to within 1/8-inch of the window frame.

F. Remove air bubbles, blisters, and other defects. Be careful to remove "fingers" to eliminate any contamination or excess water pockets. It is crucial to remove as much water as possible during installation.

G. A final squeegee pass over the entire pane using a Blue Max Blade™ with an extended handle design (or Thor's Hammer™) is recommended.

3.4 FIELD QUALITY CONTROL

A. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, wrinkles, banding, thin spots or pinholes.

B. If installed film does not meet these criteria, remove and replace with new film.

3.5 CLEANING AND PROTECTION

A. Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended by film manufacturer.

C. Replace films that cannot be cleaned.

D. Protect installed products until completion of project.

E. Touch-up, repair or replace damaged products before Final Acceptance.

END OF SECTION

SECTION 08 91 21

FIXED DRAINABLE LOUVER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fixed, extruded-aluminum drainable louvers.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
      a. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
   2. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
      a. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
      b. Show mullion profiles and locations.
   3. Samples: For each type of metal finish required.
   4. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Informational Submittals:
   1. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
   1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable Louver:
1. Manufacturers:
a. Air Balance Inc.; a Mestek company.
b. All-Lite Architectural Products.
c. Construction Specialties, Inc.
d. Greenheck Fan Corporation.
e. Industrial Louvers, Inc.
f. Nystrom, Inc.
g. Ruskin Company; Tomkins PLC.
h. Basis of Design Product: ESD-435 Extruded Aluminum Stationary Drainable Louver by Greenheck Fan Corporation.
2. Louver Frame Depth: 4 inches (101.6 mm). Verify depth with existing conditions.
3. Frame and Blade Nominal Thickness: Not less than 0.081 inch (2.06 mm) for blades and 0.081 inch (2.06 mm) for frames.
4. Louver Performance Data:
a. Performance Ratings: Louver performance shall be certified in accordance with the AMCA 511 Certified Ratings Program when tested in accordance with AMCA 500-L Air Performance and Water Penetration.
1) Based on testing 48 inch by 48 inch (1219 mm by 1219 mm) size unit in accordance with AMCA 500.
b. Free Area: 55.8 percent.
c. Free Area Size: 8.92 sf (0.83 sm).
d. Intake AirflAirflow resistance at 1000 feet per minute free area intake velocity shall not be greater than 0.161 inch water gauge pressure drop.
e. Exhaust Airflow: Airflow resistance at 1000 feet per minute free area exhaust velocity shall not be greater than 0.14 inch water gauge pressure drop.
f. Beginning Point of Water Penetration: 989 ft/min.
g. Pressure Drop @ 6,000 CFM Intake: 0.07 in wg.
h. Max Intake Volume Flow Rate: 8822 cfm.
i. Exhaust Volume Flow Rate @ 0.15 in wg: 9219 cfm.
j. Wind Load: Louvers shall be designed and manufactured to withstand a minimum 25 pound per square foot.
5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
   2. Finish: Same finish as louver frames to which louver screens are attached.
   3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:
   1. Bird Screening: Aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.60-mm) wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
   3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel unless otherwise indicated.
      a. Glazing Frame: Glazing adapter(s) for installation in storefront / curtainwall.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
   1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

G. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, 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. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 - Joint Sealants for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
   1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior gypsum board.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data: Submit manufacturer's technical data for each type of gypsum board product, including related accessories. Furnish a material list with technical data documenting the location and primary function, quality, and performance of each material component or system to be used in the Work, or other such primary characteristics as required by the Drawings or Specifications.
      a. Submit manufacturer's technical data for each gypsum drywall partition.
   2. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install 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.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
   1. Conform to applicable code for fire rated assemblies. Construct assemblies to achieve fire resistance ratings indicated on Drawings in accordance with UL, GA, or other acceptable tested approved assemblies. Where no test number is referenced, utilize and submit a tested approved assembly that achieves the fire rating required by the Drawings, including the Life Safety Plan.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers:
   1. American Gypsum.
   2. CertainTeed Corporation.
   3. Georgia-Pacific Building Products.
   4. National Gypsum Company.
   5. USG (EcoSmart gypsum board products are acceptable).

B. Gypsum Board, Type X: ASTM C1396/C1396M.
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
   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. U-Bead: J-shaped; exposed short flange does not receive joint compound.
e. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints 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 compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.6 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Verify adhesives have a VOC content of 50 g/L or less.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

D. Electrical Box Pads: Putty Pads: Moldable non-curing one component, intumescent, fire-rated material for through-penetration fire stop systems and sound attenuation systems; self-adhering; 1/8-inch-thick minimum.
1. Acceptable Products:
a. CP 617 as manufactured by Hilti Incorporated.
b. Lowry Pads as distributed by Lowry’s Specialty Distribution.
c. Firestop Putty as manufactured by Specified Technologies, Inc. (STI)
d. 3M Fire Barrier as manufactured by 3M Fire Protection Products.

E. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. Thickness / STC Rating: As scheduled on Drawings.
   3. Manufacturers:
      a. CertainTeed; Sound Control Batts or Fire Batts.
      b. Johns Manville Sound Control Batts or Fire Batts.
      c. Knauf Insulation; EcoBatt with ECOSE Technology
      d. Owens Corning Company, SAB.
      e. Rockwool; Acoustical Fire Batts.
      f. Thermafiber, Inc.; an Owens Corning Company, SAFB.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

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 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. 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.

C. Locate edge and end joints over supports. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

D. Form control and expansion joints with space between edges of adjoining gypsum panels.

E. 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.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. 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.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. STC-Rated: 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 C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
1. Install electrical box pads after gypsum panels have been installed on one side. Comply with manufacturer instructions.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
1. Type X: Vertical surfaces unless otherwise indicated.

B. Single-Layer Application:
1. On partitions/walls, apply gypsum panels vertically (parallel 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 high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
2. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

2. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF GYPSUM PANELS FOR CEILINGS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect, unless otherwise indicated.

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.

3.6 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 and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Mechanical Rooms, Electrical Rooms, and similar spaces.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    a. Primer and its application to surfaces are specified in Section 09 91 23 - Interior Painting.
5. Level 5:
    a. At exposed locations utilizing glass mat interior gypsum board products and where required by another specification Section as preparation of wall.
    b. At all exposed drywall surfaces within main entrance hallways, elevator corridors, and areas scheduled to receive accent lighting or semi-gloss finishes, refer to room finish schedules for locations.
    c. At panel surfaces receiving gloss and semigloss enamels and other surfaces subject to severe lighting.
    d. Where indicated on Drawings.
    e. Primer and its application to surfaces are specified in Section 09 91 23 - Interior Painting.

3.7 PARTITION IDENTIFICATION

A. Wall Identification: Permanently label all fire-rated walls and smoke partition assemblies with the partition identification as defined below using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
2. Partition Identification Text: Apply the following according to partition ratings on Drawings, and as acceptable to authorities having jurisdiction:
    a. SMOKE PARTITION – PROTECT ALL OPENINGS.
    b. 1-HOUR SMOKE BARRIER – PROTECT ALL OPENINGS.
    c. 1-HOUR FIRE PARTITION – PROTECT ALL OPENINGS.
    d. 1-HOUR FIRE BARRIER – PROTECT ALL OPENINGS.
    e. 2-HOUR FIRE WALL – PROTECT ALL OPENINGS.
    f. 2-HOUR FIRE BARRIER – PROTECT ALL OPENINGS.
    g. 3-HOUR FIRE WALL – PROTECT ALL OPENINGS.
3. Refer to Section 09 91 23 - Interior Painting for painting. Use Semi-Gloss, Low-Odor paint.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. 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

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Acoustical panels and exposed suspension systems for interior ceilings.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
   2. Samples: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
      a. Acoustical Panels: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
      b. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.
   3. Delegated-Design Submittal: Ceiling systems including suspension system shall be designed under the direct supervision of a Professional Structural Engineer experienced in the design of the work and licensed in the State of North Carolina, using performance and design criteria, and requirements specified in this Section.

B. Informational Submittals:
   1. 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:
      a. Ceiling suspension-system members.
      b. Structural members to which suspension systems will be attached.
      c. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
      d. Size and location of initial access modules for acoustical panels.
      e. Items penetrating finished ceiling and ceiling-mounted items including the following:
         1) Lighting fixtures.
         2) Diffusers.

3) Grilles.
4) Speakers.
5) Sprinklers.
6) Access panels.
7) Perimeter moldings.

f. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
g. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

2. Qualification Data: For testing agency.
3. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
4. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
5. Field quality-control reports.

C. Closeout Submittals:
1. Maintenance Data: For finishes to include in maintenance manuals.

D. Maintenance Material Submittals:
1. 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.
a. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
b. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site 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.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, 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.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a Professional Structural Engineer licensed in the State of North Carolina, as defined in Section 01 40 00 - Quality Requirements, to design suspension system for ceiling systems.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E1264.
   2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS

A. Manufacturers:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corporation; Saint-Gobain North America.
   3. Rockfon (Rockwool International).
   4. USG Corporation.

B. Basis of Design Products: Ultima High NRC (.85) as manufactured by Armstrong World Industries, Inc.
   1. Material: Mineral based.
   2. Size: 24"x 24"x 1".
   3. Profile: Square lay-in

2.4 METAL SUSPENSION SYSTEM

A. Manufacturers:
   1. Armstrong Ceiling & Wall Solutions.
   2. CertainTeed Corporation; Saint-Gobain North America.
   3. Rockfon (Rockwool International).
   4. USG Corporation.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

C. Standard Exposed Tee Ceiling Systems:

1. Wide-Face (15/16-inch), Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges. Provide fire-resistance rated system where required.
   a. Structural Classification: Intermediate-duty system, or greater as otherwise required to comply with seismic regulations].
   b. End Condition of Cross Runners: Override (stepped) or butt-edge type.
   c. Face Design: Flat, flush.
   d. Cap Material: Cold-rolled steel.
   e. Cap Finish: Painted white, unless otherwise noted in Finish Plan General Notes on Drawings.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
   2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corporation; Saint-Gobain North America.
   3. Fry Reglet Corporation.
   4. Gordon, Inc.
   5. Rockfon (Rockwool International).
   6. USG Corporation.

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. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

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.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. 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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

C. 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.
   1. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure 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.

2. 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.
3. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
4. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

D. 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.

E. 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

G. 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 precise fit.
1. Arrange directionally patterned acoustical panels as follows:
a. As indicated on reflected ceiling plans.
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.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.5 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.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient wall base.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
   2. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.
   3. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

B. Informational Submittals:
   1. Test Reports: Pre-installation substrate moisture and alkalinity tests.

C. Closeout Submittals:
   1. Record Documents: Showing locations of substrate moisture and alkalinity tests. Provide markups on floor plan indicating the location of each test and the dates tests were performed.

D. Maintenance Material Submittals:
   1. 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.
      a. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.3 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).

1.4 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Final Acceptance, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Johnsonite; A Tarkett Company.
   2. Nora Systems, Inc., by Interface.
   3. Roppe Corporation, USA.

2.2 RESILIENT WALL BASE

A. Rubber Wall Base , as scheduled in Finish Plan General Notes: ASTM F 1861,
   1. Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

B. Minimum Thickness: 0.125 inch (3.2 mm) or as indicated in Finish Plan General Notes on Drawings.

C. Style: Cove.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length dependent on product scheduled.

F. Inside and Outside Corners:
   1. Preformed corners on 4-inch (102 mm) high base.

G. Colors: As indicated in Finish Plan General Notes on Drawings.

2.3 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Verify adhesives have a VOC content of 50 g/L or less and 60 g/L or less for rubber stair treads.

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Do not install resilient products 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 products and installation materials into spaces where they will be installed.

C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 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 practical 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 For 4-inch (102 mm) Base: Install preformed corners before installing straight pieces.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from surfaces.
   2. Sweep and vacuum horizontal surfaces thoroughly.
   3. Damp-mop horizontal 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 subject to wear and foot traffic until Final Acceptance.

END OF SECTION

SECTION 09 91 23

INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and the application of paint systems on interior substrates.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523 (traditional matte finish - flat).

B. Gloss Level 2: 5 to 10 units at 60 degrees and 10 to 25 units at 85 degrees, according to ASTM D523 (a high side sheen flat -"velvet-like" finish).

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523 (traditional "eggshell-like" finish).

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523 ("satin-like" finish).

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523 (traditional semi-gloss).

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523 (traditional gloss).

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523 (high gloss).

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of Paint System, submit product data cut sheets, including preparation requirements and application instructions.
      a. Formulate product data cut sheets into sets for each Paint System required.
   2. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
      a. Step coats on Samples to show each coat required for system.
      b. Label each Sample with Paint System designation.
      c. Label each Sample for location and application area.
      d. Dry samples a minimum of 7-days before submitting.

e. Submit Samples on the following substrates for the Architect's review of color and texture only:
   1) Concrete: Provide two 4-inch- (100-mm-) square samples for each color and finish.
   2) Painted Wood: Provide two 12-inch-(300-mm-) square samples of each color and material on hardboard.
   3) Ferrous / Galvanized Metal: Provide two 4-inch-(100-mm-) square samples of flat metal and two 8-inch-(200-mm-) long samples of solid metal for each color and finish.
   4) Gypsum Board / Plaster: Provide two 8-inches (200-mm) square samples on rigid backing.

3. Product List: For each product indicated, include the following:
   a. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   b. VOC content.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.

B. Manufacturers: The following manufacturers are referred to in the paint schedules by use of name or shortened versions of their names, which are shown in parenthesis:
   1. Benjamin Moore (B-M).
   2. PPG Paints (PPG)
   3. Sherwin-Williams (S-W)

2.2 PAINT, GENERAL

A. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.

C. Colors: Provide custom colors of the finished paint systems to match the Architect's samples.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
2. Masonry (clay and concrete masonry units): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that the finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" or "MPI Maintenance Repainting Manual" or more stringent instructions listed below applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair the bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel (Ferrous Metal) Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 3, "Power Tool Cleaning."

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized and Galvannealed Metal Substrates: Remove soluble and insoluble contaminants and corrosion. Remove any storage stains per Section 6.2 of ASTM D6386. Chemically treat with one of the following products in accordance with manufacturer's written instructions:
   1. Henkel Galvaprep 5.
   2. Great Lakes Laboratories Clean & Etch.

H. Wood Substrates:
   1. Sand surfaces that will be exposed to view, and dust off.
   2. Prime edges, ends, faces, undersides, and backsides of wood.
   3. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

A. General:
   1. Remove cracked and deteriorated sealants and calking.

2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.
3. Wash surfaces with solution of Trisodium phospate (TSP) to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.
4. Abrade glossy surfaces by sanding or wiping with liquid de-glosser.
5. Remove mildew as specified above.
6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, provide test results and recommendations from paint manufacturer to Architect.
7. Apply specified primer to surfaces scheduled to receive coatings.

B. Gypsum Board:
1. Fill cracks and voids with spackling compound.
2. Apply primer over bare surfaces and newly applied texture coatings.

C. Metal:
1. Remove rust from surfaces to bare metal in accordance with SP3 "Power Tool Cleaning."
2. Exercise care not to remove galvanizing.
3. Complete preparation as specified for new work.

D. Wood:
1. Fill cracks, crevices and nail holes with putty or wood filler.
2. Apply primer over bare surfaces and filler material.

3.4 APPLICATION

A. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
1. Painting includes identifying fire-rated wall assemblies with stenciled lettering above the ceiling. Provide stenciled block letters in red to identify each rated wall assembly. Refer to Section 09 29 00 - Gypsum Board.

B. Paint Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in occupied spaces:
a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.

g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Unfinished and primed louvers and grilles, covers,
i. Exposed and insulated pipes.
j. Factory primed equipment.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
a. Architectural woodwork and casework.
b. Metal lockers.
c. Finished mechanical and electrical equipment.
d. Light fixtures.
e. Panelboards and switch gear
2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
a. Furred areas.
b. Ceiling plenums.
c. Pipe spaces.
d. Duct shafts.
3. Finished metal surfaces include the following:
a. Anodized aluminum.
b. Stainless steel.
c. Chromium plate.
d. Copper.
e. Bronze and brass.

D. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items, equipment, furniture, etc. the same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items, equipment, furniture, etc with prime coat only.
3. Paint entire exposed surface of door frames.
4. Paint the front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
7. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material required. Confirm use of spray equipment is acceptable to building owner in occupied areas.

E. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

F. Tint undercoats same color as topcoat but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

G. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

H. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

J. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

K. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

3.5 FIELD QUALITY CONTROL

A. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

B. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 INTERIOR PAINT SCHEDULES

A. Concrete (Co) Substrates, Nontraffic Surfaces:
1. Paint System Co-L3: Latex, Eggshell Finish:
   a. B-M:
      1) First Coat: Ultra Spec Masonry Int/Ext Acrylic Sealer 608
      2) Second Coat: Ultra Spec 500 Interior Zero VOC Eggshell 538
      3) Third Coat: Same as second
   b. PPG:
      1) First Coat: Perma Crete Alkali Resistant Primer 4-603XI.
      2) Second Coat: Speedhide Interior ZERO Eggshell 6-5310.
      3) Third Coat: Same as second.
   c. S-W:
      1) First Coat: Loxon Concrete & Masonry Primer, LX02W0050.
      2) Second Coat: ProMar 200 Zero VOC Eg-Shel B20-2600 Series.
      3) Third Coat: Same as second.

B. Steel, Unprimed (Su) Substrates
1. Paint System Su-L5: Latex, Semigloss Finish:
   a. B-M:
      1) First Coat: Corotech Acrylic Metal Primer V110
      2) Second Coat: Corotech Acrylic DTM Enamel Semi-Gloss V331
      3) Third Coat: Same as second.
   b. PPG:
      1) First Coat: Pitt-Tech Plus 4020 PF Interior/Exterior Primer/Finish, 4020PF Series.
      2) Second Coat: PPG Pitt-Tech Plus EP Semi-Gloss DTM 90-1610 Series.
      3) Third Coat: Same as second.
   c. S-W:
      1) First Coat: Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series.
      2) Second Coat: Pro Industrial Acrylic Semi-Gloss, B66-650.
      3) Third Coat: Same as second.
2. Paint System Su-D1: Water-Based Dry-Fall, Flat Finish:
   a. B-M:

1) First Coat: Corotech Acrylic Metal Primer V110
2) Second Coat: Coronado Super Kote 5000 Dry Fall Latex Flat N110
3) Third Coat: Same as second.

b. PPG:
1) First Coat: Pitt Tech Plus 4020 PF Interior/Exterior Primer/Finish, 4020PF Series
2) Second Coat: Speedhide Super Tech Dry Fall 6-725XI
3) Third Coat: Same as second.

c. S-W:
1) First Coat: Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series.
2) Second Coat: Pro Industrial Waterborne Acrylic Dry Fall Flat, B42W1181.
3) Third Coat: Same as second.

C. Steel, Factory-Primed (Sp) Substrates

1. Paint System Sp-L5: Latex, Semigloss Finish:

a. B-M:
1) First Coat: Touch-up primer if compatible or provide barrier coat.
2) Second Coat: Corotech Acrylic DTM Enamel Semi-Gloss V331.
3) Third Coat: Same as second.

b. PPG:
1) First Coat: Touch-up primer if compatible or provide barrier coat.
2) Second Coat: PPG Pitt-Tech Plus EP Semi-Gloss DTM 90-1610
3) Third Coat: Same as second.

c. S-W:
1) First Coat: Touch-up primer if compatible or provide barrier coat.
2) Second Coat: Pro Industrial Acrylic Semi-Gloss, B66-650.
3) Third Coat: Same as second.

2. Paint System Sp-D1: Water-Based Dry-Fall, Flat Finish:

a. B-M:
1) First Coat: Touch-up primer if compatible or provide barrier coat.
2) Second Coat: Coronado Super Kote 5000 Dry Fall Latex Flat N110
3) Same as second.

b. PPG:
1) First Coat: Touch-up primer if compatible or provide barrier coat.
2) Second Coat: Speedhide Super Tech Dry Fall 6-725XI.
3) Third Coat: Same as second.

c. S-W:
1) First Coat: First Coat: Touch-up primer if compatible or provide barrier coat.
2) Second Coat: Pro Industrial Waterborne Acrylic Dry Fall Flat, B42W1181.
3) Third Coat: Same as second.

D. Steel, Galvanized (Sg) Substrates

1. Paint System Sg-D1: Water-Based Dry-Fall, Flat Finish:

a. B-M:
   1) First Coat: Ultra Spec HP Acrylic Metal Primer HP04
   2) Second Coat: Benjamin Moore Latex Dry Fall Flat 395
   3) Third Coat: Same as second
b. PPG:
   1) First Coat: Pitt Tech Plus 4020 PF Interior/ Exterior Primer/ Finish, 4020PF Series
   2) Second Coat: Speedhide Super Tech Dry Fall 6-725XI
   3) Third Coat: Same as second.
c. S-W:
   1) First Coat: Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series.
   2) Second Coat: Waterborne Acrylic Dry Fall, B42W1.
   3) Third Coat: Same as second.

E. Architectural Woodwork (Ww) Substrates
1. Paint System Ww-L5: Latex, Semigloss Finish:
   a. B-M:
      1) First Coat: Insl-x Prime Lock Plus Primer PS-8100
      2) Second Coat: Ultra Spec 500 Interior Zero VOC Latex Semi-Gloss 546
      3) Third Coat: Same as second
   b. PPG:
      1) First Coat: Seal Grip Latex Primer/Finish 17-951.
      2) Second Coat: Speedhide Zero Interior Semi-Gloss, 6-5510 Series.
      3) Third Coat: Same as second.
   c. S-W:
      1) First Coat: Multi-Purpose Acrylic-Alkyd Interior Primer, B79W00450.
      2) Second Coat: ProMar 200 Zero VOC Semi-Gloss Acrylic, B31-2600 Series.
      3) Third Coat: Same as second.

F. Gypsum Board (Gb) Substrates
1. Paint System Gb-L2: Latex, Eggshell Finish:
   a. B-M:
      1) First Coat: Ultra Spec 500 Zero VOC Interior Zero VOC Latex Primer N534
      2) Second Coat: Ultra Spec 500 Zero VOC Latex Eggshell N538
      3) Third Coat: Same as second.
   b. PPG:
      1) First Coat: Speedhide Zero Interior Sealer, 6-4900XI.
      2) Second Coat: Speedhide Zero Interior Eggshell, 6-5310 Series.
      3) Third Coat: Same as second.
   c. S-W:
      1) First Coat: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.

2) Second Coat: ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series.
3) Third Coat: Same as second.

2. Paint System Gb-L1: Latex, Flat Finish:
   a. B-M:
      1) First Coat: Ultra Spec 500 Zero VOC Interior Zero VOC Latex Primer N534.
      2) Second Coat: Ultra Spec 500 Zero VOC Interior Latex Flat N536.
      3) Third Coat: Same as second.
   b. PPG:
      1) First Coat: Speedhide Zero Interior Sealer, 6-4900XI.
      2) Second Coat: Speedhide Zero Interior Flat, 6-5110 Series.
      3) Third Coat: Same as second.
   c. S-W:
      1) First Coat: ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
      2) Second Coat: ProMar 200 Zero VOC Interior Latex Flat, B30-2600 Series.
      3) Third Coat: Same as second.

END OF SECTION

SECTION 10 14 24

PANEL SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Panel signs.

1.2 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors .
   1. Aluminum.
   2. High-pressure plastic laminates.
   3. Acrylic sheet.
   4. Polycarbonate sheet.

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Aluminum: For each form, finish, and color, on 6-inch- (150-mm-) long sections of extrusions and squares of sheet at least 4 by 4 inches (100 by 100 mm).
   2. Acrylic Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
   3. Polycarbonate Sheet: 8 by 10 inches (200 by 250 mm) for each color required.
   4. Panel Signs: Not less than 12 inches (305 mm) square including border.
   5. Accessories: Manufacturer's full-size unit.

E. Sign Schedule: Use same designations indicated on Drawings.

F. Qualification Data: For Installer and fabricator.

G. Maintenance Data: For signs to include in maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metal and polymer finishes beyond normal weathering.
      b. Deterioration of embedded graphic image colors and sign lamination.
   2. Warranty Period: Five years from date of Final Acceptance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. APCO Graphics, Inc.
2. ASI-Modulex, Inc.
3. Bunting Graphics, Inc.
4. Innerface Sign Systems, Inc.
5. InPro Corporation.
6. Takeform Architectural Graphics.

2.2 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction. Coordinate with NCSU Campus Signage Standards as provided by Owner: https://facilities.ofa.ncsu.edu/resources/campus-signage-standards/
1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

B. Code Required Signs: Provide signs as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
1. Fire Doors
2. Signs for stair locations and evacuation.

C. Graphic Content and Style: Provide sign copy that complies with requirements indicated for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.
1. Signs that designate permanent rooms and spaces and signs that provide direction to or information about functional spaces (and other signs required to comply) shall comply with the ADA.

D. Frameless Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:
1. Edge Condition: Square edge.
2. Corner Condition: Square.
3. Panel thickness: 1/8 inch.
4. Panel finish: Matte.
5. Letter Style: As selected by Architect.

2.3 MATERIALS

A. Cast-Acrylic Sheet: Cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet; sizes and thicknesses indicated; minimum flexural strength of 16,000 psi when tested according to ASTM D790; minimum allowable continuous service temperature of 176 degrees F.
   1. Clear sheet: Colorless transparent sheet, matte finish, with light transmittance of 92 percent when tested per ASTM D1003.
   2. Colored opaque acrylic sheet.

B. Colored Coatings for Acrylic Sheet: Use coatings, inks and paints for copy and background colors that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.
   1. Custom match background colors indicated on finish legend, or if not indicated, match Architect's samples.
   2. For reverse engraved text color, match embedded text color.

C. All interior signs, which require tactile copy and Grade II Braille shall be manufactured utilizing a 1/32-inch, raised engraved lettering.

D. The sign core shall be thermo-set composite polyester based resin, color impregnated of 1/4-inch thickness. The expansion co-efficient of the core and laminate shall be matched to prevent warping and delamination. An acrylic core shall not be acceptable.

E. Tactile lettering shall be precision machined, raised 1/32-inch, matte polycarbonate and (select subsurface colored for scratch resistance or foil stamped for a brushed metal appearance).

F. Signs shall incorporate a metal accent bar. Bars shall be dyed, brushed anodized (select aluminum, brass, bronze or black) .125-inch thick.

2.4 ACCESSORIES

A. Adhesive: As recommended by sign manufacturer.

B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

A. General: Provide signs of configurations indicated per NCSU Campus Signage Standards as provided by Owner:

   https://facilities.ofa.ncsu.edu/resources/campus-signage-standards/
   1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

B. Fabrication of signage assemblies shall be in accordance with approved shop drawings and manufacturers' recommendations .

C. All copies must be reproduced accurately and free from distortion. Round positive or negative corners, nicked or ragged edges are not acceptable. Arrows and symbols shall be reproduced exactly by photographic process and be submitted for approval prior to fabrication. The Sign Contractor is responsible for submitting and receiving approvals for any message layouts, which must be altered from specifications because of size constraints.

D. The signage system shall utilize standard, interchangeable components that can be used singly or in combination.

E. Manufacturer shall provide a Word template containing layout, font, color, artwork and trim lines to allow owner to produce inserts on a laser or ink jet printer.

F. The signage system shall incorporate a shim plate. The shim shall raise the sign off the wall allowing for cleaning and/or painting without removal.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Finishes are to meet current Federal ADA and any State requirements.

E. Copy shall be a true, clean, accurate reproduction of typeface(s) specified. Upper and lower case or all caps as indicated in Sign Type drawings and Signage Schedule. Letter spacing to be normal and interline spacing shall be set by manufacturer.

F. Arrows, symbols and logo art: To be provided in style, sizes, colors and spacing as shown in drawings.

G. Grade II Braille utilizing perfectly round, clear raster beads.

H. Primer coats or other surface pre-treatment where recommended shall be included.

I. Sign colors shall match approved samples and shall be exactly as specified in unit descriptions. Sign colors shall be consistent in chroma and value, and shall maintain proper opacity or translucency and shall be free of all imperfections.

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 work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
   1. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
   2. Shim Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
   3. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

C. Bracket-Mounted Signs: Provide manufacturer's standard brackets, fittings, and hardware for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

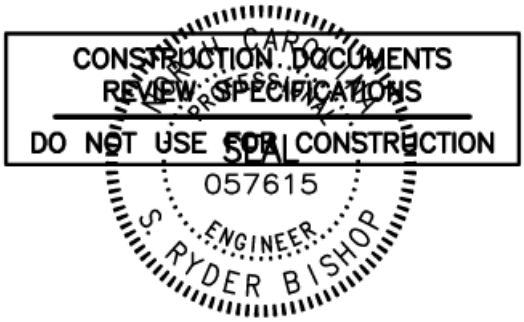
3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until Final Acceptance by Owner.

END OF SECTION

SECTION 210210 – FIRE SUPPRESSION SUMMARY OF WORK

Engineer of Record for fire suppression work is Ryder Bishop, PE, Salas O'Brien, 702 Oberlin Road, Suite 300, Raleigh, NC 27605. Fire suppression work shall be defined by drawings numbered with the prefix "FP", the general provisions of the Contract including General Conditions and Supplementary Conditions, Division 1 Specifications sections, and Division 21 Technical Specifications listed below. In addition, fire suppression work may be defined by reference to other documents from any of the above-named sources as well as by project addenda.



DIVISION 21 - FIRE SUPPRESSION

Section	Title
210210	Fire Suppression Summary of Work
210510	Fire Suppression Basic Requirements
210529	Fire Suppression Piping Hangers and Supports
210553	Fire Suppression Painting and Identification
211000	Sprinkler and Standpipe Fire Suppression Systems

END OF SECTION 210210

SECTION 210510 – FIRE SUPPRESSION BASIC REQUIREMENTS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

The requirements specified herein shall govern all Sections in Division 21, whether stated therein or not.

Where items specified in the various sections of this Division conflict with requirements of this Section, the former shall govern.

SUBMITTALS

Specific submittal requirements are defined in each section of this Division.

Welders' and Brazers' Qualifications: Operators who are to do the welding and/or brazing must be properly qualified to do satisfactory work. **Proof of an operator's qualifications shall be either the Contractor's record of suitable tests passed within the preceding six months while in the employ of the Contractor, or tests made before the start of work.** Submit qualification data for each operator prior to their starting work. Any workman considered by the A-E as not having the skill necessary for the work shall be required to pass an appropriate qualification test or shall be at once barred from further welding and/or brazing on the project.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END SECTION 210510

SECTION 210529 – FIRE SUPPRESSION PIPING HANGERS AND SUPPORTS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Testing Laboratory and FM Compliance: Provide products that are UL Listed or FM approved where required.

Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc. Standard Compliance: Comply with MSS SP-58 "Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation" for pipe hangers and supports.

NFPA Compliance: Comply with the requirements of the following, as applicable:

NFPA 13, *Chapter 9 – Hanging, Bracing and Restraint of System Piping*

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Provide spacing chart meeting NFPA 13 requirements

PART 2 - PRODUCTS

GENERAL

Hangers and supports for fire suppression piping and equipment shall withstand five times the weight of the weight of the water filled pipe plus 250 lb at each point of piping support stresses within limits and under conditions indicated according to ASCE/SEI 7.

Design supports for multiple pipes, including floor stands, to be capable of supporting combined weight of supported systems and system contents.

Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

Structural support elements shall be fabricated from standard structural shapes complying with ASTM A 36 and/or from preformed channel struts.

Preformed channel struts shall be sized to meet section moduli requirements of NFPA 13. Strut shall be made from steel meeting the minimum mechanical properties of ASTM A653 SS, Grade 33, G90 galvanized. Fittings shall be manufactured from steel meeting the minimum requirements of ASTM A907 SS, Grade 33. All fittings and hardware shall be zinc plated in accordance with ASTM B633, SC3 for fittings and SC1 for threaded hardware. Channel members shall be "Unistrut", Allied Support Systems "Power Strut", or Cooper B-Line Systems, Inc. "Strut System", specifically sized in accordance with the criteria hereinbefore specified.

Building attachments for hangers and supports shall be as indicated on the Drawings. Where attachments are not indicated, they shall be as follows:

Attachment To	Attachment Method(s)
Concrete	Bolt to channel-type concrete inserts or utilize expansion anchors. Size concrete housekeeping pads so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base. Drill at locations and to depths that avoid reinforcing bars.
Solid Concrete Masonry Unit Walls	Use expansion anchors.
Hollow Walls	Bolt to slotted steel channels fastened to wall with expansion anchors.
Wood Structural Members	Install bolts through members.
Steel	Bolt hangers to MSS Type 19, 21, or 23 clamps on flanges of beams or on upper truss chords of bar joists. **To avoid stressing building steel structural elements, provide additional steel support members that span at least two beams or bar joists as required or as shown on the Drawings.** Attach additional steel support members via welding in accordance with AWS standards.

HORIZONTAL PIPING HANGERS AND SUPPORTS

Except as otherwise indicated, provide factory-fabricated adjustable steel clevis or swirl ring hangers complying with MSS SP-58, Type 1. Select size of hangers and supports to exactly fit pipe size for bare piping.

For exterior and wet/damp locations, hangers and rods are to be hot dipped galvanized.

Outdoors: Hangers and struts located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.

Corrosive Area Finishes: Hangers and struts located in corrosive areas shall be type 304 stainless steel with stainless steel hardware.

VERTICAL PIPING CLAMPS

Provide factory-fabricated riser clamps complying with MSS Type 8 to support vertical piping systems. Select size of vertical piping clamps to exactly fit pipe size of bare pipe.

PART 3 - INSTALLATION

Install piping supports with maximum spacing and all-thread hanger rods sized in accordance with NFPA 13.

END OF SECTION 210529

SECTION 210553 – FIRE SUPPRESSION PAINTING AND IDENTIFICATION

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions.

PART 2 - PRODUCTS

PAINT FOR FERROUS SURFACES

Primer: 1 coat of fast drying, low VOC acrylic modified medium oil alkyd universal primer

Finish Paint: 2 coats of fast drying, low VOC alkyd gloss enamel

PIPE LABELS

Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1, except as hereinafter specified. Provide full-band pipe markers, extending 360 degrees around pipe at each location that attach without fasteners or adhesives.

Content: Provide minimum 1-1/4" high lettering to identify piping service using the same designations and abbreviations used on the Drawings. Include arrow indicating flow direction(s). Steam lines shall indicate pressure.

VALVE TAGS

Brass Valve Tags: Provide 0.032" thick polished brass valve tags, minimum 1-1/2" diameter, 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.

Valve Tag Fasteners: Provide 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.

PART 3 - EXECUTION

PAINTING

Equipment specified in other sections of Division 21 to be provided with factory-applied finish painting shall not be field-painted. All finish painted equipment shall be touched up where factory paint is chipped, scratched, or otherwise damaged.

All equipment not factory finish painted shall be furnished in prime coat. All prime coated equipment shall be touched up where prime coats are chipped, scratched, or otherwise damaged. All prime coated equipment shall be thoroughly cleaned and left ready for finish painting.

All welds on piping shall be painted with one coat of primer. Miscellaneous black steel items such as hangers and rods, machinery supports, breechings and stacks, etc., that are not shop primed, shall be field painted with one coat of primer. All metal surfaces shall be thoroughly cleaned of rust and dirt and shall be degreased before application of primer.

Equipment and steel piping located in mechanical equipment rooms and spaces where equipment and piping is exposed to view shall be finish painted as specified above. **DO NOT PAINT CPVC PIPING**. Where indicated or specified, existing equipment, piping, etc., shall be cleaned and painted along with new work.

Exposed To View Non-Mechanical Spaces: Architect/Owner to select colors for finish painting.

Exposed To View Mechanical Spaces: If the Owner has an existing color schedule, the Contractor shall utilize these colors for all finish painting. Otherwise, finish colors shall be as follows:

Item	Label/Paint Color	Text Color	Identification
Piping	Bright Red	White	FS
Equipment	Bright Red	White	Refer to drawings
All Other	ANSI A13.1-2007		

PIPING IDENTIFICATION

Provide pipe labels as follows wherever piping is exposed to view in finished spaces, in equipment rooms, in accessible maintenance spaces (shafts, tunnels, plenums), or concealed above lay-in ceilings. Label piping installed outdoors that is exposed to view.

Near each valve and control device.

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.

Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
At access doors, manholes and similar access points which permit view of concealed piping.

Near major equipment items and other points of origination and termination.

Spaced at maximum spacing of 25' along each piping run.

VALVE IDENTIFICATION

Provide valve tag on every valve, cock and control device in each piping system; exclude check valves.

List each tagged valve in valve schedule for each piping system. Mount valve tag schedule in a frame with a glass cover in the primary mechanical room and include schedule(s) as part of the operating and maintenance data defined in Section 019913.

END OF SECTION 210553

SECTION 211000 – SPRINKLER AND STANDPIPE FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

QUALITY ASSURANCE

Installer Qualifications: Installation and alterations of fire suppression piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified means experienced in such work (experienced shall mean having a minimum of 5 previous projects similar in size and scope to this project), familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to A/E.

NFPA Compliance: Comply with the requirements of the following, as applicable:

NFPA 13, *Standard for the Installation of Sprinkler Systems*

NFPA 25, *Inspection, Testing and Maintenance of Water-Based Fire Suppression Systems*

NFPA 72, *National Fire Alarm Code*

Testing Laboratory and FM Compliance: Fire suppression system materials and components shall be Listed and Labeled, and Factory Mutual approved for the application anticipated.

North Carolina State Construction Office (SCO) Compliance: Comply with the SCO *Water Based Fire Protection Systems Guidelines and Policies,* dated April 30, 2020.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Include each type sprinkler head, valve, piping specialty, fire suppression specialty, fire department connection, hose and rack, and hose cabinet specified.

Shop Drawings: Submit drawings which have been prepared in accordance with NFPA 13 identified as "Working Plans," which have been approved by the authority having jurisdiction.

Provide a summary list for spare sprinklers per NFPA 13 requirements and include with submittal.

State of North Carolina Shop Drawings Review: The A/E has primary responsibility for review and approval of fire suppression system shop drawings and shall determine compliance with applicable codes and standards and the project contract documentation. However, after completing this review, the A/E will send one (1) copy of the shop drawings, including A/E review comments, to the State Construction Office (SCO) for additional review. Once all comments are resolved and approved by SCO, an approval letter from SCO releasing this part of project to enter into construction will be sent to the A/E.

Test Reports and Certificates: Include "Contractor's Material & Test Certificate for Aboveground Piping" and "Contractor's Material & Test Certificate for Underground Piping" as described in NFPA 13.

SYSTEM(S) DESCRIPTION

Provide water-based fire suppression systems as follows:

Fire suppression system is a "Wet-Pipe" system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by fire.

DESIGN CRITERIA AND PERFORMANCE REQUIREMENTS

Fire Protection design drawings issued by the A/E shall be considered as preliminary design documents that establish the performance requirements and design criteria for fire suppression sprinkler and/or standpipe systems. **Responsibility for design of fire suppression sprinkler and/or standpipe system(s), including comprehensive engineering analysis by a qualified professional engineer or a NICET Certified Level III technician, using performance requirements and design criteria hereinafter specified, is delegated to the Contractor.** When prepared in accordance with approved design standards by a professional engineer, documents shall be sealed and signed. Since NICET does not authorize seals or stamps for Technicians, documents prepared in accordance with approved design standards shall bear the signature, date, NICET certification title and number of the Technician taking responsibility for the work.

Piping System and Component Working Pressure: Standard pressure sprinkler system components, listed for at least 175 psig.

PART 2 - PRODUCTS

PIPE AND FITTINGS

Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

Pipe and fittings shall be listed for use as fire sprinkler piping.

STEEL PIPE AND FITTINGS

All steel standpipe and sprinkler pipe shall include FM-approved MIC inhibiting coating.

Steel pipe shall comply with ASTM A53, Type E, Grade B for 4" and larger and ASTM A53, Type F, Grade A for 3" and smaller, black for wet pipe systems and galvanized for dry pipe, deluge, and preaction system pipe must be galvanized, as well as any fittings exposed to ambient air conditions.

Provide Schedule 40 steel pipe, sizes 2" NPS and smaller. Provide no less than Schedule 10 steel pipe, sizes 2-1/2" NPS and larger. Schedule 10 steel pipe is permitted to be used **only** with listed rolled or swaged groove joints. **Schedule 5 pipe in any size is prohibited.**

All fittings must be listed or approved for the specific pipe and type of system they are used on. For gasketed fittings, install only with the lubricant with which manufacturer obtained listing.

The following joining methods are acceptable to the extent permitted by listings, except threading is accepted for use only on Schedule 40 and heavier pipe and **cut grooves are prohibited**:

Threading

Shop Welding

Roll or Swage Groove with Gasket Fitting

Plain end, hooker, press-on, key type, or slip fittings are prohibited.

Grooved mechanical pipe couplings and fittings for use with rolled or swaged groove carbon steel pipe as hereinbefore specified shall be rated for water service up to 175 psig. All grooved products, fittings and couplings, must be of the same manufacturer and shall be listed for fire suppression service and shall be UL/FM approved. **Joints shall be rigid type.**

Couplings: Malleable iron, ASTM A47 or ductile iron, ASTM A536, fabricated in two or more parts, securely held together by two or more track-head, square, or oval-neck bolts, ASTM A449 and A183.

Gaskets: Rubber product recommended by the coupling manufacturer for the intended service.

Fittings: Malleable iron, ASTM A47; ductile iron, ASTM A536; or steel, ASTM A53 or A106, designed to accept grooved mechanical couplings.

FIRE PROTECTION VALVES

Trim and Drain Valves, 2" and Smaller: Provide with screw ends.

Ball Valves: Shall have approval rating of 175 psi WWP or greater. Valve to have TFE seats, blowout-proof stem and lever handle. Valve to be Underwriters laboratories listed and Factory Mutual Approved for trim and drain service and in compliance with ANSI/MSS-SP110.

Globe/Angle Valves: Shall have approval rating of 175 psi WWP or greater. Valves to have rubber seat disc and to be UL/FM listed and approved for trim and drain service.
Check Valves: To be rated 175 psi or greater. Valves to have rubber seat discs, be of Y-pattern horizontal swing-type, and shall be in compliance with ANSI/MSS-SP80.

AUTOMATIC SPRINKLERS

Sprinkler Heads: Glass bulb or fusible link type, style as indicated or required by the application. Unless otherwise indicated, provide heads with nominal 1/2 inch discharge orifice, for "Ordinary" temperature range. Heads shall be rated and listed for “quick response”.

Provide escutcheon plate for each ceiling or wall head.

Sprinkler Head Finishes: Provide heads with the following finishes:

Upright, Pendent, and Sidewall Styles: Chrome plated in finish spaces, exposed to view; rough bronze finish for heads in unfinished spaces and not exposed to view.

Recessed Style: Bright chrome, with bright chrome escutcheon plate.

PART 3 - EXECUTION

SPRINKLER APPLICATIONS

Sprinkler heads installed in suspended ceilings shall be recessed or concealed pendant type.
Sprinklers installed in areas without ceilings shall be upright type.

Provide sprinkler head guard for heads installed in janitor closets, equipment rooms, gymnasiums, and other spaces where there is potential for damage. Provide sprinkler head guard for all heads located 7 feet or less to the floor.

PIPING APPLICATIONS

Piping after the backflow preventer shall be Steel.

PIPING INSTALLATION

Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated.

Deviations from approved "Working Plans" for sprinkler piping, require written approval of the authority having jurisdiction. Written approval shall be on file with the A/E prior to deviating from the approved "Working Plans".

Install sprinkler piping to provide for system drainage in accordance with NFPA 13. Provide drain piping to discharge at safe points not greater than 2'-0" above finished grade outside building.

Provide auxiliary drains as required by NFPA 13. In addition, provide a permanently piped drain/test connection at each flow switch.

Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

In addition to the requirements specified in Section 210529, comply with the requirements of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions for rigid systems.

STEEL PIPE INSTALLATION

Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:

Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.

Align threads at point of assembly.

Apply appropriate tape or thread compound to the external pipe threads.

Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.

Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

Mechanical Grooved Joints: Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

SPRINKLER HEAD INSTALLATION

Use proper tools to prevent damage during installations.

Wet pipe sprinkler head connections shall be made only from the top of supply piping to eliminate potential sediment clogging.

Use return bends or swing joints to ceiling pendent sprinklers to facilitate centering of sprinklers in ceiling tiles. ***The use of corrugated or braided flexible sprinkler connectors is prohibited.***

FIELD QUALITY CONTROL

Flush, test, and inspect underground water supply piping in accordance with Section 211115.
Flush, test, and inspect sprinkler piping systems in accordance with NFPA 13.

Flush, test, and inspect standpipe systems in accordance with NFPA 14.

Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

INSTALLATION, TEST, AND CERTIFICATION

All sprinkler valves and controls must be located for safe and convenient access during emergencies and testing. Control valves shall not be located above ceilings.

Identify each valve and control with a prominent engraved phenolic or stamped metal placard.

Any such devices that are behind access doors or panels must also have their location made known by an appropriate placard on the means of access.

The contractor shall thoroughly inspect the completed system to assure compliance with this document, project plans and specs, and applicable Codes and Standards. This shall include an operational test of each waterflow alarm switch and all system supervisory devices (valve tamper, hi-low air pressure, pump status, etc) **in coordination with the fire alarm system subcontractor**.

Pressure tests shall be done with all sprinkler heads installed. System shall be tested in accordance with NFPA 13 or NFPA 14, as applicable. Any leak shall be repaired by remaking of leaking joint and the system shall be retested until no leaks occur.

Where an existing sprinkler system is being expanded or renovated, the contractor shall be responsible for the integrity of all new piping plus existing piping within three feet of new or renovation work.

Prior to the final inspection by the AHJ and/or the owner's representative, complete and submit three (3) copies each of the NFPA-required certificates for aboveground and underground piping.

EXTRA MATERIALS

Furnish to Owner two (2) valve wrenches for each type of sprinkler head installed.

Furnish extra sprinkler heads of each style included in the project, per the following table. Furnish each style with its own sprinkler head cabinet and special wrenches as specified in this Section.

Less than 20 sprinklers	2

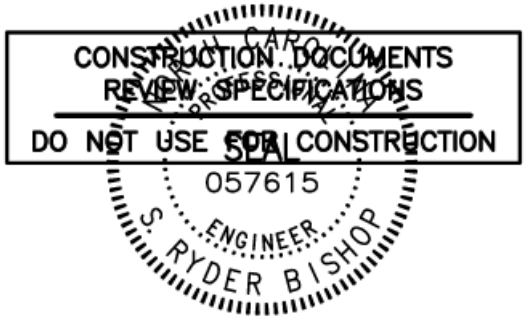
OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 211000

SECTION 230210 – HVAC SUMMARY OF WORK

Engineer of Record for Heating, Ventilating, and Air-Conditioning work is S. Ryder Bishop, PE, Salas O'Brien, 702 Oberlin Road, Suite 300, Raleigh, NC 27605. Heating, Ventilating, and Air-Conditioning work shall be defined by drawings numbered with the prefix "H-", the general provisions of the Contract including General Conditions and Supplementary Conditions, Division 1 Specification sections, and Division 23 Technical Specification sections listed below. In addition, Heating, Ventilating, and Air-Conditioning work may be defined by reference to other documents by any of the above-named sources as well as by project addenda.



DIVISION 23 - HVAC TECHNICAL SPECIFICATIONS

Section	Title
230210	HVAC Summary of Work
230510	HVAC Basic Requirements
230511	Electrical Provisions for HVAC Work
230513	Electrical Motors for HVAC Equipment
230517	Sleeves and Sleeve Seals for HVAC Piping
230529	Hangers and Supports for Piping, Ductwork & Equipment
230548	HVAC Vibration Control
230553	HVAC Painting and Identification
230593	HVAC Testing, Adjusting, and Balancing
230596	HVAC Systems Commissioning
230713	HVAC Duct Insulation
230719	HVAC Piping Insulation
230913	Instrumentation and Control Devices for HVAC
230923	Extension of Existing Direct Digital Control System for HVAC
232113	Above Ground Hydronic Piping
232300	Refrigerant Piping
233100	HVAC Ductwork
233300	Air Duct Accessories
233416	Centrifugal HVAC Fans
233713	Diffusers, Registers, and Grilles
234113	Particulate Air Filtration, Low Efficiency (MERV 6-8)
234123	Particulate Air Filtration, Medium Efficiency (MERV 9-16)
236200	Packaged Condensing Units
237311	Blower-Coil Air-Handling Units, Indoor or Outdoor
238216	Air Coils

END OF SECTION 230210

SECTION 230510 – HVAC BASIC REQUIREMENTS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

The requirements specified herein shall govern all Sections in Division 23, whether stated therein or not.

Where items specified in the other sections of this Division conflict with requirements of this Section, the former shall govern.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Submit Welder's and Brazer's Qualifications in accordance with Section 019913. Welders' and Brazers' Qualifications: Operators who are to do the welding and/or brazing must be properly qualified to do satisfactory work. **Proof of an operator's qualifications shall be either the Contractor's record of suitable tests passed within the preceding six months while in the employ of the Contractor, or tests made before the start of work.** Submit qualification data for each operator prior to their starting work. Any workman considered by the A-E as not having the skill necessary for the work shall be required to pass an appropriate qualification test or shall be at once barred from further welding and/or brazing on the project.

EQUIPMENT SELECTION

Pump heads and fan static pressures indicated on the Drawings are for estimating purposes and are based on the individual equipment losses as indicated. If the Contractor proposes using equipment, components, pipe or duct routing, etc. that will increase the pump heads and/or fan static pressures, any required pump or fan changes, along with associated motor and power wiring changes, shall be at the Contractor's expense.

TEMPERATURE AND HUMIDITY CRITERIA

Indoor temperature and humidity conditions in occupied spaces, unless specifically specified or indicated otherwise on the Drawings, shall be maintained as follows:

Space/ Area	Indoor Air Condition	Occupied Periods	Unoccupied Periods
General occupied spaces	Dry Bulb Temperature	70-77 deg F	55 deg F, Minimum 85 deg F, Maximum
	Relative Humidity	30-60% RH	65% RH Maximum

INDOOR AIR QUALITY CRITERIA

Indoor air quality shall conform to the following maximum limits averaged over an 8 hour period:

Formaldehyde: <20 μg /m^3

Sum of VOCs: <200 μg /m^3
Carbon Monoxide: <9 ppm

Airborne Mold and Mildew: The species identified in indoor air cannot exceed by more than 10% those identified from exterior samples.

Particulates (PM10): <150 μg/m^3

Particulates (PM2.5): <35 μg/m^3

Ozone: <0.075 ppm

ACOUSTIC CRITERIA

Noise levels due to HVAC equipment, ducts, grilles, registers, diffusers, etc., shall result in maximum sound levels in occupied spaces conforming to the following Room Criteria (RC):

Max. RC	Environment	Typical Occupancy
25	Extremely quiet environment, suppressed speech is audible, suitable for acute pickup of all sounds.	Broadcast or recording studios, concert halls, music rooms, bedrooms, special classrooms for the very young or hearing impaired, etc.
30	Very quiet, suitable for large conferences; telephone use satisfactory; sleeping unimpaired.	Residences, hotel or hospital sleeping rooms, theaters, auditoriums, libraries, executive offices, directors' rooms, large conference rooms, etc.
35	Quiet, suitable for conference at 15 ft. table; normal voice 10-30 feet; telephone use satisfactory.	Private offices, school cafeterias, court rooms, churches, small conference rooms, etc.
40	Satisfactory for conferences at 6-8 ft. table; normal voice 6-12 ft.; telephone use satisfactory	General (open) offices, school corridors, laboratories, restaurants, etc.
45	Satisfactory for conferences at 4-5 ft. table; normal voice 3-6 ft., raised voice 6-12 ft; telephone use is somewhat difficult.	Retail stores, cafeterias and fast food dining, lobbies or public areas, etc.
50	Unsatisfactory for conferences; normal voice 1-2 ft., raised voice 3-6 ft.; telephone use is difficult.	Workshops, machine rooms, industrial process areas, etc.

For classrooms for primary education, colleges and universities, training facilities, etc., HVAC systems and their components shall be selected/installed to comply with ANSI Standard S12.60.

Outdoor HVAC equipment shall be selected, located, and oriented to limit the "Equivalent Sound Level" (LA_{eq},T) A-scale sound pressure level (dBA), averaged over T=16 hours, to 50 dBA or less at the site boundary or at a distance of 100 feet, whichever is closer to the equipment.

VIBRATION CRITERIA

Unless indicated otherwise on the Drawings for building areas, vibration transfer to the building structure in each octave band, directly or indirectly, from HVAC equipment shall be limited to comply with the following, where "curve" indicates the applicable vibration criteria curve shown in Fig. 41, Chapter 48, *2007 ASHRAE Handbook, HVAC Applications*:

Occupancy Type	Curve
Workshops, machine rooms, industrial process areas, etc.	Workshop
Retail stores, commercial cafeterias and fast food dining, lobby or public areas, general (open) offices, school corridors, restaurant and entertainment facilities, etc.	Office
Private offices, school cafeterias, court rooms, churches, conference rooms, residences, general classrooms, theaters, libraries, executive offices, directors' rooms, hospital patient care areas, etc.	Residential, Night
Hospital operating rooms and critical care areas, etc.	Operating Room
Research laboratories, etc.	VC-A, Research Laboratory
Vibration sensitive equipment or procedure areas	VC-A through VC-E, as indicated on the Drawings

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

Contractor and Subcontractor representatives shall have the expertise and authority to act on behalf of their organizations and shall participate in and perform commissioning process activities including, but not limited to, the following:

Integrate and coordinate commissioning process activities into construction activities and schedules.

Attend and participate in Commissioning Team meetings specified in Division 1.

Complete construction checklists as work is completed and submit to Commissioning Authority.

Accomplish commissioning process test procedures and prepare test reports as specified by the Commissioning Authority.

Evaluate performance deficiencies identified in test reports and recommend corrective action.

PIPING WELDING/BRAZING/SOLDERING

High Pressure Piping (above 15 Psig):

Steam piping systems shall be fabricated, assembled and welded in accordance with ASME B31.1, and Power Piping Codes PFI ES 1, PFI ES 3, PFI ES 7, PFI ES 21, PFI ES 31, PFI ES 35, and PFI TB1 of the Piping Fabrication Institute's companion code requirements.

Refrigeration piping systems shall be fabricated, assembled and welded/brazed/soldered in accordance with the ASME B31.5.

Low Pressure Piping (15 Psig or below):

Copper make-up water and drainage piping systems shall be fabricated, assembled and brazed/soldered in accordance with ASTM B828.

Other low pressure piping including steam systems shall be fabricated, assembled and welded/brazed/soldered in accordance with the ASME B31.9.

Non-Destructive Inspection and Testing: A/E shall visually inspect pipe welds. Based on visual inspections, upon order of the A/E, non-destructive testing of selected pipe welds shall be performed by a qualified testing agency, at the expense of the Owner, using one of the following methods selected by the A/E. The welds inspected shall be selected randomly, but the selection shall include an examination of welds made by each welding operator or welder.

Radiographic testing in accordance with ASTM E 94:

Make identification of defects by comparing radiographs to reference radiographs in ASTM E 390.

Film shall positively and properly identify as to member being inspected, location of weld, and location of film on weld.

Stamp identification on steel so film may be easily identified and matched to identification mark.

Ultrasonic testing in accordance with ASTM E 164:

Size of defects will be determined by relating amplitude of oscilloscope traces to hole in ASTM reference weldment.

Diameter of reference holes shall be 3/32-inch.

Weld defects which are cause for rejection include cracks, lack of fusion, incomplete penetration, porosity, or slag inclusions which produce reflections equal to or greater than 80 percent of reference hole reflection and have linear dimensions as indicated by transducer movement exceeding 1/4-inch for material thickness up to and including 3/4-inch.

Correction of Defective Welds: If random testing reveals that **any welds** fail to meet minimum quality requirements, an additional 10 percent of the welds in that same group shall be inspected at the Contractor's expense. If all of the additional welds inspected meet the quality requirements, the entire group of welds represented shall be accepted and the defective welds shall be repaired. If any of the additional welds inspected also fail to meet the quality requirements, that entire group of welds shall be rejected. At the Contractor's option, the rejected welds shall be removed and the joints rewelded or the rejected welds shall be 100 percent tested as hereinbefore specified and all defective weld areas removed and rewelded.

OPERATION OF HVAC SYSTEMS

The use of permanent HVAC systems to support general construction activities is prohibited. The need for heating, cooling, dehumidification, and/or ventilation during construction by the General Contractor or any project sub-contractor shall be met via use of temporary HVAC units or systems, as specified in Division 01, provided by the contractor(s) having the need.

HVAC equipment, subsystems, and/or systems may be started and temporarily operated as necessary to perform the work, testing, balancing, and/or verification as specified in various sections of Division 23. Air systems shall be started **only** after general construction activities in the areas served by the air systems are such that there is low risk of contamination and/or degradation to the system. Generally, the following construction status is required within the entire area served by an individual air system:

Floor/wall/ceiling preparation that requires sanding or other dust producing work is complete.

Wall/ceiling surfaces required to be painted shall at least have one coat of primer applied.

Ceiling spray-on decorative or acoustical coatings, where specified, are complete.

Lay-in ceilings, where specified, have been installed.

Floors finishes (tile, carpet, paint, etc.) shall be complete.

Dust-producing outdoor (site) work has been completed.

During temporary operation of air systems, the following additional measures are required:

Filters shall be installed in fan coil units, air handling units, etc., as specified in Sections 234113 and 234123, as applicable.

Install temporary roll media filters (minimum MERV 13) over each air inlet (return or exhaust). Temporary filters shall be replaced regularly in order to minimize pressure losses impose on fans.

Windings of open, drip proof electric motors shall be cleaned using low pressure compressed air at the end of each 72 hours of operation.

Once HVAC systems verification/commissioning has been completed, air systems shall be shut down, temporary filters removed, and air handler filters replaced with new unless specifically directed otherwise by the A-E. **Only upon receipt of written approval by the A-E shall HVAC systems be placed into final service prior to Substantial Completion of the Project.**

END OF SECTION 230510

SECTION 230511 - ELECTRICAL PROVISIONS FOR HVAC WORK

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

The requirements specified herein shall govern all Sections in Division 23, whether stated therein or not.

Where items specified in the other sections of this Division conflict with requirements of this Section, the former shall govern.

DESCRIPTION OF WORK

Work includes, but is not necessarily limited to the following:

Provide electrical heating coils and similar elements in mechanical equipment.

Provide motor starters for furnished equipment where starters are required for the intended application when **not provided under Division 26**. Starters shall be sized in accordance with the latest edition of the National Equipment Manufacturers Association (NEMA) standard ratings for magnetic starters, and the *National Electrical Code* (NEC).

NEMA Starter Sizes for Motors					
NEMA Starter Size	Maximum HP for System Voltage (V)/ Phase (PH)				
	120V/1PH	240V/1PH	208V/3PH	240V/3PH	480V/3PH
00	1/3	1	1-1/2	1-1/2	2
0	1	2	3	3	5
1	2	3	7-1/2	7-1/2	10
2	3	7-1/2	10	15	25
3	7-1/2	15	25	30	50
4	-	-	40	50	100

Provide disconnect switches for all furnished equipment. Disconnect switches shall be sized in accordance with the latest edition of the NEC for single motor applications as follows:

Disconnect Switch Sizes for Motors						
Switch Rating Amps (A)	Maximum HP at System Voltage (V))/ Phase (PH)					
	120V/1PH	208V/1PH	240V/1PH	208V/3PH	240V/3PH	480V/3PH
30A	1-1/2	3	3	5	7-1/2	15
60A	3	7-1/2	10	15	15	30
100A	5	10	10	25	25	60
200A	-	-	-	50	60	100
400A	-	-	-	100	125	250
600A	-	-	-	150	200	400

Disconnect switches shall be sized for all other applications based on total kW rating of the equipment as follows:

Disconnect Switch Sizes for Equipment							
Switch Rating Amps (A)	Maximum kW at System Voltage (V)/ Phase (PH)						
	120V/ 1PH	208V/ 1PH	240V/ 1PH	277V/ 1PH	208V/ 3PH	240V/ 3PH	480V/ 3PH
30A	2.8	5.0	5.8	6.6	8.6	10.0	19.9
60A	5.8	10.0	11.5	13.3	17.3	19.9	39.9
100A	9.6	16.6	19.2	22.2	28.8	33.2	66.4
200A	19.2	33.3	38.4	44.3	57.6	66.4	132.9
400A	38.4	66.6	76.8	88.6	115.1	132.9	265.7
600A	57.6	99.8	115.2	133.0	172.7	199.3	398.6

Dual element fuses shall be provided with disconnect switches. Fuses shall be sized based on the nameplate rating for the equipment.

Equipment enclosures for disconnect switches, starters, variable frequency drives, control panels and any other panel enclosures housing electrical equipment shall be rated based on NEMA standard ratings. Panel enclosures shall be suitable for the environment in which they will be installed. Unless noted otherwise, provide NEMA rated enclosures based on the following environment conditions:

NEMA Enclosure Ratings for Electrical Equipment	
NEMA Type	Environment Condition
1	Indoors only, dry, low dust, and non-corrosive environment
3R	Outdoors, weatherproof and rainproof
4	Outdoors, watertight and raintight
4X	Same as 4 plus corrosion resistant
7	Hazardous locations Class I, Groups A, B, C, or D
9	Hazardous locations Class II, Groups E, F, or G
12	Indoors subject to circulating non-hazardous dust, or dripping non-corrosive liquids

Provide all single phase interlock and control wiring required for sequenced operation of mechanical devices provided for mechanical systems under Division 23. Under Divisions 26-28, a source of power for these devices shall be provided and extended to the devices under Division 23.

Make all power wiring connections for mechanical equipment as recommended by the equipment manufacturer. Under Divisions 26-28, power wiring to the line side of a disconnecting provided and installed under Division 23 will be provided.

Some items of equipment may require conductor and/or raceway combinations different from the supply conductors provided under Division 26-29 to the equipment disconnect; coordinate and provide connections as recommended by the equipment manufacturer.

Division 23 Contractor is responsible for providing and installing fuses in disconnects that supply Division 23 utilization equipment.

Provide any required power wiring not specifically shown on the electrical drawings (E-Sheets) or specified in Divisions 26-28.

Install duct smoke detectors furnished under Divisions 26-28 and incorporate smoke detectors in interlock and control wiring. Provide appropriate access doors for duct smoke detectors.

QUALITY ASSURANCE

Coordination with Electrical Work: Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Divisions 26-28 sections. Comply with requirements of applicable Divisions 26-28 sections for raceways and wiring methods associated with final electrical connections to equipment installed under this Division.

Standards:

For electrical equipment and products, comply with applicable NEMA standards and refer to NEMA standards for definitions of terminology herein.

Comply with NFPA 70, *National Electrical Code* (NEC) for workmanship and installation requirements.

Comply with NFPA 70E, *Standard for Electrical Safety in the Workplace*, while performing any electrical work. **(NFPA 70E is referenced in OSHA 29CFR Part 1910, Subpart S, Appendix A, and is considered by OSHA as the industry practice for electrical safety.)**

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for electrical materials and products.

Source Limitations: Provide motor starters, combination motor starters, and disconnects through one source from a single manufacturer.

PART 2 - PRODUCTS

MOTOR STARTERS

Motor Starters: Provide surface-mounted, heavy duty, steel enclosed motor starters with NEMA size rating, voltage rating, and current rating based on the tables provided in Part 1 of this specification.

Motor starters are three pole types. Starters shall be rated as follows unless otherwise specified:

For 480Y/277 V.: Use 600 volt type

For 208Y/120 V.: Use 250 volt type

For 120/240 V.: Use 250 Volt type

Provide full voltage, non-reversing magnetic motor starters with auxiliary control devices as indicated.

Provide units with RMS symmetrical fault withstand rating suitable for application, but no less than 22,000 amps. Design of units shall ensure that faults will be contained within the starter enclosure.

Running Overload Protection: Equip with thermal overload protection device for each motor circuit.

Auxiliary Contacts: Provide two sets of normally open auxiliary contacts and two sets of normally closed auxiliary contacts.

Provide additional **sets** of normally open and/or normally closed auxiliary contacts is such are required to accomplish control functions as defined by the drawings or required by specified control and interlock sequence(s).

Provide additional sets of contacts as required to operate pilot lights as described elsewhere. Contacts required to operate pilot lights are **not shown on the Drawings**. Contacts required to operate pilot lights are to be furnished at no additional cost.

Accessories on Cover: Provide the following accessories on the combination starter cover.

Reset Pushbutton

Hand-Off-Automatic (HOA) Switch

Push to Start Switch

Pilot Lights on Cover: Pilot lights are to be transformer types, configured to operate from the same voltage as the motor starter coil. Provide the following pilot lights on the starter cover.

Red Pilot Light, illuminated when starter is energized

Green Pilot Light, illuminated when starter is not energized

Disconnect Auxiliary Contacts: Provide 2 pole disconnect auxiliary contacts for control circuits where control circuits are provided from a separate electrical source.

Coils: Provide starters with operating coils for 120 volts.

Control Transformer: Provide control transformer having a primary voltage rating to match the line-to-line voltage of the motor supplied by the starter and a secondary voltage to match the voltage of the starter coil. Size control transformer to supply the starter and all pilot devices supplied with a 25% reserve capacity for additional pilot devices.

Provide NEMA-rated enclosure type suitable for its environment as required by Section 230511.

COMBINATION MOTOR STARTERS

General: Combination starters may be used in lieu of separate disconnect and motor starter. Provide surface-mounted, heavy duty, steel enclosed combination motor starters meeting requirements described for motor starters. Provide combination motor starters with NEMA size rating, voltage rating, current rating, and number of poles indicated on the Drawings.

Circuit Breakers: Provide factory-assembled, molded-case circuit breakers with permanent instantaneous magnetic trips in each pole, with fault-current interrupting rating suitable for application and ampere ratings as indicated. Circuit breaker ratings must be clearly visible when the compartment door is open without the necessity of removing operating mechanisms or similar items to obtain visibility. Where adjustable circuit breakers are provided, such adjustments must be also be readily accessible once the compartment door is opened. Provide push-to-trip feature for testing and exercising circuit breaker trip mechanism. Construct breakers for mounting and operating in any physical position and in ambient temperature of 40° C. Provide with AL/CU rated screw type removable connector lugs. Field coordinate all circuit breaker sizes with equipment nameplate ratings prior to purchase.

Disconnect Operators: Provide external operator handles for circuit breakers. Design handle with up-down motion and with down position indicating “OFF." Combination Motor Starters with rotary type circuit breaker operators are not acceptable. Construct handles which permit locking handle in “ON” or “OFF” position with a hasp-type padlock.

Provide two-pole interlock switches for all disconnects that are used with utilization equipment requiring control connections provided from separate electrical sources. The interlock switch is to be configured such that when the disconnect is open the interlock switch is open.

Provide additional interlock switches, auxiliary contacts, plumbing key interlocks, or other accessories as may be described by the Drawings.

Provide NEMA-rated enclosure type suitable for its environment as required by Section 230511.

CIRCUIT AND MOTOR DISCONNECTS

Safety Switches: Provide surface-mounted, heavy duty, steel enclosed safety switches, of types, voltage rating, current rating, and number of poles indicated in this Section.

Switches with no drawing indication of number of poles are three pole types. Switches shall be fusible type, rated as follows unless otherwise specified:

For 480Y/277 V.: Use 600 Volt type, with neutral and grounding bus.

For 208Y/120 V.: Use 250 Volt type, with neutral and grounding bus.

For 120/240 V.: Use 250 Volt type, with neutral and grounding bus.

Where a neutral is not provided to the specific utilization equipment served, the neutral bus can be bonded to the enclosure and used as a grounding bus.

Provide horsepower rated switches incorporating quick-make, quick-break type switches constructed so that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable. Internal current carrying components shall be high-conductivity copper; switch contacts shall be silver-tungsten type. Fuse holders shall have positive pressure type reinforced fuse clips. Where non-fused disconnect switches are indicated, provide solid copper bus bars in lieu of fuses.

Provide NEMA-rated enclosure type suitable for its environment as required by Section 230511.

Provide switches that may be locked in either the “ON’ or ‘OFF’ condition with a 1/4" shackle hasp-type lock. Safety switches shall have door interlocks that prevent the door from opening when the operating handle of the switch is in the “on” position. Manual defeat mechanisms shall be provided for the interlocks.

Provide two-pole interlock switches for all disconnects that are used with utilization equipment requiring control connections provided from an alternate power source. The interlock switch is to be configured such that when the disconnect is open the interlock switch is open.

Provide additional interlock switches, auxiliary contacts, mechanical key interlocks, or other accessories as described by the Drawings.

For all outdoor equipment, provide a fused weatherproof disconnect switch, sized and fused in accordance with manufacturer's requirements.

Fuses shall be furnished by the Contractor. Fuses shall be current limiting type with a minimum AIC rating of 100,000 AMP. The contractor shall furnish Owner with one complete set of spare fuses at the completion of the project.

PART 3 - EXECUTION

GENERAL

Coordinate the exact location of all equipment disconnects to ensure that disconnects are located within sight of mechanical equipment.

Extend power wiring circuits from load side of termination points provided under Divisions 26-28 to each item of mechanical equipment requiring electrical power. All wiring shall be installed in raceway. All wiring and raceway shall be in compliance with Division 26. Utilize liquid tight flexible metallic conduit for weatherproof for outdoor locations. Provide all necessary clamps, fitting, connectors, raceways, circuit conductors, etc., for a completely operational system.

INSTALLATION OF CIRCUIT AND MOTOR DISCONNECTS

Install disconnects as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation," and in accordance with recognized industry practices.

Coordinate placement of disconnects with electrical raceway and cable work, as necessary for proper interface. Coordinate exact location of disconnects with equipment electrical connection point.

Locate disconnects so that they are readily accessible after all project elements are installed. Location selected for disconnects must permit complete opening of the door or cover to the maximum amount permitted by the design of the switch enclosure.

Install disconnects for use with motor-driven appliances and motors within sight of the controllers, as indicated on the Drawings. In addition, each motor shall be provided with an approved disconnecting device within sight of the respective equipment as required by the NEC even though not specifically indicated on the Drawings. Disconnects installed for use with controllers may serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.

INSTALLATION OF STARTERS

Install starters as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation," and in accordance with recognized industry practices.

Coordinate placement of starters with electrical raceway and cable work, as necessary for proper interface. Coordinate exact location of starters with equipment electrical connection point.

Locate starters so that they are readily accessible after all project elements are installed. Location selected for starters must permit complete opening of the door or cover to the maximum amount permitted by the design of the switch enclosure.

GROUNDING

Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for electrical combination motor starters. All combination starters shall be grounded by means of a separate insulated grounding conductor, run with the ungrounded conductors, and bonded to the starter enclosure by means of a dedicated grounding screw terminal or bus.

FIELD QUALITY CONTROL

Subsequent to completion of installation of disconnects and motor starters, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 230511

SECTION 230513 - ELECTRICAL MOTORS FOR HVAC EQUIPMENT

PART 1 – GENERAL

RELATED DOCUMENTS

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

The requirements specified herein shall govern all Sections in Division 23, whether stated therein or not.

Where items specified in the other sections of this Division conflict with requirements of this Section, the former shall govern.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for products specified in this Section.

PART 2 - PRODUCTS

MOTOR CHARACTERISTICS

Motors shall be rated for continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

Capacity and torque characteristics shall be sufficient for motor to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or service factor.

Unless otherwise noted in the documents, Motors 1 hp and above shall be polyphase, suitable for electrical service indicated on the Drawings. Fractional horsepower motors shall be single phase, rated for operation at 120 V.

All motors shall meet the NEMA Premium™ Efficiency Standards.

All electric motor efficiencies shall comply with energy efficiency requirements of Code of Federal Regulations Title 10, Chapter II, Part 431, Subpar B “Electric Motors”.

SINGLE PHASE MOTORS

Constant speed motors larger than 1/20 hp and less than 1 hp shall be one of the following, to suit starting torque and requirements specified above:

- Permanent-split capacitor.
- Split phase.
- Capacitor start, inductor run.
- Capacitor start, capacitor run.

Constant speed motors 1/20 hp and smaller shall be shaded-pole type.

Two-speed motors shall be variable-torque, permanent-split-capacitor type.

Variable speed motors shall be electronic commutation motors (ECM), brushless DC motors with internal circuitry to convert AC power supplied to DC power to operate the motor. Motor shall be speed-controllable via internal circuitry down to 20% of full speed (i.e., 80% turndown) via 0-10 VDC or 4-20 mADC controller output signal from the building direct digital control system. Motor shall be a minimum of 85% efficient at all speeds.

Bearings shall be prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

POLYPHASE MOTORS

Polyphase motors, unless indicated otherwise, shall be in accordance with NEMA MG 1, Design B, medium induction open dripproof (ODP) type, 1.15 service factor, Class F insulation, rated as "Premium" efficiency motors by NEMA.

Motors installed on State of North Carolina projects shall comply with the requirements of Senate Bills 668 and 1946, as applicable.

Multispeed motors with 2:1 speed ratio shall be consequent pole, single winding type. Multispeed motors with other than 2:1 speed ratio shall have separate winding for each speed. Rotor shall be random-wound, squirrel cage type.

Motors located outdoors shall comply with the following:

Motor shall be TEFC with weather-resistant motor junctions, terminal box, and motor coating.

Motor bearings shall be re-greaseable, shielded, antifriction ball bearings suitable for radial and thrust loadings.

Motor frames shall be cast iron for motors 10 hp and larger; rolled steel for motors smaller than 10 hp.

For motors with reduced-voltage and multispeed controllers, match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

Motors used with variable frequency drives shall comply with the following additional requirement(s):

Motor windings shall be copper magnet wire with moisture-resistant insulation varnish and be designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulation inverters. Motors shall comply with NEMA MG 1, Part 31, to provide windings capable of withstanding up to 1600 peak volts with a rise time of 0.1 µs.

For motors less than 100 hp rating, provide shaft grounding rings to bleed current from the motor shaft to the motor casing.

PART 3 - EXECUTION

GENERAL

Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 HP and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 230513

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data, including installation instructions for each type of sleeve and sleeve seal product. Submit expansion compensation schedule showing Manufacturer's figure number, size, location, and features for each required expansion compensation product.

PART 2 - PRODUCTS

SLEEVES

Cast-Iron Pipe: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

Black Steel Pipe: ASTM A 53, Schedule 40, with plain ends and welded steel collar.

Galvanized Sheet Metal: Factory-fabricated of G90 galvanized sheet metal with lock-type longitudinal seam, minimum 18 ga.

SLEEVE-SEAL SYSTEMS

Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

Pressure Plates: Stainless steel.

Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

GROUT

Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

Characteristics: Nonshrink; recommended for interior and exterior applications.

Design Mix: 5000-psi, 28-day compressive strength.

Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

SLEEVE AND SLEEVE-SEAL APPLICATIONS

Use sleeves and sleeve seals for the following piping-penetration applications:

Penetration Application	Sleeve Type	Sleeve Seal Required
Exterior walls above grade	Cast Iron	Yes
Exterior walls below grade	Cast Iron	Yes
Concrete slab on grade	Cast Iron	Yes
Concrete slab above grade	Black Steel Pipe	No
Interior partitions, fire-rated	Black Steel Pipe	No
Interior partitions, non-fire-rated	Black Steel Pipe or Galvanized Sheet Metal Sleeve	No

SLEEVE INSTALLATION

Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

Sleeves are not required for core-drilled holes. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

Cut sleeves to length for mounting flush with both surfaces.

> Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

Install sleeves for pipes passing through interior partitions. Cut sleeves to length for mounting flush with both surfaces and install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 019913.

SLEEVE-SEAL-SYSTEM INSTALLATION

Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

SLEEVE-SEAL-FITTING INSTALLATION

Install sleeve-seal fittings in new walls and slabs as they are constructed.

Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

Secure nailing flanges to concrete forms.

Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 230517

SECTION 230529 – HANGERS AND SUPPORTS FOR PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc. Standard Compliance: Comply with MSS SP-58 *Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation* for pipe hangers and supports.

SMACNA Compliance: Fabricate and install ductwork hangers and supports in accordance with *HVAC Duct Construction Standards - Metal and Flexible*.

ASTM Compliance: Structural steel elements utilized for piping, ductwork, or equipment support shall comply with ASTM A 36.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

GENERAL

Hangers and supports for HVAC piping, ductwork, and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

Design supports for multiple pipes and/or ducts, including floor stands, to be capable of supporting combined weight of supported systems and system contents.

Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

Seismic restraints shall be provided for piping, ductwork, and equipment as required by Section 019923.

Structural support elements shall be fabricated from standard structural shapes complying with ASTM A 36 and/or from preformed channel struts.

Preformed channel struts shall be 1-5/8 inches wide by height required to meet load capacities and designs indicated on the drawings. Strut shall be made from steel meeting the minimum mechanical properties of ASTM A653 SS, Grade 33, G90 galvanized. Fittings shall be manufactured from steel meeting the minimum requirements of ASTM A907 SS, Grade 33. All fittings and hardware shall be zinc plated in accordance with ASTM B633, SC3 for fittings and SC1 for threaded hardware. Channel members shall be "Unistrut", Allied Support Systems "Power Strut", or Cooper B-Line Systems, Inc. "Strut System", specifically sized in accordance with the criteria hereinbefore specified.

Building attachments for hangers and supports shall be as indicated on the Drawings. Where attachments are not indicated, they shall be as follows:

Attachment To	Attachment Method(s)
Concrete	Bolt to channel-type concrete inserts or utilize expansion anchors. Size concrete housekeeping pads so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base. Drill at locations and to depths that avoid reinforcing bars.
Solid Concrete Masonry Unit Walls	Use expansion anchors.
Hollow Walls	Bolt to slotted steel channels fastened to wall with expansion anchors.
Wood Structural Members	Install bolts through members.
Steel	Bolt hangers to MSS Type 19, 21, or 23 clamps on flanges of beams or on upper truss chords of bar joists. **To avoid stressing building steel structural elements, provide additional steel support members that span at least two beams or bar joists as required or as shown on the Drawings.** Attach additional steel support members via welding in accordance with AWS standards.

PIPE HANGERS AND SUPPORTS

General: Piping systems shall be classified in accordance with MSS SP-58, as follows:

Classification	Temperature Range (deg F)	Typical Service Applications
Type 1: Hot Systems	Type 1A: 120-250	Hot Water, Low Pressure Steam (≤15 psig), Steam Condensate, Low Pressure Boiler Feedwater
	Type 1B: >250	High Pressure Steam (>15 psig), High Pressure Boiler Feedwater
Type 2: Ambient Systems	71-120	Condenser Water, Oil, Fuel Gas
Type 3: Cold Systems	Type 3A: 32-70	Chilled Water, Cooling Condensate Drains, Condenser Water with Waterside Economizer Cycle
	Type 3B: <32	Liquid And Cold Gas Refrigerant, Chilled Water with Ice Thermal Storage System

Horizontal Pipe Hangers: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers complying with MSS SP-58, of the following MSS types listed, to suit horizontal-piping systems:

For exterior and wet/damp locations, hangers and rods are to be hot dipped galvanized.

Adjustable Steel Clevis Hangers: MSS Type 1 for Classification Types 1A, 2, and 3 piping.
Split Ring Hanger: MSS Type 69 for Classification Types 1A and 2 piping, 2" NPS and smaller.

Adjustable Pipe Roller Hangers: MSS Type 43 for Classification Type 1B piping.

Copper Pipe Hangers: Copper-plated or -coated steel.
Insulation Protection: Provide MSS Type 39 pipe saddle for Classification Type 1B piping and MSS Type 40 insulation shield for Classification Types 1A, 2, and 3 piping at each pipe support.

Trapeze Pipe Hangers: Trapeze hangers shall be field-fabricated from structural steel members or from preformed channel members and suspended by all-thread hanger rods; weld steel, as required, in accordance with AWS standards. Each pipe on a trapeze hanger shall be individually supported as follows:

Adjustable Pipe Saddle: MSS Type 36 with adjustable support Classification Types 1A, 2, and 3 piping.

Adjustable Pipe Roller: MSS Type 41 with adjustable supports for Classification Type 1B piping.

Copper Pipe Saddle: Copper-plated or -coated steel.

Insulation Protection: Provide MSS Type 39 pipe saddle for Classification Type 1B piping and MSS Type 40 insulation shield for Classification Types 1A, 2, and 3 piping at each pipe support.

Rooftop Pipe Supports: Provide roof pipe rails of G235 galvanized steel construction, 14 gauge, in compliance with ASTM A-446, 525, 526 and 527, with welded corners and 3" raised cant fully mitered with seams joined by continuous welds. Supports shall be internally reinforced with bulkheads and spreaders 24" on center, have factory installed 2 x 4 or 2 x 6 wood nailer and 18 ga. counterflashing. Height to be 12" above roof deck or as detailed on the Drawings. Support shall be level at the top with pitch built-in when deck slopes 1/4 of an inch per foot or greater. Each pipe on a rooftop pipe rail shall be individually supported as follows:

Adjustable Pipe Saddle: MSS Type 36 with adjustable support Classification Types 1A, 2, and 3 piping.

Adjustable Pipe Roller: MSS Type 41 with adjustable supports for Classification Type 1B piping.

Copper Pipe Saddle: Copper-plated or -coated steel.

Insulation Protection: Provide MSS Type 39 pipe saddle for Classification Type 1B piping and MSS Type 40 insulation shield for Classification Types 1A, 2, and 3 piping at each pipe support.

Exception: Uninsulated piping, 2-1/2" NPS and smaller, may be supported using manufactured, weather-resistant bearing blocks with preformed channel strut load-bearing surface and matching pipe clamps, placed directly on the roof membrane. Supports shall be Cooper B-Line Systems, Inc. "Dura-Blok", Miro Industries, Inc. supports, or equivalent.

Vertical Piping: Provide factory-fabricated riser clamps complying with MSS Type 8 to support vertical piping systems. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

Pipe Stands: Where indicated on the drawing, support piping with shop- or filed-fabricated assemblies made Sch. 40 black steel pipe and corrosion-resistant components. Stands shall consist of floor plate with anchors, vertical column, and pipe or equipment support element for the required application.

Outdoors: Hangers and struts located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.

Corrosive Area Finishes: Hangers and struts located in corrosive areas shall be type 304 stainless steel with stainless steel hardware.

DUCT HANGERS AND SUPPORTS

Ductwork hangers shall be fabricated of sheet metal straps in accordance with SMACNA's *HVAC Duct Construction Standards - Metal and Flexible* or of all-thread rod.

Rooftop Duct Supports: Provide roof Duct rails of G235 galvanized steel construction, 14 gauge, in compliance with ASTM A-446, 525, 526 and 527, with welded corners and 3" raised cant fully mitered with seams joined by continuous welds. Supports shall be internally reinforced with bulkheads and spreaders 24" on center, have factory installed 2 x 4 or 2 x 6 wood nailer and 18 ga. counterflashing. Height to be 12" above roof deck or as detailed on the Drawings. Support shall be level at the top with pitch built-in when deck slopes 1/4 of an inch per foot or greater.

EQUIPMENT HANGERS AND SUPPORTS

Floor-Mounted Equipment: Floor-mounted equipment shall be installed on housekeeping pad in accordance with Section 019913 and as specified above.

Suspended Equipment: For suspended equipment, the Contractor shall provide structural steel framing to distribute the imposed operating loads without stressing building structural elements or causing damage to the building substrate. Weld steel in accordance with AWS standards.

Rooftop-Mounted Equipment: Equipment shall be mounted on structural steel supports or on continuous roof curbs, as indicated on the Drawings:

Structural steel supports shall be as detailed on the Drawings.

Roof curbs shall be constructed of G235 galvanized steel, 14 gauge, in compliance ASTM A-446, 525, 526 and 527, with welded corners and 3" raised cant fully mitered with seams joined by continuous welds. Curbs shall be internally reinforced, factory insulated with 1 1/2" thick 3# density fiberglass insulation, and factory installed wood nailers fastened from underside with tek screws. Height to be 12" above roof surface. Top of all roof curbs shall be level, with pitch built into curb when deck slopes 1/4 of an inch per foot or greater. As required, provide structural steel reinforcement below roof to avoid stressing building structural elements.

PART 3 - EXECUTION

INSTALLATION OF PIPE HANGERS AND SUPPORTS

Use only one hanger type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping and to exactly fit around piping insulation for insulated piping.

Arrange for grouping of parallel runs of horizontal suspended piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings and all-thread hanger rods sized in accordance with the following:

Nominal Pipe Size (in.)	Max. Span for Copper Tubing (ft.)	Max. Span for Steel Pipe (ft.)	Min. All-Thread Hanger Rod Size (in.)
<1	5	7	3/8
1 to 1-1/4	6	7	3/8
1-1/2	8	9	3/8
2	8	10	3/8
2 -1/2	9	10	1/2
3	10	12	1/2
4	10	12	5/8
6	10	12	3/4
8-12	10	12	7/8
14	10	12	1
18-20	10	12	1-1/4
24	10	12	1-1/2

Rigid plastic piping (ABS, PVC, CPVC, etc.) shall be suspended with adjustable band pipe hangers, MSS Type 10, with factory-fabricated, welded-in support shield. Maximum hanger spacing for rigid plastic pipe shall be 50% of the maximum span allowed for steel piping.

Where piping of various types and/or sizes is supported together by a trapeze hanger, space hangers based on the lowest maximum span allowed or install intermediate supports for pipe requiring for frequent support.

Hangers and supports for piping shall be attached to the building structure; **attachment to roof deck or cross-bracing is prohibited; attachment to other piping, ductwork, or equipment is prohibited. The use of wire or perforated strap hangers is prohibited.**

Except as allowed for uninsulated piping 2" NPS and smaller, piping installed on roofs shall be supported by pipe supports anchored to roof rails. Install and anchor pipe rails to the roof deck before roofing insulation and membrane are installed.
Pipes are to be supported within 3’ of any coil connection.

INSTALLATION OF DUCT HANGERS AND SUPPORTS

Hang or support metal ductwork in accordance with Section 5 of SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*. Where multiple ducts are supported by a common trapeze hanger, the trapeze shall comply with Table 5-3.

Suspend flexible ducts in accordance with SMACNA's HVAC *Duct Construction Standards - Metal and Flexible*, Figures 3-10 and 3-11.

Hangers and supports for ductwork shall be attached to the building structure; **attachment to roof deck or cross-bracing is prohibited; attachment to other ductwork, piping, or equipment is prohibited. The use of wire or perforated strap hangers is prohibited.**

Support metal duct risers with structural channels or angles at each floor. Attach structural members to the sides of the ducts with welds, bolts, of sheet metal screws.

Ductwork installed on roofs shall be supported by galvanized structural steel members or preformed channel struts, as indicated on the Drawings, installed on rooftop rails as specified for "Rooftop Pipe Supports" above. Install and anchor rooftop rails to the roof deck before roofing insulation and membrane are installed. Touch-up nicks, scrapes, cuts, etc. of galvanized supports with cold galvanizing paint. All bolts, screws, etc. for rooftop applications shall be stainless steel.

INSTALLATION OF EQUIPMENT HANGERS AND SUPPORTS

Floor-mounted equipment shall be installed level and plumb on housekeeping pads in accordance with Section 019913 and in accordance with the manufacturer's requirements.

Suspended equipment shall be supported by structural steel members or preformed channel struts with all-thread rod hangers. As required, vibration isolations required by Section 230548 shall be installed between the supports and the hangers. Suspended units shall be installed level and plumb and supported in accordance with the manufacturer's requirements.

Hangers and supports for equipment shall be attached to the building structure; **attachment to roof deck or cross-bracing is prohibited; attachment to ductwork, or piping is prohibited. The use of wire or perforated strap hangers is prohibited.**

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 230529

SECTION 230548 – HVAC VIBRATION CONTROL

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

DEFINITIONS

Vibration Control: A fixed device used to prevent or reduce the transmission of vibration created by mechanical equipment.

Isolation Efficiency: The percentage of vibration force transmitted to the support structure. For example, 90% efficiency results in 10% of the vibration force being transmitted.

Internal Isolation: Vibration isolators that isolate only the moving parts of a piece of equipment.

External Isolation: Vibration isolators that are attached directly to the building structure and isolate the entire piece of equipment.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of vibration isolation component used.

DESIGN CRITERIA AND PERFORMANCE REQUIREMENTS

Delegated Design: **Responsibility for the selection and application of vibration isolation elements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria hereinafter specified, is delegated to the Contractor.** The professional engineer performing delegated design shall sign and seal any drawings, calculations, product selections, etc. and submit the these documents to the A/E for review.

Performance Requirements and Design Criteria: Motor-driven equipment shall be isolated from the structure by means of resilient vibration and noise isolating supports to achieve the vibration limits imposed in Section 230510.

Supports shall be such that vibration is isolated and expansion and contraction is accommodated without creating excessive stresses in piping or equipment connections.

Isolator types and vibration bases shall be selected and sized for each equipment item in accordance with manufacturer's recommendations and in compliance with Table 47, Chapter 48, 2011 ASHRAE Handbook-*HVAC Applications*.

Examine areas and conditions under which vibration control is to be installed and the substrates that will support same. Notify A/E in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until satisfactory conditions have been met.

Coordinate layout and installation of vibration controls with building structural system, architectural features, mechanical, electrical and fire suppression systems and other building features. Coordinate the equipment bases with the building structural system.

Comply with additional criteria and specific requirements defined in Part 2 of this Section.

PART 2 – PRODUCTS

VIBRATION ISOLATION

Corrosion Resistance: Isolators shall be designed and/or treated for resistance to corrosion, as follows:

Steel components shall be hot-dipped galvanized, PVC coated, or primer coated and painted with finish coat of industrial grade enamel.

All nuts, bolts and washers shall be hot-dipped galvanized or stainless steel.

Structural steel vibration bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer and a finish coat of industrial enamel applied over the primer.

Isolators exposed to the weather shall have steel parts PVC coated, hot-dipped galvanized, or zinc-electroplated, with an additional coating of neoprene or bitumastic paint. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel. Nuts, bolts and washers shall be stainless steel.

Deflection: Isolators shall be installed in such a manner that loaded deflections are compensated for initially.

Isolator Elements: Steel springs shall be open or housed type as specified with static deflection required and the capability of 30% overtravel before becoming solid. Springs shall be designed for lateral stability with a stiffness ratio of 1 except where greater horizontal thrust required greater horizontal stiffness.

Elastomers shall be rubber, neoprene, Buna N, silicone or other material to meet specific service conditions and shall be molded in the range of 30 to 60 durometer. Material shall be of color coded stock for easy identification of rated load capacity.

Precompressed fiber glass shall consist of a high density matrix of molded glass fiber encased in a waterproof neoprene jacket resistant to oil, acids and fungus and color coded for easy identification of rated load capacity.

Isolator Types: Isolators shall be applied in accordance with the "types," as follows:

Type I - Pad type mountings consisting of any one of the following constructions:

Two layers of ribbed or waffled neoprene pads bonded to a 16 gauge galvanized steel separator plate. Bolting not required. Pads shall be sized for approximately 20 to 40 psi load, or a deflection of 0.12 inch to 0.16 inch.

Precompressed fiberglass properly sized for 5 to 60 psi loading depending on density with steel plates bonded to top of isolator.

Two layers of ribbed or waffled neoprene pads bonded to vibration cork sized for 10 to 60 psi loading.

Type II - Elastomeric mountings having steel baseplate with mounting holes and a threaded insert at top of the mounting for attaching equipment. All metal parts shall be completely embedded in the elastomeric material. Mountings shall be designed for approximately 1/4 inch deflection and loaded so that deflection does not exceed 15% of the free height of the mounting.

Type III - Adjustable, freestanding, open-spring mountings with combination leveling bolt and equipment fastening bolt. Spring (or springs) shall be rigidly attached to mounting baseplate and to the spring compression plate. A neoprene pad having a minimum thickness of 1/4 inch shall be bonded to the baseplate.

Type IV - Spring hangers consisting of a rectangular steel box, elastomeric element, coil spring, spring cups, neoprene impregnated fabric washer, and steel washer. The design shall be such as to prevent metal-to-metal contact between the hanger rod and the top of the hanger box. The elastomeric element shall meet the design requirements for Type II mountings. The hanger box shall be capable of supporting a load of 200% of rated load without noticeable deformation or failure.

Vibration Bases: **Vibration bases with isolators shall be provided for motors and motor-driven equipment, whether indicated on the drawings or not.** Bases shall incorporate isolators as herein specified, shall be designed with ample rigidity to resist all starting and operating forces without supplemental hold-down devices and meet the following criteria:

All bases supporting a given piece of equipment shall be arranged for approximately equal spring deflection.

Steel bases shall be factory-fabricated, welded, structural-steel bases and rails.

Design base for the lowest possible mounting height with not less than 1-inch clearance above housekeeping pad. Include equipment anchor bolts and auxiliary motor slide bases or rails.

Structural steel shapes, plates, and bars complying with ASTM A 36. Bases shall have shape to accommodate supported equipment.

Provide factory-welded steel support brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

Inertia bases shall be factory-fabricated or field-constructed, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

Design base for lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.

Structural steel shapes, plates, and bars complying with ASTM A 36. Bases shall have shape to accommodate supported equipment.

Provide welded steel support brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

Where height-saving brackets for side mounting of isolators and where recessed pockets for recessed mounting of isolators in inertia blocks are specified, the brackets and pockets shall be designed to provide for an operating clearance of 1 inch under the inertia base, and designed so that the isolators can be installed and removed when the operating clearance is 1 inch or less. When used with spring isolators having a deflection of 2-1/2 inches or more, the brackets and pockets shall be equipped with precompression devices to limit exposed bolt length between the top of the isolator and the underneath side of the bracket.

Piping Vibration Isolation: Flexible connectors in accordance with Section 230521 shall be installed at each pipe connection to equipment mounted on vibration isolators.

Duct Vibration Isolation: Flexible connectors in accordance with Section 233300 shall be incorporated in ductwork where connected to air moving units.

PART 3 - EXECUTION

GENERAL

Installation of vibration controls shall be in accordance with manufacturer's recommendations and building construction standards. Whenever a conflict occurs between the manufacturer or construction standards, the more stringent shall apply.

VIBRATION ISOLATORS AND BASES INSTALLATION

Base-mounted fans of 20 HP or less shall be mounted on structural steel fan and motor bases with motor slide rails and holes drilled to receive the fan and motor. The steel members shall be adequately sized to prevent distortion and misalignment of the drive, and specifically, shall be sized to limit deflection of the beam on the drive side to 0.05 inch due to starting torque. Snubbers to prevent excessive motion on starting or stopping shall be furnished, if required; however, the snubbers shall not be engaged under steady running conditions.

Base-mounted pumps smaller than 15 HP shall be mounted on factory-fabricated structural steel or cast iron pump and motor bases, with components factory-mounted.

Base-mounted fans above 20 HP and pumps 15 HP and larger shall be mounted on concrete inertia bases, consisting of a perimeter steel pouring form, reinforcing bars welded in place, bolting templates, and height-saving brackets for side mounting of the isolators. The perimeter steel members shall be structural channels having a minimum depth of 1/12 of the longest span, but not less than 6 inches deep. The base shall be sized a minimum overlap of 4 inches around the base of the equipment, and in the case of belt-driven equipment, 4 inches beyond the end of the drive shaft. Fan motors shall be mounted on motor slide rails.

Air handling units without integral mounting bases and/or vibration isolation shall be mounted on a set (two or more) of steel channel rails, to which isolators are rigidly attached. Threaded holes shall be provided for bolting equipment to the rails. Isolators shall be spaced along the rails on sufficiently close center to limit deflection of the rail to 1/360 of its length. Isolators shall be Type III less leveling feature, or Type II as specified.

MECHANICAL EQUIPMENT ANCHORAGE

Anchor equipment or equipment bases rigidly to the building structure or to a concrete housekeeping pad in accordance with Section 019913. Anchors, hanger rods, etc. shall not interfere with the required performance of isolator elements.

Where equipment with internal vibration isolation is determined by the A/E to need additional external isolation, the internal isolators shall be neutralized by bolting the isolators down or removing them and new external isolators shall be installed. Coordinate this with the equipment manufacturer for best methods.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 230548

SECTION 230553 - HVAC PAINTING AND IDENTIFICATION

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions.

PART 2 - PRODUCTS

PAINT FOR HVAC

Ferrous Surfaces:

1 coat of fast drying, low VOC acrylic modified medium oil alkyd universal primer
2 coats of fast drying, low VOC alkyd gloss enamel

Fabric Covering Insulation:

1 coat glue sizing
1 coat primer/sealer
1 coat fast drying, low VOC alkyd gloss enamel

PLASTIC LABELS FOR EQUIPMENT

General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, minimum 2-1/2" X 3/4", 1/16" thick, engraved with engraver's standard letter style of black with white letter color, minimum 1/4" high, and punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

Fasteners: Self-tapping stainless steel screws.

Content for Equipment: Equipment's designation as show on Drawings or Owner's unique equipment number. Contractor shall determine requirements prior to fabricating labels.

DUCT LABELS

Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 but not less than 1-1/2" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.

Content for Ductwork:

Label in accordance with service abbreviations used on the Drawings and arrow indicating flow direction.

Label duct access doors and panels, identifying the component for which access is provided. See Section 233300.

PIPE LABELS

Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1, except as hereinafter specified. Provide full-band pipe markers, extending 360 degrees around pipe at each location that attach without fasteners or adhesives.

Content: Provide minimum 1-1/4" high lettering to identify piping service using the same designations and abbreviations used on the Drawings. Include arrow indicating flow direction(s). Steam lines shall indicate pressure.

VALVE TAGS

Brass Valve Tags: Provide 0.032" thick polished brass valve tags, minimum 1-1/2" diameter, 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.

Valve Tag Fasteners: Provide 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.

PART 3 - EXECUTION

PAINTING

Equipment specified in other sections of Division 23 to be provided with factory-applied finish painting shall not be field-painted. All finish painted equipment shall be touched up where factory paint is chipped, scratched, or otherwise damaged.

All equipment not factory finish painted shall be furnished in prime coat. All prime coated equipment shall be touched up where prime coats are chipped, scratched, or otherwise damaged. All prime coated equipment shall be thoroughly cleaned and left ready for finish painting.

All welds on both insulated and non-insulated piping shall be painted with one coat of primer. Miscellaneous black steel items such as hangers and rods, machinery supports, breechings and stacks, etc., that are not shop primed, shall be field painted with one coat of primer. All metal surfaces shall be thoroughly cleaned of rust and dirt and shall be degreased before application of primer.

Where cast iron accessories or galvanized pipe, duct, or equipment surfaces are to receive finish painting, the item shall be properly cleaned of mill residue before priming. Use primer specific to the application.

Finish painting of equipment, piping, ducts, plenums, casings, breechings, stacks, insulation, etc., located in mechanical equipment rooms and spaces where equipment, piping, etc. is exposed to view shall be provided. Where indicated or specified, existing equipment, piping, duct, etc., shall be cleaned and painted along with new work.

Equipment, vents, etc. where installed on metal roofs shall be finished/painted to match roof color.

Exposed to view non-mechanical spaces: Architect/Owner to select colors for finish painting.

Exposed to view mechanical spaces: If the Owner has an existing color schedule, the Contractor shall utilize these colors for all finish painting. Otherwise, finish colors shall be as follows:

Item	Label/Paint Color	Text Color	Identification
Piping: Steam Supply	Dark Grey	White	HPS, MPS, LPS
Condensate Return	Light Grey	White	HPR, MPR, LPR, PC
Blowdown	Black	White	BD
Chilled Water Supply/Return	Light Blue	White	CHWS/CHWR
Condenser Water Supply/Return	Dark Blue	White	CDWS/CDWR
Hot Water Supply/Return	Dark Red	White	HWS/HWR
Make-Up Water	Green	White	CW
Drain Piping	Black	None	None
Natural Gas	Bright Yellow	White	NAT GAS
Propane/LPG	Bright Yellow	White	LPG
Fuel Oil	Bright Yellow	White	FO
Ductwork	Haze Grey	Black	Refer to drawings
Equipment	Haze Grey	White	Refer to drawings
All Other	ANSI A13.1		

HVAC IDENTIFICATION

Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

EQUIPMENT IDENTIFICATION

Install plastic equipment label 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 labels for each of the following general categories of equipment and operational devices:

Main control and operating valves, including safety devices and hazardous units such as gas outlets.

Meters, gauges, thermometers and similar units.

Fuel-burning units including boilers, furnaces, heaters, stills and absorption units.

Pumps, compressors, chillers, condensers and similar motor-driven units.

Heat exchangers, coils, evaporators, cooling towers, heat recovery units and similar equipment.

Fans, blowers, primary balancing dampers and terminal units.

Packaged HVAC central-station and zone-type units.

Tanks and pressure vessels.

Filters, humidifiers, water treatment systems and similar equipment.

DUCTWORK IDENTIFICATION

Label ductwork exposed to view in mechanical equipment rooms; at each building access point in shafts, attics, etc.; or concealed above lay-in ceilings, as follows:

Near locations where ducts pass through walls or floors/ceilings, or enter non-accessible enclosures.

At access doors, manholes, and similar access points which permit view of concealed ductwork.

Near major equipment items and other points of origination and termination.

Spaced at maximum spacing of 50' along each duct run.

PIPING IDENTIFICATION

Provide pipe labels as follows wherever piping is exposed to view in finished spaces, in equipment rooms, in accessible maintenance spaces (shafts, tunnels, plenums), or concealed above lay-in ceilings. Label piping installed outdoors that is exposed to view.

Near each valve and control device.

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.

Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

At access doors, manholes and similar access points which permit view of concealed piping.

Near major equipment items and other points of origination and termination.

Spaced at maximum spacing of 25' along each piping run.

VALVE IDENTIFICATION

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, 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. Mount valve tag schedule in a frame with a glass cover in the primary mechanical room and include schedule(s) as part of the operating and maintenance data defined in Section 019913.

CEILING IDENTIFICATION

For equipment located above an acoustical lay-in ceiling, provide a clear adhesive label on the ceiling grid directly below the equipment. The label shall indicate in black text the equipment designation (e.g., TU-#, AHU-#, etc.).

Provide blue colored adhesive 3/4" diameter vinyl “buttons” on the ceiling grid where valves, fire dampers, access doors, etc. are located above.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 230553

SECTION 230593 – HVAC TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK

Extent of testing, adjusting, and balancing (TAB) work is includes, but is not necessarily limited to, duct systems, piping systems, and associated equipment and apparatus of HVAC work.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Certification: Submit TAB subcontractor certification.

Instrument Calibration Report: Submit calibration test results for balancing instruments.

TAB Reports: Draft and final test reports

QUALITY CONTROL

TAB work shall be completed by an independent balancing subcontractor certified by the Associated Air Balance Council (AABC) [or the National Environmental Balancing Bureau (NEBB)].

Verification of HVAC systems requires participation by the TAB subcontractor as a member of the "Verification Team". See Section 230596 for requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

GENERAL

After systems have been started up and initially adjusted, the Contractor shall perform tests and accomplish the balancing necessary to provide the air and water flows indicated on the Drawings.

TAB subcontractor shall spot check systems with A/E at Final Inspection.

CERTIFIED TEST REPORTS

General: Four copies of the Draft Test and Balance Reports shall be provided to the A/E before the Final Inspection. The reports shall comply with reporting procedures defined in Chapter 13, ASHRAE Standard 111 and as hereinafter specified.

After the A/E check of the system at or before the Final Inspection, the Final Test and Balance Reports shall be provided to the A/E. **Additionally, one copy of the Final Test and Balance Report shall be submitted to the authority having jurisdiction and a copy shall be included with each copy of the Operating and Maintenance Manuals.**

Certification: Both Draft and Final Reports shall be certified by the TAB subcontractor and shall:

Be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards.

Accurately represent how the systems have been installed.

Define how the systems are operating at completion of the TAB procedures.

Draft Reports: Upon completion of TAB procedures, prepare and submit draft reports for review by the A/E. Draft reports may be hand written, but must be complete, factual, and legible. Organize and format draft reports as hereinafter specified.

Final Reports: After review and verification by the field check by the A/E of the Draft Report, submit the Final Reports, organized and formatted as hereinafter specified.

Reports Format: Bind report forms complete with schematic systems diagrams and/or plans and other referenced data in reinforced, vinyl, three-ring binders.

Provide title page listing the name, address, and telephone numbers of the TAB subcontractor. Provide list of all test instruments utilized, along with last date of calibration.

Provide certification page, signed by the TAB project manager, as hereinbefore specified.

Divide contents of the binder into the following divisions, as applicable, separated by divider tabs:

General Information and Summary

Air Systems TAB

Chilled and Condenser Water Systems TAB

Hot Water Systems TAB

Steam Systems TAB

Vibration Testing and Analysis (See Section 230510 for vibration isolation performance requirements and Section 230548 for vibration isolation requirements)
Sound Testing (See Section 230510 for acoustic criteria)

Filter Integrity Acceptance Testing for High-efficiency Filters (See Section 234133)

Fume Hood Testing and Certification
Indoor Air Quality Testing

Reports Contents:

System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

Quantities of outdoor, supply, return, and exhaust airflows.

Water and steam flow rates.

Pipe and control valve sizes and locations.

Flow and/or Flow Balancing stations.

Location and position of balancing devices (valves, dampers, etc.)

Design Data and Test Results: For each HVAC component and system, provide design data and final adjusted test data, including but not limited to the following:

Component Data	Test Data (Design and Final Adjusted Values)
Air-Handling Units	
Identification	Air flow rate in cfm
Location	System static pressure in inches wg
Manufacturer	Fan rpm.
Manufacturer model number and unit size	Discharge static pressure in inches wg.
Manufacturer's serial number	Filter static-pressure differential in inches wg
Unit arrangement and class	Preheat-coil static-pressure differential in inches wg
Discharge arrangement.	Cooling-coil static-pressure differential in inches wg
Fan sheave make, size in inches and bore.	Heating-coil static-pressure differential in inches wg
Center-to-center dimensions of sheave, and amount of adjustments in inches	Outdoor airflow in cfm
	Return airflow in cfm
Number, make, type, and size of drive belts	Outdoor-air damper position
Number, type, and size of filters	Return-air damper position
Motor make, and frame type and size.	Outdoor-air, wet- and dry-bulb temperatures in deg F
Motor Horsepower and rpm.	Return air, wet- and dry-bulb temperatures in deg F
Motor volts, phase, and hertz	Vortex damper position
Motor Full-load FLA and service factor	Coils: See requirements below
Motor sheave make, size in inches and bore	
Water, Steam, or Refrigerant Coils	
Identification	Air flow rate in cfm
Location	Average face velocity in fpm
Coil type (Water, Steam, Refrigerant)	Air pressure drop in inches wg
Number of rows	Entering-air, wet- and dry-bulb temperatures in deg F
Fin spacing in fins per inch	Leaving-air, wet- and dry-bulb temperatures in deg F
Make and model number	Water flow rate in gpm
Face area in sq. ft.	Water pressure differential in feet of head or psig
Tube size in NPS	Entering-water temperature in deg F
Tube and fin materials.	Leaving-water temperature in deg F
Circuiting arrangement.	Refrigerant expansion valve and refrigerant types.
	Refrigerant suction pressure in psig
	Refrigerant suction temperature in deg F
	Inlet steam pressure in psig

Component Data	Test Data (Design and Final Adjusted Values)
Electric Heating Coil	
Identification. Location. Coil identification. Capacity in kW. Number of stages. Connected volts, phase, and hertz. Rated FLA. Air flow rate in cfm Face area in sq. ft.. Minimum face velocity in fpm	Heat output in kW Air flow rate in cfm Air velocity in fpm Entering-air temperature in deg F Leaving-air temperature in deg F Coil voltage at each connection. Coil amps for each phase.
Fans	
Identification Location Fan type Manufacturer Manufacturer model number and size Manufacturer's serial number Arrangement and class Fan sheave make, size in inches and bore Center-to-center dimensions of sheave, and amount of adjustments in inches Motor make, and frame type and size. Motor horsepower and rpm. Motor FLA and service factor Motor sheave make, size in inches and bore. Center-to-center dimensions of sheave, and amount of adjustments in inches Number, make, and size of belts	Total airflow rate in cfm Total system static pressure in inches wg Fan rpm Discharge static pressure in inches wg Suction static pressure in inches wg
Duct Traverse	
Identification (referenced to system diagrams included in TAB reports) System, air-handling-unit, and/or fan identification	Location and zone. Traverse air temperature in deg F Duct static pressure in inches wg Duct size in inches Duct area in sq. ft. Air flow rate in cfm Air velocity in fpm
Air Terminal Device (Register, Grille, Diffuser, etc.)	
System and air-handling unit identification Room/area served Number from system diagram. Manufacturer Type and manufacturer's model number. Size (face and neck) Effective area in sq. ft.	Test method Design air flow rate in cfm Design air velocity in fpm Preliminary measured air flow rate in cfm Preliminary measured velocity in fpm Final air flow rate in cfm Final velocity in fpm Space temperature in deg F
Condensing Unit	
Identification Location	Entering air temperature in deg. F Leaving air temperature in deg. F

Component Data	Test Data (Design and Final Adjusted Values)
Manufacturer Manufacture model number and serial number Nameplate rated capacity Compressor(s): Number/type of compressors Refrigerant Nameplate data for each compressor including capacity and rated electrical data. Fans: Number/type of fans Motor(s) horsepower and rpm Motor(s) FLA and service factor	Air flow rate in cfm High side refrigerant pressure in psig at each compressor Low side refrigerant pressure in psig at each compressor Compressor and fan motor(s) voltage at each connection Compressor and fan motor(s) amps for each phase

TEST AND BALANCE PROCEDURES

Test Instruments Calibration: Instruments for air and water test and balance shall have been calibrated within a period of six months prior to balancing and tested for accuracy prior to start of work. Calibrate vibrometer utilized for vibration testing before each day of testing using calibrator provided with the meter. Calibrate sound meters before each day of testing using calibrator complying with ANSI S1.40 and NIST certification.

Air Systems Test and Balance Procedures:

General: Air handling and distribution systems, including supply, return, ventilation, and exhaust airflows shall be balanced and adjusted in accordance with Chapter 10 of ASHRAE Standard 111 and Section 7.2.2 of ASHRAE Standard 62.1. Maximum air quantities at each outlet or inlet shall not vary more than -5% to +10% from those indicated on the Drawings.

Drive Changes: If the measured cfm of a supply fan, return fan, or exhaust fan varies more than plus 10% or minus 5% from design, adjust the drive of each fan to obtain required cfm. **Any changes in the pulleys, belts and dampers required for correct balance shall be provided by the Contractor, including replacement of fan and/or motor sheaves.**

Water Systems Test and Balance Procedures: Water circuits shall be adjusted for proper flow in accordance with Chapter 11 of ASHRAE Standard 111, within plus or minus 10% of design values.

Noise and Vibration Test Procedures: TAB subcontractor shall evaluate noise and vibration conditions produced by HVAC systems. Tests for excess vibration and noise shall be conducted as follows:

Noise Testing: Perform sound power level measurements with an octave band analyzer complying with ANSI S1.4 for Type 1 sound level meters and ANSI S1.11 for octave band filters. Comply with the requirements of ANSI S1.13.

Use a microphone that is suitable for the type of levels measured.

Indoor sound measurements shall be taken as follows:

Perform measurements when the space is not occupied and when other building noise sources, inside and outside, are at a minimum. The space shall be unoccupied during testing.

Walk through the measurement area slowly and listen for sound level or sound quality variations. Based on the walk-through, establish best measurement location(s).

Set the sound level meter's Fast/Slow switch to "Slow" and point the meter's microphone at 45-degrees from the predominant sound source.

Hold the microphone at arm's length or attached to a tripod.

Make all sound measurements with the microphone at least three (3) feet from any surface (walls, floors, ceiling, etc.)

Make multiple measurements, moving the sound level meter very slowly so that the microphone scans throughout a 2-3 feet region near the predominate sound source.

Record the sound measurement results and plot on an Room Criteria (RC) work sheet.

If measured sound power levels exceed the RC limits specified in Section 230510, report the noise conditions to the Contractor for mitigation.

Outdoor sound measurements shall be taken to test sound radiation from each outdoor HVAC equipment item in accordance with ASTM E1014 "Standard Guide for Measurement of Outdoor A-Weighted Sound Levels." If the measured LA_{eq},T exceeds the limit specified in Section 230510, report the noise conditions to the Contractor for mitigation.

Vibration Testing: Through use of a vibrometer and/or other instruments to measure vibration levels, HVAC equipment installed with vibration isolation elements as specified in Section 230548 shall be tested for objectionable vibration transfer to piping, ductwork, and/or the building structure, directly or indirectly.

Vibrometer shall meet the following criteria:

Solid-state circuitry with piezoelectric accelerometer.

Velocity range of 0.1 to 10 inches per second.

Displacement range of 1 to 100 mils.

Frequency range of at least 0-1000 Hz.

Perform tests when other building and outdoor vibration sources are at a minimum. Turn off ay equipment, other than HVAC equipment, that may interfere with testing and clear space of people.

Tests shall record vibration levels of each HVAC element and the resulting vibration levels transferred to piping, ductwork, and the building structure.
If direct or indirect transferred vibration levels exceed the limits specified in Section 230510, report the vibration conditions to the Contractor for mitigation.

Indoor Air Quality Test Procedures: Conduct baseline IAQ testing using testing protocols consistent with the United States Environmental Protection Agency "Compendium of Methods for the Determination of Air Pollutants in Indoor Air". Perform IAQ testing for at least the minimum number of required sampling locations, determined as follows:

For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger. Collect air samples on three consecutive days and average the results of each three-day test cycle to determine compliance or non-compliance of indoor air quality for each air handling zone tested.
Areas with 100% outside air ventilation rates, such as laboratories, may be excluded from testing requirements upon approval by the A/E.

Perform IAQ testing following the completion of all interior construction activities, but prior to occupancy. The building shall have all interior finishes installed, testing shall be performed prior to installation of furniture, workstation components, casework, etc.

Perform IAQ testing within the breathing zone, between 3'–0" and 6'–0" above the finished floor over a minimum 4-hour period.

Collect air samples with the ventilation system(s) starting at their daily normal start times and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.

Sample and record outside air levels of formaldehyde and TVOC contaminants at three outside air locations, as approved by A/E, simultaneously with indoor tests to establish basis of comparison for these contaminant levels by averaging the three outdoor readings for each contaminant.

Perform airborne mold and mildew air sampling and speciation with simultaneous indoor and outdoor readings, as follows:

Samples are to be collected using a 12 liter-per-minute pump and a 0.45 micron polycarbonate filter, with a 4-hour duration for each sample.

Speciation shall be done with DNA detection using the quantitative polymerase chain reaction (QPCR) method. To ensure that filters are not pre-contaminated with mold, a field blank filter cartridge shall be tested after every eighth sample is tested.

A/E QUALITY CONTROL CHECK

In the presence of the A/E during or before the Final Inspection, the TAB subcontractor shall verify the balance of the air and water systems as follows:

Each air handler will be checked for proper airflow by an anemometer traverse on the entering side of the cooling coil.

Water flow will be tested by evaluating pressure drops across chillers, coils, etc.

At least 15% of registers, grilles, and diffusers will be checked for proper air flow via calibrated flow hood..

The TAB subcontractor shall provide all test instruments required for the Owner/Engineer check of the air and water systems balance.

During the A/E check, the TAB contractor shall verify the full range of air and water flows for the items selected to be checked. The Contractor shall have the controls sub-contractor present during the A/E check of the air and water systems balance.

END OF SECTION 230593

SECTION 230596 – HVAC SYSTEMS COMMISSIONING

PART 1 – GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL

HVAC systems commissioning shall be performed by the Contractor and shall include the following:

Establish a commissioning "team" consisting of the installing personnel, the controls subcontractor, and the testing, adjusting, and balancing (TAB) subcontractor(s).

Systematically evaluate all installed HVAC components, equipment, subsystems, and systems to ensure that they are working in accordance with this design documents. This includes measuring temperatures and flow rates from all HVAC devices and calibrating all sensors to a known standard.

Perform commssioning procedures, equipment functional performance tests, and tests of the sequences of operations to verify that the controls are providing the correct interaction between equipment, subsystems, and systems.

PART 2 – DESIGN INTENT

GENERAL

The contract documents define the requirements for HVAC components, equipment, subsystems, and systems, along with the control requirements for each element. It is the intent of the Designer that all HVAC components, equipment, subsystems, and systems shall perform in accordance with the stipulated requirements through the entire operational range of each element, while satisfying temperature, humidity, air quality, acoustic, and vibration criteria defined in Section 230510.

SEQUENCES OF OPERATION

Sequences of operation shall be as indicated on Drawings.

PART 3 – FUNCTIONAL PERFORMANCE

SYSTEMS START-UP

Appendix 230596 outlines basic start up and check out requirements for HVAC systems and equipment. Generally these procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct. These items provide a minimum or guideline for development of start up procedures, checklists and tests along with the general requirements indicated above (that are common to all). **Contractor shall synthesize these requirements with that of the manufacturer's and/or applicable codes and standards to develop specific and itemized start up procedures specific to that installed on this project.**

FUNCTIONAL PERFORMANCE TESTS AND CERTIFICATION

Functional performance tests shall be performed in accordance with the checklists in Appendix 230596 to prove all modes of the sequences of operation and to verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress through subsystems to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. **The checklist shall then be repeated until it has been completed with no errors.**

Functional performance tests shall begin only after all work and testing required in related specification sections have been successfully completed, after all pre-commssioning checks have been successfully completed, after the control systems are fully functional, after the testing, adjusting, and balancing work has been completed and after all test and inspection reports and operation and maintenance manuals required have been submitted and reviewed by the A/E.

Based on the functional performance test checklists in Appendix 230596, the commssioning team shall prepare standardized reporting forms for each item of equipment, subsystem, and system to document the required functional performance tests. Each test shall be certified with the following statement and the signature and date of signing by each member of the commissioning team:

"We the undersigned have witnessed the above functional performance tests and certify that the item tested has met the performance requirements in this section of the specifications.

"Signature and Date:

Mechanical Contractor's Representative _____
Testing, Adjusting and Balancing Representative _____
Controls Sub-Contactor Representative _____"

END OF SECTION 230596

APPENDIX 230596 – HVAC SYSTEMS COMMISSIONING CHECKLISTS

Section	Component
232300	Refrigerant Piping Systems

START-UP CHECKS

Confirm that piping is adequately supported, seismic requirements have been met, and vibration isolation is addressed in accordance with Sections 230529 and 230548.

Confirm that piping has been painted and that piping and valves have been labeled in accordance with Section 230553.

Confirm that refrigerant piping is complete in accordance with Section 232300 and drawings. Confirm that system has been evacuated, charged, and pressure tested in accordance with Section 232300. Provide leak test report.

Make sure that refrigerant lines are insulated in accordance with Section 230719 and supported in accordance with Section 230529 and 230548.

Confirm that service valves are accessible.

FUNCTIONAL PERFORMANCE TESTS

Confirm that refrigerant pressures and temperatures comply with associated equipment requirements.

Section	Component
233416	Fans

START-UP CHECKS

Confirm that casing condition is good: no dents, leaks, door gaskets installed.

Confirm that vibration isolation has been installed.

Confirm that equipment guards and screens have been installed (as applicable).

Checks sheaves and belts:

- Check sheave mounting bolts for tightness.
- Check sheave alignment.
- Check for proper belt tension and adjust as necessary.

Make sure that all plenums clear of debris

Confirm that fan rotates freely.

Confirm that fire dampers, backdraft dampers, and/or balancing dampers are installed and operate freely.

Confirm that electrical connections are complete.

Confirm that motor overload protection in place and properly sized.

START-UP PROCEDURES

Remove fan lockouts and start fan.

Confirm that fan belts do not squeal on start-up and that the fan rotation is correct.

Confirm that all fan interlocks work correctly.

FUNCTIONAL PERFORMANCE TESTS

Measure the airflow (CFM), static pressure (in. WG), and motor data (actual amps and volts, each phase) and compare to design and TAB data.

Test disconnect switch for proper operation

After 24 hours of operation, recheck belt tension and alignment

Section	Component

Section	Component
236200	Packaged Condensing Units

START-UP CHECKS

Evaluate air-cooled unit location: are clearances adequate to prevent air short cycling? If not, what modifications are required to ensure proper unit operation?

For water-cooled units, confirm that water piping is complete in accordance with Section 232113/232115, filled and vented. Open isolation valves and vent condenser coil.

Confirm that refrigerant piping is complete in accordance with Section 232300 and the design drawings. Confirm that system has been evacuated, charged, and pressure tested in accordance with Section 232300. Provide leak test report.
Check to ensure:

Service valve caps are installed and tightened.

Test voltage and compare with design data.

Ensure that all factory and field wiring connections are tight.

Confirm that the indoor (evaporator) fan is on the correct speed tap.

Confirm that unit is painted and labeled in accordance with Section 230553.

START-UP PROCEDURES

For water-cooled units, confirm that distribution pump is on and measure pressure drop across condenser to confirm that water flow is correct. Compare to design data and TAB results.

Energize crankcase heater (as applicable) for 8 hours before starting the unit.

Close the electrical disconnect to energize the system.
Set the thermostat system switch to OFF.

Set the thermostat to a temperature below indoor ambient conditions.

Set the control system so that unit will cool. Operate unit for 15-20 minutes, then check refrigerant charge.

Adjust refrigerant charge in accordance with the manufacturer's instructions and repeat start-up procedures.

If the condensing unit is designed for heat pump duty, repeat the above tests setting the control system so that unit will heat.

FUNCTIONAL PERFORMANCE TESTS

Start air handler to provide load for condensing unit. Activate controls system start sequence as follows.

Start air handling unit. Verify control system energizes condensing unit start sequence.

Shut off air handling equipment to verify condensing unit de-energizes.

Restart air handling equipment one minute after condensing unit shut down. Verify condensing unit restart sequence.

Verify condensing unit amperage each phase and voltage phase to phase and phase and compare to design and TAB data.

Record the following information and compare to design and TAB data:

Ambient dry bulb temperature (degrees F)
Ambient wet bulb temperature (degrees F)
Suction pressure (psig)
Discharge pressure (psig)

Confirm correct operation of hot gas bypass (as applicable).

Describe and document any unusual vibration, noise, etc.

Section	Component
237311	Air-Handling Units

START-UP CHECKS

For field fabricated or assembled units, ensure the sections are properly connected within acceptable tolerances.

Seal the all penetrations air tight and ensure access doors seat tightly.

Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete.

Ensure vibration isolation integrity is maintained throughout the AHU installation and the connections to it.

Verify proper thermal overload protection is installed in motors, starters, and disconnects.

Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.

Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

Adjust and lubricate dampers and linkages for proper damper operation.

Comb coil fins for parallel orientation.

Install clean filters.
Ensure condensate drains properly and that trap is sized correctly..

Confirm that all devices are labeled in accordance with Section 230553.

START-UP PROCEDURES

Lock out fan disconnects.
Check out fans in the following manner:

Verify shipping tie down supports were removed.

If split pillow block bearings are installed, perform the following:

Remove bearing housing caps. (**CAUTION:** Make sure to keep the inside of the bearing housing clean.)

Check for proper amount of lubrication. Should be approximately ½ full. Adjust as necessary.

Check to be sure that a stabilizer ring has been installed in only one (1) of the bearing housings.

Check both bearings to be sure that a locking tab has been set on the adapter ring lock nut. Or, If one-piece pillow block bearings are used, check to be sure that the bearing was lubricated. (The seals will purge some grease at start-up.)

Make sure all locking collars and setscrews are properly set.

Check sheaves and belts.

Check sheave mounting bolts.

Check sheave alignment.

Check for proper belt tension and adjust as necessary.

Check all mounting bolts for tightness.

Fan bearing support.

Bearing mounting bolts.

Fan casing bolts.

Fan mounting bolts to fan base.

Motor ramp-mounting bolts.

Adjustable motor base mounting bolts.

Motor mounting bolts.

Belt guard-mounting bolts.

Isolation spring mounting bolts.

Thrust arrestor mounting bolts (if applicable).

Remove inlet screen and check hub set screws.

Replace inlet screen and check all screen fasteners.

Remove fan lock outs and prepare for full volume run test. Turn on unit and check the following:

Record motor line voltage and amperage at full volume and compare to motor nameplate data.

Take a pressure profile of entire air handling unit at full volume and record on a skeleton drawing of the air handler.

Compare total, external, and internal pressures to design data.

FUNCTIONAL PERFORMANCE TESTS

END APPENDIX 230596

SECTION 230713 - HVAC DUCT INSULATION

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Flame/Smoke Ratings: Provide composite duct insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 225) method.

> Exception: Outdoor HVAC ductwork insulation may have flame spread index of 75 and smoke developed index of 150.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

Samples: Submit, as requested by A-E, manufacturer's sample of each duct insulation type required. Affix label to sample completely describing product.

PART 2 - PRODUCTS

INSULATION MATERIALS

Mineral Fiber Insulation: Insulation made up of fibers manufactured of glass, rock, or slag, processed from the molten state, with or without a binder.

> Mineral Fiber Board Insulation: ASTM C 612, Type IA or IB, with factory-applied jacket. Insulation density shall be 3.0 pcf or greater and conductivity, k, tested in accordance with ASTM C 518 or C 177 at 75ºF mean temperature shall not exceed 0.25 Btu-in./(hr-sf-ºF).
>
> Mineral Fiber Blanket Insulation: ASTM C 553, Type II, with factory-applied jacket. Insulation density shall be 1.00 pcf and conductivity, k, tested in accordance with ASTM C 518 or C 177 at 75ºF mean temperature shall not exceed 0.27 Btu-in./(hr-sf-ºF).
>
> Factory-Applied Jacket for Mineral Fiber Insulation: Jacket and tape shall comply with ASTM C 1136, Type II, as follows:
>
> > FSP Jacket: Jacket consisting of aluminum foil, fiberglass-reinforced scrim with polyethylene backing.

FSK Jacket: Jacket consisting of aluminum foil, fiberglass-reinforced scrim with kraft-paper backing.

Jacket Tape: Seams and tears/damage to jacket shall be sealed with foil-face, vapor-retarder type tape matching the factory-applied jacket, with acrylic adhesive, 3" wide, and not less than 6.5 mils thick.

Polyisocyanurate Foam Board Insulation: Rigid board material manufactured from closed cell, polyisocyanurate foam between two aluminum foil facers, complying with ASTM C 1289 Type 1, Class 2, with Grade 2 minimum compressive strength.

Duct Liner: Duct liner shall be flexible closed cell flexible elastomeric that complies with ASTM C1534 for duct liner, with the following physical properties:

Maximum thermal k value of 0.25 BTU - in./hr. - ft² - °F when tested according to ASTM C177 or C518 at 75°F mean temperature.

Water vapor transmission rate of 0.06 perm - inch or less when tested according to ASTM E96 (dry cup method).

Maximum water absorption rate of 0.2% (% by volume), when tested in accordance with ASTM C209.

Manufactured without the use of CFCs, HFCs, or HCFCs and be free of formaldehyde, fibers, and dust.

Meet the requirements of ASTM C411.

Meet the requirements of UL 181 for mildew and air erosion.

Minimum NRC of 0.55 when tested to ASTM C423 at a nominal 1” thickness.

Adhesives shall be water-based, low VOC type complying with ASTM C 916.

JACKETING MATERIAL

Insulated indoor ductwork exposed to view in areas other than mechanical rooms shall have field-applied jacket as follows:

Woven glass-fiber fabric "canvas" of approximately 8 oz./sq. yd. Cover fabric with one coat of fire retardant coating prior to finish painting.

Embossed or corrugated aluminum jacket 0.016" thick in accordance with ASTM B209, 3003 alloy, H-14 temper, banded on 8” centers. Where aluminum jacket is installed outdoors, it shall have a 3-mil thick heat bonded polyethylene and kraft-paper moisture barrier.

PVC jacket, glossy finish, 20-mil high impact UV-resistant type meeting the requirements of ASTM D 1784, Class 16353-C. **Jackets shall have integral colors as required by Section 230553.**

Insulated outdoor ductwork shall have field-applied embossed or corrugated aluminum jacket 0.016" thick in accordance with ASTM B209, 3003 alloy, H-14 temper, banded on 8” centers. It shall have a 3-mil thick heat bonded polyethylene and kraft-paper moisture barrier.

PART 3 - EXECUTION

INSULATION APPLICATION

Indoor ductwork shall be insulated as follows:

Ductwork exposed to view in mechanical equipment rooms, etc. shall be insulated with 2” thick mineral fiber board insulation.

Concealed ductwork shall be insulated with 2” thick mineral fiber blanket insulation except 6” wide board insulation at trapeze hangers.

Outdoor ductwork shall be insulated with 3" thick polyisocyanuarate insulation. **Mineral fiber insulation shall not be applied to outdoor ductwork.**

Insulate the following ductwork and plenums:

Supply air, including back side of air outlets
Return air
Relief air
Outside air
Exhaust air located in unconditioned spaces, including attics, crawl spaces, basements, mechanical rooms, etc.

Exceptions: Do not insulate the following:

Flexible connections at fans or equipment
Factory-insulated flexible ductwork

GENERAL INSTALLATION REQUIREMENTS

Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Install insulation with longitudinal seams at top and bottom of horizontal runs.

Install multiple layers of insulation with longitudinal and end seams staggered.

Keep insulation materials dry during application and finishing.

Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

Install insulation with least number of joints practical.

Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

Install insulation continuously through hangers and around anchor attachments. Extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

Install insulation with factory-applied jackets as follows:

Draw jacket tight and smooth.

Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket.

Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c. Tape laps with 3" wide foil tape.

For below ambient services, apply vapor-barrier mastic over staples.

Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal. Apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

INSTALLATION AT PENETRATIONS

Roof Penetrations: Install insulation continuously through roof penetrations.

Seal penetrations with flashing sealant.

For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

Seal jacket to roof flashing with flashing sealant.

Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

Seal penetrations with flashing sealant.

For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

Seal jacket to wall flashing with flashing sealant.

Interior Wall and Partition Penetrations, Not Fire Rated: Install insulation continuously through walls and partitions.

Fire-Rated Wall, Partition, and Floor Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches. Comply with requirements 019913 for firestopping and fire-resistive joint sealers.

INSTALLATION OF MINERAL FIBER INSULATION

Blanket Mineral Fiber Insulation Installation: Secure with adhesive and insulation pins, as follows:

Apply adhesives according to manufacturer's recommended coverage rates per unit area of duct and plenum surfaces.

Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts. **Adhesive secured pins are prohibited.** Pins shall be installed as follows:

On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

Do not overcompress insulation during installation.

Impale insulation over pins and attach speed washers.

Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface.

Cover exposed pins and washers with 3" long piece of 3" wide foil continuous vapor barrier tape.

For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface.

Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

Board Mineral Fiber Insulation Installation: Secure with adhesive and insulation pins in accordance with the requirements for blanket insulation above, with the following modifications:

For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

INSTALLATION OF POLYISOCYANURATE INSULATION

Polyisocyanurate Board Insulation Installation: Secure with adhesive and insulation pins:

Apply adhesives according to manufacturer's recommended coverage rates per unit area of duct and plenum surfaces.

Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts. **Adhesive secured pins are prohibited.** Pins shall be installed as follows:

On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
Do not compress insulation during installation.

Impale insulation over pins and attach speed washers.

Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface.

Cover each exposed pin and washer with 3" long piece of 3" wide foil continuous vapor barrier tape.

For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Seal both longitudinal seams and butt joints with adhesive and install 3" wide foil continuous vapor barrier tape over them.

Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

Outdoor Ductwork Additional Weather Jacket: Insulation on outdoor ductwork shall be protected by a covering with minimum 20 gauge aluminum complying with ASTM B 209, Alloy 3003, Temper H-14 arranged so that sides are flashed under the top and the bottom is flanged, turned down, and mechanically attached to the sides. All transverse joints shall be made with a minimum ½" standing seam, mechanically closed and caulked watertight with flexible mastic. See Drawings for construction details.

INSTALLATION OF DUCT LINER

Comply with SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*, Figure 7-11, "Flexible Duct Liner Installation."

Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. **Attaining indicated thickness with multiple layers of duct liner is prohibited.**

Apply adhesive coating on longitudinal seams.

Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

Butt transverse joints without gaps and coat joint with adhesive.

Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints; and at intervals not exceeding 18 inches longitudinally. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts. **Adhesive secured pins are prohibited.**

Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

Fan discharges.

Intervals of lined duct preceding unlined duct.

Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 225) method.

> Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

Samples: Submit, as requested by A-E, manufacturer's sample of each piping insulation type required. Affix label to sample completely describing product.

PART 2 - PRODUCTS

PIPING INSULATION MATERIALS

Mineral Fiber Insulation:

> Insulation shall be made of fibers manufactured from glass, rock, or slag, processed from the molten state, with or without a binder.
>
> Insulation shall be heavy density pre-formed sectional type for piping in accordance with ASTM C 547, Class I, factory-jacketed.
>
> Glass fiber insulation shall be rated for fluid temperature up to 850-degrees F.
>
> Mineral wool insulation shall be rated for fluid temperature to 1200-degrees F.

Cellular Glass Insulation: Pre-formed sections of foamed or cellulated glass with annealed, rigid, hermetically sealed closed cells in accordance with ASTM C 552, Type II, Class 2, factory-jacketed.

Calcium Silicate Insulation: Pre-formed sections of hydrous calcium silicate with non-asbestos fiber reinforcement in accordance with ASTM C 533, Type I.

Closed Cell, Flexible Elastomeric Insulation: Flexible elastomeric, closed cell, thermal insulation in accordance with ASTM C534, Type I, preformed tubes, black in color, rated for piping temperatures to 220 degrees F. Insulation shall be AP/Armaflex or equivalent.

Polyisocyanurate Insulation: Preformed pipe and fitting closed cell foam insulation, ASTM C 591, Type IV, K=0.027 Btu-in/hr-SF-°F, for use at temperatures up to 300°F. Supply insulation with factory-applied vapor retarder/vapor barrier with jacket as hereinafter specified. **Insulation with pre-applied adhesive is prohibited.**

Polystyrene Insulation: Insulation shall be closed cell foam insulation, pre-formed into sections complying with ASTM C578, Type IV, except that thermal conductivity shall exceed 0.26 Btu-in/hr-SF-F at 75 F after 180 days of aging.

Jackets for Piping Insulation: Insulation jackets shall be all-service vapor retarder type as follows:

Piping Operating at Temperatures Above Ambient: Jacket shall be "ASJ" type, consisting of white, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

Piping Operating at Temperatures Below Ambient: Jacket shall be one of the following:

FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

Exceptions:

Piping insulated with cellular glass, polyisocyanurate, or polystyrene may have ASJ jacket.

Covering for Piping Insulation Exposed to View:

Encase Temperature Range 3 indoor straight piping insulation with glossy, 20-mil high impact UV- resistant PVC jacket meeting requirements of ASTM D 1784, Class 16353-C. **Jackets shall have integral colors as required by Section 230553.**

Encase all indoor pipe fittings insulation with one-piece pre-molded 20-mil UV-inhibited PVC fitting covers complying with ASTM C450 for dimensions and fastened as per manufacturer's recommendations.

Encase all outdoor straight piping insulation with embossed or corrugated 0.016" thick aluminum jacket in accordance with ASTM B209, 3003 alloy, H-14 temper, banded on 8” centers. It shall have a 3-mil thick heat bonded polyethylene and kraft-paper moisture barrier.

Encase all outdoor pipe fittings insulation with pre-formed, factory-fabricated, 0.016" thick aluminum fitting covers to match adjacent straight piping jacket.

Exception: Indoor flexible elastomeric insulation exposed to view in mechanical rooms shall not be covered.

PART 3 - EXECUTION

PIPING SYSTEM INSULATION APPLICATIONS

Piping systems shall be classified in accordance with MSS SP-58, as follows, and be insulated as hereinafter specified:

Classification	Temperature Range (deg F)
Type 3: Cold Systems	Type 3A: 32-70
	Type 3B: <32

Classification Type 3A Piping: Insulate the following cold HVAC piping systems:

Cooling coil condensate drain piping.

Insulate indoor piping with cellular glass insulation, 2" thick for pipe sizes up to and including 4", 3" thick for pipe sizes over 4".

Insulate outdoor piping with additional 1" thickness of insulation.

Exceptions:

Outdoor piping may be insulated with polyisocyanurate foam insulation, with the same thickness as insulation hereinbefore specified, or with polystyrene foam insulation, with thickness 1” greater than insulation hereinbefore specified.

Indoor Type 3A piping 1" NPS and smaller may be insulated with 1” thick flexible elastomeric insulation.

Condensate drain piping within mechanical equipment rooms, and chilled water air separators and compression/expansion tanks may be insulated with 1” thick flexible elastomeric insulation.

Classification Type 3B Piping: Insulate the following cold HVAC piping systems:

Refrigerant suction lines between evaporators and compressors.

Insulate chilled water/brine piping with cellular glass insulation, 3" thick for pipe sizes up to and including 4", 4" thick for pipe sizes over 4". Insulate outdoor piping with additional 1" thickness of insulation.

Exceptions:

Indoor Type 3B piping 1" NPS and smaller and condensate drains may be insulated with 1” thick flexible elastomeric insulation.

GENERAL INSTALLATION REQUIREMENTS

For Classification Type 3 piping, install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

Insulate pipe elbows using preformed fitting insulation or mitered sections made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

Install removable insulation covers for valves and piping specialties and where indicated on the Drawings. Installation shall conform to the following:

Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

Install insulation accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state. Install insulation with longitudinal seams at top and bottom of horizontal runs.

Install multiple layers of insulation with longitudinal and end seams staggered. Do not weld pins, clips, or other insulation attachment devices to piping, fittings, and specialties.

Keep insulation materials dry during application and finishing.

Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

Install insulation with least number of joints practical.

Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

Install insulation continuously through hangers and around anchor attachments:

At pipe hangers and supports, protect the insulation from compression as follows:

Piping Classification Type 3 shall be insulated with cellular glass piping insulation for the length of the insulation shield specified in Section 230529. Insulation vapor barrier shall be lapped and sealed in accordance with manufacturer's instructions to maintain continuous vapor barrier integrity.

Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

Install insulation with factory-applied jackets as follows:

Draw jacket tight and smooth.

Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket.

Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

For below-ambient services, apply vapor-barrier mastic over staples.

Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Outdoor piping shall be covered by vapor barrier and exterior (weatherproofing) jacket as soon as possible after the insulation has been installed. All polyisocyanurate and/or polystyrene materials applied in one day shall have their vapor barrier installed the same day. Any exposed insulation shall be temporarily protected with a combination moisture and UV barrier (such as 6 mil black polyethylene film) to keep out moisture. Mastics shall not be applied with the ambient air temperature is below 40° F or is expected to be below 40° F within 24 hours of the application.

INSULATION INSTALLATION AT PENETRATIONS

Roof Penetrations: Install insulation continuously through roof penetrations.

Seal penetrations with flashing sealant.

For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

Seal jacket to roof flashing with flashing sealant.

Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

Seal penetrations with flashing sealant.

For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

Seal jacket to wall flashing with flashing sealant.

Interior Wall, Partition, and Floor Penetrations: Install insulation continuously through walls, partitions, and floors. Seal penetrations through fire-rated assemblies complying with requirements of Section 019913 for firestopping and fire-resistive joint sealers.

INSTALLATION OF CALCIUM SILICATE INSULATION

Insulation Installation on Straight Pipes and Tubes:

Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.

Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

Insulation Installation on Pipe Flanges:

Install preformed pipe insulation to outer diameter of pipe flange.

Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

Finish flange insulation same as pipe insulation.

Insulation Installation on Pipe Fittings and Elbows:

Install preformed sections of same material as straight segments of pipe insulation when available.

Secure according to manufacturer's written instructions.

When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.

Finish fittings insulation same as pipe insulation.

Insulation Installation on Valves and Pipe Specialties:

Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

Install insulation to flanges as specified for flange insulation application.

Finish valve and specialty insulation same as pipe insulation.

INSTALLATION OF CELLULAR GLASS INSULATION

Insulation Installation on Straight Pipes and Tubes:

Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.

For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

Insulation Installation on Pipe Flanges:

Install preformed pipe insulation to outer diameter of pipe flange.

Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.

Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch and seal joints with flashing sealant.

Insulation Installation on Pipe Fittings and Elbows:

Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

Insulation Installation on Valves and Pipe Specialties:

Install preformed sections of cellular-glass insulation to valve body.

Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

Install insulation to flanges as specified for flange insulation application.

INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

Flexible elastomeric insulation shall be installed in strict accordance with the manufacturer's written installation instructions.

Insulation Installation on Straight Pipes and Tubes:

Install un-slit insulation sections to the maximum extent possible. Seal butt joints with manufacturer's recommended adhesive.

Where slit insulation sections must be used, seal longitudinal seams and butt joints with manufacturer's recommended adhesive. **Secure slit sections on both sides of each fitting and 12" o.c. on straight pipe or tubing runs with 2" wide, 1/8" thick insulation tape matching the adjacent insulation. The use of metal bands, plastic bands, and wire are prohibited.**

Insulation Installation on Pipe Flanges:

Install pipe insulation to outer diameter of pipe flange.

Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

Insulation Installation on Pipe Fittings and Elbows:

Fabricate mitered sections of pipe insulation as fitting covers.

On soldered, brazed, or buttwelded joint fittings, insulation that fits the adjacent piping may be used.

For screwed or socket weld joint fittings, the insulation inside diameter shall match the outside diameter of the adjacent piping. Fitting covers shall lap adjacent piping insulation by at least 1".

Secure insulation materials and seal longitudinal seams and butt joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

Insulation Installation on Valves and Pipe Specialties:

Install preformed valve covers manufactured of same material as pipe insulation when available.

When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

Install insulation to flanges as specified for flange insulation application.

Secure insulation to valves and specialties and seal longitudinal seams and butt joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

Insulation installed outdoors shall be painted with two coats of UV-inhibiting coating recommended by the insulation manufacturer.

INSTALLATION OF MINERAL FIBER INSULATION

Insulation Installation on Straight Pipes and Tubes:

Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

Insulation Installation on Pipe Flanges:

Install preformed pipe insulation to outer diameter of pipe flange.

Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

Insulation Installation on Pipe Fittings and Elbows:

Install preformed sections of same material as straight segments of pipe insulation when available.

When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

Insulation Installation on Valves and Pipe Specialties:

Install preformed sections of same material as straight segments of pipe insulation when available.

When preformed sections are not available, install mitered sections of pipe insulation to valve body.

Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. Install insulation to flanges as specified for flange insulation application.

INSTALLATION OF POLYISOCYANURATE INSULATION

Insulation Installation on Straight Pipes and Tubes:

Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.

For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.

All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

Insulation Installation on Pipe Flanges:

Install preformed pipe insulation to outer diameter of pipe flange.

Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch thickness.

Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.

Insulation Installation on Fittings and Elbows: Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

Insulation Installation on Valves and Pipe Specialties:

Install preformed sections of polyisocyanurate insulation to valve body.

Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

Install insulation to flanges as specified for flange insulation application.

INSTALLATION OF POLYSTYRENE INSULATION

Insulation Installation on Straight Pipes and Tubes:

Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.

For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.

All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

Insulation Installation on Pipe Flanges:

Install preformed pipe insulation to outer diameter of pipe flange.

Make width of insulation section same as overall width of flange and bolts, and make thickness same as adjacent pipe insulation, not to exceed 1-1/2-inch.

Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.

Insulation Installation on Pipe Fittings and Elbows: Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

Insulation Installation on Valves and Pipe Specialties:

Install preformed section of polystyrene insulation to valve body.

Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

Install insulation to flanges as specified for flange insulation application.

FIELD-APPLIED JACKET INSTALLATION

Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.

Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.

Completely encapsulate insulation with coating, leaving no exposed insulation.

Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water and located at 4 o'clock position. Seal end joints, laps, gauges, thermometers and other devices with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

END OF SECTION 230719

SECTION 230913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work of this section.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for all components including the following to demonstrate compliance with the contract documents:

Catalog cut sheets of all equipment used. This includes, but is not limited to sensors, actuators, valves, and dampers.

Catalog cut sheets of air measuring stations used for the volumetric control system. Include as a separate volumetric control section velocity transmitters, static pressure transmitters, and flow chart for sequence of operation.

As applicable, control air supply components and sizing computations for compressors, receivers, and main air piping.

Operation and Maintenance (O/M) Manuals: See Section 019913 for requirements. O/M manuals shall include the following, at a minimum, elements:

General description and specifications for all sensors and final control elements.

Complete troubleshooting procedures and guidelines for all sensors and final control elements.

Documentation of all required maintenance and repair/replacement procedures.

PART 2 -PRODUCTS

ELECTRONIC SENSORS

General: Provide all remote sensors and instrumentation as required for the control system. All sensors shall have accuracies as stated hereinafter. Electronic sensors shall include integral transmitter and provide input analog input signal as either 4-20 mA or 0-10 VDC over the full range specified below.

Sensor Accuracy and Range: Each electronic sensor shall have accuracy and range as follows:

Sensed/Measured Variable	Sensor Characteristics Required	
	Measurement Accuracy	**Range**
Space Temperature	±1°F	+50°F- +85°F
Outside Air Temperature	±2°F	-30°F- +130°F
Relative Humidity (indoor air)	±5% RH	20% - 80% RH
Relative Humidity (outdoor air)	±2% RH	10% - 95% RH
Ducted Air Temperature	±1°F	+40°F- +140°F
Airflow (terminal)	±10% of full scale	
Airflow (duct measuring stations)	±5% of full scale	
Airflow (fan total)	±5% of full scale	
Air Pressure (ducts)	±0.1 in. w.g.	0 - 5.0 in. w.g.
Air Pressure (space)	±0.01 in. w.g.	-0.25 - 0.25 in. w.g.
Water Temperature		
- Chilled Water	±1°F	+20°F- +70°F
- Hot Water	±1°F	+50°F- +250°F
Water Pressure	±2% of full scale	
Water Differential Pressure	±2 psig	0-30 psig
Water Flow	±5% of full scale	
Steam Pressure	±2% of full scale	0-25 psig, low pressure 0-200 psig, high pressure
Steam Flow	±5% of full scale	

Temperature Sensors:

Space Sensors: Space sensors shall be negative temperature coefficient thermistor type within wall-mounted enclosures with blank covers and no temperature display. No setpoint adjustment by occupants shall be provided **unless specifically indicated on the Drawings or if project is to be constructed to meet the requirements of the USGBC LEED Rating System**. Where setpoint adjustment is required, range of adjustment shall be limited to +/- 2 deg F from setpoint defined by control sequences. Select thermistor resistance and temperature/resistance curve for maximum accuracy in the range of 50-100 deg F.

Duct-mounted Sensors: Sensors shall be RTD type averaging sensors with integral transmitter and a sensing element incorporated in a copper capillary with a minimum length of 20 feet.

Indoor Air Relative Humidity Sensors: Analog type with polymer element for comfort conditions monitoring and platinum element for critical areas including laboratories, hospital procedure rooms, etc. Space sensors shall have blank covers and no humidity display and no setpoint adjustment unless specifically indicated on the drawings. Duct sensors shall meet the requirements specified below for outdoor relative humidity sensors.

Outdoor Air Relative Humidity Sensors: Relative humidity sensors installed outdoors or in HVAC ductwork shall utilize a platinum or ceramic capacitive sensing element that is impervious to damage by (1) humidity levels exceeding 95% RH and (2) wetting by rain or surface condensation. Measurement range shall be 10 - 95% RH within a temperature range of -40ºF to 140ºF. Sensors installed in outdoors shall include a weatherproof enclosure.

Duct-Mounted Dew Point Sensors: Provide sensor/transmitters designed for duct installation to provide both dewpoint and dry bulb temperature output. Sensors shall incorporate both an RH sensor and an RTD temperature sensor, with a microprocessor that computes the dew point temperature. Humidity sensor shall utilize a platinum or ceramic capacitive sensing element that is impervious to damage by (1) humidity levels exceeding 95% RH and (2) wetting by surface condensation. Measurement range shall be 10 - 95% RH within a temperature range of 40ºF to 140ºF. Provide a linear 4-20mA output signal for dewpoint temperature and a 4-20 mA output signal for dry bulb temperature. Sensor shall be Vaisala Model HMS82TD or equivalent.

Occupancy/Vacancy Sensor: Sensor shall be dual technology ultrasonic (US) and passive infrared (PIR) type with relay photocell and manual adjustments (8-30 minutes) for time-on delay and sensitivity. Relay photocell must be capable of operation by N/O + N/C relay contact SPDT; 500 mA rated @ 24VDC with adjustable natural light override ranges from 0 to 100 footcandles. Sensor shall provide up to 2000 square feet coverage and have 360-degree field of view with vertical sensing adjustment. Sensor shall be designed for ceiling mounting and provided with two color LED lamps, red for infrared motion, green for ultrasonic motion. Sensor must operate indoors at temperatures from 32F-104F and relative humidity (non-condensing) 0%-95%. Sensors shall also be provided with a single pole, isolated relay for interface with BAS. Relays and contact ratings shall be clearly indicated in submittal literature. Provide 5 year warranty. Sensor shall be user-adjustable for the following alternative modes of operation for each independent relay:

Occupancy Mode: Sensor shall automatically energize controlled elements when the space becomes occupied and de-energize them when the space becomes unoccupied. (Mechanical Equipment)

Vacancy Mode: Controlled elements shall be energized by manual occupant control when the space is occupied and de-energized by the sensor when the space becomes unoccupied. (Lighting)

Motor Status Sensor: Status of pumps and fans shall be proven by adjustable current sensing relays. Provide user adjustable time delays (10 seconds default) to prevent false alarms during starting/stopping of motor.

Barometric Pressure Sensors: Sensors shall measure atmospheric pressure within a minimum range of 300 hPa to 1100 hPa. Sensors shall Type 316 stainless steel construction with the following characteristics:

Linear Output Signal: 4 to 20 mA.

Accuracy (Combined Linearity, Hysteresis and Repeatability): ±0.08% Best Straight Line

Zero and Span Balance: 1% max

Span Setting: ±0.5% full scale typical, 1% max; calibrated in vertical direction with fitting down

Minimum Operating Temperature Range: -40°F to 140°F

Power Requirement: Not to exceed 5 mA @ 10 Vdc

Duct, Plenum, and Outdoor Air Intake Airflow Measuring Stations:

Airflow measuring stations shall measure airflow by pitot tube traverse method or by the thermal dispersion airflow method.

Pitot tube method stations shall consist of an array of static and total pressure sensors, factory positioned and connected in parallel, to produce an equalized velocity pressure. The measured velocity pressure shall be converted to airflow (cfm) with accuracy within ± 2% of the full scale throughout the velocity range from 200 to 4000 fpm.

Thermal dispersion method stations shall utilize precision thermistors arranged to measure airflow rate and temperature at multiple sensing locations and relate the thermal transfer rate of a heated element to a total airflow rate (cfm). Ensure senor accuracy within ± 2% of reading shall be obtained through individual sensor characterization over a range of 0 to 5,000 FPM in wind tunnels calibrated to volumetric airflow standards. Sensor shall include a flow integration filter.

The maximum resistance to airflow shall not exceed 0.3 times the velocity head for the duct or stations and 0.6 times the velocity head for the fan stations. The unit shall be suitable for continuous operation up to a temperature of 250 degrees F.

Where application is measurement of outdoor airflow at air-handling unit inlet, station shall incorporate bellmouth inlet.

Fan Inlet Airflow Measuring Station:

Provide airflow monitoring device within the inlet cone of centrifugal fans or inlet bell of tubeaxial/vaneaxial fans where indicated on the Drawings. Air monitoring device shall be pitot tube type or thermal dispersion type, as follows:

Pitot tube type shall consist of an array of total and static pressure flow sensors constructed of aluminum or copper and mounted at opposing 90-degree positions around the fan inlet. Flow sensors shall be manifolded together to produce measured velocity pressure that is converted to airflow (cfm) within accuracy range specified herein below. The measured velocity pressure shall be converted to airflow (cfm) with accuracy within ± 2% of the full scale throughout the velocity range from 200 to 4000 fpm.

Thermal dispersion type shall utilize precision thermistors to arranged to measure airflow rate and temperature at multiple sensing locations and relate the thermal transfer rate of a heated element to total airflow rate (cfm). Ensure senor accuracy within ± 2% of reading shall be obtained through individual sensor characterization over a range of 0 to 5,000 FPM in wind tunnels calibrated to volumetric airflow standards. Sensor shall include a flow integration filter.

Air monitoring station shall not obstruct the fan inlet nor have any effect on fan air performance or sound power levels.

Condensate Level Sensor: For each FCU/BCU/AHU, provide a plenum-rated water level detection device, conforming to UL 508, consisting of one or more moisture sensors and a N.O. dry contact to serve as a binary input point connected to the building control system to disable mechanical cooling and initiate an alarm in the event the condensate drain is blocked. Device shall include adjustable 1-3 minute time delay before opening to reduce short term nuisance shutdowns. Device shall be mounted on the FCU/BCU/AHU, with remote sensor(s) installed in the equipment's factory-installed primary drain pan, located at a point higher than the pan's primary drain line connection and below the overflow rim of the pan. Sensor(s) shall be retained by clips and/or adhesive tape.

Exceptions:

Where the primary drain pan is too shallow or otherwise designed so that sensor(s) cannot be located as required, a drain pan overflow sensor, installed in the pan's secondary drain line connection, may be used.

Where an auxiliary drain pan is required, as indicated on the Drawings, provide water level detection device with sensor(s) installed at the lowest possible level in the auxiliary drain pan.

ELECTRIC CONTROLS ELEMENTS

Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F set-point range, and 2 deg F maximum differential.

Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
Selector Switch: Integral, manual on-off-auto.

Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

Bulbs in water lines with separate wells of same material as bulb.

Bulbs in air ducts with flanges and shields.

Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.

Scale settings and differential settings are clearly visible and adjustable from front of instrument.

On-Off Thermostat: With precision snap switches and with electrical ratings required by application.

Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

Fire-Protection ("Firestat") Thermostat: Manual reset on-off thermostat with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature. Firestat shall be listed and labeled for the application.

Electric, Low-Limit Duct Thermostat ("Freezestat"): Snap-acting, single-pole, single-throw, manual-reset switch that opens if temperature sensed across any 12 inches of bulb length is equal to or below setpoint of 40°F.

Bulb Length: Minimum 20 feet.

Quantity: One thermostat for every 20 sq. ft. of coil surface. Where multiple low-limit thermostats are required, they shall be wired in series so that any one thermostat will result in the system shutdown as indicated on the Drawings.

Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that opens if temperature sensed across any 12 inches of element length is equal to or above set point.

Bulb Length: Minimum 20 feet.

Quantity: One thermostat for every 20 sq. ft. of coil surface. Where multiple high limit thermostats are required, they shall be wired in series so that any one thermostat will result in the system shutdown as indicated on the Drawings.

FINAL CONTROL ELEMENTS AND OPERATORS:

Control Dampers: Provide dampers with parallel blades for 2- position control, opposed blades for modulating control. Dampers shall be in accordance with Section 233300.

Damper and Valve Operator/Actuators: Unless indicated otherwise on the Drawings, all actuators shall have fail-safe operation via a mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.

Actuators for Pressure Independent Control Valves: Actuators shall be electronic type furnished and mounted by the control valve manufacturer. Actuators shall accept 2-10 VDC or 4-20 mA input signal from the facility direct digital control system. Actuators shall be electronically programmed by use of external computer software provided by the valve manufacturer for adjustment of flow settings.

Types of Operators/Actuators: Damper operators for dampers larger than 5 sf shall be electronic. Damper operators for dampers 5 sf or smaller in area shall be electronic.

Electronic Damper Actuator: Shall be direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

For dampers, size actuator for running torque calculated as follows:

Parallel-Blade Dampers: 7 inch-lb/sq. ft. of damper.

Opposed-Blade Dampers: 5 inch-lb/sq. ft. of damper.

Dampers with Face Velocities exceeding 1000 fpm: Increase running torque by 2.0.

Couplings shall be V-bolt and V-shaped, with toothed cradle.

Provide electronic overload or digital rotation-sensing circuitry.

Actuator shall operate with proportional input signal of 2-10 VDC or 4 to 20 Ma.

Rated temperature operating range for actuators shall be -20 deg F to +120 deg F for conventional applications and -20 to +250 deg F for smoke or fire/smoke damper application.

Actuator full stroke time requirement shall not exceed 12 seconds to open or 5 seconds to close when applied to control smoke dampers or cooling tower bypass valves.

Electric Two-Position Damper Operator/Actuator: Provide a bi-directional, 120-VAC operator with spring return, size actuator for running torque calculated as follows:

Parallel-Blade Dampers: 7 inch-lb/sq. ft. of damper.

Opposed-Blade Dampers: 5 inch-lb/sq. ft. of damper.

Dampers with Face Velocities exceeding 1000 fpm: Increase running torque by 2.0.

Position Indicator: Actuators shall be provided with a compact, adjustable visual position indicator attached to the actuator. As a damper or valve is cycled, the position indicator shall rotate, causing a cylinder to rotate inside a second cylinder with "display windows." When the damper or valve is open, the word "OPEN" shall be displayed in the two windows located 180° apart. When the damper or valve is closed, the word "CLOSED" shall be displayed. Between the two extremes, the display shall be scaled in degrees (0-90).

PART 3 - EXECUTION

INSTALLATION

Sensors and Controls:

Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.

Label or code each field wire at each end. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.

Temperature Sensors:

Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.

Low-limit thermostats ("freezestats") shall be located at an elevation at or above the top of the coil being protected and the capillary element installed in a serpentine arrangement across the face of the coil starting at the top and ending at the bottom.
Mount sensors rigidly and adequately for the environment within which the sensor operates.

Sensors used in mixing plenum or in air-handling unit hot and cold decks shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.

Pipe-mounted temperature sensors shall be installed in wells completely filled with thermal conducting material.

All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.

Duct Pressure/Airflow Sensors/Switches:

Sensors shall be connected to pressure or airflow monitoring stations.

Duct, Plenum, and Outdoor Air Intake Airflow Monitoring Stations.

Each airflow measuring station shall be installed as located and detailed on the Drawings in accordance with the manufacturer's minimum installation conditions for the indicated application and shall not amplify the sound level. **Install duct-mounted airflow monitoring stations or sensors a minimum of 5 duct diameters up stream and 8 duct diameters downstream or 6 feet, whichever is greater, from fittings and other obstructions.**

Actuators:

Mount damper and valve actuators according to manufacturer's written instructions.

Damper actuators shall be located outside of the airstream.

Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.

Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.

FIELD TEST AND INSPECTIONS

Upon completion of installation of each sensor or final control element, field inspect and mechanically and electrically test for proper function.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 230913

SECTION 230923 – EXTENSION OF EXISTING DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work of this section.

Section 230913, which specifies the requirements for sensors, devices, actuators, and final control elements utilized by the DDC system.

Section 230924, which specifies the requirements for original equipment manufacturer (OEM) controllers/ gateways provided under Division 23.

QUALITY ASSURANCE

Single Source Responsibility of Supplier: The controls system sub-contractor shall be responsible for the complete installation and proper operation of the control system. The sub-contractor shall be in the regular and customary business of design, installation and service of computer-based building environmental control systems similar in size and complexity to the system specified. The sub-contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years. The sub-contractor must be licensed as an “unlimited electrical contractor” in the state in which the Project is constructed, shall have a factory-certified trainer on staff, and provide 5 day per week local technical support. **Submit documentation of these sub-contractor qualifications to the A-E for review.**

Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

Verification of HVAC systems requires participation by the direct digital controls subcontractor as a member of the "Verification Team". See Section 230596 for requirements.

GUARANTEE PERIOD SERVICES

Maintenance of Control Hardware: The Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the file server/workstation(s), associated peripheral equipment, and control units. The Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all software is functioning correctly.

Maintenance of Control Software: The Contractor shall maintain all software. In addition, all factory or sub-vendor upgrades to software shall be added to the systems, when they become available, at no additional cost to the Owner.

Service Period: Routine system service shall be provided on a monthly basis for the first six (6) months of the guarantee period and at least every three months during the second six (6) months. Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.

Service Documentation: A copy of the service report associated with each routine service visit or Owner-initiated service call shall be provided to the Owner and the A-E with 10 days after the date of each service call.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, model number, and other relevant technical data. Include technical data for operator workstation equipment, interface equipment, control units, communicating thermostats, transducers/ transmitters, sensors, actuators, valves, relays/switches, control panels, operator interface equipment, etc..

DDC System Software:

Include technical data for operating system software, operator interface, color graphics, and other third-party applications.

List of graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.

Controlled Systems:

Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Bill of materials of equipment indicating quantity, manufacturer, and model number for each controlled system

Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring and termination labels.

Details of control panel faces, including controls, instruments, and labeling.

Written sequences of operation. The sequence shall include reference to schematic diagram(s) that is/are applicable. Include "on/off" and "occupied/unoccupied" schedules, as applicable for each controlled system.

Schedule of software interlocks between HVAC equipment or components. Include any "groupings" of controlled systems that may be used to initiate on/off control of any other controlled system.

Schedule of dampers including size, leakage, and flow characteristics.

Schedule of valves including flow characteristics.

DDC System Hardware:

Wiring diagrams for control units and communicating thermostats, with termination numbers.

Schematic diagrams and floor plans for field sensors and control hardware.

Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.

Graphic Displays: Include color prints or "screen shots" of each proposed graphic display proposed, complete with clear indication of (1) static components and dynamic components and (2) "on"/"off"/"alarm" condition designation convention.

Samples for Initial Selection: For each color available for each type of thermostat, sensor, etc. cover exposed to view with factory-applied color finishes.

Data Communications Protocol Certificates:

For extension of an existing DDC system that utilizes the BACnet communications protocol, certify that each proposed DDC system component complies with ASHRAE Standard 135-2012 **and is BACnet Laboratory tested and certified**.

For extension of an existing DDC system that utilizes LonWorks technology using CEA-709.1-C as the communications protocol, each proposed DDC system component shall be certified by LonMark International.

Closeout Submittals:

Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.

Interconnection wiring diagrams with identified and numbered system components and devices.

Keyboard illustrations and step-by-step procedures indexed for each operator function.
Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

Calibration records and list of set points.

Software and Firmware Operational Documentation: Include the following:

Software operating and upgrade manuals.

Program Software Backup: On a magnetic media or compact disc, complete with data files.

Device address list.

Printout of software application and graphic screens.

Software license required by and installed for DDC workstations and control systems.

PART 2 - PRODUCTS

SYSTEM DESCRIPTION

Provide extension to the Owner's existing direct digital control system utilizing the Owner's network system consisting of existing server, LAN/WAN, and server-resident network software.

Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on a token-passing network and programmed to control mechanical systems.

JOB CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

LAN hardware shall be designed to operate in ambient conditions of 65 to 90 degrees F at a relative humidity of 20 to 80 percent, non-condensing.

Digital control equipment shall comply with the following:

Digital control equipment shall be designed to operate in ambient conditions of 35 to 120 degrees F at a relative humidity of 0 to 95 percent non-condensing.

Control units as hereinafter specified shall operate properly with power fluctuations of plus 15 percent to minus 10 percent of nominal supply voltage.

Electric and electronic equipment shall be properly mounted and organized in a grounded and Listed NEMA 1 cabinet (panel). Cabinets or enclosures shall protect equipment from dust, liquids or accidental blows.

NETWORK COMPONENTS

Via either direct or web browser access, the following functions shall be provided:

Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.

Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any control unit.

Network Software: Software shall be upgraded as necessary to include the following capabilities:

I/O capability from any network operator workstation or through a browser. The system operator interface shall be an easy to use, self-guiding, menu-penetration, windowing approach. Key features that shall be included in the interface are as follows:

Object/point descriptions used for applications such as graphics, reports, alarms, etc. shall be same as the object/point name as specified above.

Engineering units shall be the English ("inch-pound") system.

Interactive operation and help messages.

Organization of points into logical groups or "systems" and an information penetration scheme that provides quick and simple method for maintenance staff to determine HVAC conditions and problems at any school, as follows:

Initial facility information display will be one or more graphic "floor plans" that include basic site information and specific room by room data. Each of these data points are displayed as "hot buttons" so that selecting any data display takes the user to next, more detailed information level. The floor plan display(s) shall provide display of room numbers, along with temperature, humidity, CO_2, occupancy, etc. conditions in each space. Designation of the HVAC terminal unit, air unit, and/or system serving each space shall also displayed and selecting that hot button shall take the operator to the detailed system points display for that terminal unit, air unit, and/or system serving the room.

At the HVAC system, subsystem, or component level, a graphical display or "tree structure" structure display may utilized, as selected by the user.

Site information shall include direct hot button links to primary heating and cooling systems. (For example, selecting "CHWSTemp" shall take the operator immediately to the graphic or tree structure display of the facility chilled water cooling system, while selecting "HWSTemp" shall lead to the facility hot water heating system.)

Pictorial representation of data on color graphic terminals with dynamic data.

Capability to alternate between graphic and text displays for the same logical group.

Automatic system diagnostics; monitor system and report failures of both controlled equipment and control system components.

Database creation and support.

Automatic and manual database save and restore.

Dynamic color graphic displays with multiple screen displays at once.

Custom graphics generation and graphics library of HVAC equipment and symbols.

Alarm and event processing.

Provide audible, visual, and printed means of alarm indication. The alarm dialog box shall al ways become the top dialog box upon receipt of an alarm irrespective of the foreground application. Alarms assigned for printout shall be routed to the destination printer. In addition, alarms shall be capable of being routed to specified personnel by means of pager or mobile telephone.

User-defined alarm messages shall be generated and delivered in conjunction with the alarm notification.

Alarms shall be routed to the appropriate destination device(s), based on time and other conditions. An alarm shall be able to initiate sequences, print, be logged in the event log, generate custom messages, and automatically display an associated system graphic.

Any object in the system shall be configurable to generate alarms on transition in and out of normal state. The operator shall be able to configure the alarm category, alarm limits, alarm limit differentials, states, al arm message, states and reporting actions for each alarm in the system.

Minimum alarm categories required are notification, maintenance, critical and security.

Automatic restart of field equipment on restoration of power.

Data collection, reports, and logs. Include standard reports for the following:

Current values of all objects.

Current alarm summary.

Disabled objects.

Alarm lockout objects.

Logs:

Retrieve and display default logs, including "all points log", "system points log", "alarm log", etc.

Create, retrieve, and display trend logs, in real time, of historical object data stored in remote CUs.

Maintain trend log files saved to hard disk for subsequent use in spreadsheet or database programs.

Dynamically graph the trend logged object data by creating two-axis (x, y) graphs that simultaneously display values relative to time for up to eight objects in different colors.

It shall be possible to trend log any number of points at least equal to twice the number of connected physical points. Any object in the system (physical or calculated) may be logged.

Once established, trend logs shall continue until deleted by user. Data storage sufficient for at least 30 days shall be provided for each trend log.

Custom report development.

Utility and weather reports.

Application editors for controllers and schedules.

DIRECT DIGITAL CONTROL UNITS

General: Multiple digital control units (CUs) shall be provided. ***CUs shall be fully field programmable and the use of firmware-based application specific controllers is prohibited.*** All control functions shall be resident in the CUs, including those involved in building-wide strategies.

Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

Control units shall fully comply with the system architecture and communication requirements specified hereinbefore.

Units shall monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.

Stand-alone mode control functions shall operate regardless of network status. Functions include the following:

Global communications.

Discrete/digital, analog, and pulse I/O.

Monitoring, controlling, or addressing data points.

Software applications, scheduling, and alarm processing.

Testing and developing control algorithms without disrupting field hardware and controlled environment.

Provide local operator interface to provide for download from or upload to operator workstation or diagnostic terminal unit.

Standard Application Programs:

Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short cycling, P/PI/PID control as hereinafter, DDC with fine tuning, and trend logging.

HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.

Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.

Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.

Remote communications.

Maintenance management.

Units of Measure: Inch-pound.

Local operator interface to provide for download from or upload to operator workstation or diagnostic terminal unit.

Control Modes: Control loops shall be able to utilize any of the following control modes:

Two position (e.g., on-off, slow-fast)

Proportional (P), proportional plus integral (PI), or roportional plus integral plus derivative (PID), applied as follows:

Controlled Variable	Control Mode
Space Temperature	P
Mixed Air Temperature	PI
Coil Discharge Temperature	PI (cooling), P (heating)
Hot Water Supply Temperature	P
Airflow	PI (with wide proportional band and fast reset rate) or PID
Fan Static Pressure	PI
Humidity	P (PI throttling range is less than 5%)
Dewpoint Temperature	P (PI throttling range is less than 2 F)

For any unlisted application, the control mode shall be as approved by the A-E.

I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

Digital (Binary) Inputs: Allow monitoring of on-off signals without external power.

Pulse Accumulation Inputs: Accept up to 10 pulses per second.

Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.

Digital (Binary) Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.

Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.

Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.

Universal I/Os: Provide software selectable binary or analog outputs.

Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

Output ripple of 5.0 mV maximum peak to peak.

Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.

Built-in over-voltage and over-current protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

Minimum dielectric strength of 1000 V.

Maximum response time of 10 nanoseconds.

Minimum transverse-mode noise attenuation of 65 dB.

Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

Diagnostic Devices: Each CU shall be supplied with connections to which Owner's maintenance personnel can connect portable diagnostic operator's terminals (PDOTs) for data display, setpoint modification, and reloading and modification of controller programs.

Spare Equipment: Provide spare control unit boards and spare I/O boards as required. It shall be possible for trained Owner personnel to replace CU boards and load software via a workstation or PDOT:

Provide two spare control unit boards. If power supplies are separate, supply separate power supplies and other parts to make at least two complete sets of DDC control equipment spares.

If I/O boards are separate from the CU boards, provide four spare I/O boards for each spare CU board provided above.

Control Functions: All control functions shall execute within the standalone control units via DDC algorithms. The operator shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters. Each CU shall include the following standalone functions:

Direct Digital Control algorithms and control sequences are to be CU resident and be capable of standalone operation. All DDC programs shall be custom written as required to meet the performance criteria spelled out in the sequence of operation paragraphs for each controlled mechanical system. PID control mode shall be employed as appropriate to the application and per sequences or operation.

Enable/Disable: All CU resident DDC programs shall be capable of being enabled or disabled from any workstation. In the enable mode all DDC loops shall be active and output signals shall be routed to the final control elements. In the disable mode all DDC loop calculations shall continue but outputs to actuators shall be suppressed. (When disabled, control outputs shall stay in the same state or position as commanded from the central or until they are manually set to automatic.)

Integral Windup Prevention: To eliminate integral windup, all PID programs shall automatically invoke integral windup prevention routines whenever the controlled unit is off, under manual control or under control of an system or time initiated program, or when the controlled unit is in the process or starting or stopping.

Default Value Operation: All CUs shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the central control and command station. Each CU shall have capability for local readouts of all functions.

Heat Pump Thermostat: Thermostat shall have a backlit display that displays room temperature and provides for adjustable setpoints. The thermostat shall have the capability to be programmed locally with the setpoint parameters adjustable from the facility DDC system. The heating and cooling setpoint adjustments shall have the ability to be limited through the facility DDC system. The thermostat shall directly control the heating and cooling stages, reversing valve, and unit fan; shall have at least two configurable binary inputs for points indicated in the sequence of operation on the Drawings; and shall have an analog input for monitoring discharge air temperature. The thermostat shall use BACnet or LonWorks communication protocol as applicable to the existing network and be integrated into the building DDC system.

APPLICATION SOFTWARE

Provide the following programs in addition to control algorithms defined on the drawings:

Scheduling: Provide a calendar format for annual time-of-day scheduling for equipment operation, trending, logging and reports, etc. Provide the following minimum features:

Day-type schedules (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday, Holiday, Pre-Holiday day, Vacation day, Special Day, etc., 24 hours per day)

Monthly schedules (allow individual assignment of day types to each day of the month).

Yearly schedules (allow schedules to be applied on an annual basis and be edited and re-applied to a following year).

Provide user-defined "on-off" schedules as specified assignable to an individual HVAC system, subsystem, and/or component. This schedule shall dictate the starting and stopping times, on a daily basis, of the designated systems and components.

Provide user-defined "occupied-unoccupied" schedules as specified above for operation of each fan coil unit, blower coil unit, air-handling unit, ventilation air system, etc. This schedule shall dictate the opening and closing of ventilation air dampers, the starting and stopping of exhaust fans associated with each unit, the operation of make-up air units, etc., on a daily basis, so that ventilation air is provided only during the specific periods during which the area served is occupied.

Temporary override of above schedules shall be allowed by operators with access levels as specified above. A temporary override shall (1) extend hours of use of HVAC systems, subsystems, and/or components up to midnight on weekdays and (2) allow use of HVAC systems, subsystems, and/or components during scheduled "off" periods for a maximum of 12 hours. When an override use period terminates, the temporary override time(s) shall be voided and affected HVAC elements shall return to their normal schedules.

When multiple motors associated with an HVAC are commanded "on" at the same time, the individual DDC start commands shall be staggered by 5 second intervals to second intervals to minimize inrush current.

Optimum On/Off: Program shall consider both outdoor weather conditions and indoor thermal zone conditions to perform the following functions to minimize the operation of space cooling and heating systems:

Start HVAC equipment at the latest possible time after its scheduled “on” time in order to achieve the desired zone comfort condition in the coolest or warmest zone by its “occupied” time.

Stop HVAC equipment at the earliest possible time after its “unoccupied” time and before its scheduled “off” time and still maintain desired zone comfort condition in the coolest or warmest zone.

Coordinate automatically with on/off schedules assigned by the user.

Event Initiated Programs (EIPs): Event initiators may be any digital data point in the system, real time values, or any analog alarm limit. The EIPs shall be structured so that one initiator may set and reset the EIP as it goes from normal to off-normal and back to normal, or one initiator may set the program and a second initiator reset the program, or reset may be manual via the console keyboard. Setting an EIP shall cause a series of start or stop commands to assigned loads to be executed to EIP's points. EIP's shall have priority assignments to allow them to override other programs in the set mode when desired. The operator's terminal shall have read-write capability for initiator load and priority assignment.

Alarm Initiation and Response:

All AI points shall have user-defined upper and/or lower condition limits. If user-defined limits are not defined, ***default limits shall be initially set as follows***:

Space temperature	5ºF below low setpoint of comfort zone or 5ºF above high setpoint of comfort zone
Space humidity	≥5% RH above setpoint
AHU mixed air low limit	≤38ºF
Cooling coil leaving air	≥60ºF
Heating coil leaving air	≤90ºF

Monitor and display "status" (on/off, high/low, open/closed, etc.) of each DI point. Motor on/off status shall be indicated by current sensing relays with field-adjustable trigger point to provide DI "switch", as hereinafter specified.

Monitor and display condition of each AO point (valve or damper percent open, motor speed percent of full speed, etc.)

An alarm shall be initiated whenever any of the following conditions occur:

Any AI point high or low limit alarm setpoint is exceeded.

Any DI status condition does not correspond to the DDC command condition (i.e., damper is closed when occupied/unoccupied schedule requires damper to be open, motor is operated in "hand" rather than "auto" mode, etc.)

Any AI or DI device fails or goes "out of range".

Any AO device fails to respond to DDC command condition.

If any AO control loop continues to cycle its output more than 40% of its range (user adjustable) 3 or more times in any 60 minute internal.

For variable air volume AHUs, if any supply fan or return/relief fan speed AO output signal remains above 95% for more than 8 hours (user adjustable) accumulated per "on" period for 3 or more consecutive "on" periods.

If any AHU coil control valve(s) AO output signal remains above 95% for more than accumulated 8 hours (user adjustable) per "on" period for 3 or more consecutive "on" periods.

If any humidifier valve AO output signal remains above 85% for more than accumulated 8 hours (user adjustable) per "on" period for 3 or more consecutive "on" periods.

During "on" periods, if any cooling coil chilled water return temperature is greater than design for more than 4 hours during which coil chilled water supply temperature was at or below design setpoint temperature.

Automatic Restart Programming:

When a power failure is detected in any phase, the DDC system shall command all electrical equipment served by the failed power source "off".

If the associated CU is powered by normal or emergency power, it may monitor its own power source as an indication of power status.

If the CU is powered by uninterruptible power supply (UPS), or if it is not capable of monitoring its own power for use in sequences, Contractor shall provide at least one voltage transformer (three phase when applicable) for each facility for the DDC system to monitor for power status.

When the DDC system detects normal or emergency power has been restored to the failed power source, all equipment served by that source that was commanded "off" shall be automatically restarted. Restart shall be sequenced by the CU network restart program with a 5 second interval between starts to minimize inrush current.

Preventive Maintenance Instruction (PMI) programming: A preventive maintenance alarm shall be printed indicating maintenance requirements based on run time. The log shall include all equipment listed in the runtime schedule data base that have reached limit criteria of calendar-date (month-day-year) or high accumulation of totalized run-time (for points with start/stop or run status indication). Each PMI message shall include point descriptions, limit criteria and preventive maintenance instruction assigned to that limit. PMI shall be provided for each component of units such as air handling units. All limit criteria, PMI and reset-to-zero assignments shall be operator programmable, on-line at the keyboard. Stagger initial alarms to distribute maintenance throughout the year.

Program initial PM alarms as follows:

Fans and pumps, run time 4000 hours

Refrigerators/freezers, converters, cooling tower system, water treatment, calendar time 3 months

Emergency generator oil samples, calibration of instrumentation and controls, calendar time 12 months

All other, calendar time 4 months

Air Flow and Pressure Control:

Air flow and static pressure shall be controlled via direct digital CUs with inputs from air flow control measuring stations and static pressure inputs as specified in Section 230913 and indicated on the Drawings. Controller outputs shall be true analog output signals. Pulse width modulation outputs are not acceptable. The airflow control programs shall be standard factory tested programs that are documented in the literature of the control manufacturer.

Constant Volume Control: Systems shall consist of a static/total pressure sensor as specified in Section 230913 and a differential pressure transmitter, along with such relays and auxiliary devices as required to produce a complete functional system. The transmitter shall receive its primary total pressure and static pressure signal from the flow measuring station and shall have a span not exceeding three times this differential pressure at the design flow rate. The CU shall receive the transmitter signal and shall provide an output to the fan volume control device to maintain a constant flow rate. Overall system accuracy shall be plus or minus 0.008-inch velocity pressure as measured by the flow station.

Additional application control requirements shall be met as required by the DDC control logic diagrams on the Drawings.

CABLING AND WIRING

DDC Cabling: Cabling between buildings shall be fiber optic. **Network cabling within buildings shall be shielded twisted pair or fiber optic**. Cabling or wiring between control units and I/O point devices shall be as follows:

Application	Cable/Wire Type and Min. Gauge (AWG)
Digital Input Wiring	24 gauge, twisted pair
Analog Input Wiring	24 gauge, shielded twisted pair
Digital Output Wiring	24 gauge stranded for 24V 18 gauge stranded for 120V
Analog Output Wiring	24 gauge, twisted pair

Data Cable:

Twisted shielded cables shall have FFEP insulation in thermoplastic jacket, with #24 AWG stranded conductors, minimum. Shield shall be tinned, soft-copper strands formed into a braid or equivalent foil. Shielding coverage on conductors shall not be less than 100 percent.

Multimode fiber optic cables shall be 62.5/125 micron Class Ia Graded Index Multimode Optical Fiber**,** OFNR, OFNP, Outdoor or Indoor / Outdoor (I/O) NEC Rating, FDDI Compliant.

Coating Diameter: 250 Microns

Core Eccentricity: 7.5% maximum (1.5% typical)

Numerical aperture: .275 plus or minus .015

Attenuation: 3.5 dB/km @ 850 NM / 1.50 dB/km @ 1300 NM

Bandwidth: 160 MHz at 850 NM / 500 MHz @ 1300 NM

Fiber connectors: ST .75 dB maximum insertion loss

Cable bend radius: 10 times diameter

Single mode fiber optic cables shall be 8.3/125 micron Class IVa Dispersion-Unshifted Single-mode Optical Fiber, OFNR, OFNP, Outdoor or Indoor / Outdoor (I/O) NEC Rating, FDDI Compliant.

Coating Diameter: 250 Microns

Core Eccentricity: 7.5% maximum
(1.5% typical)

Attenuation: 0.5 dB/km @ 1310 NM/1550 NM

Zero dispersion wavelength 1300 -1320 NM

Cable bend radius: 10 times diameter

Control and Interlock Wiring: All 24V-120V control and interlock wiring shall comply with Section 230511 and the following:

Conductors:

All wire and conducting components shall be THWN standed copper.

Conductors shall be continuous from device to device and no splices shall be made except within device or junction boxes. ***Wire nuts and crimp slices are prohibited.***

Control wiring shall be color-coded in accordance with reviewed submittals.

Where conductors pass through a junction box or connect to a device, the conductor and the box shall be tagged to indicate the circuit and/or terminal number shown on the submittal drawings.

Raceway: Provide electrical metallic tubing (EMT), minimum 3/4" size. Fittings shall be steel insulated throat compression type. ***Set screw fittings, fittings constructed of alloys of aluminum or fittings of the indenter type are prohibited.*** Flexible metallic raceway may be utilized for the last 24" up to the connection point for devices, sensors, etc.

Routing of Raceway: Exposed raceway shall line up work true to adjacent surfaces and be placed in a workmanlike manner. Raceway shall be run at right angles to building lines; this requirement does not apply to raceway located below concrete placed as a part of this project. Raceway shall be sturdily supported and separated in a manner satisfactory to the A/E; raceway shall not be supported by the ceiling grid or ceiling grid support wires. In general, all raceway is to be concealed and routed overhead, below the floor, or in walls except in electrical or mechanical equipment rooms. Raceway in such rooms may be surface mounted.

Device Boxes: Device boxes for use in sheetrock or paneled surfaces shall be of galvanized steel, 4 inches square of a depth necessary to contain the intended device(s) and associated conductors. Boxes shall be sized to have no less than the minimum volume as required by the NEC. Boxes must be flush mounted and accommodate device(s) and all wires and connections without crowding. Boxes shall be furnished with a suitable plaster ring of the depth required to match the wall (or ceiling) material. Where the surface material or covering is combustible the front edge of the plaster ring shall be absolutely flush with the surface. Where the wall material is non-combustible, the front of the plaster must be recessed into the wall no further than 3/16 inch. Device boxes for flush mounted use in masonry walls shall be of the concrete tight masonry type sized for the number of device(s) and conductors. In locations where surface mounting of device boxes is permitted on masonry walls, provide 1/2 inch raised cover and suitable plaster ring.

Junction Boxes: Junction boxes shall be of galvanized steel of size, type, and shape for intended use and having adequate volume as required by NEC. All junction boxes shall be concealed unless specifically permitted elsewhere in these Specifications or on the Drawings. Boxes must be supported from the building structure without dependence on support of conduit, fixture support wires, ceiling support wires, or similar items.

Device and/or Junction Box Wall Penetrations: All wall penetrations at device or equipment locations must be protected in such a manner that the fire rating of the wall is maintained. ***It is the responsibility of the Contractor to assure that fire and smoke integrity of all walls is maintained at all penetration points***.

PART 3 - EXECUTION

INTERFACE WITH OEM CONTROLLERS/GATEWAYS

Section 230924 addresses specific requirements for equipment or subsystem OEM controllers/gateways that must interface with a facility DDC system may be encountered. The OEM is responsible for coordination between the DDC system sub-contractor and OEM unit controls provided to ensure that required control interface is implemented, resulting in full interoperability between OEM unit controls and the DDC system.

The OEM shall provide a Protocol Implementation Conformance Statement (PICS) that identifies the particular objects and options specified by BACnet or LonMark, as applicable, that are implemented in the OEM controller/gateway. *The controls system sub-contractor shall utilize the information provided by the OEM to correctly interface the DDC system with the OEM controllers/gateways provided and coordinate with the OEM to ensure that the interface provided complies with the information/data provided by the OEM*.

INSTALLATION

Provide skilled technicians, properly trained and qualified for the work and directed by experienced engineers.

Except for short apparatus connections, run raceway and pneumatic tubing parallel to or at right angles to the building structure. Conceal raceway and tubing in finished spaces.

Do not run tubing or raceway concealed under insulation or inside ducts. Mount control devices, tubing and raceway located on ducts or apparatus with external insulation on standoff supports to avoid interference with insulation.

Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing. Rack connections bridging a cabinet door along the hinge side and protect from damage. Provide grommets, sleeves or vinyl tape to protect plastic tubing or wires from sharp edges of panels, raceway, and other items.

Cabling and Wiring Installation:

Raceway: All control cabling and interlock wiring shall be installed in raceway.

Exception: Where Class 2 wiring is located in concealed and accessible locations, including supply or return air plenums, plenum-rated cables complying with NFPA 262 may be installed without raceway, provided that:

Circuits meet NFPA 70 Class 2 (current-limited) requirements.

All cables shall be UL-listed for the application.

Do not install Class 2 wiring in raceway containing Class 1 wlring. Boxes and panels containing high voltage (120 V+) may not be used for low voltage wiring except for the purpose of interfacing the two via relays, transformers, etc.

Shielded, twisted pair cable shielding shall be grounded at each connection point.

Fiber Optic Cable:

Route all interior cables in raceway within walls and inaccessible ceiling spaces.

Use nylon bushings at top of conduit where stubbed in accessible ceiling spaces.

Support all cables using J type hooks where open cable is permitted.

Route all fiber optic cable in raceway with innerducts. The innerducts shall contain a pull string, if no fiber is pulled at the time of the installation of the duct.

All conduit where fiber optic cable is installed shall be sized to maintain the manufacturer's recommended bend radius of fiber optic cables. As a minimum, conduit shall be provided with long radius elbows.

All cables shall be terminated using appropriate termination equipment.

Fiber Termination Panels: Provide a rack mountable, modular cabinet capable of terminating up to 24 type ST multimode fiber cables. Panels shall be as manufactured by Ortronics, Amp, Siecor, or Superior.

Fiber Optic Testing

Upon completion of the passive optical cable system, the system must be tested to ensure compliance with the design and link loss specifications. The tests include:

Power Meter Tests: For building risers, power meter tests are required.

End-to-End Attenuation Testing: Tests shall be completed on each fiber span at both operational wavelengths:

850/1310 nm multimode

1550 nm single mode

Testing in one direction is required. Link attenuation does not include any active devices or passive devices other than cable, connectors and splices (e.g., link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers. Test results should be retained for inclusion into the documentation package.

Connector loss readings of each completed connector should be recorded using an OTDR at 850 and 1310 nm in one direction.

Optical time domain reflectometer (OTDR) signature traces of each terminated fiber should be recorded at 850 nm and 1310 nm for fiber continuity purposes. OTDR testing is mandatory for runs longer than 2 km.

Final report shall be compiled which records system configuration, fiber labels, cable routes and "as built" details. Loss measurements with calibrated light source and power meter shall be included. OTDR traces shall also be included when requested in advance.

Pneumatic Tubing: Metallic tubing is required throughout. Except for short (24" max) flexible tubing final connections to pneumatic operators.

Exception: Non-metallic tubing may utilized when operating at 45 psig or less and not more than 125 degrees F. Except for short apparatus connections (not exceeding 24" in length), non-metallic tubing in mechanical rooms and other exposed locations shall be protected from mechanical damage by installation in raceway. Provide protective grommet where tubing exits raceway.

Smoke detectors and/or fan shutdown relays initiated by a fire alarm system shall be integrated into the control system and sequence of operation as indicated and/or required.

FIELD QUALITY CONTROL

Perform the following field tests and inspections and prepare test reports after completion of DDC system installation:

After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.

Test and adjust controls and safeties.

Test pneumatic components, as applicable:

After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Pressure test control air piping at 1.5 times the operating pressure for 24 hours, with maximum 5-psig loss.

Test calibration of control units by disconnecting input sensors and stimulating operation with compatible signal generator.

Test each control point through its full operating range to verify that safety and operating control set points are as required.

Test each control loop to verify stable mode of operation and compliance with sequence of operation.

Test each system for compliance with sequence of operation.

Test software and hardware interlocks.

DDC Verification:

Verify that instruments are installed before calibration, testing, and loop or leak checks.

Check instruments for proper location and accessibility.

Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.

Check instrument tubing for proper fittings, slope, material, and support.

Check installation of air supply for each instrument.

Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.

Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.

Check temperature instruments and material and length of sensing elements.

Check control valves. Verify that they are in correct direction.

Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.

Check DDC system as follows:

Verify that DDC controller power supply is from emergency power supply, if applicable.

Verify that wires at control panels are tagged with their service designation and approved tagging system.

Verify that spare I/O capacity has been provided.

Verify that DDC controllers are protected from power supply surges.

Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

CALIBRATION AND ADJUSTMENT

General:

Make three-point calibration test for both linearity and accuracy for each analog instrument.

Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

Control System Inputs and Outputs:

Check analog inputs at 0, 50, and 100 percent of span.

Check analog outputs using milliampere meter at 0, 50, and 100 percent output.

Check digital inputs using jumper wire.

Check digital outputs using ohmmeter to test for contact making or breaking.

Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

Flow:

Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.

Manually operate flow switches to verify that they make or break contact.

Pressure:

Calibrate pressure transmitters at 0, 50, and 100 percent of span.

Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

Temperature:

Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.

Calibrate temperature switches to make or break contacts.

Stroke of valves and dampers:

Without positioners, follow the manufacturer's recommended procedure, so that valve or damper is 100 percent opened and closed.

With positioners, follow manufacturer's recommended procedure, so that valve and damper is positioned at 0%, 50%, and 100% closed.

Provide diagnostic and test instruments for calibration and adjustment of system.

Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

Adjust initial temperature and humidity set points.

VERIFY SENSOR ACCURACY

Select 100% of installed gas concentration sensors for testing:

Carbon Dioxide (CO_2): Prior to placing the DDC system in operation, sensors shall be tested and recalibrated as needed in accordance with the manufacturer's written procedures. Calibration shall use a minimum of two calibration gas samples, one a 950-1050 ppm and one at either 0 ppm or 450-550 ppm, with the concentration of the calibration gas known within +/- 2%. *Sensors that cannot be calibrated to within +/- 60 ppm of calibration gas CO_2 concentrations at each test point shall be replaced*. The replacement sensor shall then be calibrated. Provide sensor test/calibration reports for review by the A/E.

Refrigerant: Test sensor calibration factor using a diluted sample of refrigerant gas at or near sensor full scale concentration level in strict accordance with the manufacturer's calibration procedure. Re-calibrate or replace sensor if calibration factor cannot be maintained within the range of 0.95-1.05. Provide sensor test/calibration reports for review by the A/E.

Select at least 10% of the installed temperature, humidity, pressure, airflow, etc. sensors, including at least one of each sensor type, for testing. If calibration of 10% or more of this sample is found to be incorrect, select an additional 10% of the installed sensors for testing. **If calibration of 10% or more of this second sample is found to be incorrect, test/calibrate all sensors.**

Sensor calibrating instruments shall be used in checkout of the overall performance. The sensors of these instruments shall be placed at the proximity of DDC system sensors to indicate the conditions of the controlled media (air, water, etc.). A preliminary evaluation shall be made as to the suitability of having the DDC system sensors checked in-place or they may be placed in simulated environment. If the response times of the two sensors (DDC system sensor and calibration sensor) are similar, testing may be performed with the sensors in place. If the conditions of the controlled media change slowly, testing may also be performed with the sensors in place. However, if the conditions of the controlled media change rapidly and the time responses of the two sensors vary considerably, testing shall be done with the sensors placed in a known environment such as a temperature bath.

Verification procedures: Verification of sensor accuracy shall be made using the following procedures. Compare readings for each sensor from the calibration instrument and the DDC system to determine if the measurement accuracy meets the requirements of Section 230913.

Temperature: Use a multi-point verification check at various points in the operating range (including minimum, typical, and maximum), utilizing a calibrated thermometer and Dewar flask or a calibrated portable drywell (±0.5ºF) temperature probe calibrator.

Relative Humidity: Use a single point calibrator or portable environmental chamber that has been lab calibrated with a NIST traceable dew point monitor (±3% RH).

Fluid Flow: Use a portable ultrasonic flow meter (UFM) to spot check flows. The meter's flow profile compensation shall be turned off and the acceptable deviation between the measuring flow meter and the UFM be restricted to ±5% for applications with less than 10 pipe diameters of straight length pipe upstream of the UFM. If variable flow conditions exist, both the flow and the flow profile will need to be evaluated at a range of conditions. See ASHRAE Standard 150, Annex D, for a detailed method.

Air Flow: Utilize calibrated pitot tube or propeller anemometer traverses in at least two planes upstream of the air flow monitoring station. For VAV systems, test airflows over a range of at least five flow rates between 20% and 100% of design flow.

Pressure: Use a multi-point verification check at various points in the operating range (including minimum, typical, and maximum) with a calibrated dead weight tester or an electronic pressure calibrator for ranges above atmosphere, or an accurate digital pressure gage for ranges below atmosphere.

Vacuum: Vacuum range pressures can be attained with a vacuum pump, with an atmospheric pressure gage as the reference. Draw a vacuum on the transmitter. Use a 0 to 1000 micron vacuum gage to verify that 0 psia has been reached, if it is one of the calibration-check points. Zero the reference gage if necessary. Gradually bleed air into the system. At each point, stop the bleed and record the data.

Differential pressure: Use a dead weight tester or electronic calibrator or a magnehelic gauge with a pressure bulb to their high-pressure side to apply a known pressure at various points in the operating range (including minimum, typical, and maximum).

Very Low Differential Pressure: Use a micromanometer or digital manometer of narrow range to spot check pressures at various points in the operating range (including minimum, typical, and maximum). The manometer must be zeroed. A hand pump/bleed valve setup can be used to apply the small pressures required to the high sides. The manometer is adjusted and the instrument readings are compared at the high and low point. The temperature of the manometer fluid should be used to adjust its readings to the standard temperature conditions of the transmitter.

VERIFY FINAL CONTROL ELEMENT FUNCTIONALITY

Test each final control element operator to ensure performance in accordance with Section 230913 and the control sequences defined on the Drawings. Test shall include full range of movement, stability through that range, and power and/or control signal failure performance. Operators found to be non-functional in any way shall be replaced.

VERIFY OPERATOR AND SYSTEM FUNCTIONALITY

Verify backup system operations and switchovers including redundant processors, backup power supplies, battery backed memories, etc.

Verify DDC system command software by issuing commands at the operator's console and observing display, printer output, or HVAC equipment responses. The following software operation shall be verified:

Software for checking input commands and issuing error messages. Enter various correct and incorrect commands.

System and point addressing check. Enter command to display I/O data. Verify all data points defined on the drawings and/or required by the specifications.

Start-stop or enable-disable of HVAC equipment or DDC system control points. Enter commands to start/stop selected HVAC equipment, and to disable and enable selected points.

Operator override/automatic mode. Enter command to change selected automatic control under DDC system to manual and vice versa.

Display format. Enter commands to display data and graphics on terminal and graphic display. Check display content for adequacy and clarity as specified.

Ability to modify, cancel and confirm operator's commands. Verify by entering commands.

Set-point adjustment and limiting. Enter commands to adjust set points of controllers and range limits of the controlled media. Verify by display. Also enter commands to adjust set-points outside their range limits. DDC system shall display error messages.

System access and access level control. Try to log on to system with both incorrect and correct ID codes. Try to enter different commands with different access level of the operators. The responses of the DDC system shall be as specified.

Start/stop equipment. Enter command to start or stop selected equipment. Also reset time to initiate automatic mode. Verify responses by observation of equipment and DDC system display.

Change parameter of points. Enter commands to change parameters of selected points such as high and low limit alarms, scale factor, etc. to test the adequacy of software.

Verify graphic display of each HVAC system and component. Confirm that the graphic is in accordance with the design data and reviewed submittals, includes all data points required, displayed data is correct and in the correct format and units, and changes in point conditions or status are accurately updated. Evaluate the refresh rate of data display.

Verify report generation (status, profile, energy, etc.) by entering commands to generate reports such as all points, trend, total display of a system, timed display, and other specified reports. Examine the report content for general format, system/point code, time interval of reporting, point status/value/unit, energy amount/rate/unit, status of control and set time (manual or automatic), and other specification required information.

Check for proper operation of system status reports, including point status reviews which would include information such as points currently in alarm, points removed from alarm checking, points off of scan, etc.

Test alarm reporting by initiating alarm conditions of different points at different alarm levels in sequence to examine alarm reports. The reports shall show alarm location and device, alarm time, cause of alarm, current status of the point, etc. as required in the specifications. When alarm conditions are removed the printer shall print updated status report. Also verify audible alarm operations in accordance with specification requirements. Then initiate alarm conditions at different levels at the same time to check alarm priority.

Trending performance shall be tested by creating trend logs for each control sequence and monitoring the trend reports throughout the period that each control sequence is tested.

TEST CONTROL SEQUENCES

General: The test procedures described below do not check the details of the software, rather, they try to verify the final output as indicated by the field equipment. Before testing each program the required input and output of the program and those listed in the contract specifications shall be compared to make sure that the program covers the specified operations. Verification of HVAC equipment operation (such as equipment status or temperature of space air) may be done by either (1) actual observation of equipment status and test instruments, or (2) obtaining DDC system reports if the accuracy of these reports has been verified previously.

Basic Functional Tests: Through the user interface conduct the following series of tests:

Raise/lower space temperature setpoints in software to verify if the system responds in accordance with design requirements.

Raise/lower AHU discharge temperature setpoints and verify control valve and damper positions.

Raise/lower static pressure setpoints and verify variable speed drive or vortex damper control.

Initiate a high priority, off-hours alarm and verify that the remote notification procedures are carried out correctly.

Verify that the interface with system safeties allow operation of dampers, etc., if safety conditions are met.

Conduct an emergency start-up after power failure test. Verify that all systems return to automatic control.

Verify DDC system maintains required outside air requirements under low airflow conditions.

Disconnect communication cable to the DDC system and verify if the DDC panel can control the respective system (stand-alone control).

Disconnect a sample of DDC space-temperature sensors and verify control sequence default.

Test HVAC Systems Sequences of Operation:

Scheduled start-stop control. Verify that input includes start/stop time and days for specified equipment. Verify input for time delays of specified equipment. Check holiday effect. For each air handler, log operation for at least three days to confirm that unit starts and stops in accordance with the schedule.

Optimum start-stop control. Verify that the required input includes space temperature, outdoor temperature, occupied time and days of the week, and the response time of the air handling equipment, on an individual system by system basis. For each air handler, log space temperature for at least three days to confirm that space is at required temperature by the start of the occupied period.

Electrical demand limiting control. Verify required input data, as follows: electrical loads under control, load priority, demand metering interval, demand limit setpoint, delay time, minium off-time, minimum on-time, and maximum off-time. Test control by the following process:

Override demand sensor and input demand limit setpoint 10% lower than current electrical consumption rate (kW).

Confirm equipment shutdown by observation of equipment and/or display.

Day-night setback control. Confirm that required input data is provided. To test control, change the setback time from occupied to unoccupied time and confirm that HVAC systems respond to the setback mode. If system is an air-handling system, the outside air damper should close and the fan should cycle to maintain the setback temperature setpoint.

Change the setback temperature setpoint to 5°F higher than the actual space temperature. The system should operate to increase the space temperature to the new setpoint condition. For air-handlers, the outside air damper should remain closed.

Economizer cycle control. If the outdoor air temperature is above the discharge air temperature setpoint, but below the defined 100% outdoor air changeover temperature setpoint, verify that the outside air damper is fully open, the return air damper is fully closed, and that the air-handler discharge air temperature is maintained by modulation of the chilled water control valve.

Heating/cooling coil discharge temperature reset. Verify that the required input points are provided and that the coil discharge air temperature setpoint is in accordance with the input conditions and the sequence of operation defined on the control drawings.

Hot water temperature reset. Verify that the required input points are provided and that the heat exchanger supply hot water temperature setpoint is in accordance with the input conditions and the sequence of operation defined on the control drawings.

Chilled water temperature reset. Verify that the required input points are provided and that the chilled water supply temperature setpoint is in accordance with the input conditions and the sequence of operation defined on the control drawings.

Condenser water temperature control. Verify that the required input points are provided and that the condenser water supply temperature setpoint is in accordance with the input conditions and the sequence of operation defined on the control drawings.

Space Pressurization: For spaces with pressurization control, confirm that pressure measurements via the control system are accurate. Check the repeatability of the controls by successive tests to temporarily alter the ability to achieve space pressurization. Test over-pressurization and under-pressurization and correct any deficiencies.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 230923

SECTION 232113 – ABOVE GROUND HYDRONIC PIPING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Fabricate and install hydronic piping in accordance with ASME B31.9, *Building Services Piping*.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for water piping materials and products.

PART 2 - PRODUCTS

MATERIALS AND PRODUCTS

Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements.

PIPE AND PIPE FITTINGS

Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

STEEL PIPE AND PIPE FITTINGS

Carbon Steel Pipe: ASTM A53, Type E, Grade B for piping 2-1/2” NPS and larger or ASTM A53, Type F, Grade A for piping 2” NPS and smaller; plain or galvanized as indicated.

Cast-Iron Threaded Fittings: ANSI B16.4, plain or galvanized as indicated.
Malleable-Iron Threaded Fittings: ANSI B16.3, plain or galvanized as indicated.

Malleable-Iron Threaded Unions: ANSI B16.39, screwed, ANSI B1.20.1, Class 150 hexagonal stock with metal-to-metal bronze seats, plain or galvanized as indicated.

Threaded Pipe Plugs: ANSI B16.14, plain or galvanized as indicated.

Steel Flanges: Forged carbon steel, ASTM A105, slip-on type, 150 lb rating, plain, ANSI B16.9 raised face with 1/16" thick, non-asbestos ring type gasket, PTFE filled. Bolting shall be heavy hex head machine bolts or cap screws, ASTM A193-B7 steel alloy, with full nuts, ASTM A194- Gr. 2H steel alloy.

Carbon Steel Buttwelding Fittings: ASTM A234 Gr. WPB, seamless or welded, plain, ANSI B16.9, except ANSI B16.28 for short-radius elbows and returns, rated to match connected pipe.

Carbon Steel Flanged Fittings: ASME B16.5, 150 lb rating, plain or galvanized as indicated, with 1/16" thick, non-asbestos ring type gasket, PTFE filled. Bolting shall be heavy hex head machine bolts or cap screws, ASTM A193-B7 steel alloy, with full nuts, ASTM A194, Gr. 2H steel alloy.

Forged Steel Socket Weld Fittings: ASME B16.11, Class 2000, plain.

Forged Steel Branch Fittings (Weld-o-lets™, Thread-o-lets™, etc.): Comply with MSS SP-97, with thickness to meet pipe pressure ratings; plain

COPPER TUBE AND FITTINGS

Copper Tube: ASTM B 88, Type (wall thickness) as specified for each service, hard-drawn temper, solder joint except as otherwise indicated.

Copper Solder-Joint Fittings: Cast copper allow per ANSI B16.18 or wrought copper per ANSI B16.22, with "Type" to match adjacent piping, solder joint

Brass Pipe Flanges: ANSI B16.1, cast brass, with heavy head machine bolts or cap screws, ASTM A193-B7 steel alloy, with hex full nuts, Type 304 stainless steel per ASTM A194-Gr. 2H. Gasket shall be 1/8" natural rubber, 35-45 Durometer hardness.

Copper-Tube Unions: Provide unions with cast copper alloy body with ball-and-socket, metal-to-metal seating surfaces complying with MSS SP-123, solder joint.

PLASTIC PIPE AND PIPE FITTINGS

Polyvinyl Chloride (PVC) Water Pressure Pipe and Fittings: PVC piping shall be UV-inhibited and fabricated in accordance with ASTM D 1785. Fittings shall be socket type to match adjacent piping. Utilize primer complying with ASTM F 656 and solvent cement complying with ASTM D 2564 joints.

MISCELLANEOUS PIPING MATERIALS

Welding Materials: Except as otherwise indicated, provide welding materials to comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

Soldering Materials: Except as otherwise indicated, provide soldering materials as follows:

Tin-Antimony Solder: ASTM B 32, Grade 95TA
Silver-Lead Solder: ASTM B 32, Grade 96TS. **Use on potable water systems is prohibited.**

Brazing Filler Metals: AWS A5.8, Classification BAgl (silver)

Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally effected by the chemical and thermal conditions of the fluid being carried.

SPECIAL DUTY VALVES

Calibrated Plug Valves: 125 psig water working pressure, 250 deg F maximum operating temperature, bronze body, plug valve with calibrated orifice. Provide with connections for portable differential pressure meter with integral check valves and seals. Valve shall have integral pointer and calibrated scale to register degree of valve opening. Valves 2 inch and smaller shall have threaded connections and 2-1/2 inch valves shall have flanged connections.

Pressure Reducing Valves: Diaphragm operated, cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure and have the capability for field adjustment.

Combined Pressure/Temperature Relief Valves: Diaphragm operated, cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure and have the capability for field adjustment. Safety relief valve designed, manufactured, tested, and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shall be cast-iron, with all wetted internal working parts made of brass and rubber, 125 psig working pressure and 250 deg F maximum operating temperature. Select valve to suit actual system pressure and Btu capacity. Provide with fast fill feature for filling hydronic system.

Spring-Loaded Pump Pressure Relief Valves: Spring operated, brass body valve actuated by inlet static pressure and designed to open to relieve excess pressure and to close to prevent further flow after inlet pressure falls below opening pressure setpoint. Valve shall have rapid opening/slow closing action. Valve shall be factory-set for opening pressure and flow scheduled on the Drawings and have the capability for field adjustment. Valve shall be Watson-McDaniel Model 10691, or equivalent.

PART 3 - EXECUTION

PIPING APPLICATIONS

Hydronic systems pressure pipe shall be steel as hereinbefore specified, applied as follows:

Pipe Size 2" NPS and Smaller: Carbon steel pipe, black, Schedule 40, Class 125 black cast-iron fittings, with threaded joints.

Exceptions:

At the Contractor's option, socket weld fittings may be used in lieu of threaded fittings.

At the Contractor's option, copper tube may be utilized lieu of steel piping.

Copper Tube: Type L, hard-drawn temper, wrought-copper fittings with soldered joints, applied as follows:

Utilize copper tube for HVAC make-up water piping and condensate drain piping inside buildings. **Connect copper drain tubing to condensate drain pan nipples with dielectric unions.**

At the Contractor's option, pipe 2" NPS and smaller for any hydronic service may be copper.

INSTALLATION OF PIPING

Install eccentric reducers for horizontal piping where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush. Vertical piping use concentric reducers.

Reducers to be installed only where shown and at final connections to equipment. Install piping with 1/32" per foot (1/4%) to a point of drainage. Provide sufficient drains so that entire piping system can be emptied.

Connect branch-feed piping to mains at not more that 45-degrees above horizontal center line of mains, connect run-out piping to branches at not more that 45-degrees above horizontal center line of branches. **Connections above 45-degrees above horizontal center line or below the horizontal center line are prohibited.** Branch connections may be by forged steel branch fittings where branches are at least two pipe sizes smaller than the main.

Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

Fabricate pipe nipples from same pipe as used for connected pipe. Use Schedule 80 pipe for nipple fabrication where unthreaded length is less than 1-1/2" or where pipe size is less than 1-1/2" NPS. **Do not thread nipples full length, "close" nipples are prohibited.**

Strainers on condenser water lines shall be basket type, installed on pump suction lines. Strainers on all other water lines shall be Y-type. Run blow-off lines to nearest drain.

Construct piping joints as follows:

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

For screwed joints, thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

Construct welded joints in accordance with Section 019913.

For flanged Joints, select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.

For soldered joints for copper tubing, apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's *Copper Tube Handbook*.

For brazed joints for copper tubing, comply with CDA's *Copper Tube Handbook*, "Brazed Joints" Chapter 9.

For plastic piping joints, clean and dry joining surfaces. Apply primer and then solvent cement to both surfaces. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. PVC joints shall comply with ASTM D 2855.

EQUIPMENT CONNECTIONS

Arrange piping to minimize the need to dismantle piping to provide routine maintenance of equipment. Where piping must be dismantled, provide additional isolation valves and unions or flanges to facilitate its removal and replacement.

Connect piping to mechanical equipment as indicated on the Drawings, in compliance with the equipment manufacturer's instructions. Install shutoff valve on both supply and return connections and drain valve on each drain connection.

Install control valves in accessible locations close to connected equipment. Install valve with actuator on top and configure piping to provide adequate space for service and/or removal of operator.

Arrange and install vertical piping to not interfere with access for maintenance of HVAC equipment.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 232113

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

ANSI/ASME Compliance: Fabricate and install refrigerant piping in accordance with ANSI B31.5 *Refrigeration Piping and Heat Transfer Components.*

ASHRAE Compliance: Fabricate and install refrigerant piping in accordance with ASHRAE 15 *Safety Code for Refrigeration Systems.*

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for refrigerant piping materials and products.

PART 2 - PRODUCTS

COPPER PIPING

Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

Size 1" and Larger: Utilize copper tube in compliance with ASTM B88, Type K, hard-drawn temper, wrought-copper, brazed-joint fittings, brazed joints.

Size 3/4" and Smaller: Utilize copper tube in compliance with ASTM B 280, Type ACR, soft annealed temper fittings, cast copper-alloy fittings for flared copper tubes; flared joints.

Brazed Joints: Brazed joints using brazing alloy in compliance with ASTM B32. Use silver brazing alloy.

COPPER FITTINGS

Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.
Copper Brazed-Joint Fittings: Cast copper per ANSI B16.18 or wrought copper per ANSI B16.22, with “type” to match adjacent piping.

Brass Pipe Flanges: ANSI B16.1, cast brass, with heavy head machine bolts or cap screws, ASTM A193-B7 steel alloy, with hex full nuts, Type 304 stainless steel per ASTM A194-Gr. 2H. Gasket shall be 1/8" natural rubber, 35-45 Durometer hardness.

Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

REFRIGERANT VALVES

Service and Check Valves:

Service Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300 deg. F temperature rating, 500 psi working pressure.

Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250 deg. F temperature rating, 500 psi working pressure.

Solenoid Valves:

2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760 and UL 429, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., Listed, 1/2" conduit adapter, 250 deg. F temperature rating, 400 psi working pressure. Provide manual operator to open valve.

Safety Relief Valves: Comply with ASME *Boiler and Pressure Vessel Code*, Listed and Labeled. Valve construction and ratings shall be as follows:

Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.

Piston, Closing Spring, and Seat Insert: Stainless steel.

Seat Disc: Polytetrafluoroethylene.

End Connections: Threaded.

Working Pressure Rating: 400 psig.

Maximum Operating Temperature: 240 deg F.

Thermostatic Expansion Valves: Comply with ARI 750. Incorporate reverse-flow option for heat-pump applications. Valve construction and ratings shall be as follows:

Body, Bonnet, and Seal Cap: Forged brass or steel.

Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.

Packing and Gaskets: Non-asbestos.

Capillary and Bulb: Copper tubing filled with refrigerant charge.
Suction Temperature: 40 deg F.

Superheat: Adjustable.

Working Pressure Rating: 450 psig.

Hot-Gas Bypass Valves: Comply with UL 429. Valve construction and ratings shall be as follows:

Body, Bonnet, and Seal Cap: Ductile iron or steel.

Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.

Packing and Gaskets: Non-asbestos.

Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.

Seat: Polytetrafluoroethylene.

Equalizer: Internal.

Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter.

Throttling Range: Maximum 5 psig.

Working Pressure Rating: 500 psig.

Maximum Operating Temperature: 240 deg F.

REFRIGERANT SPECIALTIES

Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, Listed, 500 psig working pressure.

Moisture-Liquid Indicators: Forged brass, single port, removable cap, fused glass, 240 deg. F temperature rating, 500 psi working pressure.

Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.

Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated.

Refrigerant Discharge Line Oil Separator: Separator shall be high efficiency centrifugal type designed for use with the type of refrigerant in the system, rated for at least 450 psig working pressure.

Replaceable-Core Filter Dryers: Provide filter dryers in compliance with ARI 730. Body and cover shall be painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets. Filter media shall be 10 micron, pleated with integral end rings; stainless-steel support. Working pressure rating of 500 psig and maximum operating temperature of 240 deg F.

Flexible Connectors: Connectors shall have stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket. Connector shall be capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly. Factory test at minimum of 500 psig and maximum operating temperature of 250 deg F.

PART 3 - EXECUTION

PIPING INSTALLATION

Select system components with pressure rating equal to or greater than system operating pressure.

Provide protections to all refrigerant pipes per 2024 NCMC Chapter 11.

Install refrigerant piping according to ASHRAE 15, as follows:

Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

Install piping adjacent to machines to allow service and maintenance.

Install piping free of sags and bends.

Install fittings for changes in direction and branch connections.

Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.

Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Slope refrigerant piping as follows:

Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.

Install horizontal suction lines with a uniform slope downward to compressor.

Use double-suction riser for maximum compressor efficiencies if load variation is expected.

Install traps and double risers to entrain oil in vertical runs.

Liquid lines may be installed level.

When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Protect refrigerant piping as follows:

Install underground refrigerant piping in protective PVC piping or conduit.

Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

PIPE JOINT CONSTRUCTION

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

Construct solder joints according to ASTM B 828 or CDA's *Copper Tube Handbook*.

Construct brazed joints according to AWS's *Brazing Handbook*, Chapter "Pipe and Tube."

Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.

Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

For flanged joints, select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

VALVE AND SPECIALTY APPLICATIONS

Refrigerant valves and specialties shall be installed for each refrigerant system either as an original equipment manufacturer (OEM) installation or field-installed, as follows:

Install line-sized shutoff valves and flexible connectors in suction and discharge lines of each compressor.

Install line-sized shutoff valves on each side of other refrigeration equipment, including condensers, evaporators, receivers, etc. in multiple unit installations.

Install service valves for gage taps at strainers if they are not an integral part of strainers.

Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

Install filter dryers in liquid line between compressor and thermostatic expansion valve and in the suction line at each compressor, complete with full-sized three-valve bypass around filter dryers utilizing line-sized shutoff valves, so that filter dryer may be replaced while system remains in operation. Filter dryers shall be installed in the horizontal position, except that replaceable core filter dryers may be installed in the vertical position with the access flange on the bottom.

Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with operator at top.

Install thermostatic expansion valves as close as possible to distributors on evaporators. Install valve so diaphragm case is warmer than bulb. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Locate bulb on top of the suction line smaller than 2-1/8" OD and at the 4 o'clock or 8 o'clock position on larger lines. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

Where required by the compressor manufacturer, install discharge line oil separator on the discharge of each compressor, downstream of the flexible connector and/or discharge muffler, securely anchored to the unit. Oil return shall be connected to the compressor in accordance with manufacturer recommendations.

Install safety relief valves where required by ASME *Boiler and Pressure Vessel Code*. Pipe safety relief valve discharge line to outside according to ASHRAE Standard 15.

Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
Install strainers upstream from and adjacent to the following unless they are furnished as an integral OEM assembly for device being protected:

Solenoid valves

Expansion devices

Compressors

FIELD QUALITY CONTROL

Clean and test refrigerant piping in accordance with ANSI B31.5, Chapter VI. Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum, and then 200 psi using electronic leak detector. System must be entirely leak-free. **Submit leak test reports to A/E for review.**

Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

DEHYDRATION AND CHARGING SYSTEM

Install core in filter dryer after leak test but before evacuation.

Evacuate refrigerant system with vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.

Break vacuum with refrigerant gas, allow pressure to build up to 2 psig.

Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 232300

SECTION 233100 – HVAC DUCTWORK

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

NFPA Compliance:

Comply with NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*.

Comply with NFPA 90B, *Standard for the Installation of Warm Air Heating and Air Conditioning Systems*.

SMACNA Compliance: Fabricate and install all ductwork and ductwork accessories in accordance with *HVAC Duct Construction Standards - Metal and Flexible*.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data and installation instructions for ductwork and products.

PART 2 - PRODUCTS

DUCTWORK MATERIALS

Galvanized Sheet Metal: Except as indicated otherwise, fabricate ductwork from galvanized sheet steel complying with ASTM A 653, lockforming quality, with G 90 zinc coating in accordance with ASTM A 653 and mill phosphatized for exposed locations. Stamp gauge and manufacturer's identification on each sheet. Break sheets so that identification is exposed.

Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A 480, Type 304L or 316L with No. 4 finish where exposed to view in occupied spaces, No. 2D finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B 209, Alloy 3003, Temper H14.

Flexible Ducts: Metallic or non-metallic, insulated flexible ductwork complying with UL 181B. Provide 1" thick continuous flexible fiberglass sheath with vinyl vapor barrier jacket.

DUCT FABRICATION

Shop fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated. Preassemble 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 reassembly and coordinated installation.

Shop fabricate supply, return, and ventilation air ductwork of gauges and reinforcement complying with SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*, **with the exception that sheet metal less than 24-ga. shall not be used for rectangular duct**, in accordance with the following:

Application	Construction Pressure Class
Return and Ventilation Ductwork	-2" W.G.
Supply Ductwork Downstream of Air Terminal Units	+1" W.G.
Supply Ductwork With Fan Static Pressure Less Than 2.5" W.G.	+2" W.G
Supply Ductwork with Fan Static Pressure Greater than or equal to 2.5" W.G.	+3" W.G
Supply Ductwork with Fan Static Pressure Greater than 5.0"W.G.	+4" W.G.
Smoke Control System Ductwork	1.5 times the design static pressure, but not less than +/-3" W.G.

Shop fabricate exhaust and relief ductwork of the following gauge sheet metal with reinforcement complying with SMACNA's *HVAC Duct Construction Standards - Metal and Flexible:*

Maximum Diameter or Maximum Rectangular Dimension (inches)	Sheet Metal Gauge
8	24
18	22
30	20
>30	18

Elbows/Tees:

Radius elbows and tees shall be fabricated as **full radius** elbows with the centerline radius 1.5 times the duct width.

Square throat elbows shall be constructed with double-wall airfoil turning vanes properly spaced for the duct width. Turning vanes and vane runners shall be constructed in accordance with SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*, Figure 4-3. **Square throat elbows may be used only when the available space is insufficient for use of a full radius elbow**.

Perforated Metal Plenum Air Baffles: Construct of 50% free area perforated 304 stainless steel with angle iron supports and bracing to prevent bulging, rattling, etc. Metal thickness shall be as follows:

Fan Total Static Pressure	Gauge
Up to 4"	22
4" to 6"	20
Above 6"	18

ROUND AND OVAL DUCTWORK

Construction: Construct round and flat oval ductwork in accordance with Section 3 of SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*, complying with the Pressure Class designations hereinbefore specified. Use spiral lockseam construction for ductwork up to 58" diameter and welded longitudinal seam for larger ductwork, 26 gauge minimum.

Exception: Round ducts that connect to air outlets or inlets may be constructed with a snaplock longitudinal seams complying with Fig. 3.2 of SMACNA's *HVAC Duct Construction Standards - Metal and Flexible,* 26 gauge minimum.

Double-Wall Ductwork: Round or flat oval ductwork shall be double walled where indicated. Construct with outer pressure shell, insulation layer, and perforated inner liner. Construct shell and liner of sheet metal as hereinbefore specified. Use spiral lockseam construction for ductwork up to 58" diameter and welded longitudinal seam for larger ductwork, in minimum gages listed, but not less than 24 gauge..

Inner Liner: Perforated sheet metal with holes for 23% open area. Provide metal spacers welded in position to maintain spacing and concentricity.

Insulation: Mineral fiber insulation complying with Section 230713, 2" thick. Cover insulation with polyester film complying with UL181, Class 1.

PART 3 - EXECUTION

INSTALLATION OF DUCTWORK

Assemble and install ductwork to achieve air-tight operation with no objectionable noise, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth.

Support ducts in accordance with Section 230529 to hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor or roof penetration in accordance with Section 230529.

At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure fabricated of 6 mil PVC film or other covering that will prevent entrance of dust and debris until time connections are to be completed.

Routing:

Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs unless such routing is clearly indicated on the Drawings. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route that does not obstruct useable space or block access for servicing building and its equipment. Coordinate layout with suspended ceiling, lighting, fire suppression systems, and similar finished work.

Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Unless indicated otherwise, install duct as high as possible.

Limit clearance to 1/2" where furring is shown for enclosure or 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 ceilings.

Elbows: **Utilize radius elbows for all changes of direction unless specifically indicated otherwise on the drawings or space limitations dictate the use of square throat elbows with turning vanes**. Where square throat elbows with turning vanes are installed, provide a duct access door or panel immediately upstream of each elbow.

Sealing: Ductwork shall be sealed in accordance with SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*, as follows:

Duct Construction Class	Seal Class
+/- 1" W.G. or less	C
+/- 2" W.G.	B
+/- 3" W.G. and greater	A

Testing:

Ductwork indicated to be constructed in accordance with Pressure Class +/-3" W.G. or greater shall be tested, section by section, in accordance with SMACNA's HVAC *Air Duct Leakage Test Manual*. Air leakage factor (CL), computed in accordance with the following relationship, shall be less than or equal to 6.0:

$$CL = \text{Leakage rate (cfm/100 sf of duct surface)} \times (\text{Test static pressure})^{0.65}$$

Ductwork utilized as part of a smoke control system shall be tested, section by section, in accordance with SMACNA's HVAC *Air Duct Leakage Test Manual* and leakage shall not exceed 5% of design airflow.

DUCTWORK AT HUMIDIFIERS

Provide stainless steel or aluminum duct for 10' downstream and 5' upstream of humidifier. Slope duct 1/4" per foot toward humidifier and provide drain piped to waste in accordance with Section 232113.

INSTALLATION OF FLEXIBLE DUCTS

Flexible duct shall only be allowed where indicated on the drawings, installed as follows:

Install duct fully extended; do not install in the compressed state or use excess lengths.

Avoid bending ducts across sharp corners or incidental contact with metal fixtures, pipes or conduits. Radius at center line of bends shall not be less than one duct diameter.

All connections, joints and splices should be made in accordance with the manufacturer's installation instructions.

All tapes, mastics and non-metallic fasteners (plastic clamps) used for field installation of flexible ducts should be listed and labeled to UL 181B.

Sheet metal collars to which flexible ducts are attached should be a minimum of 2 inches in length and shall be beaded.

Sheet metal sleeves used for joining two sections of flexible duct should be a minimum of 4 inches in length and beaded on both ends.

Maximum Length: **Do not exceed 8'-0" extended length**.

Metal Duct Connection: Spin-in conical connectors with integral balancing damper shall be used for connecting flexible runouts to metal ductwork.

Ceiling Diffuser Connections: Connect flexible duct to supply air diffusers in accordance with SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*, Figure 7-7, and as indicated on the Drawings.

CLOTHES DRYER DUCT INSTALLATION

Clothes dryer ductwork shall be installed in strict compliance with Section 504 of the *North Carolina State Building Code: Mechanical Code*. Provide a permanent label or tag, within 6 feet of the dryer, identifying the equivalent length of exhaust duct.

ADJUSTING AND CLEANING

Clean ductwork internally, section by section, as it is installed, of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration. After cleaning, seal open ends and connections with 6 mil PVC film.

Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 233100

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

UL Compliance:

Construct, test, and label fire dampers in accordance with UL Standard 555, *Standard for Fire Dampers*.

Construct, test, and label smoke and combination fire/smoke dampers in accordance with UL Standard 555S, *Standard for Smoke Dampers*.

Construct, test, and label ceiling radiation dampers in accordance with UL Standard 555C, *Standard for Ceiling Dampers*.

Smoke and combination fire/smoke dampers in accordance with UL 864 Category UUKL.

NFPA Compliance: Comply with applicable provisions of NFPA 90A and/or NFPA 90B pertaining to installation of ductwork accessories.

AMCA Compliance:

Test and rate airflow dampers in accordance with ANSI/AMCA Standard 500-D, *Laboratory Methods of Testing Dampers for Rating*.

Test and rate louvers in accordance with AMCA Standard 500-L, *Laboratory Methods of Testing Louvers for Rating*.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction, and installation instructions. Provide specific instructions for installation of fire and smoke dampers to comply with listed installation arrangement.

Samples: Submit louver manufacturer's standard colors for selection by A/E.

PART 2 - PRODUCTS

AIRFLOW DAMPERS

Low Pressure Manual (Balancing) Dampers:

Construction: Dampers installed in dishwasher exhaust ductwork, return air ductwork in natatoriums, and in other wet locations shall be constructed of Type 316 stainless steel, including shafts and hardware exposed to the airstream. All other dampers shall be constructed of G90 galvanized steel with zinc-plated shafts and hardware exposed to the airstream. Single blade or multiblade volume damper shall be constructed in accordance with SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*, Figures 7-4 and 7-5.

Quadrant Locks: Provide each low pressure balancing damper with a quadrant lock device on one end of shaft, and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

Control Dampers: Provide dampers with parallel blades for 2- position control, opposed blades for modulating control. Dampers shall be constructed of 0.108-inch-minimum thick steel or 0.125-inch-minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch-thick steel with maximum blade width of 8 inches and maximum length of 48 inches. Dampers installed in dishwasher exhaust ductwork, return air ductwork in natatoriums, and in other wet locations shall be constructed of Type 316 stainless steel, including shafts and damper hardware exposed to the airstream. All other dampers shall be constructed of G90 galvanized steel with zinc-plated shafts and hardware exposed to the airstream.

Secure blades to 1/2-inch-diameter axles with oil-impregnated sintered bronze blade bearings, blade-linkage hardware, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of each blade.

Operating Temperature Range: From minus 40 to plus 250° F.

Edge Seals: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for Leakage Class I according to ANSI/AMCA 500-D.

Smoke Control Systems: Control dampers in a smoke control system shall comply with UL 864 Category UUKL, ANSI/UL 555S and leakage rates shall be as follows:

Return Air Dampers:	Leakage Class I at 250°F according to ANSI/AMCA 500-D.
AHU Isolation Dampers:	Leakage Class II at 250°F according to ANSI/AMCA 500-D.

Gravity Backdraft Dampers: Provide multi-blade, parallel configured damper with aluminum blades and frame. Frame shall be 2 inches x minimum 0.090 inch extruded aluminum channel with mitered corners and have 1-1/2" flange on entering or leaving side as required by the indicated installation condition. Damper designed for horizontal installation shall incorporate counterbalance weights and/or spring assist as required for tight close-off. Blades shall be single-piece, horizontally overlapping type, 6" wide. constructed of extruded aluminum with interlocking edge seals and stainless steel spring end seals, stainless steel pivot pins, and steel ball bearing pivot raceways. Blades shall be linked together in a "rattle-free" arrangement with 90-degree open blade stop(s). Linkage shall be fully concealed within the damper frame. All dampers shall be equipped with manually adjustable spring tensioning mechanism for setting "start to open" pressure. Dampers for low pressure applications (maximum 1-1/2" wg discharge pressure) shall be designed for 2,000 fpm air velocity at 2" wg differential pressure. All other dampers shall be designed for 3,500 fpm air velocity at 10" wg differential pressure. After fabrication, entire damper shall be spray-coated with a clear acrylic or epoxy corrosion protection coating.

Barometric Pressure Relief Dampers: Provide multi-blade, parallel configured damper with aluminum blades and frame. Frame shall be 2 inches x minimum 0.090 inch extruded aluminum channel with mitered corners and have 1-1/2" flange on entering or leaving side as required by the indicated installation condition. Blades shall be single-piece, horizontally overlapping type, 6" wide. constructed of extruded aluminum with interlocking edge seals and stainless steel spring end seals, stainless steel pivot pins, and steel ball bearing pivot raceways. Blades shall be linked together in a "rattle-free" arrangement with 90-degree open blade stop(s). Linkage shall be fully concealed within the damper frame. Dampers shall be designed for 2,000 fpm air velocity at 2" wg differential pressure. Dampers shall be equipped with manually adjustable spring tensioning mechanism for setting "start to open" pressure at maximum 0.010" w.g. interior air pressure. After fabrication, entire damper shall be spray-coated with a clear acrylic or epoxy corrosion protection coating.

LOUVERS

All fresh air, relief air, and exhaust louvers required to be provided under Division 23 shall be horizontal and drainable, constructed of heavy gauge extruded aluminum, assembled in a neat and substantial manner, properly reinforced, and installed in wall or frame with anchors suitable for installation conditions, as follows:

Louvers shall be designed and installed to withstand wind loading in compliance with Section 019913.

Louvers shall be rated for maximum rain intrusion/entrainment of 0.01 oz/sf of louver free area **at the maximum design intake velocity**. This water penetration rate shall be determined for a minimum 15-minute test duration when subjected to a water flow rate of 0.25 gal/min as described under the "Water Penetration Test" in AMCA 500-L-9913 or equivalent.

Provide 1/2 inch mesh, aluminum birdscreen on inside of all louvers.

All louvers shall have factory finish of etched surface, with final coat of clear acrylic lacquer.

Louvers shall have nominal 6" deep frames shall be standard channel type, 0.081" minimum section, with fixed 37.5° blades.

Contractor shall flash and counter-flash all louvers as required, with flashing to match louver color.

Louver color shall be one of the manufacturer's standard colors as selected by A/E.

Louver shall bear AMCA seal.

DUCT ACCESS DOORS

Provide duct access doors where indicated on the Drawings or required by Division 23 specification sections, of size required for the application.

Provide access doors, whether indicated or not, for all duct mounted coils, fire damper or fire/smoke damper links, duct smoke detectors, and for visual access to all manual and automatic dampers. Unless indicated otherwise, doors shall be square, 2" less than smaller duct dimension, but not smaller than 12" by 12".

Fabricate access panels according to SMACNA's *HVAC Duct Construction Standards - Metal and Flexible*, Figures 7-2 and 7-3, as applicable, except that locks shall be cam type with steel or cast aluminum handles. **Plastic handles are prohibited.**

Doors shall be rectangular double-wall type, constructed of G90 galvanized sheet metal with mineral fiber insulation fill and thickness in accordance with Section 230713. Frame shall be galvanized sheet steel with bend-over tabs and foam gaskets.

Fabricate doors airtight and suitable for duct pressure class.

FLEXIBLE DUCT CONNECTORS

Provide flexible connector between ductwork and any fan or air-handling unit connected to the ductwork. Connectors shall be fabricated of noncombustible fabrics and any coatings or adhesives applied shall comply with UL 181, Class 1. Frame shall be steel and fabric shall be 26 oz/sq. yd or heavier. Connector shall be sized for minimum 50% additional travel and/or deflection at full airflow.

Where flexible connectors are located downstream of electric heating coils or installed in ductwork that serves as part of a smoke control system, the connector shall be rated for application at temperatures up to 250°F.

PART 3 – EXECUTION

INSTALLATION

Install fire dampers in accordance with the manufacturer's installation requirements to comply with installation as UL-tested. Do not firestop the gap between the fire damper sleeve and the penetration unless specifically required by the damper manufacturer's installation instructions.

Install fire/smoke and smoke dampers in accordance with manufacturer's requirements to comply with installation as UL-tested. **Provide final connections to nearest fire alarm control module.**

Install louvers level and plumb with flange tight against outside of wall and caulked rain tight. Install wall sleeve where wall thickness exceeds louver depth. Use concealed anchorages where possible. Make louver joints weathertight with concealed gaskets, flashings, joint fillers and sealants.

Locate duct access doors clear of obstructions and located for ready access to all ductwork accessories. Install duct access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter. Label access doors in accordance with Section 230553.

Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

EXTRA STOCK

Furnish extra fusible links to Owner, one link for every ten installed of each temperature range; obtain receipt.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 233300

SECTION 233416 – CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY CONTROL

AMCA Compliance:

Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.

Operating Limits: Classify according to AMCA 99.

Comply with AMCA 301, *Methods for Calculating Fan Sound Ratings from Laboratory Test Data*.

Factory test fans according to AMCA 300, *Reverberant Room Method for Sound Testing of Fans*.

Label fans with the AMCA-Certified Ratings Seal.

Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, *Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating*.

Acoustic Criteria: HVAC equipment shall be selected and installed to comply with the acoustic criteria defined in Section 230510.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data for fans, including specifications, capacity ratings, fan performance curves with operating point clearly indicated, gages and finishes of materials, dimensions, weights, accessories furnished, and installation instructions.

PART 2 - PRODUCTS

GENERAL

Fan Types: Fans requiring 5 horsepower motor size or less may be centrifugal type with forward curved blades. All fans exceeding 5 horsepower motor size shall be non-overloading centrifugal type with backward-inclined blades.

Coatings: Ferrous metal parts shall be factory prime coated and finish coated with baked enamel protective coating. Nonferrous and galvanized units and components shall not be factory coated. Where indicated, fans shall be provided with factory applied epoxy phenolic coating applied in multiple layers.

Sparkproof Fans: Fans indicated on the Drawings to be "spark-proof" shall be constructed with nonferrous, non-sparking wheels and shaft rubbing plate per AMCA "C.

FORWARD CURVED BLADE CENTRIFUGAL FANS

Description: Fans shall be Arrangement 3, direct drive centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.

Housings:

Formed panels to make curved-scroll housings with shaped cutoff.

Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.

Spun inlet cone with flange.

Outlet flange.

Forward-Curved Wheels:

Black-enameled or galvanized-steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow.

Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

Shafts:

Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.

Turned, ground, and polished hot-rolled steel with keyway. Design to operate at no more than 70 percent of first critical speed at top of fan's speed range.

Bearings: Prelubricated and sealed shaft ball bearings, self-aligning, pillow-block-type life rated in accordance with ABMA 9, Ll0 at 100,000 hours.

BACKWARD INCLINED BLADE CENTRIFUGAL FANS

Description: Fans shall be Arrangement 3, belt driven, of class indicated on the Drawings.

Fan wheel shall have backward inclined airfoil pattern blades welded to a heavy gauge backplate and equipped with a heavy duty reinforced hub. Fan wheels shall be statically and dynamically balanced and shall be keyed to ground and polished steel shaft. Shaft and wheel shall be designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

Fan casing shall be heavy steel plate, reinforced with structural members, provided with angle iron duct collars, and inlet cones and shall be of all-welded construction.

Bolted and gasketed cleanout door required for fans with wheel diameter larger than 24 inches. Provide drain tapping and plug for all fans.

Bearings shall be grease-lubricated, self-aligning heavy duty ball bearings mounted in pillowblocks with dust seals and grease fittings and shall have rated life in accordance with AMBA 9, L10 of 100,000 hours.

Motor shall be mounted on adjustable slide rail base with fan and motor mounted on a common fabricated steel vibration base.

Belt Drives: Comply with requirements of Section 019913.

PLUG AND PLENUM FANS

Plug or plenum fans shall be backward-inclined, non-overloading centrifugal type as specified above, less an enclosing fan casing. Provide factory-assembled fan consisting of fan wheel, shaft, bearings, motor, belt drive, and open support structure for installation as indicated on the Drawings.

INLET VANES

Where required or indicated on the Drawings, provide fan inlet vane dampers with pivot points operating in nylon or bronze bushings shall be provided complete with linkage. Linkage shall be rigidly attached to the fan casing and shaft-to-crank arm connections shall be made with cotter pins, through bolting, or other means acceptable to the A/E. Include manual operator with locking quadrant.

PART 3 - EXECUTION

INSTALLATION

Install fans level and plumb, supported in accordance with Section 230529.

Install units with clearances for service and maintenance.

FIELD QUALITY CONTROL

Perform the following tests and inspections with the assistance of a factory-authorized service representative:

Verify that shipping, blocking, and bracing are removed.

Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

Verify that cleaning and adjusting are complete.

Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

Adjust belt tension.

Verify lubrication for bearings and other moving parts.

Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
Shut unit down and reconnect automatic temperature-control operators.

Remove and replace malfunctioning units and retest as specified above.

Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

Prepare test and inspection reports.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 233416

SECTION 233713 - DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650, *Standard for Air Outlets and Inlets*.

ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70, *Method of Testing for Rating the Air Flow Performance of Outlets and Inlets*.

NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*.

ASTM Compliance: Paint hardness shall pass 125 hour ASTM B 117 salt spray test, 500 hour ASTM D-870 water impression test, and ASTM D-2794 reverse impact cracking test with a 50 in/lb force applied.

Acoustic Criteria: HVAC equipment shall be selected and installed to comply with the acoustic criteria defined in Section 230510.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

Samples: Samples of each unit proposed shall be submitted for review upon request by A-E.

PART 2 - PRODUCTS

REGISTERS, GRILLES AND DIFFUSERS

General: Diffusers, registers, and grilles for supply, return, and exhaust air shall be provided as indicated on the Drawings. Units shall be selected for noise levels required by Section 230510, with "draftless" distribution (terminal air velocity 50 fpm or less). Units that are noisy in the opinion of the A-E, shall be removed and replaced with acceptable ones. Performance based on volume controls fully opened.

Units shall be furnished with gaskets at edges to prevent leakage.
The interior portions of wall grilles and registers, including connecting duct, which are exposed to view, shall be painted flat black. Interior portion of ceiling diffusers shall be of the same color as the diffusers and accessories shall be flat black.

Manufacturer's model numbers specified herein are intended for ease of identification and comparison. Equivalent products by manufacturers other than those listed, equal in appearance and performance, may be acceptable upon review by A/E.

Unless indicated otherwise on the Drawings, all registers, grilles, and diffusers shall be steel construction.

Exception: Registers, grilles, and diffusers located in wet areas, including but not limited to bathrooms and toilets, kitchens, dining areas, etc. shall be aluminum construction. Egg-crate return or exhaust registers or grilles shall be aluminum construction. **Registers, grilles, and diffusers located in coastal counties shall be aluminum construction**.

Rectangular Louvered Face Ceiling Diffuser **(Type-B)**: Louvered full face diffuser with round neck that is adjustable horizontal to vertical, constructed of 24 gauge steel or aluminum, as indicated on the Drawings, and finished with baked white enamel unless otherwise noted. Frame style shall match ceiling types(s). Diffuser shall be as follows:

Manufacturer	Steel Construction Model No.	Aluminum Construction Model No.
Titus	TMSA	TMSA-AA
Tuttle & Bailey	1300A	A1300A
Price	SCDA	ASCDA
Nailor	RNSA	ARNSA

Standard Blade Sidewall Supply Register and/or Grille **(Type-F)**: Supply register and/or grille that is adjustable double deflection type with horizontal front blades, constructed of 20 gauge steel, 0.05”thick aluminum, or 20 gauge Type 316 stainless steel as indicated on the drawings and finished baked white enamel unless otherwise noted. Blades shall be spaced 5/8” – 3/4" apart. Frame style shall match surface type(s). Register or grille shall be as follows:

Manufacturer	Steel Construction Model No.	Aluminum Construction Model No.	Stainless Steel Construction Model No.
Titus	300 RL	300FL	300RL-SS
Tuttle & Bailey	T54	A54	T54SS
Price	520	620	720
Nailor	61DH	51DH	67DH

Standard Blade Sidewall Return or Exhaust Register and/or Grille **(Type-V)**: Return and exhaust register and/or grille that is single deflection type with fixed horizontal blades at 35-40 degrees, constructed of 20 gauge steel, 0.05" thick aluminum, or 20 gauge Type 316 stainless steel as indicated on the Drawings and finished baked white enamel unless otherwise noted. Blades shall be spaced 5/8" – 3/4" apart. Frame style shall match surface type(s). Register and/or grille shall be as follows:

Manufacturer	Steel Construction Model No.	Aluminum Construction Model No.	Stainless Steel Construction Model No.
Titus	350RL	350FL	350RL-SS
Tuttle & Bailey	T70D	A70D	T70DSS
Price	530	630	730
Nailor	6145H	5145H	6745H

Perforated Face Register or Grille **(Type-Z)**: Perforated panel face diffuser with adjustable louver vanes, hinged flush face, backpan and interior painted flat black. Register/grille shall be constructed of 26 gauge steel or aluminum as indicated on the Drawings and finished baked white enamel unless otherwise noted. Frame style shall match ceiling type(s). Register or grille shall be as follows:

Manufacturer	Steel Construction Model No.	Aluminum Construction Model No.
Titus	PAR	PAR-AA
Tuttle & Bailey	PG	APG
Price	PDDR	APDDR
Nailor	4360	4360AA

PART 3 - EXECUTION

INSTALLATION

Locate ceiling air diffusers, registers, and grilles as indicated on general construction "Reflected Ceiling Plans." Unless otherwise indicated, locate units in center of acoustical ceiling modules.

Install diffusers, registers, and grilles in full accordance with the manufacturer's recommendations. **Modifications in ductwork, accessories, and arrangement from that indicated on the Drawings, but required for integration of the diffusers, registers and grilles proposed into the system as designed shall be the responsibility of the Contractor.**

Unless indicated otherwise on the Drawings, registers, grilles, and diffusers shall be provided with balancing dampers located at the branch duct connection, not at the air distribution device. Where a balancing damper is indicated at the register, grille, or diffuser, it shall be a rectangular opposed blade damper for installation in square or rectangular necks or a radial opposed blade damper for installation in round necks. **The use of butterfly dampers or horizontal radial dampers at air distribution devices is prohibited.**

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 233713

SECTION 234113 - PARTICULATE AIR FILTRATION, LOW EFFICIENCY (MERV 6-8)

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

QUALITY ASSURANCE

Particulate filters shall have Minimum Efficiency Rating Value (MERV) specified herein when tested in accordance with ASHRAE 52.2

Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

Filters shall comply with the requirements of NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

FLAT PANEL FILTERS

Description: Factory-fabricated, 1"thick, self-supported, flat, nonpleated, panel-type, disposable air filters with holding frames with MERV rating of 6-8, as indicated on the Drawings.

Smoke And Flammability Limits: UL 900, Class 2.

Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Media shall be coated with an antimicrobial agent.

Metal Retainer: Upstream side and downstream side.

Filter-Media Frame: Cardboard with perforated metal retainer sealed or bonded to the media.

Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

Capacities and Characteristics: Rated airflow, size, and pressure losses shall be as indicated on the Drawings.

PLEATED PANEL FILTERS

Description: Factory-fabricated, 1" or 2" thick as indicated on the Drawings, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames with MERV rating of 8.

Smoke and Flammability Limits: UL 900, Class 1.

Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Media shall be coated with an antimicrobial agent.

Separators shall be bonded to the media to maintain pleat configuration.

Welded wire grid shall be on downstream side to maintain pleat.

Media shall be bonded to frame to prevent air bypass.

Support members on upstream and downstream sides to maintain pleat spacing.

Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.

Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

Capacities and Characteristics: Rated airflow, size, and pressure losses shall be as indicated on the Drawings.

PART 3 - EXECUTION

INSTALLATION

Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

Install filters in position to prevent passage of unfiltered air.

Do not operate fan system until filters are in place. Replace filters used during construction and testing with new, clean filters prior to final acceptance.

EXTRA STOCK

Coordinate with owner on preference for extra filter stock.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 234113

SECTION 234123 - PARTICULATE AIR FILTRATION, MEDIUM EFFICIENCY (MERV 9-16)

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

QUALITY ASSURANCE

Particulate filters shall have Minimum Efficiency Rating Value (MERV) specified herein when tested in accordance with ASHRAE 52.2

Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

Filters shall comply with the requirements of NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

PLEATED PANEL FILTERS

Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames and with MERV rating of 9-16 and thickness as indicated on the Drawings.

Smoke And Flammability Limits: UL 900, Class 1.

Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Media shall be coated with an antimicrobial agent.

Separators shall be bonded to the media to maintain pleat configuration.

Welded wire grid shall be on downstream side to maintain pleat.

Media shall be bonded to frame to prevent air bypass.

Support members on upstream and downstream sides to maintain pleat spacing.

Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.
Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

Capacities and Characteristics: Rated airflow, size, and pressure losses shall be as indicated on the Drawings.

BAG FILTERS

Description: Factory-fabricated, dry, extended-surface, supported or nonsupported filters with header frames with MERV rating of 9-16, as indicated on the Drawings.

Smoke And Flammability Limits: UL 900, Class 1.

Media: Glass-fiber or synthetic material constructed so individual pockets are maintained in tapered form under rated-airflow conditions by flexible internal supports. Media shall be coated with an antimicrobial agent.

Filter-Media Frame: Galvanized steel.

Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

Capacities and Characteristics: Rated airflow, size, and pressure losses shall be as indicated on the Drawings.

RIGID CELL BOX FILTERS

Description: Factory-fabricated, disposable, packaged air filters with media perpendicular to airflow, and with holding frames and with MERV rating of 9-16, as indicated on the Drawings.

Smoke And Flammability Limits: UL 900, Class 1.

Media: Adhesive-coated fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.

Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Media shall be coated with an antimicrobial agent.

Filter-Media Frames: Galvanized steel.

Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

AUTOMATIC ROLL FILTERS

Description: Factory-fabricated, automatic, motor-driven, roll-type filters with holding casing and with MERV rating of 9-16, as indicated on the Drawings.

Arrangement: Horizontal or vertical as indicated on the Drawings.

Smoke And Flammability Limits: UL 900, Class 1.

Media: Compressed and rolled, fibrous-glass material; viscous coated. Media shall be coated with an antimicrobial agent.

Holding Frame: Galvanized steel with enclosed, clean media roll arranged to allow upstream replacement of filter media.

Auxiliary Frame: Locate on downstream side of unit with downstream access.

Control and Drive: Electric, gear-reducer, motor-driven, feed-control mechanism equipped with manual media advance and runout switches for stopping media movement of filter bank and operating remote warning signal lights.

Manual Control: Manual switch to advance media, and wired to override automatic controls.

Automatic Control: Prewired control package to advance media when filter resistance exceeds preselected high limit.

Capacities and Characteristics: Rated airflow, size, and pressure losses shall be as indicated on the Drawings.

SIDE-SERVICE FILTER HOUSINGS

Description: Factory-assembled, side-service housings, constructed of galvanized steel with flanges to connect to duct or casing system.

Prefilters: Where indicated on the Drawings, incorporate integral tracks to accommodate 2-inch pleated media filters with MERV 9 efficiency.

Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking devices, and arranged so filter cartridges can be loaded from either access door.

Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.

FILTER GAGES

Diaphragm-type gage with 4-1/2 inch diameter dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment. Gage scale range shall be as follows:

Manufacturer Recommended Final Filter Resistance (inches wg)	Gage Range (inches wg)
Less than 2	0-2
2-3	0-3
3-4	0-4
4 or greater	0-10

Provide static-pressure tips, tubing, gage connections, and mounting bracket for duct or AHU installation as required.

Gage shall include manual set high pressure setpoint and incorporate integral Form C relay (DPDT switch) for connection to facility DDC system to indicate that filter replacement is required. Gage shall be Dwyer Series A3000 Photohelic, or equivalent, differential pressure switch/gage.

PART 3 - EXECUTION

INSTALLATION

Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

Install filters in position to prevent passage of unfiltered air.

Install filter gage for each filter bank.

Do not operate fan system until filters are in place. Replace filters used during construction and testing with new, clean filters prior to final acceptance.

Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position.

Coordinate filter installations with duct and air-handling-unit installations.

EXTRA STOCK

Coordinate with owner on preference for extra filter stock.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 234123

SECTION 236200 – PACKAGED CONDENSING UNITS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

AHRI Compliance:

Capacity ratings for condensing units shall be in accordance with AHRI Standard 365, *Standard for Commercial and Industrial Unitary Air-Conditioning Equipment,* for units of 135 MBH capacity or greater, AHRI Standard 210/240, *Standard for Unitary Air-Conditioning Equipment*, for units of capacity less than 135 MBH.

Rate air-cooled condensing unit sound power levels according to AHRI 270, *Sound Rating of Outdoor Unitary Equipment*, or AHRI 370, *Sound Rating Of Large Outdoor Refrigerating And Air-Conditioning Equipment*, as applicable.

Rate water-cooled condensing unit sound power levels according to AHRI 575, *Method of Measuring Machinery Sound Within an Equipment Space*.

ASHRAE Compliance: Refrigeration system of condensing units shall be constructed in accordance with ASHRAE 15, *Safety Code for Mechanical Refrigeration*.

North Carolina Building Code Compliance: Condensing units, air-, water-, or evaporatively cooled, shall meet or exceed the minimum efficiency rating required by the *North Carolina State Building Code: Energy Conservation Code* when tested, rated, and certified in accordance with AHRI 365 or AHRI 210/240, as applicable.

Extended Warranty: **The Contractor shall provide an extended parts and labor warranty on each refrigeration compressor in addition to guarantees and warranties required under the General Conditions to the Construction Contract.**

The *parts* portion of the warranty shall be directly from the manufacturer to the Owner.

The *labor* portion of the warranty shall also be provided directly from the manufacturer to the Owner.

Exception: Where a manufacturer labor warranty is not available, the Contractor shall provide a labor warranty directly to the Owner.

This warranty shall provide for repair or replacement of the covered compressor**, including removal and/or replacement of refrigerant,** that becomes inoperative as a result of defects in materials or workmanship within 4 years after the date ending the initial 1-year guarantee period for the Project.

Acoustic Criteria: HVAC equipment shall be selected and installed to comply with the acoustic criteria defined in Section 230510.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories, and installation and start-up instructions.

Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation of condensing units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

PART 2 - PRODUCTS

AIR-COOLED CONDENSING UNITS

General: Factory-assembled and tested air-cooled condensing units, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls. Capacities and electrical characteristics are scheduled.

Unit Casings: Design for outdoor installation, complete with weather protection for components and controls, with removable panels for service access to compressors, controls, condenser fans, motors, and drives.

Refrigerant: R-454B or R32

Scroll Compressors: Scroll-type compressors designed for air-cooled condensing, complete with crankcase heater and backseating service access valves on suction and discharge ports. For condensing units 5 tons and less capacity, provide 2-speed compressors. For condensing units greater than 5 tons, provide multiple compressors, maximum 20 tons per compressor. **For units with multiple compressors, provide separate and independent refrigeration circuit for each compressor**.

For each compressor, include the following:

Thermally protected compressor motor.

Crankcase heater.

Condensing Section:

Condenser coil shall be seamless copper tubing mechanically bonded to configured aluminum fins. Condenser coils shall be factory-tested at 450 psig, vacuum dehydrate, and filled with a holding charge of nitrogen.

Units shall include liquid accumulator and subcooling circuit and backseating liquid line service access valve.

Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

Condenser coil shall have phenolic protective coating.

Condenser Fans and Drives: Propeller-type condenser fans for vertical air discharge, either direct drive or belt drive. Additional features shall include:

Permanent lubricated ball bearing condenser fan motors;

Separate motor for each condenser fan;

Each fan assembly shall be dynamically and statically balanced.

Controls: Operating and safety controls shall include the following:

High and low pressure cutouts.
Oil pressure cutout,

Compressor winding thermostat cutout,

3-leg compressor overload and single-phasing protection

Condenser fan motors thermal and overload cutouts.

Automatic non-recycling pumpdown and timing device to prevent excessive compressor cycling.

Multi-stage cooling control where two-speed compressors and/or multiple compressors are provided.

Low Ambient Control: Provide factory-installed low ambient damper assembly, fan speed control, or fan cycling control for cooling operation down to 0°F ambient. Include all other accessories necessary for low-ambient application.

Heat Pump Control: Units designed for heat pump duty shall be as specified above with the following additional requirements:

Reversing Valves: 4-way low voltage solenoid valve piping to direct hot gas flow to the indoor coil when energized (heating mode) and to the outdoor coil when de-energized (cooling mode).

Heating Cycle Controls:

Heating: Provide multistage heating control. For each refrigerant circuit, the first stage shall energize the reversing valve, directing hot gas to the indoor coil. On a continued fall in space temperature, energize the supplemental heat.

Defrost Cycle: When in the heating cycle, a buildup of ice on the outdoor coil shall result in the controls de-energizing the reversing valve, directing hot gas from the compressor to the outdoor coil to defrost it. The outdoor fan(s) shall stop. Once the ice melts, energize the reversing valve shall be energized to the heating position to direct hot refrigerant gas to the indoor coil. The outdoor fan shall operate.

Refrigerant Piping Size**: Regardless of refrigerant piping sizes indicated on plans, condensing unit manufacturer shall verify sizing to complement length and elevation of piping. Additionally, include all condensing unit accessories necessary to complement length and elevation of piping.**

PART 3 - EXECUTION

INSTALLATION

Install condensing units in accordance with manufacturers installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

Outdoor, ground mounted units shall be installed on concrete pads complying with the requirements of Section 019913. Pads shall extend beyond unit minimum of 7" in each direction. Set unit on 6"high prefabricated corner supports with internal vibration isolation.

Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 236200

SECTION 237311 – BLOWER-COIL AIR-HANDLING UNITS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

Air handling unit components shall meet the specific requirements of the following Specification sections:

Component	Section
Electrical	230511
Motors	230513
Fans	233416
Coils	238216
Support/Vibration Control	230529/230548/233300
Filters	234113/234123
Dampers	233300

QUALITY ASSURANCE

AHRI Compliance: Test and rate air handling units in accordance with AHRI Standard 440, *Room Fan-Coil Air Conditioners*.

NFPA Compliance: Comply with NFPA 90A or NFPA 90B

UL Compliance: Construct and install air handling units in compliance with UL 883, *Safety Standards for Fan Coil Units and Room Fan Heater Units*.

Acoustic Criteria: HVAC equipment shall be selected and installed to comply with the acoustic criteria defined in Section 230510.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's specifications for terminal units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

PART 2 - PRODUCTS

DESCRIPTION

Provide horizontal or vertical blower coil units, as indicated the Drawings, shall be factory assembled and consist of fans, motor and drive assembly, coils, damper, filters, condensate pans, mixing dampers, and accessories.

CASING

Materials: Utilize 1" thick double wall insulated panels, fabricated to allow removal for access to internal parts and components:

Outside Casing: Minimum gauge for maximum deflection of 1/240, G90 galvanized steel with outer panel finish specified below.

Inside Casing: Minimum gauge for maximum deflection of 1/240, G90 galvanized steel.

Outer Panel Finish: Immediately after cleaning and pre-treating, apply manufacturer's standard color two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.

Casing Insulation and Adhesive: Provide 1" thick fiberglass insulation, ASTM C612, Class I, unfaced securely mounted between inside and outside panels of casings.

Drain Pans:

Fabricate of Type 304 stainless steel, insulated double wall construction, minimum 2 inches deep, with minimum 2% slope in at least two planes to collect condensate from cooling coils (including uninsulated coil piping connections, coil headers, and return bends).

Condensate drain pan shall extend throughout the coil and fan sections of the AHU.

Locate drain connections at lowest point of pan on both ends of pan, sized to prevent overflow, minimum 1-1/2" NPS. Terminate with threaded galvanized pipe nipple.

AHUs with stacked coils shall have an intermediate drain pan and drain piping at each coil level to collect condensate from upper coils.

Access Panels: Panels shall be constructed of same materials and with same finishes specified for casings, with threaded screw fasteners. Panels shall be sized and located to allow periodic maintenance and inspections. Provide access panels in the following locations:

Fan Section: Inspection and access panels.

Coil Section: Inspection and access panels.

Filter Section: Inspection and access panels to allow periodic removal and installation of filters.

FAN SECTION

Fan section shall house backward inclined centrifugal fan as indicated on the drawings in accordance with 233416, fan motor that complies with Section 230513, and belt drive in accordance with Section 019913.

Fans and motors shall be mounted within the fan section on a common vibration base, with the motor installed on an adjustable motor base. Vibration base shall be equipped with vibration control in accordance with Section 230548.

Connect fan discharges to attached ductwork with flexible duct connectors specified in Section 233300.

COIL SECTION

Provide common or individual coil sections for heating and cooling coils as indicated on the Drawings. Air coils shall comply with Section 238216. Provide galvanized or aluminum sheet metal blank-offs around each coil to eliminate air bypass.

FILTER SECTION

Provide air filtration section(s) as indicated on the Drawings to house particulate filters complying with Sections 234113 and/or 234123, as applicable.

MIXING SECTION

Provide mixing section, as indicated on the Drawings, with flanged return air and outdoor air openings. Dampers shall comply with the requirements of Section 233300 and be sized by the manufacturer in accordance with ASHRAE Guideline 16, *Selecting Outdoor, Return, and Relief Dampers for Air-Side Economizer Systems*.

MOUNTING

Base-Mounted Units: Install as indicated on the Drawings in housekeeping pad in accordance with Section 019913.

ELECTRICAL CONNECTION

General: The unit shall be provided with single-point power connection, factory-wired to the power connection lug set. Electrical connection work shall be in accordance with Section 230511.

PART 3 - EXECUTION

INSTALLATION OF AIR HANDLING UNITS

Install air handling units where indicated, in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.

AHUs shall be installed level and plumb with building construction.

Suspended units shall be hung from structural-steel support frame using threaded steel rods and spring hangers in accordance with Sections 230529 and 230548.

Install suspended units with auxiliary drain pan extending 3" beyond unit casing in each direction. Drain pan shall be constructed of minimum 20 gauge galvanized steel, minimum 1 1/2" deep, with hemmed edges. Provide separate condensate auxiliary drain or provide condensate level switch wired to de-energize the unit and pan drain connection with hose-end NC ball valve.
Do not operate AHU until filters are in place. Install new filters in each AHU prior to final acceptance.

Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. Install piping adjacent to air-handling unit to allow for required access for service and maintenance.

Connect piping to suspended air-handling units with flexible connectors.

Refrigerant piping located in any area other than the room or space where the refrigerating equipment is located

- Labeled at every 20ft
- Minimum height of lettering is ½"
- Identification should indicated refrigerant designation and safety group classification

When refrigerant piping installed <7'3" it must be installed within the building elements or within a protective enclosure. Protective enclosure could include:

- a chase or installing it within studs, joists, etc.
- If pipe is installed within 1.5" from the nearest edge of the member, shield plates must be installed.
    - Shield plates to be minimum 16 gauge
    - Plates should cover the area of the piping plus 2" on either side

Piping does not require any additional protection Refrigerant piping installed 7'3" or higher, if pipe is located within 6' of the refrigerant unit or appliance, if pipe is located within a machinery room.

FIELD QUALITY CONTROL

Upon completion of installation of air handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 237311

SECTION 238216 – AIR COILS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to construction and installation of electric coils.

UL Compliance:

Comply with applicable requirements of UL 1025, *Electric Air Heaters*.

Comply with UL 486A, *Wire Connectors and Soldering Lugs for Use with Copper Conductors*.

Assemble electric coils in accordance with UL 1995.

NEMA Compliance: Provide electric duct heater accessories that comply with NEMA standards.

NFPA Compliance: Comply with applicable requirements of NFPA 90A and NFPA 90B pertaining to construction and installation of electric coils.

SUBMITTALS

General: Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification. Where a submitted item does not **comply fully** with each and every requirement of the Specifications, the submittal shall clearly indicate such deviations. Identification requirements for non-complying features of items are very specific. See Section 019913 for exact requirements.

Manufacturer's Data: Submit manufacturer's specifications for terminal units showing dimensions, capacities, ratings, performance characteristics, gages and finishes of materials, and installation instructions.

PART 2 - PRODUCTS

REFRIGERANT COILS

Fins: Construct of continuous aluminum or copper configured plate-fin type, as indicated on the Drawings. Provide minimum thickness of .0075”.

Tubes: Construct of 5/8" seamless copper tubes in accordance with ASTM B 753. Provide minimum thickness of .025”.

Suction and Distributor Piping: ASTM B 88, Type L copper tube with brazed joints.

Casings: Construct of 16-ga continuous coated galvanized steel for coil heights 33" and smaller; 14-ga for coil heights over 33". Provide formed end supports and top and bottom channels. Provide 16-ga steel center tube support for coil lengths 42" to 96", 2 or more supports for coil lengths over 96".

Testing: Factory test refrigerant coils at 450 psi and leak test at 300 psi under water; clean, dehydrate, and seal with dry nitrogen charge.

Coating: As indicated on the Drawings, coils shall be coated with epoxy phenolic coating.

Headers: Provide refrigerant distributor of venturi type with low pressure drop design, arranged for down feed and maximum of 12 circuits per distributor. Provide seamless copper tube suction header.

ELECTRIC COILS

General: Provide slip-in electric coils with disc type automatic reset thermal cutouts for primary over-temperature protection and with disc type load-carrying manual reset thermal cutouts, factory-wired in series with each heater stage, for secondary protection. Heat limiters or other fusible overtemperature devices are not acceptable. Provide electric coils with the following additional construction features:

Open-Coil Electric Element: Construct coils with resistance wire type A of 80 percent nickel/20 percent chromium, insulated by floated ceramic bushings. Recess bushings into casing openings and secure on supporting brackets, spaced 4" o.c. maximum. The heating wire for each stage shall be strung across the entire face of the coil to prevent stratification when operating at less than full capacity.

Heaters shall be rated for the voltage, phase, and number of heating stages as indicated in the schedule. All three phase heaters shall have equal, balanced, three phase stages. All internal wiring shall be stranded copper with 105 degrees C insulation and shall be terminated in crimped connectors or box lugs.

Terminal blocks shall be provided for all field wiring and shall be sized for installation of 75 degrees C copper wire in accordance with NEC requirements.

Trim: All terminals and nuts shall be constructed of stainless steel, and terminal insulators, brackets and bushings shall be constructed of ceramic and securely positioned.

Casings: Heater frames and terminal boxes shall be constructed of aluminized or galvanized steel. Terminal box shall be NEMA 1 construction and shall be provided with a hinged, latching cover and multiple concentric knockouts for field wiring.

Heater controls shall be factory wired in insulated enclosure and shall be provided complete with the items indicated below:

Automatic reset thermal cutouts prewired into control circuit

Differential pressure switch

Limit control duty magnetic contactors

Control circuit transformer for 24V control
Non-fused safety disconnect switch interlocked with heater terminal box cover

SCR modulating control.

PART 3 - EXECUTION

REFRIGERANT COILS

Install coils as indicated, and in accordance with manufacturer's installation instructions.

Mount coils on steel supports to form banks or stacks as indicated, brace, secure to air intake chamber. Place in location to permit installation of bypass damper if required, provide steel baffles where required to prevent bypassing of air.

Pitch coil casings for drainage, not less than 1/8" toward return connections, except where drainage feature is included in coil design.

INSTALLATION OF ELECTRIC COILS

Install electric coils including components as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices; complying with applicable installation requirements of NFPA 70 and NECA's "Standard of Installation."

Coordinate with other electrical work, including wiring/cabling, as necessary to properly interface installation of electric coils with other work.

Clean dust and debris from each electric duct heater as it is installed to ensure cleanliness.

Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A.

Provide equipment grounding connections for electric coils as required by NFPA 70. Tighten connections to comply with tightening torque values specified in UL Std. 486A to assure permanent and effective grounding.

OWNER INSTRUCTION AND TRAINING

Provide Owner instruction and training in accordance with Section 019926.

END OF SECTION 238216

SECTION 260000 - SUMMARY OF ELECTRICAL WORK

Engineer of Record for electrical work is Matthew J. Johnson, PE, Salas O'Brien., 702 Oberlin Road, Suite 300, Raleigh, NC 27605. Electrical work shall be defined by drawings numbered with the prefix "E", the general provisions of the Contract including General Conditions and Supplementary Conditions, Division 1 Specifications sections, and Division 26-28 Technical Specifications listed below. In addition, electrical work may be defined by reference to other documents from any of the above-named sources as well as by project addenda.

DIVISION 26 - ELECTRICAL

Section	Title
260000	Summary of Electrical Work
260500	Basic Electrical Requirements
260519	Secondary Voltage Wires and Cables
260526	Grounding
260529	Supporting Devices
260533	Electrical Identification
260534	Raceways
260535	Electrical Boxes and Fittings
260593	Electrical Connections for Equipment
260596	Lighting Systems Commissioning
260800	Testing and Placing in Service
260923	Lighting Control Devices
262416	Panelboards
262726	Wiring Devices
265000	Lighting Fixtures

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Section	Title
283110	Fire Alarm System Modifications

END OF SECTION 260000

SECTION 260500 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE

The electrical design for this project is based on the requirements of the *National Electrical Code* (NEC), NFPA-70, 2020 Edition. Where not restricted to more stringent requirements by the Drawings and Specifications, the minimum requirements of the NEC shall prevail.

Contractor shall coordinate the work and equipment of this Division with the work and equipment specified elsewhere in order to assure a complete and satisfactory installation.

It is the intention of these Specifications and Drawings to call for finished work, tested and ready for operation. Whenever the words "supply," "provide," or "furnish" are used, it shall mean "furnish and install complete and ready for use at no additional cost."

Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the Work the same as if herein specified or shown.

Some items of equipment are specified in the singular; however, the Contractor shall provide and install the number of items of equipment as indicated on the Drawings, and as required for complete systems. The words “and” and “or” shall be interpreted in both the singular and plural sense (and/or) as appropriate to the use.

Electrical service entrance equipment arrangements for temporary and permanent connections to the Owner's system shall conform to the Owner's requirements. Coordinate circuit breakers with the existing system.

All ampacities or other conductor references where indicated or otherwise specified in the Drawings or Specifications are based on copper conductors. **Aluminum conductors are not acceptable and will not be permitted.**

DEFINITIONS

Definitions for "Concealed" and "Exposed" are provided for the purpose of specifying wiring methods or for defining the appearance of finished work and are not the same as definitions used in the National Electrical Code.

Concealed: Work within or behind various construction elements or in crawl spaces or trenches that is not exposed to view when the project is complete.

Exposed: Not "concealed" as defined above, or anything exposed to view when the project is complete.

Labeled: Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization accredited by NCBCC (North Carolina Building Code Council) to label electrical equipment and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed: Equipment or materials included in a list published by an organization accredited by NCBCC (North Carolina Building Code Council) to label electrical equipment and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets appropriate designated standards or has been tested and found suitable for use in a specified manner.

Wiring: Cable, raceways, fittings, mechanical supports, wire, junction boxes, device boxes, outlet boxes, switches, cutouts, and related items.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

ENERGIZED SYSTEM WARNING

Extreme caution is enjoined with regard to work with and around energized electrical equipment. The Contractor is urged to coordinate all such activities with the Owner or the local electric utility so that electrical equipment may be de-energized as required to safely perform necessary construction activities as defined in the Drawings and Specifications. Suitable OSHA approved lockout-tagout procedures shall be used when circuits or equipment have been de-energized for the purpose of performing construction activities. All work practices related to worker safety are the complete responsibility of the Contractor.

DUTIES OF CONTRACTOR

The Drawings are generally diagrammatic in nature and are neither intended to show each fitting, box, elbow, offset, hanger, *etc.*, nor a complete detail of all work to be done. The Drawings are for the purpose of illustrating the type of system, showing raceway sizes, *etc.*, and special conditions considered necessary for the experienced mechanic to take off materials and lay out work. This Contractor shall be responsible for taking such measurement as may be necessary at the job and adapting his work to local conditions.

Contractor shall furnish and install all materials called for or reasonably implied in these Specifications and accompanying Drawings. Apparatus must be furnished complete and ready for operation in every respect. Materials and equipment called for in the Specifications and not indicated on the Drawings, or indicated on the Drawings and not called for in the Specifications, shall be furnished by the Contractor.

Contractor is responsible for familiarizing himself with the project area and details of the construction of building. Work performed under these Specifications that is installed improperly or which requires modification due to improper reading or interpretation of building plans shall be corrected or otherwise modified as directed by the A-E without additional cost to the Owner.

Contractor shall follow Drawings in laying out work and shall refer to drawings of other trades to verify exact spaces in which work will be installed. Arrange installed items in such a manner as to maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, A-E shall be notified before proceeding with installation.

INSPECTIONS

The contractor shall schedule inspections with the State Electrical Inspector through the State Construction Office (SCO), Consulting Services section. This shall include all inspections of concealed work, interior and exterior, as well as intermediate and final reviews. All scheduling of electrical inspections with the SCO electrical inspector shall be Monday thru Friday unless specifically exempted and approved by SCO.

COOPERATION WITH OTHER TRADES

The Contractor shall give full cooperation to other trades and shall furnish any and all information necessary to permit the work of other trades. Information to be provided by the Contractor includes, but is not limited to templates, patterns, setting plans, and shop details as may be necessary for the proper installation of work and for the purpose of coordinating adjacent work. Information required by other trades shall be provided in a timely manner and shall be sufficient to allow the work of such other trades to proceed with the least possible interference or delay.

Where the work of the Contractor will be installed in close proximity to, or may interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. **If the Contractor installs his work before coordination with other trades, he shall make the necessary changes in his work to correct the condition without extra charge.**

Scaled Shop Drawings: If so directed by the A-E, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 3/8"=1'-0", clearly showing how his work is to be installed in relation to the work of other trades.

SAFETY REQUIREMENTS

All systems shall be installed so as to operate in a safe manner; all moving parts shall be covered where there is any possibility of danger from such moving parts. All rough edges of equipment and materials shall be made smooth.

All safety controls shall be checked under the supervision of the Owner's representative and two (2) copies of test data showing setting and performance of safety controls shall be submitted to the A-E by the Contractor.

During the construction the Contractor shall keep the site reasonably clean of debris and upon completion of construction he shall clean up the premises to remove all evidence of his work. The Contractor shall provide, at no additional cost to the Owner, additional cleaning of the site as directed by the Owner. In addition, upon completion of construction, he shall clean, wash and/or polish all fixtures, equipment and exposed material and leave each item clean, bright, and without blemish. Damaged items shall be replaced or repaired in a manner satisfactory to the Owner by the Contractor at no additional cost to the Owner.

It shall be the responsibility of the Contractor to maintain a safe working environment at all times and to comply with all OSHA regulations for the duration of the project.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Manufacturer's Data: Submit manufacturer's technical product data.

NAMEPLATE DATA

Each item of electrical utilization equipment shall be provided with a permanent operational data nameplate that shall, as a minimum, indicate the following: equipment manufacturer, product name, model number, serial number, capacity, voltage requirements, and either full load current or full load volt-amperes. Labels of tested compliances and similar essential data shall be a part of this label or located nearby. All equipment nameplates shall be in an accessible location.

In the event that the installation of equipment renders the manufacturer's nameplate inaccessible, the above information shall be etched onto a laminated plastic nameplate securely fastened to the equipment by no less than two machine screws or by other fastening methods approved by the A-E.

FLASH PROTECTION WARNING

Each piece of new electrical equipment, such as switchboards, parallel switchgear, panelboards, circuit breaker enclosures, control panels, motor control centers, transfer switches, etc. that are likely to require examination, adjustment, servicing or maintenance while energized, shall be field marked in a clearly visible location on the equipment enclosure to warn qualified persons of potential electric arc flash hazards, in accordance with NEC 110.16.

ACCESSIBILITY

Contractor shall be responsible for the sufficiency of the size of shafts and chases and the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with all other trades whose work is in the same place and shall advise the General Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required for such installations.

Contractor shall locate all equipment that must be serviced, operated, or maintained in fully accessible positions and shall coordinate with other trades as necessary to meet the workspace requirements of the National Electrical Code. Equipment where such space is required includes switchboards, motor control centers, panelboards, fire alarm control panels, telephone and data terminal panels and cabinets, and similar items.

Minor deviations from Drawings may be made to allow improved accessibility. Submit requests for all changes to the A-E for approval. Relocation of equipment, should such be required to meet NEC workspace requirements, shall be made by the Contractor at no additional cost.

CONCEALED RACEWAY

In general, all raceway or cable wiring methods in finished spaces shall be run concealed in walls, partitions, structural concrete panels, or above ceilings.

Exterior Raceway: Raceway may not be routed on exterior surfaces of the building or across a building roof (either above, below, or within roof insulation) unless specifically indicated on the Drawings.

Raceway Below Concrete Floor Slabs: Raceway may not be routed below concrete floor slabs unless such is specifically shown on the Drawings.

Concealment of raceway and covering of same shall not be done until authorized by the Authority Having Jurisdiction (AHJ). This applies to all interior work and exterior work.

SLEEVES AND PLATES

Contractor shall provide and locate all sleeves and inserts required, or shall be responsible for the cost of cutting and patching required where sleeves and/or inserts were not installed, or where incorrectly located. The Contractor shall be responsible for all drilling required for the installation of his hangers.

Sleeves shall be provided for all raceway passing through concrete, masonry, or tile wall, floor, or overhead deck construction. Sleeves shall be constructed of Schedule 40 black steel pipe unless otherwise indicated on Drawings. Sleeves through concrete beams shall be constructed as indicated on Drawings.

Fasten sleeves securely in walls so that they will not become displaced when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into the space between raceway and sleeve during construction.

Escutcheon plates shall be provided for all exposed (where permitted) raceway passing through walls and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the raceway. Where plates are provided for pipes passing through sleeves that extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

SUPPORTS, ATTACHMENTS

Contractor shall furnish and install all necessary supports required for all electrical equipment, lighting fixtures, raceway, outlet boxes, panelboards, generators, and for all other equipment furnished under this contract, and shall submit drawings to the A-E for approval before purchase, fabrication, or construction of same.

All equipment, unless otherwise shown, shall be securely attached to the building structure in an approved manner. Attachments shall be of a strong and durable nature; any attachments that are deemed by the A-E to be insufficient due to reasons of strength, location, quality, or appearance shall be replaced as directed at no additional cost to the Owner.

Framing members shall be standard rolled steel shapes, ASTM A36 steel, except that members welded to main structural member shall be of the same specification as the main structural member.

Framing shall be "simple beam" type with end connections welded or bolted for shear loads. Cantilevers may be used when detailed or specifically approved. Location of supplementary framing shall be subject to approval. Welding, where required, shall be performed by certified welders.

Framing members shall be designed for their actual loads with allowable stresses set forth in the AISC Specifications and the AISC Code, without excessive deflection and with consideration for rigidity under vibration, in accordance with standard structural practices. Supplementary framing, including design loads, member size and location shall be clearly shown on shop drawings.

When supplementary framing is indicated, verify that dimensions are suitable and that framing is structurally adequate for the equipment furnished.

FIRE RATED CONSTRUCTION

The fire rating of all floors, ceilings, and partitions shall be maintained. It is the responsibility of this Contractor provide and install any necessary fire resistive components so that the fire integrity of all fire rated structures supporting or containing items required under Divisions 26-28 will not be diminished by the installation of such items. Where device or junction boxes penetrate any fire rated structure, the boxes shall be located in such a manner as not to reduce the fire rating of the structure. Where the Drawings indicate adjacent boxes or devices in rated partitions that would reduce the fire rating of the partition if unprotected, suitable Listed protection methods shall be used to insure the fire rating of the partition will not be decreased by the proximity of other boxes or penetrations.

Where recessed fixtures are used in fire rated ceilings, suitable construction shall be installed above and around the fixture so that the fire rating of the ceiling is maintained. Refer to Architectural Drawings for fire ratings of ceilings.

Where recessed panelboards, recessed cabinets, or other items are located in a fire rated partition, suitable construction behind and around the item shall be used to maintain the fire rating of the partition.

Where fire resistive insulation or other coverings have been applied to a structure or to structural elements to obtain a fire rating and this insulation or covering is removed or otherwise disturbed by the installation of Division 26-28 components or other related items, this Contractor shall be responsible for restoring the material to a condition that matches the original fire protective ability.

Approval must be obtained from the A-E before any boxes, devices, or other components are relocated for the purpose of maintaining fire ratings.

TESTING LABORATORY APPROVAL

All equipment shall be approved for the intended use and shall be Labeled or Listed. In any case where the suitability for a particular application is in question by the A-E or inspection authorities the Contractor shall furnish appropriate standards covering the specific piece of equipment in question. Such standards, if required, shall be requested by the A-E in writing and shall be furnished by the Contractor at no additional cost.

PERSONNEL GROUND FAULT PROTECTION

Personnel ground fault protection is to be provided for certain receptacles as indicated on the Drawings and/or as required by the National Electrical Code. Protection is to be provided by the use of GFCI receptacles; the use of GFCI circuit breakers is not acceptable for the protection of general use receptacles. GFCI receptacles may not be used to protect other downstream non-GFCI receptacles unless specifically indicated on the Drawings.

If required, use GFCI circuit breakers to protect equipment or dedicated receptacles in locations as indicated on Drawings or panel schedules. GFCI receptacles may not be used to protect downstream circuit components.

TYPICAL MOUNTING HEIGHTS OF DEVICES

Typical mounting heights for electrical equipment shall be as follows unless otherwise noted on Drawings:

DEVICE	MOUTING HEIGHT ABOVE FINISHED FLOOR (AFF)	TO
Panelboards	6’-6”	Top
Toggle Switches	3’-6”	Center Line
Receptacles	1’-6”	Center Line
Telephone Outlets	1’-6”	Center Line
Telephone Cabinets	6’-6”	Top
Telephone Backboards	6’-6”	Top
Safety Switches	5’-6”	Top
Data Outlets	1’-6”	Center Line

SCAFFOLDING, RIGGING, HOISTING

The Contractor shall furnish all scaffolding, rigging, hoisting and related sub-contract services necessary for equipment delivery and final placement as indicated on the Drawings.

All scaffolding, rigging and hoisting equipment shall be removed from the job site in a timely manner when such equipment is no longer required.

EARTHWORK

Excavating and backfilling inside and outside the building shall include shoring and bracing, pumping and protection for safety of persons and property. Backfill shall be compacted in layers not exceeding 6" in depth. Completed backfill shall conform to surrounding ground and finish grade. Restore any sidewalks, roads, or existing work which is cut or damaged to "as found" conditions. Dispose of excess material in a manner approved by the A-E at no additional cost to the Owner.

The Drawings for this project show anticipated underground utilities at locations where they will not interfere with proposed construction. Information on the Drawings concerning existing utilities or other underground services is believed to be accurate and is presented in good faith. Exact locations for such services may be determined only by excavation; extreme caution shall be used with regard to trenching or excavation in the vicinity of underground services. In trenching or other excavation work always assume the presence of undocumented underground services. In the event underground services are damaged by the Contractor the Contractor shall repair same in a manner satisfactory to the A-E at no additional cost to the Owner.

ELECTRICAL CIRCUITS

Circuit designations and connections are shown on the Drawings. Indicated circuit numbers and circuit breaker positions are mandatory unless changes are specifically approved by the A-E in writing.

Electrical neutral connections are indicated on the Drawings. Neutrals may not be reconfigured or otherwise changed without specific approval in writing from the A-E.

Request for circuit or neutral changes **can not be a part of the equipment submittal process.**

EQUIPMENT CONNECTIONS

In general, provide complete electrical power supply system connections to all equipment shown on Drawings. In addition, provide disconnection and re-connection to the power system of any items that are indicated on the Drawings as being moved or relocated.

Control wiring shall be installed in raceways and box system separate from power wiring, unless otherwise indicated on Drawings. Wiring within equipment enclosures shall be in raceways provided under this section of the Specifications unless approved raceway is provided by the manufacturer of the equipment or unless the equipment is listed for use as a raceway.

ELECTRICAL PROVISIONS FOR DIVISIONS 21 - 23

Division 26-28 Contractor shall provide complete power wiring to a disconnecting means provided under Division supplying the equipment. Extension of power from the disconnecting means to the utilization equipment shall be made under the Division supplying the equipment.

Starters, contactors, and similar control equipment shall be furnished and installed by other divisions unless specifically shown on the electrical Drawings. Control wiring is furnished by the Division supplying the control equipment.

Fuses for fused disconnects are furnished and installed by the division supplying the equipment to be protected.

Refer to Sections 210511, *ELECTRICAL PROVISIONS FOR FIRE PROTECTION WORK,* 220511, *ELECTRICAL PROVISIONS FOR PLUMBING WORK* and/or 230511, *ELECTRICAL PROVISIONS FOR HVAC WORK* for a complete description and breakdown of the responsibility of each trade (Divisions 20-23 and Divisions 26-28).

END OF SECTION 260500

SECTION 260519 - SECONDARY VOLTAGE WIRES AND CABLES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of electrical products, of types and ratings required in this Section, whose products are Listed and Labeled for the purpose intended. Subject to compliance with requirements provide devices equivalent to one of the following:

Encore Wire Corporation
General Cable Corporation
Southwire Company
Cerro Wire

Codes and Standards:

NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical wires and cables.

Testing Laboratory Compliance: Provide wiring/cabling and connector products that are Listed and Labeled.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's data on electrical wires, cables and connectors.

PART 2 - PRODUCTS

SECONDARY VOLTAGE WIRES, CABLES, AND CONNECTORS

General: Provide electrical wires, cables, and connectors of manufacturer's standard materials, as indicated by published product information. Connections shall be designed and constructed using connectors as recommended by manufacturer for a complete installation for the application indicated. Provide copper conductors with conductivity of not less than 98% at 68° F.

Building Wires: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by Contractor to comply with project's installation requirements, NEC and NEMA standards. Select from the following Listed types those wires with construction features that fulfill project requirements:

Type THWN/THHN: For general use as interior branch circuits and feeders; maximum operating temperature 90° C (194° F). Insulation, flame-retardant, moisture- and heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.

Type XHHW: For general use as exterior feeders and service entrance conductors, as conductors in all underground raceway, as conductors in wet locations and as specifically indicated on the Drawings; maximum operating temperature 90° C (194° F). Insulation, moisture and heat-resistant cross-linked polymer; conductor, annealed copper.

Building wire shall be installed in raceway for all applications. Cables are not approved for use in this project under Division 26.

Connectors:

General: Provide factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following, those types, classes, kinds and styles of connectors to fulfill project requirements:

Type: Pressure, threaded

Class: Insulated

Kind: Copper (for Cu to Cu connection)

Style: Wirenut, wingnut, power distribution block

Use power distribution blocks or other splicing device having a minimum of one clamping screw per conductor where conductor size or quantity exceed limits for "wirenut" or "wingnut" type connectors.

Provide power distribution blocks that are attached to the gutter, box, or enclosure into which they are installed. Free-floating, unattached power distribution blocks are not acceptable.

Provide suitable insulating covers for all connection devices where such insulation is not a part of the device design.

Use of split bolt connectors, insulation piercing connectors, or tape as a means of insulating connection devices is not acceptable.

PART 3 - EXECUTION

INSTALLATION OF WIRES AND CABLES

General: Install wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation," and in accordance with recognized industry practices.

Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.

Circuits of size #8 AWG and larger shall have Class B stranded conductors.

Power and lighting circuits #10 AWG and smaller shall have solid conductors. The minimum size for all power and lighting circuits shall be #12 AWG.
Control wiring shall have stranded conductors and a minimum size of #14 AWG.

Maximum size for feeders and service conductors shall be 500 kcmil.

Increase Drawing indicated size of conductors for ampacity and temperature rating as described below:

Conductor sizes shown on Drawings are based on the use of terminations Listed and Labeled for use at 75° C. (167° F.). Where terminations are not Listed and Labeled for use at 75° C. (167° F.), the Contractor shall increase the size of the conductor as required to meet the temperature rating of the conductor in accordance with NEC Article 110.14(c). Conductor size increases required under this section shall be made without additional cost.

Increase Drawing indicated size of conductors for voltage drop as follows:

Use #10 AWG conductor for 20 Ampere, 120 Volt branch circuit home runs longer than 50 feet, unless otherwise noted on Drawings.

Use #10 AWG conductor for 20 Ampere, 277 Volt branch circuit home runs longer than 100 feet, unless otherwise noted on Drawings.

Conduit runs shall contain the number of phase conductors shown on the plans. A dedicated neutral shall be installed for each phase conductor served by single pole, 120 and 277 Volt, 20 Amp circuit breakers. Multi-pole circuit breakers serving 120 and 277 Volt, 20 Amp multi-wire branch circuits with a common neutral shall not be permitted. Conduits runs shall contain related grounding and/or isolated grounding conductors.

Conduit runs that contain more than one neutral shall have each neutral conductor uniquely identified at each termination, splice and where routed through junction or pull boxes. Neutral conductors containing a factory applied, trace line along the length that matches the color of the associated phase conductor shall be used to meet this requirement. Machine printed labels with the panel and associated circuit number shall also be permitted for identifying neutral conductors. Colored tape and pre-printed tags shall not be acceptable.

Feeders and/or branch circuits shall not be combined either with each other or one with another into junction boxes, pull boxes, device boxes, manholes, or other common routing unless such routing is specifically indicated on the Drawings.

Neatly train wiring inside boxes, equipment and panelboards; Avoid bundling conductors with lacing or cable ties so that generated heat may be more easily dissipated.

Conduit runs indicated on the Drawings as composed of parallel runs of conductors shall be made identical with respect to length, conduit size, wire type, insulation type, routing, and terminations at each end.

Conductors Shall Be Color Coded as Follows:

Grounding Conductors: Green

Isolated Grounding Conductors: Green with yellow tracer
Grounded Neutral Conductors: White for 120 V systems, gray for 277 V systems

Ungrounded Phase Conductors for 208Y/120V Systems: Black (phase A), red (phase B), and blue (phase C)

Ungrounded Phase Conductors for 480Y/277V Systems: Brown (phase A), orange, (phase B) and yellow (phase C)
Switch Leg Travelers: Violet

Provide other wire colors as indicated on the Drawings.

Remarking of insulation colors by use of colored marker tape shall be permitted only as allowed by the NEC.

Install exposed cables (where permitted) parallel and perpendicular to surfaces, or exposed structural members. Cables shall follow surface contours, where possible.

Completely and thoroughly swab raceway system before installing conductors.

Branch circuit wiring shall not loop through receptacle terminals, but shall be connected by means of conductor taps joined to branch circuit conductors. At end of run, branch circuit conductors may terminate on receptacle screw terminals. Quick make, clamp, or push-in type terminations may not be used to make connections to devices.

Position all splices in pull boxes and junction boxes of adequate volume so they are accessible from the removable cover side of the box.

Conductors for signal systems shall be continuous (without splice) and shall be terminated on terminal strips or terminate in a manner approved by the system's manufacturer.

All neutrals and ground wires in panels shall be labeled with cloth wire markers to indicate the circuits being served.

Pull conductors simultaneously where more than one is being installed in same raceway.

Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation. After conductors have been pulled, clean exposed conductors and surrounding area to remove all evidence of the use of pulling compound.

Use pulling means including fish tape, cable, rope and basket weave wire/cable grips that will not damage cables or raceway.

Keep conductor splices to a minimum.

Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

Use splice and tap connectors that are compatible with conductor material.

Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A and B.

WIRING CONNECTIONS AND TERMINATIONS

Splices shall be permitted on conductors up to #4 AWG. No splices shall be permitted on conductor #3 AWG and larger without specific approval in writing by the A-E. Splices shall be made in accessible junction boxes; no splices shall be made in conduit bodies.

Splices, taps, and attachments of fittings and lugs shall be electrically and mechanically secure. Connectors and lugs shall be proper size and labeled as suitable for the number and type of conductors joined.

Solid conductors, namely those sized #10 and #12 AWG copper shall be spliced or tapped only by the use of Ideal "Wing-Nuts" or "Wire Nuts", Buchanan's "B-Cap" or 3M Co.'s "Scotchlox" connectors. "Sta-Kon" or other permanent type crimp connectors shall not be used.

Self-stripping electrical pigtail and tap connectors shall not be used.

Stranded conductors, namely #8 AWG to #4 AWG, shall be spliced or tapped by approved mechanical connectors. Insulation for splices or taps shall be obtained by the use of Listed insulating covers designed for use with the particular connector. Quality of insulation at splices shall equal that of the conductor insulation in terms of temperature resistance, covering ability and durability.

Conductors, in all cases, shall be continuous from outlet to outlet, and no splicing shall be made except within outlet or junction boxes, troughs, and gutters. No splices shall be permitted in panel enclosures, disconnects or utilization equipment.

Lugs for conductors #8 through #4 AWG shall be copper, with a direct acting screw. Where permitted, lugs for conductors #3 AWG and larger shall be copper, applied directly to the cable by hydraulic pressure. Lugs shall not be split bolt or screw types.

Tape, where used, shall be made using special oil resistant vinyl plastic tape that is Listed, rated 105° C.

Splices or taps in grounding conductors (where permitted) in sizes #8 AWG and larger shall be by means of exothermic welding and termination shall be by means of approved grounding connectors. As an alternate, connectors using hydraulic compression tools may be used as a contractor selection option. Solder shall not be used as a means of joining grounding conductors.

Thoroughly clean wires before installing lugs and connectors.

Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

Terminate spare conductors with electrical tape.

FIELD QUALITY CONTROL

Prior to energizing circuitry, check installed wires and cables with megohm meter to determine insulation resistance levels to insure requirements are fulfilled. Provide additional testing as directed by the A-E in accordance with Section 260800, *TESTING AND PLACING IN SERVICE*.

Prior to energizing circuitry, test wires and cables for electrical continuity and for short circuits. Verify proper phasing connections.

Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 260519

SECTION 260526 - GROUNDING

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of grounding and bonding products, of types, and ratings required, and ancillary grounding materials, including stranded cable, grounding rods, and bonding jumpers whose products are Listed and Labeled for their intended usage.

Codes and Standards:

Electrical Code Compliance: Comply with applicable State electrical code requirements and the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.

Testing Laboratory Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment," and 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products that are Listed and Labeled for their intended usage.

IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

PART 2 - PRODUCTS

GROUNDING AND BONDING SYSTEMS

Materials and Components:

General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated, assemble materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding rods, bonding jumpers, service arresters, and additional accessories as needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Contractor's option. Where materials or components are not indicated, provide products that comply with NEC and UL requirements and with established industry standards for those applications indicated.

Conductors: Unless otherwise indicated, provide equipment grounding conductors in all conduit and wiring systems. Grounding conductors shall be insulated by the same type insulation as the ungrounded conductors and sized in accordance with NEC Table 250.122 unless otherwise specified.

Bonding Connectors, Terminals and Clamps: Provide electrical bonding connectors, terminals, lugs and clamps as recommended by bonding connector, terminal and clamp manufacturers for indicated applications.

Ground Rods: Provide rods made of steel with copper welded exterior, 3/4" diameter by 10 feet.

Ground Bus Bars: Provide copper bus bars mounted on standoff insulating bushings.

Hardware: Provide hardware for all grounding and bonding applications that consist of Type 300 series stainless steel, silicon bronze or brass. Hardware used for connections to enclosures shall include flat washers and split lock washers.

Electrical Grounding Connection Accessories: Provide electrical insulating tape, bonding straps, as recommended by accessories manufacturers for type service indicated.

PART 3 - EXECUTION

EXAMINATION

Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify A-E in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements.

Install grounding systems as designed and submit certified test report on grounding system.

Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.

Ground electrical service system neutral at service entrance equipment to grounding rod(s), grounded copper water pipe, and building steel where effectively grounded. All ground corrections shall be accessible. Provide additional bonding connections to miscellaneous metallic piping systems entering the building such as fire protection and gas piping.

Provide an intersystem ground bus bar adjacent service equipment as shown on the drawings.

Ground each separately-derived system neutral to:

Effectively grounded copper water pipe

Building structural steel

Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and cold water systems.
Install direct burial type ground clamps for grounding electrode conductors to underground grounding rods.

Provide a separate, insulated equipment grounding conductor from each device to ground buses in panelboards. Terminate each end on a grounding lug, bus, or insulated grounding bushing.

Provide separate insulated equipment grounding conductor, size to be determined from NEC Table 250.122, for each circuit and in each conduit run. The grounding conductor shall be attached by means of a dedicated green screw to a common point in each junction box, cabinet, device box, enclosure, or utilization equipment to which it runs or through which it passes. Grounding methods depending on the continuity of electrical raceway, clips, or mounting screws are not acceptable. This grounding requirement will be rigidly enforced.

Connect grounding electrode conductors to copper water pipe using a suitable grounding clamp as indicated on drawings. Provide conduit grounding hubs and water pipe ground clamps as required.

Provide copper grounding conductor from supplemental ground bus bar adjacent service equipment to communications (telephone/data or cable TV) backboards where shown on drawings. Terminate conductor on insulated ground bus bar for use by others.

Provide an insulated bonding bushing on all panelboard feeders. Terminate feeder equipment grounding conductor by passing the conductor through the terminal of the insulated bonding bushing and then onward to terminate at the panel ground bus.

Provide an insulated bonding bushing at boxes, enclosures or cabinets with concentric, eccentric or over-sized knockouts. Terminate equipment grounding conductor by passing the conductor through the terminal of the insulated bonding bushing and then onward to terminate at ground bus or lug.

Connect grounding electrode conductors to 1-inch diameter, or greater, metallic cold water pipe using a suitably sized ground clamp.

Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed.

Install clamp-on connectors on clean metal contact surfaces to ensure electrical conductivity and circuit integrity.

Sectionalizing switchgear housing, cable shielding and primary grounding conductors shall be connected to a driven copper ground rod having a maximum resistance of 25 Ohms by means of # 3/0 AWG bare copper stranded conductor.

Service transformer housing, cable shields, primary and secondary neutrals shall be connected to a driven copper ground having a maximum resistance of 25 Ohms using # 3/0 AWG bare stranded copper conductor. Primary neutral conductor shall be unbroken to transformer primary neutral bushing, and thereafter grounded as indicated on the Drawings.

FIELD QUALITY CONTROL

Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 25 Ohms, take appropriate action to reduce resistance to 25 Ohms, or less, by driving additional ground rods; then retest to demonstrate compliance.

Provide written certified testing report indicating resistance-to-ground value.

END OF SECTION 260526

SECTION 260529 - SUPPORTING DEVICES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to work of this section.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required.

Codes and Standards:

NEC Compliance: Comply with NEC requirements as applicable to construction and installation of electrical supporting devices.

Testing Laboratory Compliance: Provide electrical components that are Listed and Labeled.

ANSI Compliance: Comply with ANSI/MSS SP-69, Hangers and Supports – Selection and Application for selecting electrical supporting devices.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve and seal.

PART 2 - PRODUCTS

MANUFACTURED SUPPORTING DEVICES

General: Provide supporting devices as herein specified which comply with manufacturer's standard materials, design and constructed in accordance with published product information and as required for complete installation. Where more than one type of supporting device meets indicated requirements, selection is Installer's option.

Supports: Provide supporting devices of types, sizes and materials indicated that have the following construction features:

Clevis Hangers: For supporting large rigid metal conduit hangers shall be steel with finish appropriate for application and 1/2" diameter hole for round steel rod. Approximate weight is 54 pounds per 100 units.

Reducing Couplings: Steel rod reducing coupling shall be 1/2", 3/8” or ¼” x 5/8" steel, with finish appropriate for application.

C-Clamps: C-clamps shall be ductile iron, with finish appropriate for application and 1/2", 3/8” or ¼” rod size. Approximate weight is 50 pounds per 100 units.

I-Beam Clamps: I-beam clamps shall be steel, with finish appropriate for application. 1-1/4" x 3/16" stock with 3/8" cross bolt. Flange width shall be 2". Approximate weight is 52 pounds per 100 units.

Conduit Hangers: Hangers shall be galvanized steel used for supporting conduit up to 2". Weight varies with conduit size, up to 25 pounds per 100 units for 2" trade size.

One-Hole Conduit Straps: One hole conduit straps used for supporting 1/2" conduit (where such is permitted) and 3/4" conduit, shall be galvanized steel. Approximate weight is 7 pounds per 100 units.

Two-Hole Conduit Straps: Two hole conduit straps, used for supporting conduit larger than 3/4", shall be galvanized steel. Weight varies with conduit size.

Hexagon Nuts: For 1/2", 3/8" or ¼" rod sizes, nuts shall be galvanized steel.

Round Steel Rod: Use black steel for 1/2", 3/8" or ¼" diameter rod.

Anchors: Provide anchors of types, sizes and materials indicated, with the following construction features:

Lead Expansion Anchors: 1/2", approximately 38 pounds per 100 units.

Toggle Bolts: Springhead type, 3/16" x 4", approximately 5 pounds per 100 units.

Powder actuated anchors and fasteners are not permitted.

Watertight Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals of types and sizes indicated. Wall and floor seals shall be suitable for sealing around conduit, pipe, or tubing passing through concrete walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment and conduit where runs of more than two conduit must be supported from overhead structure. System shall be 12-gage minimum hot-dip galvanized steel of types and sizes indicated. Use 1 1/2" deep channel to support conduit larger than 1 1/2" trade diameter. Furnish with the following fittings that mate and match with U-channel:

Channel hangers

End caps

Beam clamps

Wiring studs

Thinwall conduit clamps

Rigid conduit clamps

Conduit hangers

U-bolts

FABRICATED SUPPORTING DEVICES

Pipe Sleeves: Provide pipe sleeves as follows:

Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

Sleeve Seals: Provide sleeves for piping which penetrates foundation walls below grade, or exterior walls. Caulk between sleeve and pipe with non-toxic, UL classified caulking material to ensure watertight seal.

PART 3 - EXECUTION

INSTALLATION OF SUPPORTING DEVICES

Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.

Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

Install hangers, supports, clamps and attachments to support conduit properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

Torque sleeve seal nuts, complying with manufacturer's recommended values. Ensure that sealing grommets expand to form water tight seal.

END OF SECTION 260529

SECTION 260533 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of electrical identification products, of types required.

Codes and Standards:

NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.

UL Compliance: Comply with applicable requirements of UL Std. 969, "Marking and Labeling Systems," pertaining to electrical identification systems.

NEMA Compliance: Comply with applicable requirements of NEMA Std. No's. WC-1 and WC-2 pertaining to identification of power and control conductors.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's data on electrical identification materials and products.

Label Wording: Submit exact wording for approval prior to the construction of laminated nameplates or specialized signs. Submittal shall show both proposed wording and physical layout of each label, including mounting holes.

PART 2 - PRODUCTS

ELECTRICAL IDENTIFICATION MATERIALS

General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

Engraved Plastic-Laminate Signs:

General: Provide engraving stock melamine plastic laminate, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated or as required to properly identify items installed under this division.

Color scheme shall be as indicated herein or on the Drawings. Signs shall be punched for mechanical fastening.

Thickness: 1/16", for units up to 20 sq. in. or 8" length; 1/8" for larger units.

Fasteners: Self-threading, blunt end, stainless steel machine screws.

Color-Coded Plastic Tape:

General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils. thick by 1-1/2" wide. Tape shall be listed for use at 105°C. or the temperature rating of the conductors to be marked, whichever is higher.

Cable/Conductor Identification Bands:

General: Provide pre-numbered or pre-lettered manufacturer's standard cloth self-adhesive cable/conductor markers of wrap-around type. Printing shall show circuit identification by indicating panel designation and circuit number.

Underground Type Plastic Line Marker:

General: Manufacturer's standard permanent, bright colored, continuous printed plastic tape, intended for direct burial service, not less than 6" wide x 4 mils thick. Provide electrically conductive tape with printing which most accurately indicates type of service of buried conduit or cable.

Place line marker 6" to 8" below finished grade and directly above line to be protected. For multiple conduit or cable runs in the same trench, use multiple line markets, one above each conduit or cable.

Baked Enamel Danger Signs:

General: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gage steel. Signs shall be of standard red, black and white graphics, 14" x 10" size. Where larger size exceeds space available, the 10" x 7" size may be used. Signs shall have recognized standard explanation wording, such as, “HIGH VOLTAGE,” “KEEP AWAY,” “BURIED CABLE,” “DO NOT TOUCH SWITCH,” etc.

Code-Colored Conduit Markers:

General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, plastic-sheet conduit markers, for feeders extending 360 degrees around conduits. Markers shall be designed for attachment to conduit by adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pre-tensioned snap-on. Except as otherwise indicated, provide lettering that indicates voltage of conductor(s) in conduit. Provide 8" minimum length for 2" and smaller conduit, 12" length for larger conduit.

Colors: Unless otherwise indicated on the Drawings or required by governing regulations, provide white markers with black letters.

LETTERING AND GRAPHICS

General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

WIRE COLOR CODE SCHEDULE

Where more than one nominal voltage system exists within a single facility, a schedule of conductor color codes shall be posted at each panelboard that is installed, relocated, renovated, or otherwise modified. The schedule, meeting the requirements of NEC 210.5(C) for branch circuit panelboards, shall be permitted to be either a plastic laminate sign or a printed label with permanent self-adhesive containing the information given in Section 260519, *SECONDARY VOLTAGE WIRES AND CABLES*. The label shall be installed so that it is clearly visible with the panelboard cover removed but with any shields or protective barriers in place. The label shall be installed after the installation of all conductors so that it may be located in an un-obscured location.

SERVICE EQUIPMENT AVAILABLE FAULT CURRENT LABEL

Based on the short circuit study conducted by the engineer for the distribution system, the Contractor shall prepare a phenolic field label to identify the available fault current at service equipment. This label shall be consistent with the requirements of this Section, with respect to color scheme and size. The label shall clearly indicate the date in which the calculation was prepared, as indicted by the engineer.

PART 3 - EXECUTION

APPLICATION AND INSTALLATION

General Installation Requirements:

Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.

Coordination: Where identification is to be applied to surfaces that require finish, install identification after completion of painting.

Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

Conduit and Box Identification:

General: Apply color-coded identification to match system color code on electrical conduit and junction boxes in accordance with the following:

All empty conduit runs and conduit with conductors for future use shall be identified for such use; identification shall indicate where such conductors or empty conduct terminates. Identification shall be by tags attached to the pull cord or spare conductors. Each end of the pull cord shall be identified.

All outlet boxes, junction boxes and pull boxes, either exposed or concealed, shall have their covers and exterior visible surfaces painted with the field colors described in this section. Boxes shall also be marked to indicate the panelboard and circuit number(s) of the circuits contained within. Lettering may be by hand for concealed or non-public locations only. Machine printed labels are to be used to identify boxes where such are permitted to appear in areas accessible by the public; embossed type plastic labels are not acceptable for use on this project. Where hand produced marking is permitted, the lettering shall be made with waterproof ink.

Equipment/System Identification:

General: Install an engraved plastic laminate sign on each major unit of electrical equipment on project. Such equipment includes central or master unit of each electrical system including communication, control, and signal systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, 1/2" high lettering, on 1-1/2" high sign (2" high where 2 lines are required), white lettering in field color as indicated below. Provide text matching terminology and numbering of the Contract Documents and shop drawings.

Field Colors shall be the following:

Blue surface with white core for 120/208 Volt equipment.
Black surface with white core for 277/480 Volt equipment.
Bright red surface with white core for all equipment related to fire alarm system.
Dark red (burgundy) surface with white core for all equipment related to security.
Green surface with white core for all equipment related to emergency systems.
Yellow surface with black core for all equipment related to optional stand-by systems.
Yellow surface with red core for all equipment related to legally required stand-by systems.
Orange surface with white core for all equipment related to telephone systems.
Brown surface with white core for all equipment related to data systems.
White surface with black core for all equipment related to paging systems.
Purple surface with white core for all equipment related to TV systems.

Provide Signs for Each Unit of the Following Categories of Electrical Work:

Panelboards, electrical cabinets and/or enclosures
Switchgear
Disconnect or safety switches

Cable/Conductor Identification (Low Voltage):

General: Apply cable/conductor identification, including feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

Cable/Conductor Identification (High Voltage):

General: Apply cable identification, including feeder number and phase identification, on each cable in each box, manhole, handhole, enclosure, and/or cabinet where high voltage cables are present. Use of color coded tape to identify phases is acceptable provided this identification is accompanied by feeder identification attached to each cable.

Match identification with marking system used elsewhere in the Contract Documents. Identification means used on high voltage cables shall be waterproof and shall not deteriorate when used in a wet environment.

Underground Cable Identification:

General: During backfilling/top soiling of each exterior underground conduit, install continuous underground type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Install line marker for all buried conduits.

Optional Identification and Warnings:

General: Install self adhesive plastic signs or similar equivalent identification wherever reasonably required to prevent misuse by unauthorized personnel or to ensure safe and efficient operation and maintenance of electrical systems, electrically connected mechanical systems, and general systems and equipment. Install self-adhesive plastic signs or similar equivalent identification giving instruction or warnings on switches, outlets, controls, or devices where instructions or explanations are needed. Provide plasticized tags with clearly written messages adequate for intended purposes.

END OF SECTION 260533

SECTION 260534 - RACEWAYS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products are Listed and Labeled.

Codes and Standards:

NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.

Testing Laboratory Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components that have been Listed and Labeled.

NEC Compliance: Comply with applicable requirements of the latest edition of the NEC pertaining to construction and installation of raceway systems.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of raceway system required. Include data substantiating that materials comply with requirements.

PART 2 - PRODUCTS

METAL CONDUIT AND TUBING

General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each use indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements as stated herein while complying with applicable portions of NEC for raceways.

Rigid Metal Conduit (RMC): Provide rigid steel, zinc-coated, threaded type conforming to ANSI C80.1 and UL 6. Provide zinc coating fused to inside and outside walls.

Electrical Metallic Tubing (EMT): Provide electrical metallic conduit conforming to ANSI C80.3 and UL 797.

Flexible Metal Conduit (FMC): Provide steel flexible metal conduit conforming to UL 1. Conduit shall be formed from continuous length of spirally wound, interlocked zinc-coated strip steel.

Liquid-Tight Flexible Metal Conduit (LFMC): Provide flexible liquid-tight metal conduit constructed of single strip, flexible, continuous, interlocked, and double-wrapped steel. Inside and outside shall be galvanized; conduit shall be coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).

Rigid Metal Conduit Fittings: Provide cast malleable iron, galvanized or cadmium plated.

Use Type 1 fittings for raintight connections.
Use Type 2 fittings for concrete tight connections.

Conduit Locknuts: Provide case-hardened steel locknuts for use on threaded raceway.

Conduit Bushings:

Insulated: Provide Listed and Labeled, threaded, thermosetting plastic bushings at each end of all threaded raceway. Provide grounding type if same is indicated elsewhere.

Grounding (bonding type): Provide Listed and Labeled, threaded, insulated throat, bonding type bushings. Provide steel frame bushings for use on ferrous raceway //and aluminum frame bushings for use with aluminum raceway//. Provide bushings with tin-plated copper grounding saddle sized to accept grounding conductor size as indicated on the Drawings. Where grounding conductors are oversized, provide separate copper grounding lugs that are appropriately sized.

Flexible Metal Conduit Fittings: Provide steel conduit fittings for use with flexible steel conduit of threadless hinged clamp type. All flexible metal conduit fittings shall be Listed as suitable for grounding.

Straight Terminal Connectors: Provide insulated throat type, one piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with steel locknut.

45° or 90° Terminal Angle Connectors: Provide steel insulated throat type, two-piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with steel locknut.

Liquid-Tight Flexible Metal Conduit Fittings: Type 1, Class 3, Style G. Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated throat and steel locknut. All liquid tight flexible metal conduit fittings shall be Listed as suitable for grounding.

EMT Fittings:

EMT Conduit Couplings: Cadmium plated steel, dual compression type with two (2) hexagon compression fittings. Fittings that can not be tightened with an open-end wrench of the appropriate size are not acceptable.

EMT Conduit Connectors: Cadmium plated steel, insulated throat, compression type with hexagon compression fitting and steel locknut. Fittings that can not be tightened with an open-end wrench of the appropriate size are not acceptable.

Unacceptable fitting types: Pot metal, set screw, and indenter type fittings, or connectors that do not have insulated throats, are not acceptable for use on this project.

Conduit Bodies: Provide galvanized steel conduit bodies of types, shapes and sizes as required to fulfill job and NEC requirements. Conduit bodies shall be constructed with threaded conduit entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws.

Metallic Conduit, and Tubing Accessories: Provide metallic conduit and tubing accessories of types, sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.

PART 3 - EXECUTION

INSPECTION

Examine areas and conditions under which raceways are to be installed, and substrate that will support raceways. Notify A-E in writing of conditions detrimental to proper completion of the Work. Do not proceed with work until unsatisfactory conditions have been corrected.

SELECTION OF RACEWAY AND SIZE OF RACEWAY SYSTEM

General: Install concealed raceway system in new construction work, either in walls or above hung ceilings.

Do not route raceway below slabs unless such routing is specifically indicated on the Drawings.

Do not use surface metal raceway unless such use is specifically indicated on the Drawings.

Conduit Installation: Unless otherwise indicated on the Drawings, provide rigid steel zinc-coated conduit (RMC) where embedded in concrete, masonry, earth, or installed outdoors. Follow minimum requirements in other areas as follows:

Steel zinc-coated EMT may be installed in all areas except where specifically indicated otherwise in the Drawings or under the conditions of use listed below:

- Where it will be installed in exterior walls.
- Where it will be installed outdoors, in concrete or in direct contact with the earth.
- Where it will be subject to physical damage.
- Where it will be installed lower than four (4) feet from finished floor in areas where exposed to possible damage from area use activities.
- Where it will be subject to corrosive influence.
- Where it will be installed indoors in wet or damp locations.
- Where trade size is larger than 2".

Any of the above use conditions may be overridden by the Drawings.

Avoid use of dissimilar metals throughout system to reduce the possibility of galvanic action. Where dissimilar metals must be in contact, coat surfaces with corrosion inhibiting compound before assembling.

Use liquid-tight flexible metal conduit (LFMC) only where specifically indicated on the Drawings or where subjected to one or more of the following conditions:

- Flexible connection in an exterior location.
- Final 18" connection to motors.
- Equipment subject to movement or vibration.

Do not use PVC raceway unless such use is specifically indicated on the Drawings.

Use Flexible Metal Conduit (FMC) only for final connections to light fixtures and utilization equipment. Any other use shall be limited to applications where specifically indicated on the Drawings

Flexible Metal Conduit may not be used to interconnect device or junction boxes, utilization equipment, fixtures.

Flexible Metal Conduit length shall not exceed six feet.

Size raceway and raceway systems as follows:

Size raceway to meet NEC requirements, or as indicated on the Drawings, whichever size is larger, except no conduit smaller than 3/4 inch trade size shall be installed.

For underground use external to the building foundation no raceway smaller than 3/4 inch trade size shall be installed.

INSTALLATION OF RACEWAY SYSTEMS

General: Install raceways as indicated, in accordance with manufacturer's written installation instructions, and in compliance with the NEC and NECA's "Standards of Installation." Install raceway and related boxes and fittings plumb and level, ±2°. Maintain manufacturer's recommended clearances.

Fasten heavy wall conduit terminations in sheet metal enclosures by two locknuts, one inside and one outside of enclosure, and terminate with insulated bushing; terminate other conduit systems with connectors listed for the purpose and as described above.

Conduit couplers shall be steel threaded type in all locations where such use is possible. Otherwise use 3-piece union.

Conduits are not to cross pipe shafts or ventilating duct openings. Conduit is not to be routed in elevator shafts unless necessary to serve items within the shaft.

Keep conduits a minimum distance of 6" from parallel runs of hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water piping.

Support riser conduit at each floor level with clamp hangers.

Use of running threads at conduit joints and terminations is prohibited. Where required, use threaded nipples and 3-piece unions.

Support exposed conduit by use of hangers, clamps or clips Listed for the purpose. Support conduit on each side of bends and on spacing not to exceed following:

- Rigid Metal Conduits Up to 1": 8'-0".
- Rigid Metal Conduits 1-1/4" and Over: 10'-0".
- EMT Up to 1": 8'-0".
- EMT 1-1/4" and Over: 10'-0".

Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers Listed for the purpose. Requirements for exposed conduits also apply to conduits installed in space above hung ceilings.

Concealed Conduits:

- Metallic raceways installed underground, in floors below grade (where permitted), or outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure a water tight joint.
- For floors-on-grade (where permitted), install conduits under crushed rock and concrete slabs.
- Install underground conduits 24" below finished grade (24" cover) as a minimum or as otherwise indicated on the Drawings if a greater depth is shown.

Exposed Conduits:

- Install conduits in a manner so as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
- Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.
- Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets. Coordinate conduit installation with other trades as required.
- Install exposed conduit directly on structure using two hole straps. Provide offsets at all boxes and as required to avoid exiting utilities.
- Conduits installed on interior of exterior walls shall be spaced off the wall surface a minimum of ¼ inch with appropriate straps.

Run conduits for outlets on waterproof walls exposed where indicated on the Drawings. Set anchors for supporting conduit on waterproof wall in waterproof cement. Requirements for exposed conduit also apply to conduits installed in space above hung ceilings.

Raceway Fittings: Install connectors, couplers, and related fittings as required for a complete raceway system.

Install insulated bushings for terminating all types of raceway where termination is not made with an insulated throat connector.

Where concentric, eccentric or over-sized knockouts are encountered, a grounding-type insulated bushing shall be provided. Bushing shall be connected to the equipment grounding conductor.

Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, and plugs are to be constructed from steel and specifically designed and Listed for their particular application.

Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.

Mechanically fasten together metal conduits, enclosures, and other components comprising raceway system to form a continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.

Raceway must be installed as a complete system prior to the installation of cables, conductors, or pull wires into any part of the systems.

Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200' linear run maximum and wherever structural expansion joints are crossed.

Use roughing-in dimensions of electrically supplied utilization equipment furnished by supplier or by other divisions as appropriate. Set conduit and boxes for connection to units only after receiving review of dimensions and after verification of location with other trades.

Do not set final connections for fixtures and/or utilization equipment until connection points and requirements are accurately known. The Contractor is responsible for the relocation of mis-located connection points as required to match equipment at no additional cost.

Cut conduits straight, properly ream. Threads shall be cut into heavy wall conduit using equipment designed for the purpose.

Make changes in direction of raceway run by means of proper field bends or with proper fittings, supplied by raceway manufacturer.

Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.

Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported for lengths in excess of the maximum support distance as previously specified. Raceways may not be used to support other raceways or other items of equipment.

Arrange conduit to maintain headroom and present a neat appearance.

Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

Group raceway in parallel runs where three (3) or more raceway are routed together. Use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25% additional conduit.

Do not fasten and/or hang conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used during construction for temporary conduit support.

Bring conduit to the shoulder of fittings and couplings and fasten securely. All raceway shall be cut to proper length so ends fit accurately in connectors or couplers.

Use conduit hubs for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp or wet locations.

Use conduit bodies to make sharp changes in direction, as around beams.

Use hydraulic one-shot conduit bender for all field bends in conduit. All field made conduit bends shall meet minimum bending radius requirements of the NEC. Bends in metallic conduit shall be made while "cold". Factory made conduit sections may be used in lieu of field made bends for conduit larger than 2".

Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

Where raceways penetrate walls or partitions separating spaces with differing environmental conditions, such as freezers, coolers and exterior walls, provide an internal seal to prevent condensation within the raceway as it enters the conditioned space.

Where conduit penetrates fire rated partitions, provide penetration protection in accordance with the UL through-penetration detail indicated on the Drawings for the type of partition and conduit involved. All instructions furnished with firestopping materials shall be followed explicitly.

Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket. All pitch pockets shall be absolutely water tight; once conduit has been routed thought a pitch pocket the water integrity of the pitch pocket is the responsibility of the Division 26-28 Contractor.

Combining of circuits into raceway systems other than indicated on Drawings shall not be permitted.

Bolts, clamps, screws and expansion bolts shall be used in securing conduit, equipment, etc. Holes for lead shields or other anchors shall be the size recommended by the fastener manufacturer and shall be completely covered by the mounted item. Holes used for support of conduit on brick or block walls shall be located in mortar joints where such location is possible.

Provide nylon pull string in empty conduits where indicated, including conduit placed for telephone and data use. Conduit installed but left empty (with pull string) shall be tested with a ball mandrel. Clear any conduit that rejects ball mandrel. Any costs involved for restoration of conduit and surrounding surfaces to original condition are the responsibility of the Contractor.

END OF SECTION 260534

SECTION 260535 - ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of types, sizes, and capacities required, whose products are Listed and Labeled.

Codes and Standards:

NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.

Testing Laboratory Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings that are Listed and Labeled.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's data on electrical boxes and fittings.

PART 2 - PRODUCTS

FABRICATED MATERIALS

Aluminum products are not acceptable for use on the project.

Outlet Boxes: Provide galvanized coated flat rolled sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable or conduit-size knockout openings in bottom and sides. Provide boxes with threaded screw holes for attachment of grounding conductor and cover plate or device attachment fittings.

Provide waterproof outlet boxes where box is installed in an outdoor location or in a wet location as defined by the NEC.

Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes. Supplied items shall be compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Contractor's code-compliance option.

Device Boxes: Provide galvanized coated flat rolled sheet-steel device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Unless otherwise specified device boxes shall be 4" square by 2 1/8" deep, flush mounted, and furnished with suitable plaster ring for the type devices to be used and of a depth to match the type of construction involved. Device boxes shall have ¾" knockout openings in bottom and ends, and with threaded screw holes in the rear for attachment of a grounding conductor. All fasteners shall have a corrosion resistant finish.

Where more than two devices are ganged together at a single location provide gangable device boxes with suitable partitions, conduit knockouts and attachment hardware.

Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Contractor's code-compliance option.

Where device boxes are surface mounted (as may permitted elsewhere) use cast steel type 'FS' boxes. Raintight device boxes shall have threaded conduit holes for the attachment of electrical conduit, cast-metal face plates with spring-hinged watertight caps suitable configured for each application, including face plate gaskets and corrosion-resistant plugs and fasteners. Boxes provided under this section shall have a threaded internal grounding conductor attachment point.

Device boxes exposed to outdoor or wet locations shall be flush mounted and shall be equipped with cast steel covers that are designed to exclude water when closed.

Provide covers that are suitable for use in wet location with device attached if such use is indicated on the Drawings.

Where flush mounting is not possible or not practicable due to the location of the device, provide surface mounted cast steel type 'FS' boxes as described elsewhere.

Junction boxes with no more than 4 entries of ¾" conduit containing conductors no larger than #12 may be 4" square by 2 1/8" deep with ¾" knockouts, threaded hole for connection of grounding conductor and threaded holes for the attachment of a blank cover plate. Provide suitable blank cover plate. Box extensions shall not be used to obtain more volume in 4" square junction boxes.

If box volume is not sufficient, the contractor may, as a code compliance option, may use 4 11/16" square by 2 1/8" deep boxes with ¾" knockouts, threaded hole for connection of grounding conductor and threaded hoses for the attachment of a blank cover plate. Provide suitable blank cover plate. Box extensions shall not be used to obtain more volume in 4 11/16" square junction boxes.

Use fabricated junction boxes as described below if box volumes that can be obtained by the use of 4" square or 4 11/16" square boxes are not sufficient to meet NEC minimum volume requirements.

Junction and Pull Boxes: Provide as required galvanized code-gage sheet steel junction and pull boxes, no knockouts, Listed, with screw-on covers. Types, shapes, and sizes of junction and pull boxes shall be suitable for each respective location and installation. Boxes shall have welded seams and shall be equipped with stainless fastening hardware. Provide steel barriers in boxes with multiple feeder circuits.

Auxiliary Wireways: Construct as required in accordance with UL 870, with Listed and Labeled components.

Construction: 16-gage galvanized sheet metal parts for 4" x 4" to 6" x 6" sections, and 14-gage parts for 8" x 8" and larger sections. Provide wireways with no knockouts.

Finish: Provide 14-gage and 16-gage galvanized sheet metal parts. Plate hardware to prevent corrosion.

In outdoor or wet locations provide wireways that are NEMA 3R. Do not use gaskets that can rip or tear during installation, or would otherwise compromise raintight capability of the wireway.

Do not use cover screws that will protrude into the trough area and damage wire insulation.

Size of device, outlet, junction, pull boxes, gutters, and similar components shall be as required to match the number of devices and/or conductors contained within as based on the requirements of NEC Article 314.16.

Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit insulated bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.

Floor Boxes for Electrical/IT Devices: Provide fire rated poke-thru adjustable floor boxes in locations as indicated. Boxes shall have threaded-conduit entrance ends, vertical adjusting rings and gaskets. Floor box shall accommodate quantity of power and telephone/data receptacles as indicated below and/or on the Drawings. Cover plate flange shall be suitable for the floor finish installed in locations as indicated. Cover plate, flange and screws shall be brushed aluminum finish.

Floor Boxes for Electrical/IT/AV Devices: Provide stamped sheet metal, fire classified, adjustable, concealed service floor boxes suitable for concrete floors in locations as indicated. Boxes shall be rectangular with appropriate partitions, threaded-conduit entrance ends, vertical adjusting rings, and gaskets. Cover plate flange shall be suitable for the floor finish installed in locations as indicated. Cover plate, flange and screws shall be brass finish. Floor box shall accommodate quantity of power, telephone/data and AV devices as indicated below and/or on the Drawings. Conduit connection sizes and quantities shall be coordinated with devices specified. Provide floor pan assembly for maintaining fire rating of floor assembly for larger boxes in elevated slabs.

PART 3 - EXECUTION

INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.

Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

Provide weatherproof boxes and fittings for interior and exterior locations that are exposed to weather or moisture. Weatherproof boxes must be Listed and Labeled and identified as “extra duty” for use in wet locations.

Provide knockout closures to cap unused knockout holes where blanks have been removed.

Install electrical boxes and similar items only in those locations that ensure accessibility to enclosed electrical wiring.

Avoid installing boxes back-to-back in walls. Provide not less than 6" separation in non-rated partitions. Provide 24" minimum horizontal separation in fire-rated partitions or in acoustic rated walls.

Position recessed outlet or device boxes in walls or ceilings accurately to allow for surface finish thickness. Where the surface material or covering is combustible the front edge of the plaster ring (or box) shall be flush (- 0”,+1/32”) with the finished surface. Where the wall or ceiling material is non-combustible, the front edge of the plaster ring (or box) may be recessed into the wall no further than 3/16". The maximum gap between the edge of an installed box/plaster ring combination shall not exceed 1/8”. **These requirements will be rigidly enforced.**

Set floor boxes so that top edge of the box is level (± 5°) with finish flooring material. Install cover plates so that plate is flush (- 1/32”,+ 0”) with the finished floor level. **These requirements will be rigidly enforced**.
Do not use round boxes unless noted otherwise on the Drawings.

Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. All boxes shall be supported independently of conduit.

Provide electrical connections for installed boxes.

Electrical box locations indicated on Drawings are approximate unless dimensioned. Verify location of outlets prior to rough-in. Coordinate exact locations with the work of other Divisions. Mis-located outlets and/or devices shall be relocated upon instruction from Owner's representative at no additional cost.

Locate and install to maintain headroom and to present a neat appearance.

Use multiple gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems. Provide barriers to separate adjacent devices where the voltage is greater than 150 Volts between the devices.

Install boxes in walls without damaging wall insulation or fire proofing.

Position outlets to locate lighting fixtures and/or luminaries as indicated on Drawings. Boxes are to be positioned plum and vertical, $\pm$ 2°.

Align wall mounted outlet boxes for switches, thermostats, and similar devices.

Subsequent to installation of boxes, protect boxes from construction debris and damage.

GROUNDING

Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION 260535

SECTION 260593 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, solder/fluxes, and cable ties, whose products are Listed.

Codes and Standards:

NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.

Testing Laboratory Compliance: Comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials that are Listed and Labeled.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's data on electrical connections for equipment products and materials.

PART 2 - PRODUCTS

MATERIALS AND COMPONENTS

General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wire-nuts, and other items and accessories as needed to complete splices and terminations of types indicated.

Metal Conduit, Tubing and Fittings:

General: Provide metal conduit, tubing and fittings of types, grades, and sizes indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Section 260534, *RACEWAYS*, and in accordance with the following listing of metal conduit, tubing and fittings:

Rigid steel conduit

Rigid metal conduit fittings

Electrical metallic tubing

EMT fittings

Flexible metal conduit

Flexible metal conduit fittings

Liquid-tight flexible metal conduit

Liquid-tight flexible metal conduit fittings

Wires, Cables, and Connectors:

General: Provide wires, cables, and connectors complying with Section 260519, *SECONDARY VOLTAGE WIRES AND CABLES*.

Wires/Cables: Unless otherwise indicated, provide conductors for electrical connections that match, including sizes and ratings, of wires/cables that are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 68° F.

Connectors and Terminals: Provide copper electrical connectors and terminals that mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications. **Aluminum conducting components are not acceptable for use on this project.**

Electrical Connection Accessories: Provide electrical insulating tape, wirenuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

INSPECTION

Inspect area and conditions under which electrical connections for equipment are to be installed and notify A-E in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

INSTALLATION OF ELECTRICAL CONNECTIONS

Install electrical connections as indicated in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA'S "Standard of Installation" to ensure that products fulfill requirements.

Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating than electrical insulation rating of those conductors being spliced.

Prepare cables and wires by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes that will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance. Leave a minimum of 6” of excess spare conductor at each termination.

Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torque requirements are not available, tighten connectors and terminals to comply with torque values contained in UL 486A.

Provide flexible connections to equipment as follows:

Provide Flexible Metal Conduit (FMC) for connection of electrical equipment where subject to movement and vibration or as otherwise required by the Specifications or on the Drawings.

Provide metal Liquidtight Flexible Metal Conduit (LFMC) for equipment in exterior locations, wet locations, or in other locations where so indicated on the Drawings.

Fasten identification markers to each electrical power supply wire/cable conductor that indicates their voltage, phase and feeder number in accordance with Section 260533, *ELECTRICAL IDENTIFICATION*. Affix markers on each terminal conductor, as close as possible to the point of connection.

FIELD QUALITY CONTROL

Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION 260593

SECTION 260596 – LIGHTING SYSTEMS COMMISSIONING

PART 1 – GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

GENERAL

Lighting systems commissioning shall be performed by the Contractor and shall include the following:

Establish a verification "team" consisting of the installing personnel and the controls subcontractor.

Systematically evaluate all installed lighting control systems and components to ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's instructions

Perform verification procedures, equipment functional performance tests, and tests of the sequences of operations to verify that the controls are providing the correct interaction between equipment and controls systems.

PART 2 – DESIGN INTENT

GENERAL

The contract documents define the requirements for lighting control systems and components, along with the control requirements for each element. It is the intent of the Designer that all lighting control systems and components shall perform in accordance with the criteria defined in Sections 260923 and 260924.

PART 3 – FUNCTIONAL PERFORMANCE

SYSTEMS START-UP

Contractor shall organize the requirements outlined in this section with that of the manufacturer's and/or applicable codes and standards to develop specific and itemized start up procedures specific to that installed on this project.

OCCUPANT SENSOR CONTROLS

Where occupant sensor controls are provided, perform the following procedures for each installed sensor:

1. Verify that the occupant sensor has been located and aimed in accordance with manufacturer recommendations.

2. Verify that the occupancy sensor functions have been correctly set up in accordance with the requirements of Section 260923.

3. Verify correct operation of status indicators.

4. Verify controlled lights turn off or down to the permitted level within the required time.

5. Verify occupancy sensors turn lights on to the permitted level when an occupant enters the space.

6. Verify vacancy sensors require manual activation of lights.

7. Verify lights are not turned on by movement in adjacent spaces or by HVAC operation.

TIME CLOCKS

Where time clocks are provided, perform the following procedures for each installed unit:

1. Verify that the time clock is programmed with accurate weekday, weekend and holiday schedules. Provide documentation of the applied program settings for schedules and procedures for programming.

2. Verify the correct time and date are established in the time clock.

3. Verify that battery backup is installed, energized and operational.

Where time clocks are arranged to directly control area lighting, perform the following procedures for each unit:

1. Verify that the override limit is set to 2 hours.

2. Verify that time clock controls all intended areas of building.

3. Verify that all nonexempt lighting turns on/off in response to set times in time clock.

PHOTOCONTROL SWITCHES

Where photocontrol switches are provided, perform the following procedures for each installed switch:

1. Verify that switch correctly turns lights on/off in response to external lighting conditions.

2. Verify that switch is not adversely impacted by artificial lighting.

Where photocontrol switches are arranged to directly control area lighting, perform the following procedures for each switch:

1. Verify that the override limit is set to 2 hours.

2. Verify that switch controls all intended lighting.

RELAY CONTROL SWITCH

Where relay control switches are provided, perform the following procedures for each installed switch:

1. Verify that relay control switch is wired in accordance with separation requirements in NEC Section 700.

2. Verify that relay control switch responds correctly to a loss of power in the normal lighting circuit.

3. Verify that relay control switch controls all lighting specified on drawings.

LIGHTING INVERTERS

Where lighting inverters are provided, perform the following procedures for each installed inverter:

1. Verify that inverter is wired in accordance with separation requirements in NEC Section 700.
2. Verify that inverter responds correctly to a loss of power in the normal lighting circuit.
3. Verify that inverter controls all lighting specified on drawings.
4. Verify that inverter provides power to the load for a full 90 minutes, maintaining a minimum of 90% of initial illumination levels.

RELAY PANELS

Where relay panels are provided, perform the following procedures for each installed panel:

1. Verify that each relay controls lighting specified on drawings.
2. Verify the correct time and date are established in the relay panel.
3. Verify that battery backup is installed, energized and operational.
4. Verify that time controlled and photocontrol switch inputs are properly mapped to intended relays.
5. Verify that the override stations are arranged to control intended lighting as shown on the drawings. Verify the override limit is set to 2 hours.
6. Verify that master station controls all intended zones of building.
7. Verify that all nonexempt lighting turns on/off in response to set times in time switch.

DAYLIGHT SENSOR CONTROLS

Where daylight sensors are provided, perform the following procedures for each installed sensor:

1. Verify that control devices have been properly located, field calibrated and set for accurate setpoints and threshold light levels.
2. Verify that daylight controlled lighting loads adjust to light level set points in response to available daylight.
3. Verify that locations of calibration adjustment equipment are readily accessible only to authorized personnel. Verify that switch correctly turns lights on/off in response to external lighting conditions.

FUNCTIONAL PERFORMANCE TESTS AND CERTIFICATION

Functional performance tests shall be performed in accordance with the checklists in this section to prove all modes of the sequences of operation and to verify all other relevant contract requirements. Tests shall begin with equipment or components and shall progress to complete systems. Upon failure of any functional performance test checklist item, the Contractor shall correct all deficiencies in accordance with the applicable contract requirements. **The checklist shall then be repeated until it has been completed with no errors.**

Functional performance tests shall begin only after all work and testing required in related specification sections have been successfully completed and the lighting control systems are fully functional, after all test and inspection reports and operation and maintenance manuals required have been submitted and reviewed by the A/E.

The verification team shall utilize standardized reporting forms included in project manual for each item described in this section to document the required functional performance tests. Each test shall be certified with the following statement and the signature and date of signing by each member of the verification team:

"We the undersigned have performed the functional performance tests described herein and certify that the item tested has met the performance requirements of Sections 260923 and 260924.

Signature and Date:

Electrical Contractor's Representative _____

Lighting Controls Sub-Contactor Representative _____"

END OF SECTION 260596

SECTION 260800 - TESTING AND PLACING IN SERVICE

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of contract, including general and supplementary conditions and Division-1 Specification Sections, apply to work of this Section.

WORK INCLUDED

Provide all material, equipment, labor and technical supervision to perform and complete the electrical acceptance tests in accordance with the requirements of this section for equipment installed as the Work of this contract. Notify A-E at least four (4) working days in advance of tests.

Perform Tests on the Following Equipment and/or in the following areas:

Cable Tests
    Low Voltage (≤ 600 Volt)
Grounding
Ground fault operation and coordination
Overcurrent devices
Switchboards and Panelboards (≤ 600 Volt)

DEFINITIONS

Measure: To obtain the requested system information by use of suitable instruments and to record this information in the appropriate section of the test report.

Repaired: Material or equipment that has been brought to new condition, retested and made to pass all required tests.

QUALITY ASSURANCE

Perform tests to obtain required information in accordance with accepted industry procedures and/or in accordance with manufacturer's recommendations. Should manufacturer's recommendations conflict with these specifications, notify A-E. Do not proceed with tests until directed by A-E.

Material or equipment failing tests shall be repaired or replaced at the Contractor's expense.

The Contractor shall be responsible for all tests and for documentation of test data. Testing shall be performed by or under the immediate supervision of the Contractor.

DOCUMENTATION

Records of all tests and inspections, with complete data on all readings taken, shall be made and incorporated into a single report.

Five (5) bound copies of all test reports shall be submitted at the end of the test period. All required documentation of readings indicated above shall be submitted to the engineer prior to, and as one of the prerequisites for, final acceptance of the project.

PART 2 - PRODUCTS

The Contractor shall employ testing devices as required to accomplish specified testing herein and as described elsewhere in the Contract Documents.

Test Equipment Suitability: The test equipment used by the Contractor shall be suitable for the intended tests and shall comply with ANSI/NETA ATS-2009, Section 5.2.

Test Equipment Calibration: The test equipment used by the Contractor shall be suitable for the intended tests and shall comply with ANSI/NETA ATS-2009, Section 5.3.

PART 3 - EXECUTION

GENERAL

Check cable continuity and phase identification for each conductor used on the project. This includes service conductors, feeders, and branch circuit conductors. It is not required to document this test in the testing report required under this section.

Insulation testing: The insulation tests (megger tests) as specified in this Section are the minimum readings desired at an ambient temperature of 60° F and a low relative humidity.

Megger readings taken at other than ambient temperature of 60° F shall be corrected to 60° F.

When megger readings fall below the specified minimum values utilize recognized means to dry out the equipment. The method utilized by the Contractor must be in accordance with manufacturer's written instructions.

If drying is to be accomplished by applying an electric potential to a cable or piece of equipment, then, in no case (induced or direct) shall the voltage or current exceed the ampacity or the continuous rating of the equipment being dried.

CABLE TESTS

General: Disconnect each end of all cables from their associated equipment prior to the test.

Cables ≤ 600 Volt: Inspect all cable connections for workmanship and conformance with standard practice.

Perform the following tests:

Test cable insulation using a megger.

Perform megger tests between phases and between each conductor and ground with the other conductors and interlocked armor (if part of cable assembly) grounded.

Test other conductors in the same manner. The minimum acceptable megger reading for cables shall be 1 megohm (MΩ) for #6 AWG conductors and smaller and 250,000 ohms (Ω) for #4 AWG conductors and larger.

The Test Record Shall Include the Following:

Complete identification of the cable, including approximate length.

Megger reading data.

Leakage current versus time data.

The approximate average cable temperature.

GROUNDING

Resistance: Measure the resistance (relative to earth) of each electrical equipment ground brought up from each grounding electrode, made electrode (rod), and the underground grid.

Do not measure outside ground rod and ground grid resistances to earth during unusually wet weather.

The Test Record Shall Include the Following:

Identification of the ground point where the test is performed.

Value of resistances relative to earth.

Test ground resistance with tester equivalent to Fluke 1625. Test arrangement shall be based on a three point, fall of potential test. Two field installed stakes used for the test shall be placed to form a line with the driven grounding electrode and separated at intervals of 60 feet. Where tests show resistance-to-ground is over 25 Ohms, take appropriate action to reduce resistance to 25 Ohms, or less, by driving additional ground rods; then retest to demonstrate compliance.

GROUND FAULT OPERATION AND COORDINATION

Upon selection of the product line and approval of the equipment submittal package, the engineer shall conduct a coordination study to determine appropriate settings for adjustable circuit breakers. The ground fault protection on the circuit breakers shall be set in accordance with information provided by the engineer.

Performance Testing of Time-Current Functions: For services 1,000 amperes and larger, the following tests should be performed on the service circuit breakers and the distribution circuit breakers. Using circuit breaker test set, set and field test time-current trip functions for new circuit breakers to verify operation in accordance with the circuit breaker settings provided by the engineer. Testing shall be performed by a qualified factory technician at the job site. All readings shall be tabulated:

Ground fault tripping tolerance (within 20% of UL requirements).

Trip time in seconds.

Where additional testing of existing equipment is indicated on the drawings, use circuit breaker test set to set and field test time-current trip functions for existing circuit breakers to verify operation in accordance with the circuit breaker settings provided by the engineer.

OVERCURRENT DEVICES

Upon selection of the product line and approval of the equipment submittal package, the engineer shall conduct a coordination study to determine appropriate settings for adjustable circuit breakers. The time-current protection on adjustable circuit breakers shall be set in accordance with information provided by the engineer.

Performance Testing of Time-Current Functions: For services 1,000 amperes and larger, the following tests should be performed on the service circuit breakers and the distribution circuit breakers. Using circuit breaker test set, set and field test time-current trip functions for new circuit breakers to verify operation in accordance with the circuit breaker settings provided by the engineer. Testing shall be performed by a qualified factory technician at the job site. All readings shall be tabulated:

Phase tripping tolerance (within 20% of UL requirements).

Trip time (per phase) in seconds.

Instantaneous trip (amps) per phase.

Insulation resistance (in megohms) at 1,000 volts (phase to phase, and line to load).

Where additional testing of existing equipment is indicated on the drawings, use circuit breaker test set to set and field test time-current trip functions for existing circuit breakers to verify operation in accordance with the circuit breaker settings provided by the engineer.

Operational Test Procedures for Circuit Breakers: Visually inspect and manually operate breakers through a minimum of three (3) open/close cycles. Check for correct alignment, freedom from binding and good contact. Check phase matching and phase rotation immediately prior to energizing of equipment.

SWITCHBOARDS AND PANELBOARDS (≤ 600 VOLT)

Prior to testing, inspect all compartments and apparatus.

With all breakers, fused switches, starters, and contactors in the open position and cables connected, test the bus insulation for each phase with a megger. The minimum acceptable megger reading shall be 100 megohms (MΩ).

Manually and automatically, as applicable, operate all breakers, switches, contactors, relays, motor starters and the like to ascertain that correct and positive operation, interlocking and alarm have been achieved.

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 and test each branch circuit neutral wire to the grounded enclosure to isolate the low readings. The Contractor shall correct troubles, reconnect and retest until a minimum resistance of 250,000 Ohms exists between the neutral bar and ground with only the feeder neutral disconnected.

The Test Record Shall Include the Following:

Complete identification of panelboard.
Resistance of each phase bus relative to ground

Resistance between neutral bus and ground bus with neutral lifted.

DOCUMENTATION

All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.

All required documentation of readings indicated above shall be submitted to the engineer prior to, and as one of the prerequisites for, final acceptance of the project.

TEST RESULTS

The Contractor shall send a letter to the engineer, with a copy to the State Construction Office (SCO) official project observer, certifying that the above testing has been performed. This shall be done at least four (4) days prior to final inspection.

Final testing reports are to be available at the SCO final inspection.

At final inspection, the Contractor shall furnish instruments as required to demonstrate to the A-E and to the SCO representative that all testing requirements have been satisfied. All measurement instruments, labor, and materials associated with the testing, verification, and demonstration of results shall be provided without additional cost. The contractor shall provide ladders, hand tools, digital multimeters, meggers, two-way radios and other specific items required by the Engineer for the final inspection.

END OF SECTION 260800

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 – GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes time control switches, daylight sensors, occupancy sensors, and multi-pole lighting relays and contactors.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of lighting control devices, of types and ratings required in this Section, whose products are Listed and Labeled for the purpose intended. Subject to compliance with requirements provide equipment equivalent to that provided by manufacturers listed in this Section.

Codes and Standards:

NEC Compliance: Comply with NEC requirements pertaining to lighting control devices.

Code of Federal Regulations Compliance: Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Include dimensions and data on features, components, and ratings for lighting control devices.

Samples: Provide samples of submitted occupancy sensors for color selection and evaluation of technical features if requested in writing by the A-E. If approved, the sample may be used on the project.

Shop Drawings: Submit shop drawings showing equipment, with proposed quantities and locations, and connecting wiring of lighting controls system. Layout and wiring diagrams shall be based on the project floor plans, with devices and proposed control groups shown. Provide clearly drawn connections between control devices and controlled lighting in all rooms and/or areas where multiple control groups are present. Provide distinctive boundaries for override zones on each floor unless specified as a single zone for floor. Provide equipment designations that will coincide with documentation of Functional Performance Tests outlined in Section 260596. Provide a draft of the narrative of system operation specified in this section as part of the Operations and Maintenance Manual.

Provide coverage pattern templates for each occupancy sensor type used as part of the project. Where requested by the Engineer, provide drawings that overlay the proposed coverage patterns on the project lighting plans. Provide summary of settings available for each sensor type. Identify and highlight deviations from options/setting specified in this Section.

Provide summary of settings available for each time clock.

Maintenance Data: For lighting control devices to include in maintenance manuals specified in Division 1.

PART 2 – PRODUCTS

OCCUPANCY SENSORS

Manufacturers: Provide equipment equivalent to that provided one of the following manufacturers:

- Wattstopper
- Novitas
- Sensor Switch
- Hubbell

Sensors shall be provided with a single pole, isolated relay (30V AC/DC, 1A) for interface with building automation system. Relay and contact ratings shall be clearly indicated in submittal literature.

Occupancy sensors are diagrammatically indicated on the lighting plans, based on coverage areas of approximately 1,000 square feet/sensor for ceiling heights up to 10 feet. Contractor shall verify the locations and quantities of sensors installed to properly cover each space based on actual coverage patterns of submitted/approved products. Sensors shall be installed in coordination with the manufacturer's instructions, including separation from air distribution patterns associated with HVAC diffusers.

Wall Switch Occupancy Sensor: Provide a wall mounted, dual technology occupancy sensor with a manual on/off switch. Switch shall support manual-on and automatic-on (previous setting) operation. Switch to be rated at 800W @ 120V and 1,200W @ 277V. Provide vandal resistant, hard usage lens for sensor.

Wall Switch Occupancy Sensor/Dimmer: Provide a wall mounted, dual technology occupancy sensor with 0-10V dimming. Switch shall support manual-on and automatic-on (previous setting) operation. Multiple switches may be used together, each providing full dimming operation, in up to four locations for a switch group. Switch to be rated at 1,000W @ 120V and 1,200W @ 277V. Provide vandal resistant, hard usage lens for sensor.

Dual Technology Ceiling Mounted Occupancy Sensor: Provide a 24 VAC ceiling mounted combination passive infrared and ultrasonic sensor. Coverage for normal desktop motion shall be 900 square feet at a 360° pattern. Provide sensor with an integral daylighting control interface. Provide compatible power modules as required to interconnect sensors to controlled loads.

Sensors shall be provided with the following options and set in accordance with values listed.

Sensor Parameter	Option	Setting
Activation	Manual / Automatic	Automatic
Time Delay		15 minutes
Walk Through	On / Off	Off
PIR Sensitivity	10-100% (10% increments) / Off	90%
Ultrasonic Sensitivity	10-100% (10% increments) / Off	70%
Test Mode	In / Off	Off
Detection Technology	Ultrasonic / PIR / Both / Either	Both
Retrigger Technology	Ultrasonic / PIR / Both / Either	Either

LOW VOLTAGE ROOM CONTROL PACKAGES

Where indicated on the drawings, provide integrated low voltage room control platforms equivalent to that provided one of the manufacturers listed above. Control package shall utilize Cat 5E (minimum) connections from room controller to ancillary control devices (manual switch/dimming, occupancy sensors, daylight sensors) indicated for the application. Connection to sensors shall be accommodated by RJ45 adaptors included with the room control package. Where specified as part of the control scheme, fixture dimming shall be smooth across 0-10V range in response to daylight sensors.

TIME CLOCKS

Electronic Time Clock: Provide a 365-day, 2 circuit astronomic programmable controller. Controller to include following functions and options:

- 4 On's and Off's per day.
- Skip a day capability.
- Four seasonal schedules.
- Daylight Savings and Leap year adjustment.
- Up to 40 assignable holiday blocks.
- Battery backup 72 hour minimum.
- Integral Digital Display.

Time clocks shall be provided with the following options and set in accordance with values listed. Contractor shall request in written form all Owner Defined settings and provide written response as part of documentation of testing and commissioning.

Control Parameter	Option	Setting
Daylight Savings Time	Override or Automatic	Automatic
Leap Year Adjustment	Override or Automatic	Automatic
Sunrise Offset		30 minutes after
Sunset Offset		30 minutes before
Holidays	0-40 minimum	Owner Defined
On		Owner Defined
Off		Owner Defined

CONTACTORS

General: Except as otherwise indicated, provide contactors and ancillary components that comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation.

Lighting Contactors: Provide full voltage alternating current lighting contactor, of types, sizes, ratings, and NEMA sizes indicated. Equip contactors with mechanically held contacts. Construct and mount starters in NEMA Type 1 enclosure; coat with manufacturer's standard color finish.

OVERRIDE SWITCHES

General: Provide override switches as indicated on the Drawings. Switches shall be located to provide for the override specific lighting during unoccupied hours. Switch type and arrangements shall be compatible with the automatic control device (time clock, contactor) used for lighting. Lights shall be energized in response to override switches for 2 hours.

PUSHBUTTONS

General: Except as otherwise indicated, provide pushbuttons and ancillary components that comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation.

Selector Switches: Provide selector switches (H-O-A) with red pilot light as indicated, flush mounted, heavy duty, oil-tight, maintained contact, indicating lights. Selector switches shall be mounted in flush wall mounted enclosures.

Provide galvanized sheet steel cabinet type enclosures, flush wall mounted, in sizes and NEMA 1 as indicated, code gauge, minimum 16 gauge thickness. Construct without knockouts. Provide fronts with adjustable trim clamps, and with concealed piano door hinges and door swings as indicated. Provide metal pushbutton mounting within enclosure, 14 gauge thickness. Equip with interior directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Provide enclosures that are fabricated by same manufacturer as panelboards.

TIME CONTROL SWITCHES

Provide electrically operated time control switches with 24-hour dials capable of periodically and automatically switching indoor and outdoor lamps both ON and OFF. Select switches that permit selection of from 1 to 12 ON-OFF operations each day and allows timing durations of 1 to 23 hours, with ratings of 125 Volts, 60 Hz, and with SPST switch of 10-amperes per pole. Provide enclosure with side hinged door and lock, mounting holes and knockouts, of 0.036" drawn steel. Provide timing switch with manual circuit by-pass switch and separate grounding terminal. Finish enclosure with manufacturer's standard gray finish.

Spring Wound Timer: Provide spring wound 0-1 hour twist timer, rated for 10 Amps, 120-277 Volts.

PHOTOCONTROL SWITCHES

Photocontrol Switches: Provide electrically operated photocontrol switches, rated 1,800 Watts, 120 Volts, 60 Hz, weatherproof enclosure, external pipe threaded nipple, fail safe, load to remain ON in case of cell failure.

RELAY CONTROL SWITCHES

Provide branch circuit relay control switches suitable for use with auxiliary generator or inverter system to control branch circuit lighting loads up to 20A regardless of local switch position. The device consists of relay switching circuitry in a single, wall mounted enclosure. The relay control switch includes integral sensing circuitry that senses loss of power of an identified circuit. Once power loss is sensed it automatically switches to the emergency source. Unit shall be suitable for any type of light source at both 120V and 277V.

Unit shall meet applicable requirements of UL 1008, Standard for Safety Transfer Switch Equipment and applicable NEC requirements.

Provide relay control switch in 9”W x 6”H x 3.5” D steel enclosure, UL listed for use in damp location. Provide enclosure with LED indicators that identify switch position.

Provide relay control switch with 45mA, 4 watt sensing circuit to monitor normal source. Provide auxiliary relay contacts as required to bypass dimming controls when used to control circuits served through a dimming system.

LIGHTING INVERTERS

Single Circuit Inverter: Provide stackable/modular single circuit inverter with 1,500 VA capacity. Unit shall be suitable to provide 90 minutes of back up battery power for the full rating of the unit. Inverter shall be suitable for LED and fluorescent, dimming and non-dimming loads at 120V/277V single phase.

Manufacturers: Provide equipment equivalent to that provided one of the following manufacturers:

Myers Power Products Illuminator IE Series
Dual-Lite Synchron Series
Beghelli Nova UAC-P Series

Unit shall have a 16 gauge steel enclosure and powder coated painted surface. Unit shall have sealed lead calcium maintenance free batteries.

Unit shall be NFPA, OSHA, NEC compliant and shall be UL 924 listed.

Unit shall have circuit breaker trip alarm, self testing, diagnostics and integral event alarm and test logs, RS 232 interface, LCD display. Unit shall include battery, input and output circuit breakers and an integral alarm dry contact.

PART 3 – EXECUTION

INSTALLATION

Install equipment level and plumb and according to manufacturer's written instructions.

Mount lighting control devices according to manufacturer's written instructions and requirements in Section 260500, *BASIC ELECTRICAL REQUIREMENTS*.

Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

Spare Parts: Provide the following spare parts with the system, each individually packaged and labeled. For multi-building projects, calculate separately for each building:

Wall mounted occupancy sensors (each type)	4% of installed quantity
Ceiling mounted occupancy sensors (each type)	4% of installed quantity

Increase decimal quantities of spare parts to the next higher whole number. For example if a system has 20 wall mounted passive infrared sensors, provide 2 spare sensors.

CONTROL WIRING INSTALLATION

General: Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Section 260519, *SECONDARY VOLTAGE WIRES AND CABLES*, for low-voltage connections and for digital circuits.

Wiring Method: Install all wiring in raceway as specified in Section 260534, *RACEWAYS* and Section 260535, *ELECTRICAL BOXES AND FITTINGS*.

Connections: 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.

IDENTIFICATION

Identify components and power and control wiring according to Section 260533, *ELECTRICAL IDENTIFICATION*.

FIELD QUALITY CONTROL

Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.

Verify settings of photoelectric devices with photometer calibrated within previous six months.

Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform continuity tests of circuits prior to installing devices. Perform operational tests according to manufacturer's written instructions. Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions. Test devices under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

CLEANING

Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

TESTING & DOCUMENTATION

Provide a minimum 90 minute battery test for each inverter under complete load. Provide documentation of output voltage at unit at beginning of the test and at the end of the 90 minute period. All product features shall be verified by the Contractor and demonstrated for the engineer.

Provide verification of proper installation of components and systems as outlined in Section 260596, Lighting Systems Commissioning. Provide all necessary components to properly demonstrate operation of equipment to engineer.

OPERATIONS AND MAINTENANCE MANUAL

Manuals shall include product data for all installed products that identifies all selected options for each component of lighting controls system.

Identify manufacturer’s requirements and recommendations for routine maintenance actions, recalibration and cleaning. Identify schedule for items above.

Provide a narrative of the system operation, specific to the installation, including the actual set points.

TRAINING

Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of 16 hours of training.

Training Aid: Use the approved final version of maintenance manuals as a training aid.

Schedule training with Owner, through A-E, with at least seven days' advance notice.

WARRANTY PERIOD

Warranty period for occupancy sensors shall be one year, beginning upon acceptance of the installation by the Owner. Include up to three site visits within the first year, upon request by the Owner, to adjust light levels, make program changes, and adjust sensors and controls to suit actual conditions.

Warranty period for branch circuit inverters shall be full 3 years for defects in workmanship, battery and materials. Battery shall have an additional 7 year prorated warranty.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of panelboards, of types and ratings required in this Section, whose products are Listed and Labeled for the purpose intended. Subject to compliance with requirements provide equipment equivalent to that provided by one of the following manufacturers:

- Square-D Company
- Cutler Hammer
- Siemens
- General Electric

Codes and Standards:

Electrical Code Compliance: Comply with applicable State code requirements of the authority having jurisdiction and NEC Article 408 as applicable to installation and construction of electrical panelboards and enclosures.

Testing Laboratory Compliance: Comply with applicable requirements of Std. No. 67, "Electric Panelboards," and Stds No.'s 50, 869, 486A, 486B, 489, and 1053 pertaining to panelboards, circuit breakers, accessories and enclosures. Provide units that are Listed and Labeled.

Special-Use Markings: Provide panelboards, constructed for special-use, with appropriate Listed marks that indicates that they are suitable for special type of use/application including service entrance equipment.

NEMA Compliance: Comply with NEMA Stds. Pub./No. 250 "Enclosures for Electrical Equipment (1000 Volts Maximum)," Pub/No. PB 1, "Panelboards," and Pub/No. PB 1.1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's data on panelboards and enclosures.

Submit Time-Current Timing Charts: Provide response curves for all overcurrent protection devices furnished as a part of the project. Provide specific circuit breaker and trip unit model numbers for all specified electronic trip breakers, with available settings for engineer’s use in developing system coordination.

PART 2 - PRODUCTS

PANELBOARDS:

General: Except as otherwise indicated, provide panelboards, bolt-on breakers, integral common trip, enclosures and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials. Panelboards shall be designed and constructed in accordance with published product information. Equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL and established industry standards for those applications indicated.

Distribution Panelboards: Provide factory assembled, dead front safety constructed, power distribution panelboards with circuit breaker type in sizes and ratings indicated. Provide panelboard switching and protective devices in quantities, ratings, types, characteristics and with arrangement indicated. Provide with anti-turn solderless pressure type main lug connections approved for use with copper conductors. Construct with rectangular shaped bus bars of solid copper, with conductivity not less than 98%. Bus bars shall be securely mounted and braced and have solderless lugs bolted to main bus bars. Panelboards shall have full sized neutral bus and full sized bare un-insulated ground bus suitable for bolting to enclosures.

Panelboards shall have voltage ratings suitable for service voltage at which they will be used. Provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide molded case bolt-on type main circuit breaker with toggle handles that indicate when tripped where Main Circuit Breaker (MCB) panelboards are indicated. Provide bolt-on circuit breaker types with toggle handles that indicate when tripped for each indicated branch or feeder circuit.

Where multiple pole breakers are indicated, provide with integral common trip so that overload on one pole will trip all poles simultaneously. Select enclosures, as noted on Drawings, fabricated by same manufacturer as panelboards and which mate and match properly with panelboards.

Branch Circuit Panelboards: Provide factory assembled, dead front safety constructed, branch circuit panelboards of the circuit breaker type, in sizes and ratings indicated. Provide panelboard switching and protective devices in quantities, ratings, types, characteristics and with arrangement indicated. Panelboards shall be equipped with anti-turn solderless pressure type main lug connections approved for use with copper conductors. Construct panelboards with rectangular shaped bus bars of solid copper, with conductivity not less than 98%, which are securely mounted and braced, and with solderless lugs bolted to main bus bars. Panelboards specified with dual lugs for sub-feed shall include dual lugs for each phase at the point of termination. Feed-through bus arrangements are not acceptable.

Panelboards shall have full sized neutral bus and bare un-insulated ground bus suitable for bolting to enclosures. Panelboards shall have voltage ratings suitable for service voltage at which they will be used. Provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide molded case main and branch circuit bolt-on breaker types for each circuit, with toggle handles that indicate when tripped. Branch circuit breakers for switching lighting circuits shall be Type “SWD”’ those used for switching high intensity discharge lighting circuits, Type “HID”.

Provide branch circuit panelboards with a maximum 42 branch circuit breaker positions. Where multiple pole breakers are indicated, they shall be provided with integral common trip so that overload on one pole will trip all poles simultaneously. Select enclosures, as noted on Drawings, fabricated by same manufacturer as panelboards and which mate and match properly with panelboards.

Panelboard Enclosures: Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage, minimum 16-gage thickness. Construct with no knockouts and code sized wiring gutters. Design enclosures for recessed or surface mounting as indicated on Drawings. Provide enclosures that are fabricated by same manufacturer as panelboard and which mate properly with panelboards to be enclosed.

Panelboard Fronts: Provide panelboard fronts with adjustable trim clamps, and doors with flush locks and keys. All locks for panelboard enclosures shall be keyed alike. Panelboard fronts shall be constructed with concealed piano door hinges and provided with baked gray enamel finish over a rust inhibitor coating. Panel doors are left hand doors unless otherwise indicated on the Drawings. Panelboard front shall be secured to the enclosure by the use of screws.

Provided hinged-type access for all panelboard doors so that access to the interior of the panelboard can be gained without the necessity of physically removing the panelboard cover.

Equip panelboard fronts with interior circuit directory frame, and card with clear plastic covering. Information from panel schedules shall be typed on the directory card. Hand lettering of directory cards is not acceptable.

Molded Case Circuit Breakers: Provide factory assembled, molded case circuit breakers of frame sizes, characteristics, and ratings including RMS symmetrical interrupting ratings indicated. Select breakers with permanent thermal and instantaneous magnetic trip, and with fault current limiting protection, ampere ratings as indicated. Construct with overcenter, trip free, toggle type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position in an ambient temperature of 40^{o}C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

Circuit Breaker Lugs: Provide circuit breaker lugs to match feeder conductors or branch circuit conductors as indicated on the Drawings. In general, the ampere rating of circuit breakers is selected to support the requirements of the load. In cases where circuit conductor size has been increased for improved voltage drop, or other reasons, provide increased lug size as needed to match increased conductor size. Provide larger circuit breaker frame size if same is required to accommodate increased conductor size as described above.

Fully Rated Circuit Breakers: Series rated circuit breakers are not permitted. Provide fully rated circuit breakers unless specifically indicated otherwise on the Drawings.

Electronic Trip Circuit Breakers: Provide electronic trip units for main breakers 500 Amps and larger and branch breakers 400 Amps and larger, with field-replaceable rating plug and RMS sensing, responsive to current in each pole. Provide following field-adjustable settings:

1. Instantaneous trip.
2. Long and short-time pickup levels.
3. Long and short-time delay adjustments.

Provide ground fault pickup for breakers rated 1,000 amps and larger, where unit serves as a main disconnecting means, as required under NEC.

1. Ground-fault pickup level, time delay and I^2t response.

Energy Reduction Provisions: Provide breakers rated at 1,200 Amps and larger with maintenance switch and associated indicator light to permit the reduction of arc energy at and beyond the load side terminals for the breaker.

Special Purpose Circuit Breakers: Where indicated, provide circuit breakers with the following additional features:

1. Ground-Fault Circuit Interrupter (GFCI), UL 943, single-and two-pole configurations with //5//30//-mA trip sensitivity with Ampere rating as indicated on panelboard schedule. Breaker shall also be listed to UL 489 for molded case circuit breakers.

2. Arc-Fault Circuit Interrupter (AFCI), UL 1699, for protection of branch circuit wiring, rated 15 or 20 Amps as indicated on panel schedule. Breaker shall also be listed to UL489 for molded case circuit breakers.

Circuit Breaker Positions: Circuit breaker positions are indicated on panel schedules in the Drawings. Indicated positions are mandatory unless changes are specifically approved in writing by the A-E.

Panelboard submittals shall not be used as a means of obtaining approval for alternate circuit breaker positions.

Panelboard Accessories: Provide panelboard accessories and devices including, but not necessarily limited to, cartridge and plug time-delay type fuses, circuit-breakers, ground-fault protection units, lugs, grounding terminations, labels, etc., as recommended by panelboard manufacturer for ratings and as indicated on the Drawings.

Short Circuit Rating: Unless otherwise indicated, panelboards and all devices shall have a minimum short circuit withstand rating of 10,000 RMS symmetrical Amperes.

PART 3 - EXECUTION

EXAMINATION

Examine areas and conditions under which panelboards and enclosures are to be installed, and notify A-E in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

INSTALLATION OF PANELBOARDS

General: Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standard of Installation," and in compliance with recognized industry practices to ensure that products fulfill requirements.

Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.

Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.

Provide properly wired electrical connections for panelboards within enclosures.

Fill out panelboard's circuit directory card with typewriter upon completion of installation work. Circuit descriptions shall match those on the panel schedule in the Drawings.

Equipment/System Identification: Provide equipment identification nameplates complying with Section 260533, *ELECTRICAL IDENTIFICATION*.

GROUNDING

Provide equipment grounding connections for panelboards as indicated. Tighten connections to comply with tightening torques specified in UL Stds 486A to assure permanent and effective grounds. All panelboards shall be grounded with an insulated grounding conductor routed with the panel feeder. The grounding conductor shall be bonded to the panel grounding bus and a bonding bushing on the panelboard feeder raceway.

FIELD QUALITY CONTROL

Prior to energizing electrical circuitry, check all accessible connections to manufacturer's tightening torque specifications.

Prior to energizing panelboards, check with resistance tester phase-to-phase and phase-to-ground insulation combinations to ensure insulation and continuity requirements are fulfilled.

Prior to energizing, check panelboards for electrical continuity of circuits, and for short-circuits.

ADJUSTING AND CLEANING

Adjust operating mechanisms for free mechanical movement.

Touch-up scratched or marred surfaces to match original finishes.

DEMONSTRATION

Subsequent to wire and cable hookups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturers: Firms regularly engaged in manufacture of wiring devices, of types and ratings required in this Section, whose products are Listed and Labeled for the purpose intended. Subject to compliance with requirements provide devices equivalent to that provided by one of the following manufacturers:

- Hubbell
- Cooper Devices
- Leviton
- Pass & Seymour

Codes and Standards:

NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.

Testing Laboratory Compliance: Comply with applicable requirements of UL 20, 486A, 498, and 943 pertaining to installation of wiring devices. Provide wiring devices that are Listed and Labeled.

NEMA Compliance: Comply with applicable portions of NEMA Standards No. WD 1, "*General Purpose Wiring Devices*", WD 2, "*Semiconductor Dimmers for Incandescent Lamps*", and WD 5, "*Specific Purpose Wiring Devices*".

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

FABRICATED WIRING DEVICES

General: Provide factory fabricated wiring devices in types, colors, and electrical ratings for applications indicated and which comply with NEMA WD 1.

"Specification" grade devices, as used in this section shall be "Federal Specification" grade devices.

Color: Provide gray color devices unless indicated otherwise for selected locations elsewhere in the Specifications or on the Drawings.

Provide red face devices in all cases where receptacles are supplied from a generator derived power source.

Provide blue face for self-contained surge protected devices

Receptacles:

General-Use Duplex: Provide duplex specification grade, tamper resistant type receptacle, 2-pole, 3-wire, grounding, with green hexagonal equipment ground screw, high impact nylon face, ground terminal, brass triple wipe contacts, 20 Ampere rated, 125-volts, with metal plaster ears. Provide receptacles with grounding terminal internally connected to mounting yoke. Receptacles shall be designed for side and back wiring with spring-loaded, screw activated pressure plates, with NEMA configuration 5-20R unless otherwise indicated.

General-Use Simplex: Provide single specification grade, tamper resistant type receptacle, 2-pole, 3-wire, grounding, with green hexagonal equipment ground screw, high impact nylon face, ground terminal, brass triple wipe contacts, 20 Ampere rated, 125 volts, with metal plaster ears. Provide receptacles with grounding terminal internally connected to mounting yoke. Receptacles shall be designed for side and back wiring with spring-loaded, screw activated pressure plates, with NEMA configuration 5-20R unless otherwise indicated.

Ground-Fault Interrupter: Provide specification grade, tamper resistant type ground-fault circuit interrupter, with heavy-duty duplex receptacles capable of being installed in a 1-1/2" deep outlet box without adapter. Ground fault interrupter receptacles shall be grounding type, UL Class A, Group 1, 20 ampere rated, 120-volts, 60 Hz, with high impact nylon face, brass triple wipe contacts, and solid-state ground-fault sensing and signaling. Devices shall have 5 milliamperes ground-fault trip level and shall be equipped with NEMA configuration 5-20R.

Special Receptacles: Provide special receptacles with NEMA configuration, voltage rating, current rating, and other attributes as indicated on the Drawings in Receptacle Schedules, General Notes, Keyed Notes, or other designations.

Receptacles provided are to be either straight blade, locking type, or pin type as indicated. All receptacles are to be equipped with green hexagonal equipment ground screw, brass triple wipe contacts and brass connector screws.

Receptacles shall be designed for both side and back wiring with spring-loaded and screw activated pressure plates where such are available in the device type indicated.

All 15- and 20-ampere, 125- and 250-volt, non-locking (straight blade) receptacles specified in areas identified in NEC 406.12 shall be tamper resistant type.

Miscellaneous Features:

Provide the following additional receptacle features where such is required by code or indicated on the drawings:

Surge protected

Weather resistant (WR) for all general use and ground fault interrupter receptacles installed in damp and wet locations.

Duplex receptacles with two vertical USB ports. Ports shall provide 3.0 minimum amps charging capacity and include LED indicator light to indicate presence of USB power (5 VDC). Ports shall be compatible with USB 2.0 and 3.0 devices

Switches:

Snap: Provide heavy-duty, specification grade, flush single-pole AC quiet toggle switches, 20 Amperes, 120-277 Volts AC, with silver cadmium oxide contacts, brass terminal screws, and mounting yoke insulated from mechanism. Equip switches with plaster ears, switch handle, and green hexagonal equipment grounding screw. Switches shall be designed for side and back wiring with spring-loaded, screw activated pressure plates.

Three Way: Provide heavy-duty, specification grade, flush 3-way AC quiet switches, 20 Amperes, 120-277 Volts, with silver cadmium oxide contacts, brass terminal screws, and mounting yoke insulated from mechanism. Equip switches with plaster ears, switch handle, green hexagonal equipment grounding screw. Switches shall be designed for side and back wiring with spring-loaded, screw activated pressure plates.

Miscellaneous Features:

Provide the following additional switch features where such is indicated on the drawings:

Key operation; supply one key per switch.

0-10 Volt Dimmers: Provide specification grade, preset type slide control, single pole branch lighting solid state 0-10 Volt DC dimmer control for LED source fixtures. Dimmers shall be designed for side and back wiring with spring-loaded, screw activated pressure plates where such are available. Wattage shall be a minimum of 125% of the connected load unless otherwise specified on the Drawings. Dimmer shall be compatible with fixture driver/ballast in coordination with light fixture package provided.

WIRING DEVICE ACCESSORIES

Wallplates for Flush Mounted Devices: Provide standard sized stainless steel (Type 302) wallplates for flush mounted single and combination wiring devices of types, sizes, and with ganging and cutouts as required for the application. Select plates that mate and match wiring devices to which attached; provide blank plates for empty or unused boxes. Provide screws for securing plates to devices; screw heads shall match finish of plates. Oversized plate shall not be used unless specifically permitted by the A-E. A quantity of 2% spare plates shall be provided for the Owner.

Wallplates for Surface Mounted Devices: Provide steel plates as required to match device box construction.

Wallplates for exterior and/or wet locations: Provide weatherproof PVC products listed as "extra duty while in use." Covers shall be rectangular, transparent high-impact, UV-resistant polycarbonate.

PART 3 - EXECUTION

INSTALLATION OF WIRING DEVICES

Install wiring devices as indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.

Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.

Install wiring devices only in electrical boxes that are clean, free from excess building materials, dirt, and debris.

Install wiring devices after wiring work is completed.

Install wallplates after painting work is completed.

Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torque's specified in UL Stds 486A and B. Use properly scaled torque indicating hand tool.

PROTECTION OF WALLPLATES AND RECEPTACLES

Upon installation of wallplates and receptacles, advise other project Contractors regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items that have been damaged, including those burned and scored by faulty plugs.

GROUNDING

Provide equipment grounding connections for all wiring devices, unless otherwise indicated. All devices, including switches, shall be grounded by an individual insulated green equipment grounding conductor connected to the grounding conductor that is run with the ungrounded conductors, and attached to the device box. Comply with tightening torque's specified in UL Std. 486A to assure permanent and effective grounds.

TESTING

Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices to demonstrate compliance with requirements.

FIELD QUALITY CONTROL

Subsequent to completion of installation of electrical disconnect switches, energize circuitry and demonstrate capability and compliance with requirements. Correct any faults to assure compliance with requirements. Retest to demonstrate compliance. Devices that fail to comply with requirements shall be removed and replaced with new units. Retest all replaced devices.

END OF SECTION 262726

SECTION 265000 - LIGHTING FIXTURES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in the manufacture of interior lighting fixtures of types, sizes, and ratings required, whose products are Listed and Labeled.

Codes and Standards:

Electrical Code Compliance: Comply with applicable State building code requirements, the requirements of the authority having jurisdiction, and the NEC as applicable to installation and construction of lighting fixtures.

NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub/No.'s LE 1 and LE 2 pertaining to lighting equipment. Comply with applicable requirements of NEMA Std. Pub No.'s 1B 4, 1B 5, and FA 1 pertaining to emergency lighting. Comply with NEMA Std. Pub. No.'s SH 5 and TT 1 pertaining to pole/standard construction materials, installation and pole hardware.

Testing Laboratory Compliance: Comply with UL standards, including UL 486A and B, pertaining to interior lighting fixtures. Provide lighting fixtures and components that are Listed and Labeled.

ANSI Compliance: Provide lamp ballast which comply with ANSI C82.

NFPA Compliance: Comply with applicable requirements of NFPA 99, "Health Care Facilities" and NFPA 101, "Life Safety Code."

NC Code Compliance: Comply with applicable requirements of current NC Energy Code.

IEC Compliance: Provide LED drivers and transformers which comply with IEC 61000-3-2 – Harmonic current emissions.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Product Data: Submit manufacturer's product data and installation instructions on each type interior building lighting fixture and component. Include product data on lamps and ballasts used for each fixture type. Submit manufacturer’s data from the ballast manufacturer that certifies compatibility for the lamps served. Include warranty data for each fixture type.

Photometric Data: Where indicated below or for substitutions, supply complete photometric data for the fixture, including optical performance, rendered by NVLAP approved laboratory developed according to the methods of the Illuminating Engineering Society of North America. Submit electronically, in IESNA LM-63 standard format.

Shop Drawings: Submit layout drawings of interior lighting fixtures and their spatial relationship to each other. In addition, submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling system and methods of support for each interior fixture type. Mounting standards or poles for each exterior fixture type shall be clearly indicated, include certified dimensioned drawings for fabricated poles, standards and mast arms.

Mockups: Provide one full size, physical assembly of each type of recessed fixture to be installed in inaccessible ceilings (gyp-board, non-removeable panels (metal, wood or other material), etc). Mockups shall include light fixture, ceiling material, fixture whip, and wiring within whip and integral junction box. Each mockup shall be constructed on site. Mockups shall be provided on site prior to the submission of submittals. Mockups shall be reviewed by the engineer, the owner maintenance group, and the electrical inspector. Mockups are used to demonstrate compliance with accessibility requirements as stated in the National Electrical Code. Approved mockups establish the standard by which the Work will be judged.

Maintenance Data: Submit maintenance data and parts list for each interior lighting fixture and accessory; including "trouble-shooting" maintenance guide. Include that data, product data, and shop drawings in a maintenance manual submitted in accordance with requirements of Division 1.

Specification Sheets: If lacking sufficient detail to indicate compliance with contract documents, standard specification sheets will not be accepted. This includes, as applicable to the respective luminaire source, but is not limited to, luminaire type designation, manufacturer's complete catalog number, voltage, LED type, CCT, CRI, specific driver information, system efficacy, lumen maintenance (L70) rating, Total Harmonic Distortion (THD), R9 color value, driver/transformer IEC 61000-3-2 compliance, and any modifications necessary to meet the requirements of the contract documents.

Lumen Maintenance Rating: Lumen maintenance ratings shall be identified for LED luminaires, based on short term test data obtained under LM-80 test methods. Long-term lumen maintenance projections shall be based on IES Test Method TM-21-11, to render L80 rating.

PART 2 - PRODUCTS

INTERIOR LIGHTING FIXTURES

General: Provide lighting fixtures of sizes, types and ratings indicated. Fixtures shall be supplied complete with all suspension accessories, canopies, housings, hickeys, sockets, starters, holders, reflectors, ballasts, louvers, frames, poles, hangers, standards, and any and all other items necessary to install fixtures.

Provide fixtures with accessories appropriate for all ceiling types into which the fixtures are placed. See architectural Drawings and Specifications to verify ceiling types, modules, or suspension systems appropriate to installation. Refer to the Fixture Schedule for specific fixture requirements.

Fixtures shall have the manufacturer's name, trademark, model number, serial number, date of manufacture (month-year), and lot number as identification permanently marked inside each unit and the outside of each packaging box. Operating characteristics shall be permanently marked inside each unit, including rated voltage and power in Watts and Volt-Ampere.

All fixture systems in linear, corner, square, rectangular, or other continuous patterns to be of approximate length and configuration as shown on plans. Electrical contractor to be responsible for field measurements to determine exact lengths so that fixture will fit precisely between walls where required. Fixtures to be pre-wired for feeding location as determined by electrical contractor. Fixture to be supplied with steel splines for sides of housing to allow for positive alignment on continuous linear mounting. Fixture to also be supplied with the correct number and size of corners, extensions, end caps, and other associated appurtenances as required to create the indicated pattern. All extraneous components shall match exactly the finished fixture (including baffles) and be provided by same manufacturer as individual fixtures.

All recessed fixtures in inaccessible ceilings shall have an integral junction box easily accessible through the fixture opening (as defined by the electrical inspector). All fixture drivers shall be able to be disconnected and removed with one hand.

Wiring: Provide electrical wiring within fixture suitable for connecting to branch circuit wiring. Maximum temperature at point of connection to branch circuit wiring shall not exceed 75ºC.

LED FIXTURES

LED luminaires shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply) and integral controls as per this specification. All electrical components shall be RoHS compliant.

Luminaire shall be designed to operate at an average operating temperature of 25°C. The overall operating temperature range shall be -20°C to 50°C ambient.

Minimum operational life shall be minimum 50,000 hours at 80% light output (L80) when operated at the average operating temperature.

LED luminaire housing to have no visible welding, screws, springs, hooks, rivets, bare LED's or plastic supports. The luminaire shall be a single, self-contained device, not requiring on-site assembly for installation. The power supply and circuit board for the luminaire shall be integral to the unit.

Individual LED's shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire. LED Boards shall be suitable for field maintenance and have plug-in connectors. LED boards shall be upgradable.

LED Drivers: Provide solid state drivers that are modular and field serviceable, capable of operating lamp types indicated. Provide drivers meeting the following minimum requirements:

- UL Listed 8750, Sound Rated A.
- Lighting regulation: ±10% over design voltage range.
- Voltage range: ±10% nominal.
- Power factor: >0.90; THD: <20%.
- Operating range: -20°C to 50°C ambient.
- Built-in transient protection per ANSI/IEEE C64.41 2002, Category A.
- Must meet requirements of FCC 47 Part 15 (radiated RF).

Dimming: Driver shall be suitable for full-range dimming, where indicated on the Fixture Schedule. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, inaudible in 26 db environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Dimming range shall be 100% to 10% of rated lumen output with a smooth shut off function.

Drivers shall track evenly at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.

The electronics/power supply enclosure shall be internal to the luminaire and be accessible per UL requirements.

Surge Suppression: The luminaire shall include surge protection within the driver to withstand high repetition noise and other interference.

In Rush Current: Meet or exceed NEMA 410 2020 driver inrush standards per the table below.

	120V			277V		
Steady State Current (A)	Peak Current (A)	Pulse Width Vac (ms)	I^2t (A^2s)	Peak Current (A)	Pulse Width Vac (ms)	I^2t (A^2s)
0.5	75	0.34	11	77	0.50	11
1	107	0.48	24	131	0.71	27
2	144	0.70	41	205	0.85	76
3	166	0.89	51	258	0.98	111
5	192	1.20	74	320	1.20	205
8	221	1.25	98	370	1.25	274
10	230	1.50	106	430	1.50	370
12	235	1.80	110	440	1.80	387
15	239	2.00	114	458	2.00	420
16	242	2.10	117	480	2.10	461

RF Interference: The luminaire and associated on-board circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 Non-Consumer requirements for EMI/RFI emissions.

Electrical connections between normal power and driver must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation and be replaceable without removing the fixture from the ceiling.

The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.

The driver manufacturer's maximum case temperature shall be stated in the product submittal and shall not be exceeded at the maximum operating ambient. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.

Warranty: The manufacturer shall provide a single source, 5 year minimum limited warranty against loss of performance and defects in materials and workmanship for all components of the luminaire. Warranty is from the time of acceptance of the Luminaires. All warranty documentation shall be provided to customer prior to the first shipment. Provide manufacturer's warranty covering 5 years minimum on drivers from date of acceptance.

Lamps:

Provide LED lamps of types and wattages as indicated in the Fixture Schedule. Correlated Color temperature (CCT) of 4000K shall be correlated to chromaticity as defined by the absolute (X, Y) coordinates on the 2-D CIE chromaticity chart. Color shift over 6,000 hours shall be <0.007 change in u' v' as demonstrated in IES LM-80 report.

LED lamp R9 value shall be 30 or greater. The color rendition index (CRI) shall be a minimum of 80. LED boards to be tested for color consistency and shall be within a space of 2.5 MacAdam ellipses on the CIE chromaticity chart.

EMERGENCY LIGHTING FIXTURES

General: Provide lighting fixtures, of sizes, types and ratings indicated complete with, but not limited to, housings, batteries, lamps, lamp holders, reflectors, energy-efficient ballasts, starters, and wiring.

Wiring: Provide wiring within fixtures for connection to branch circuit wiring as follows:

NEC Type SF-2 for 120 Volt, minimum No. 18 AWG.

Exit Fixtures - Battery Powered: Provide surface, wall, or ceiling mounted Light Emitting Diode (LED) type fixtures as indicated. Fixtures shall have selectable exit arrow directions. The arrow directions, where indicated on the Drawings, shall be selected to point as shown.

Legend Panels: Provide panels or other legend medium with permanent letters, minimum size to be: 6" high, 3/4" stroke. Letter color and background color shall be the same as the fixture indicated in the Fixture Schedule. Provide special wording on legend panels in lieu of "EXIT" where indicated in the Fixture Schedule.

Exit Fixtures - Non-battery Powered: Provide surface, wall, or ceiling mounted Light Emitting Diode (LED) type fixtures as indicated. Fixtures shall have selectable exit arrow directions. The arrow directions, where indicated on the Drawings, shall be selected to point as shown.

Legend Panels: Provide panels or other legend medium with permanent letters, minimum size to be: 6" high, 3/4" stroke. Letter color and background color shall be the same as the fixture indicated in the Fixture Schedule. Provide special wording on legend panels in lieu of "EXIT" where indicated in the Fixture Schedule.

Emergency Lights - Battery Powered: Provide surface, wall, or ceiling mounted emergency fixtures as indicated. Light units shall operate at 12 VDC. Provide two, incandescent lamps in heads that permit azimuth and elevation adjustments to provide accurate aiming. In selected fixtures as indicated on the Fixture Schedule, the emergency light feature may be combined with the exit sign as a single fixture.

Fixtures with Emergency Battery: In selected fixtures as indicated on the Drawings emergency battery ballasts shall be installed. Where the illuminated test switch is not mounted on the fixture provide a 1/4" diameter red dot on the fixture frame, visible from the floor, to identify its use as an emergency fixture.

Provide charging system for exit and emergency fixtures that are automatic solid state, full wave rectifying, current limiting type. Systems shall be furnished complete with nickel cadmium battery which shall be automatically connected to the lamps upon loss of AC power. Batteries shall be a high temperature type with an operating range from 0-60 degrees C and contain a re-sealable pressure vent. Normal life expectancy for battery shall be no less than 10 years. The battery shall be sized to supply light for a minimum of 90 minutes unless otherwise specified in the Fixture Schedule. Upon restoration of normal AC supply the unit shall return to the pre-loss condition. Provide a test push button and a fault indicator light that indicates battery or charging system failure; provide any accessory items as described in the Fixture Schedule.

Provide exit and emergency fixtures with pilot light to indicate the unit is connected to A.C. power. The battery shall have high-rate charge pilot light, unless self-diagnostic type. Provide a test switch to simulate the operation of the unit upon loss of A.C. power by energizing the lamps from the battery. This simulation must also exercise the transfer relay.

Provide exit and emergency fixtures with manufacturer's three year warranty. The battery must have an additional two more years pro-rated warranty. Warranty shall start from the date of project final acceptance. Warranty shall be included in the contract document.

PART 3 - EXECUTION

EXAMINATION

Examine areas and conditions under which lighting fixtures are to be installed, and substrate for supporting lighting fixtures. Notify A-E in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

INSTALLATION OF INTERIOR LIGHTING FIXTURES

Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

Where fixtures are supported directly from an outlet box, provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by A-E.

Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surfaces.

Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

Fasten fixtures securely to indicated structural supports; ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than 2 feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one-inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row.
Lighting fixtures, related junction boxes, and conduit are to be supported directly from the building structure. Support fixture independently from each corner using ceiling grid gauge wire; use of the ceiling grid or wires supporting ceiling grid to support fixtures, junction boxes, or conduit is not permitted. Provide a screw at four corners to secure fixture to ceiling grid system.

Support surface mounted fixtures greater than 2 feet in length at two points in addition to the outlet box fixture stud.

Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code. Tap connections are permitted within fixtures that are mounted end-to-end and supplied with power from a single end.

Otherwise, no splices, other than those necessary for the connection of a single fixture, shall be made within a fixture enclosure.

INSTALLATION OF EMERGENCY LIGHTING FIXTURES

Install emergency lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

Coordinate with other electrical work as appropriate to properly interface installation of emergency lighting fixtures with other work.

Wall mounted fixtures shall be installed plumb and vertical. Fixtures shall be located as shown on the Drawings, mounted to fixture boxes or other suitable boxes with matching plaster rings as required by the type of construction. Where used over single doors, the fixture shall be centered in the door opening. Where used over double doors, the fixture shall be centered over either the center of the door or over the exit side of the door as indicated in the Drawings. Where emergency lighting is used at a door location and ceiling height is low, fixtures shall be mounted so that there is no conflict between the door swing and the fixture.

Ceiling mounted fixtures shall be supported from fixture boxes or other suitable boxes with matching plaster rings as required by the type of construction. Fixture boxes used to support ceiling mounted fixtures shall be supported directly by the building structure using threaded rod and appropriate hardware. Use of grid ceiling tile, grid support wires, or grid members for the support of emergency fixtures shall not be permitted.

FIELD QUALITY CONTROL

Replace defective and burned-out lamps for a period of one year following approval of final inspection.

Replace fixtures with defective and burned-out LEDs for a period of one year following approval of final inspection.

Upon completion of installation of emergency lighting fixtures, and after building circuitry has been energized with normal power source, apply electrical energy to demonstrate capability and compliance with requirements. Test emergency lighting after units have been permanently installed and charged per manufacturer's instructions, but no less than 24 hours. Batteries shall be tested for 90 minutes and meet the minimum illumination requirements of NFPA-101. Record battery voltage and foot candle output of each unit before and after test and submit to engineer for review. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

ADJUSTING AND CLEANING

Clean lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.

Protect installed fixtures from damage during remainder of construction period.

GROUNDING

Provide equipment grounding connections for all interior lighting fixtures. Each interior lighting fixture shall be grounded by means of a separate insulated grounded conductor routed with the ungrounded conductor(s). The grounding conductor to each fixture shall terminate on a dedicated green screw within the fixture itself. Tighten connections to comply with tightening torques specified in UL Std. 486A to assure permanent and effective grounds.

END OF SECTION 265000

SECTION 283110 - FIRE ALARM SYSTEM MODIFICATIONS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

SCOPE

This section of the specifications includes the furnishing, installation, and connection of new initiation devices, alarm appliances, and related items to an existing fire alarm system. The final product shall be a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, auxiliary control devices, annunciators, power supplies, and wiring as shown on the Drawings and specified herein.

The design provided is based on the NC Department of Administration 2020 Fire Alarm Guidelines and Policies and includes the relevant criteria from that document.

QUALITY ASSURANCE

Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire alarm systems of types, sizes, and electrical characteristics required, and whose products are Listed and Labeled. Products of firms that do not maintain factory authorized service organization and spare parts stock are not acceptable for use on this project.

Installer's Qualifications: Installer shall be a company specializing in performing the work of this section, with a minimum of 5 years documented experience installing fire detection and alarm systems similar in size and scope to this project. Installer shall be certified by the manufacturer to install, program and service the system. Installer shall directly provide the final connections between the equipment and the wiring system and the addressing of all system devices.

Installer shall directly provide the installation of all wiring and devices required in the system, or provide supervision over this work when provided by the electrical contractor. Installer shall not sub-contract any portion of the required work to a third party. All work shall be performed in accordance with the Installer's submitted and approve fire alarm shop drawings and calculations.

System programming shall be done only by a manufacturer, or by an authorized Installer. The Installer's technicians who perform this work shall be trained and individually certified by the manufacturer, for the model and series of equipment being installed. The technicians' training and certification must have occurred in the most recent 24 months. Qualifications of installer, including technician certifications, shall be provided with equipment submittal.

Installer shall be present on site for the 100% test, Designer's pre-final review and Owner inspections.

Codes and Standards:

NFPA Compliance: Comply with applicable requirements of NFPA-72, 2013 National Fire Alarm Code.

NEC Compliance: Comply with applicable requirements of NFPA-70, National Electrical Code (NEC) standards pertaining to fire alarm systems.

Testing Laboratory Compliance: Comply with provisions of UL safety standards pertaining to fire alarm systems. Provide products and components which are Listed and Labeled.

UL Compliance: Provide fire alarm notification appliances consistent with requirements in UL 1971, Signaling Devices for the Hearing Impaired, for determining device operating currents and device ratings.

NCBC Compliance: Fire Alarm notification appliances shall comply with NC Building Code and NC Accessibility Code criteria for intensity and placement.

FM Compliance: Provide fire alarm systems and accessories which are FM approved.

SUBMITTALS

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

Prior to accepting the fire alarm shop drawing package, the Engineer shall conduct a fire alarm review meeting to review the fire alarm shop drawing package with the owner.

The contractor shall conduct a mandatory pre-construction meeting with the electrical contractor and the owner.

Shop drawings shall be submitted to the owner for review.

Product Data: Submit Manufacturer's technical product data, including specifications and installation instructions, for each type of fire alarm system equipment. Submit technical product data on the fire alarm service equipment. Submittals shall provide mA draw for each device submitted and UL listed minimum voltage required to operate. Panel submittal shall list voltage drop allowed for panel and for individual NAC circuits.

Shop Drawings: Submit shop drawings showing equipment, device identification numbers and locations, and connecting wiring of entire fire alarm system. Include wiring and riser diagrams. Wiring diagrams shall be based on the project floor plans, with devices and proposed conduit routing shown. Provide conductor composition for each conduit section. Provide distance and route for each NAC (Notification Appliance Circuit). Risers diagrams shall show consecutive connections for all devices with addresses and ratings. Copies of Project Construction Documents or details therefrom may not be a part of the shop drawing submittal. Shop drawings shall be prepared in an electronic format that is convertible to DXF files. The fire alarm contractor shall submit complete shop drawings to the engineer for review prior to installation.

Wiring and Cabling: Submit wire and cable for signal circuits and notification circuits.

Installation Instructions: Submit Manufacturer's detailed installation instruction for all duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.

Battery Calculations: Provide battery calculations used to size secondary power source. Calculations must be submitted prior to installation of equipment. Battery calculations shall utilize the UL 1971 RMS DC or full wave rectified (FWR) current values of notification appliances, as appropriate for the power supply used, provided by the product manufacturer. These values shall be highlighted in the submittal for each appliance used in the project. Identify notification appliance circuit (NAC) current draws and calculate voltage drops for each circuit in the submittal package. Identify EOL voltage for each proposed NAC, based on a source voltage of 20.4 volts. In no case shall the calculated EOL for any NAC be below the minimum listed operating voltage for the devices used.

Device List: Submit a listing for each addressable device that indicates the device address, function and location. This information shall be the basis for the device descriptions to be programmed into the system, contingent upon approval of Designer and Owner. Information shall be included in device identification that is observed at the FACP and FAAP. Device addresses shall exactly match the information provided on the shop drawings.

Maintenance Data: Submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. Include this data, product data, and shop drawings in maintenance manual.

Certifications: Submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses, and telephone numbers in the certification.

PART 2 - PRODUCTS

ALARM APPLIANCES

Speakers shall be located as shown on the Drawings: shall operate with synchronized audible output and have the following specifications:

Voltage: Speakers shall operate on 24 VDC nominal.

Taps: Provide speakers for audible sound with taps at 1/4 watt, 1/2 watt, 1 watt. Speakers shall be tapped at 1 watt for design purposes. Speakers shall provide the ANSI S3.41 three-pulse temporal pattern audible evacuation signal, described in NFPA 72.

Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. Unless otherwise indicated on the Drawings, speakers shall be mounted at 6'-8" (2.05 M) Above Finished Floor (AFF) or 6" (15.3 Cm) Below Finished Ceiling (BFC), whichever is lower.

Strobe Lights shall be located as shown on the Drawings. Strobe lights indicated for use exterior to the building shall be mounted at the indicated elevation and listed for use in wet locations. Strobe lights shall operate with synchronized flash output and have the following specifications:

Voltage: Strobe lights shall operate on 24 VDC nominal.

Maximum pulse duration: 2/10ths of one second.

Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. Unless otherwise indicated on the Drawings, strobe lights shall be mounted with the lower edge of the visual element at 6'-8" (2.05 M) Above Finished Floor (AFF) or 6" (15.3 Cm) Below Finished Ceiling (BFC), whichever is lower.

Strobe intensity and flash rate: Must meet minimum requirements of UL 1971. Provide strobe lights with minimum intensity Candela (Cd) rating of 15 Cd, or greater if such is indicated adjacent to the device symbol on the Drawings.

Audible/Visual Combination Devices shall be located as shown on the Drawings and shall comply with all applicable requirements for both Audible Device and Strobe Lights. Unless otherwise indicated on the Drawings, combination A/V devices shall be mounted with the lower edge of the visual element at 6'-8" (2.05 M) Above Finished Floor (AFF) or 6" (15.3 Cm) Below Finished Ceiling (BFC), whichever is lower.

INITIATING DEVICES

Addressable Devices - General: Unless otherwise indicated on the Drawings all initiating devices shall be individually addressable. Addressable devices shall comply with the following requirements:

Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with two (2) wires. Signaling Line Circuits shall originate as indicated on the Riser Diagram shown in the Drawings.

Operational Indications: Addressable initiation devices shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the device is operational and in regular communication with the control panel. Both LEDs shall be placed into steady illumination by the FACP to indicate that an alarm condition has been detected. The flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the device base to connect an external remote alarm LED.

Intelligent Initiation Devices: All smoke detectors shall be the "intelligent" in that smoke detector sensitivity shall be set through the FACP and shall be adjustable in the field through the field programming of the system. Sensitivity shall be capable of being automatically adjusted by the FACP on a time-of-day basis. Using software in the FACP, detectors shall be capable of automatically compensating for dust accumulation and other slow environmental changes that may affect performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.

Device mounting Base: Unless otherwise specified all detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.

Sounder Base: Where indicated on the Drawings, provide bases with a built-in (local) sounder rated at 85 dBA minimum. Configure sounder bases such that sounders are activated under conditions as described or otherwise indicated on the Drawings.

Test Means: The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel when in the "test" condition.

Device Identification: Detectors shall store an internal identifying type code that the control panel shall use to identify the type of device. Device identifications shall be either ION, PHOTO, or THERMAL.

Addressable Pull Stations - General: Addressable pull stations shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key. Pull stations that employ a glass break rod are not acceptable.

All pull stations shall be dual-action, have a positive, visual indication of operation and utilize a key type reset.

Construction: Pull stations shall be constructed of Lexan or other material suitable to the installation environment with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger. Stations shall be suitable for surface mounting or semiflush mounting as shown on the plans. Unless otherwise indicated on the Drawings pull stations shall be mounted at 42" Above Finished Floor.

Photoelectric Smoke Detectors: Photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. Unless otherwise indicated on the Drawings all smoke detectors shall be photoelectric type.

Ionization Smoke Detector: Ionization smoke detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion. Ionization type smoke detectors are indicated on the Drawings by the designation ION adjacent to the smoke detector symbol.

Thermal Detectors: Thermal Detectors shall be intelligent addressable devices rated at 135°F. (58° C.) and unless otherwise indicated on the Drawings shall have a rate-of-rise element rated at 15° F. (9.4° C.) per minute. It shall connect via two wires to the Fire Alarm Control Panel Signaling Line Circuit. Up to 99 intelligent heat detectors may connect to one SLC loop. Thermal detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.

Non-Rate of Rise Detectors: Where indicated on the Drawings provide thermal detectors with non-rate of rise thermal elements. Non-rate of rise detectors are indicated by NRR adjacent to the thermal detector symbol.

Specialized Element Temperature Ratings: Where indicated on the Drawings provide thermal detectors with specialized element temperature ratings. Specialized element temperatures are indicated by a temperature rating adjacent to the thermal detector symbol, *e.g.* 195°F.

Duct Smoke Detector: In-Duct Smoke Detector Housings shall accommodate either an intelligent ionization sensor or an intelligent photoelectric sensor as described elsewhere. The device, independent of the type used, shall be velocity rated and provide continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal shall be initiated at the FACP.

Installation: Duct detectors and related items shall be furnished and connected by the Division 28 (Electrical) Contractor but installed by the Division 20-25 (Mechanical) Contractor.

MISCELLANEOUS SYSTEM ITEMS

Addressable Dry Contact Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone (either Style D or Style B) of non-addressable Alarm Initiating Devices (any Normally Open [N.O.] dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings. Modules must be located in conditioned spaces unless they are tested, listed and marked for continuous duty across the range of temperature and humidity levels expected at their installed location.

Indication of Operation: Module shall include an LED that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.

Mounting Requirements: Monitor Modules shall mount in a standard 4-inch square, 2-1/8" deep electrical box. LED shall be clearly visible through light pipe in box cover.

Supervision: Unless specifically noted otherwise on the drawings provide one monitor module for each sprinkler switch (tamper and flow) and one for each non-addressable detector.

Two Wire Detector Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone, either Class A or B (Style D or Style B operation) of non-addressable 2- wire smoke detectors or alarm initiating devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration and be UL Listed to operate with the specific smoke detectors in the IDC zone. All required monitor modules may not be shown on the Drawings. Modules must be located in conditioned spaces unless they are tested, listed and marked for continuous duty across the range of temperature and humidity levels expected at their installed location.

Indication of Operation: Module shall include an LED that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.

Mounting Requirements: Monitor Modules shall mount in a standard 4-inch square, 2-1/8" deep electrical box. LED shall be clearly visible through light pipe in box cover.

Addressable Control Module: Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual (A/V) Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. The control module shall provide address-setting means using decimal switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel. Modules must be located in conditioned spaces unless they are tested, listed and marked for continuous duty across the range of temperature and humidity levels expected at their installed location.

Indication of Operation: Module shall include an LED that shall flash under normal conditions, indicating that the Control Module is operational and in regular communication with the control panel.

Mounting Requirements: Control Modules shall mount in a standard 4-inch square, 2-1/8" deep electrical box. LED shall be clearly visible through light pipe in box cover.

Configuration: The control module NAC circuit may be wired for Style Z or Style Y (Class A/B) with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

Power Source: Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply. A/V power sources and connections are not shown on the Drawings.

Test Switch: A magnetic test switch shall be provided to test the module without opening or shorting its NAC wiring.

Isolator Module: Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. Modules must be readily accessible (not above ceiling) and clearly labeled. Modules must be located in conditioned spaces unless they are tested, listed and marked for continuous duty across the range of temperature and humidity levels expected at their installed location. Modules shall be shown on shop drawings and as-built drawings.

Indication of Operation: Module shall include an LED that shall flash under normal conditions, indicating that the Isolator Module is operational and in regular communication with the control panel. The LED shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

Operation: Isolator Modules shall operate such that if a wire-to-wire short occurs, the Isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section. The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.

Mounting: The Isolator Module shall mount in a standard 4-inch square, 2-1/8" deep electrical box. LED shall be clearly visible through light pipe in box cover.

Remote Annunciator Indicator Lights (RAIL): Remote annunciator indicator lights shall be provided in locations where indicated on the Drawings. RAILs shall be provided with a key type switch for testing of the annunciated device. In addition, RAILs shall have the following features:

Voltage: RAILs shall operate on 24 VDC nominal.

Mounting: Provide flush mounting devices suitable for mounting in a standard single gang device box unless otherwise indicated on the Drawings. Unless otherwise indicated on the Drawings, RAILs shall be mounted as described for electronic sounders above.

PART 3 - EXECUTION

Fire and smoke detection and alarm systems shall comply with the following system requirements with regard to operation and installation.

All equipment and components shall be installed in strict compliance with manufacturers' recommendations. All equipment supplied must be specifically listed for its intended use and shall be installed in accordance with any instructions including in its listing. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagram for all specific system installation/termination/wiring data.

All system components shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (*e.g.*, detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Adhesives are not permitted to mount fire alarm system components to building surfaces or structure.

The system shall be new and furnished with a warranty (parts & labor) of at least one year from the date of final inspection and acceptance by the Owner. Equipment, initiating devices, and alarm appliances shall be arranged as described in the Drawings; annunciator zones shall be configured as described in the Drawings.

The system shall be equipped with the following protective devices to prevent damage or nuisance alarms by nearby lightning strikes, stray currents, or voltage transients. The devices are to be provided by the fire alarm equipment supplier:

On AC Input: Provide a 120 volt, 20 amp feed through branch circuit series connected surge protective device (SPD) in dedicated enclosure. Install at panelboard and trim excess lead lengths. Wind small coil in branch circuit phase conductor, within SPD enclosure, downstream of the SPD connection. Coil is to be about 1" diameter, 5 to 10 turns, and tie-wrapped. Ditek DTK-120SRD series is a product meeting this performance specification. Equivalent unit with UL 1449 listing by other supplier are acceptable.

On DC Circuits Extending Outside Building: Near the point of entry to or exit from each building, provide a hybrid technology surge protection device on each leg. The filter shall consist of gas discharge tube (GDT) technology paired with silicon avalanche diode (SAD) technology, clamping voltage between 30 and 40 Volts. Ditek DTK – 2MHLPB series is a product meeting this performance specification. Equivalent unit with UL 497B listing by other supplier are acceptable. Devices shall not use only MOV active elements for protection.

Both audible and visible alarm signals shall be provided. Visible signals must be the strobe (flash discharge) type, with white or clear lens, and shall comply with current ADA requirements for intensity and placement.

The coverage of each fire alarm zone as described in the Drawings shall be indicated on the FACP and any remote annunciator. This may be accomplished by engraved labels, framed directories, and/or graphic displays. Label tape or handwritten labels are not acceptable.

Systems are to be provided with a separate and independent source of emergency power. Switching to emergency power during alarm shall not cause signal drop-out. Batteries must meet the appropriate NFPA capacity requirements, with a 25% safety factor. This requirement is in effect even if generator power is supplied to the Fire Alarm Control Panel.

Wiring: Provide Class A wiring for Signal Line Circuits (SLC) transmitting alarm, trouble and supervisory signals from all intelligent reporting devices. Initiation Device Circuits (IDC) and Notification Appliance Circuits (NAC) shall be wired Class B.

All wiring shall be color coded in accordance with the following scheme, which shall be maintained throughout the system, without color change in any wire run:

Signal Line Circuit cable	Red jacket with Red(+)/Black(-)
Alarm Indicating Appliance Circuits	Blue (+)/Black (-)
AHU Shutdown Circuits	Yellow (+)/Brown (-)
Initiation Circuits from Monitor Modules	Violet (+)/Gray (-)
Door Control Circuits	Orange
Elevator Capture Circuits	Brown

There shall be NO splices in the system other than at terminals in panels, fire alarm terminal cabinets (FATC) and devices. "Wire nuts," crimp splices, or insulation piercing type connectors are not acceptable. All terminal blocks shall be mounted in enclosures. All terminal screws shall have pressure wire connectors of the self-lifting or box lug type.

Permanent wire markers shall be used to identify all splices and terminations for each circuit. For splices within FATC's, use markers or other means to indicate which conductors leads to the FACP.

All fire alarm system cables and conductors shall be installed in raceway, couplers, and connectors meeting the performance of installation requirements of Section 260534, RACEWAYS. The minimum size for fire alarm system raceway shall be 3/4" trade size.

The exterior of all junction boxes containing fire alarm conductors shall be painted red; box interiors shall not be painted. Box covers for junction boxes containing fire alarm conductors shall be painted red on both sides. All painting of junction boxes and junction box covers shall be accomplished prior to installation of the boxes to avoid possible problems with overspray. Those boxes in finished areas are permitted to be painted to match the finish color.

Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained therein. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

Raceways that penetrate outside walls from conditioned space shall have an internal seal to prevent condensation within the raceway as it enters the conditioned space.

Provide metal backboxes or plastic skirts as manufactured by the fire alarm manufacturer for devices installed in a surface mounted application. Such boxes shall match device in size and color.

Wire shall be new AWG 14 minimum stranded copper, type THHN/THWN for Notification Appliance Circuits. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG 18 minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACP. Acceptable cables include Atlas 22-18-1-1STP, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft maximum between conductors. The cable jacket color shall be red, with red (+) and black (-) conductor insulation.

EXCEPTION #1: Unshielded cable, otherwise equal to the above, is permitted to be used where the manufacturer's installation instructions unequivocally require, or state a preference for, the use of unshielded cable for all systems, AWG #16 minimum.

EXCEPTION #2: In underground conduit, use Type TC or PLTC cable (PE insulated) to avoid problems from moisture.

Detection or alarm circuits must not be included in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power must be properly separated from other circuits and the enclosure must have an appropriate warning label to alert service personnel to the potential hazard.

Provide an engraved label in FACP identifying its 120 VAC power source. This label shall include panelboard location, identification, and circuit number.

Branch circuit breakers serving fire alarm systems shall be physically protected from inadvertent contact using a breaker handle lock. Load designation shall be clearly identified (typed) in the panel directory. Breakers shall be further identified with a permanent red dot applied to the handle or other visible portion of the breaker. Do not cover operable portions of the breaker or written information on the case in meeting this requirement.

All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum resistance to ground or between any two conductors shall be ten megohms (10 MW), as verified with a megger. Provide advance notice to the A-E of these tests.

All connections at the FACP must be made by the Manufacturer's authorized, factory trained representative (rather than by the electrical contractor).

The system shall be electrically supervised for open or (+/-) ground fault conditions in SLC, alarm circuits, and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.

Spare Parts: Provide the following spare parts with the system, each individually packaged and labeled. For multi-building projects, calculate separately for each building:

Fuses	2 of each size used in the system
Manual Stations	2% of installed quantity
Addressble Control Modules	4% of installed quantity
Indoor Horns/Strobes	4% of installed quantity
Indoor Strobe-only Notification Appliances	4% of installed quantity
Monitor Modules (Addressable interface)	4% of installed quantity
Isolation Modules /Isolation Bases	4% of installed quantity
Addressable Heat Detectors, Bases	4% of installed quantity
Spot Smoke Detectors, Bases	6% of installed quantity

Provide a minimum of 1 spare of each new part used in the project.

Increase decimal quantities of spare parts to the next higher whole number. For example, if a system has 20 spot-type smoke detectors provide 2 spare detectors with bases.

ALARM VERIFICATION FOR SMOKE DETECTORS

Fire alarm systems with automatic drift compensation functions shall be programmed with this feature activated for all spot-type detectors. Fire alarm systems equipped with alarm verification, shall not be programmed with the feature activated unless it is determined necessary through system testing.

Alarm verification shall be by device, with timer and tally. The system shall provide a timer function that can be set for a specific detector or input module.

The timer function shall delay alarm signal for a field-programmable time period. The control panel shall override the alarm verification functions if a subsequent alarm is reported during the verification period.

The tally function shall be capable of monitoring the total quantity of verification cycles initiated at the panel. A maximum verification count may be set in the field, ranging from 0-20. When the counter threshold is exceeded, a trouble signal shall be generated to the FACP.
Alarms from other than spot type smoke detectors must not be delayed by Alarm Verification. Alarm Verification is NOT to be applied to duct smoke detectors, nor to any software configured "cross-zoned" detection devices.

SMOKE DETECTORS

Detectors must be the plug-in type, each having a separate base, not a mounting ring, to facilitate replacement and maintenance. The base shall have integral terminal strips for circuit connections, rather than wire pigtails. Each detector or detector base shall incorporate an LED to indicate alarm. When installed in a room, detectors shall be oriented so their alarm light is visible from the nearest door to the corridor, unless Remote Alarm Indicator Light (RAIL) equipped.

A smoke detector shall be mounted with in 15 feet horizontally of each piece of fire alarm control system equipment, including transponders, sub-panels, and booster power supplies.

Spot type smoke detectors mounted within 12 feet of a walking surface shall have their built-in locking device activated. Activate the locks after the system has passed the final inspection by the owner.

Spot type smoke detectors shall not be used where ceiling height exceeds 25 feet, due to the increased difficulty with access for maintenance and the impact on device performance.

Activate automatic drift compensation feature for all spot type smoke detectors. Systems shall not have alarm verification feature activated with drift compensation functions activated.

Set spot-type smoke detector sensitivity to normal/ medium, unless directed otherwise by the design engineer or owner's representative. Make additional changes as directed during testing and certification of the system.

Unless suitably protected against dust, paint, etc., detectors shall not be installed until the final construction clean-up has been completed. Covers supplied with smoke detectors do not provide adequate protection from heavy construction activities and shall not be used in this manner. Contaminated detectors must be REPLACED by the Contractor at no additional cost to the Owner.

Identification of individual detectors is required. These device numbers, which must also be shown on the shop drawings, shall be permanently affixed to the detector base. Device labels may not be affixed to the device. Identification labels must be printed labels with black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

Where shown on the Drawings air duct/plenum detectors must have a RAIL with a keyed Alarm Test switch, located in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling.

FIRE ALARM SYSTEM INSTALLATION AND CONFIGURATION

In addition to other requirements of these Specifications the fire alarm system must comply with the following:

The addressable fire alarm system shall be connected, programmed, and tested only by the Manufacturer or by an authorized distributor who stocks a full compliment of spare parts for the system. Technicians performing this service shall be trained and individually certified by the Manufacturer for the model of system being installed. Copies of installer certification must be included with the Contractor's submittal.

The complete configuration data (site-specific programming) for the system must be permanently stored on a USB drive or compact disc (CD) and archived by the manufacturer or authorized distributor. A USB drive or compact disc (CD) copy of this data must be submitted to the A-E for transmission to the Owner when the system is commissioned.

The Manufacturer or authorized distributor must maintain software version (VER) records on the system installed. The system software shall be upgraded free of charge if a new VER is released for any reason during the warranty period. For any new VER to correct problems, free upgrade shall apply during the entire life of the system.

All addressable loop controller circuits (SLCs) must be NFPA 72 Style 6 ("Class A") and shall have a minimum of 20% spare addresses for future use. "T-taps" from the loop are not permitted. To minimize the impact of a wiring fault on the system, isolation modules must be provided as follows:

1. At the FACP, at each end of the loop.
2. At the mid-point of a loop with less than 20 devices or control points.
3. After each 20 devices/control points on any addressable circuit.
4. For each circuit extending outside the building.
5. At each terminal cabinet on loops serving multiple floors (each floor).

Notification Appliance Circuits (NACs) shall be NFPA 72 Style Y (Class B). The load connected to each circuit must not exceed 80% of rated supply output. The coverage of each circuit shall not exceed 3 floors. The NAC voltage drop during alarm shall not exceed 14% of the voltage measured across the batteries. The contractor shall use power outage testing to verify proper installation.

Supervision required: The connection between individual addressable modules and their contact type initiating device(s) must be supervised.

Graphic Chart must be mounted behind Plexiglass and secured to surface. Mounting shall be such that charts cannot be removed without a flat head screw driver.

Floor Plans with Device Numbers: A copy of the floor plans shall be provided in the control panel. A separate sheet shall be provided for each floor. Plans shall be reduced in size from engineering plans in order to fit on 11 x 14 sheets. All device addresses shall be clearly labeled on plans. Indicate locations of all cabinets, modules and end of line resistors. Plans shall be bound in book form. Sheets shall be laminated. Provide legend for symbols. Provide holder for plan book in panel or in a locked box adjacent to panel keyed to match panel. Provide label for box and book.
In addition to the system tests and certification described elsewhere, the Manufacturer or authorized distributor must 100% test all site-specific software functions for the system and provide a written test report or detailed check list.

SYSTEM DOCUMENTATION

The contractor shall provide the A-E with three copies of the following:

1. As-built wiring and conduit layout diagrams, including wire color code and/or label numbers, and showing all interconnections in the system.
2. Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
3. Technical literature on all major parts of the system, including control panels, batteries, detectors, manual stations, alarm indicating appliances, power supplies, and remote alarm transmission means.
4. Detailed maintenance requirements as recommended by the fire alarm manufacturer.

The contractor shall provide the A-E with one copy of the following:

1. All software required, both for the installed fire alarm system and for any personal computer (PC) necessary to access the fire alarm system for trouble shooting, programming, modifications, monitoring, de-bugging, or similar functions.
2. Complete documentation for all software for both the installed fire alarm system and for any interface PC software necessary for system functions as described in (1) above.
3. Framed floor plans for installation at the FACP. Plans shall show all system devices with the unique device identification numbers indicated adjacent to each device. The identification numbers shall match those represented in the as-built drawings and those reported at the FACP and the LCD annunciator.

SYSTEM TESTING & CERTIFICATION

Upon completion of the installation the Division 28 Contractor and the Manufacturer's authorized installer together shall conduct a 100% performance test of each alarm initiating device that is added and/or modified as part of the construction activity for proper response. In addition, a 10% test as defined in NFPA 72 shall be conducted for system devices and circuits in the building that were not directly impacted by the specified work. The system shall operate for 48 hours prior to start of test. The Division 28 Contractor shall be present for the full 100% test.

The Contractor's 100% Performance test shall consist of the following. Upon activation of each alarm initiating device, verify effective operation of every alarm notification appliance and all other functions such as elevator capture, control smoke doors/dampers, proper operations of HVAC systems, and pressurization fans. In addition, verify proper annunciation of each activated device, including device identification number, type and location, at the FACP and each remote annunciator. The FACP shall reset after testing of each alarm initiating device. The digital communicator shall be on-line and tested for proper communication to the receiving station. Equivalent methods of demonstrating proper operation of HVAC shutdown are acceptable for this test. All supervised circuits must also be tested to verify proper supervision. (Control circuits and remote annunciation lines are among those required to be supervised.)

All testing described above shall be repeated in the event that subsequent software or wiring modifications are determined necessary to meet the requirements of the contract documents. Such re-testing shall be included as part of the base bid and provided at no additional cost to the Owner.

The A-E must be given 7 days advance notice of the tests.

The contractor must submit the following test documentation:

1. Written verification that this system test (100% and 10%) was done with copy of print out generated during test.

2. System status and programming report, including a system operation matrix showing the actual FACP response for each initiating device. In addition, provide the measured sensitivity of each smoke detector. (Generate on date of Designer Pre-Final).
3. NFPA 72-2013 "Record of Completion" form: Use this form to detail the system installation and to certify that it was installed per code requirements.
4. Voltage table indicating voltage at battery and at the last device on each NAC circuit. Take readings at the start of test and every 15 minutes during NAC test. Test shall be 30 minutes minimum.

After completion of the Contractor's 100% performance test and submission of the above documentation, the contractor will request in writing that the A-E set up a pre-final review.

If the initial inspection determines that the required 100% system test was not reasonably done, or if a reinspection of the project is requested without the punch list being nearly completed, the Contractor *may* be required to reimburse the Designer for inspection costs.

System Report: In addition to the shop drawing submittal the fire alarm system contractor shall provide the engineer two bound copies of the following technical information, for transmittal to the owner:

1) As-Built wiring diagram showing all loop numbers and device addresses, plus terminal numbers where they connect to control equipment.
2) Manufacturer's detailed maintenance requirements
3) Technical literature on all control equipment, isolation modules, power supplies, alarm/ supervisory signal initiating devices, alarm notification appliances, relays, etc…
4) The as-built "calculations" sheet referenced elsewhere in this specification.

Electronic archive: Complete configuration data (site-specific programming) for the system must be stored on electronic media and archived by the fire alarm system manufacturer or authorized distributor. A USB drive or compact disc (CD) copy of this data shall be submitted to the engineer for transmission to the owner.

INSPECTIONS

Fire Alarm System Designer Pre-final Review: Upon completing the fire alarm system installation, and prior to scheduling the Designer Pre-final review, the installation contractor must successfully conduct and complete a 100% performance test of the entire fully functional system. All audio visual device tests shall be scheduled with the owner.

As part of the Designer Pre-final review the system will be inspected and functionally tested on a comprehensive basis. Equipment intended for open area protection or releasing device service may be subjected to simulated or actual test fires in accordance with ANSI/UL guideline and sound engineering practice, to verify proper response.

The Contractor shall provide two-way radios, equipment keys, as-built drawings, ladders, smoke products, meter and other materials required to test the system. The test will be conducted entirely by the Contractor. Any deficiencies shall be recorded and corrected. After the items have been corrected, the system shall be tested again in the presence of the Engineer.

In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections. Continued improper performance during the warranty period shall be cause to require the Contractor to remove and replace the system.

Test Report: Upon successful completion of the Performance Inspection and correction of all deficiencies, the manufacturer's authorized representative shall issue a test report to the Engineer, detailing and certifying the test.

Final Inspection: At the Owner's request and after passing the pre-final review, the Division 28 Contractor and Manufacturer's authorized installer will conduct a full system test in the presence of the Owner and the Designer. Upon request, a copy of the final database software must be presented to the Owner on USB drive before this test. The software shall be loaded from the drive into the system in the presence of the Owner and Engineer. See requirements for pre-final test and conduct similarly.

System Acceptance: After successful completion of the Final Inspection and recommendation of the Engineer, the system will be accepted by the Owner. At this time the warranty period begins. In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections. Continued improper performance during the warranty period shall be cause to require the Contractor to remove the system.

END OF SECTION 283110

Attach to bid **Attach to bid** **Attach to bid** **Attach to bid** **Attach to bid**

Identification of HUB Certified/ Minority Business Participation

I,_____, do hereby certify that on
(Name of Bidder)
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 Number	Work Type	*Minority Category	**HUB Certified
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N
			Y / N
			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 ($)_____.

Attach to bid (as appropriate) **Attach to bid (as appropriate)** **Attach to bid(as appropriate)**

AFFIDAVIT A
Listing of Good Faith Efforts
(The University of North Carolina)

County of _____

Affidavit of_____

(Name of Bidder)

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 _____

AFFIDAVIT B
Intent to Perform Contract with Own Workforce
(The University of North Carolina)

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 _____

Do not submit with bid **Do not submit with bid** **Do not submit with bid** **Do not submit with bid**

AFFIDAVIT C

Portion of the Work to be Performed by HUB Certified/Minority Businesses

(The University of North Carolina)

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 bidder's 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.

County of _____

Affidavit of _____ I do hereby certify that on the

(Name of Bidder)

_____ contract.

(Name of Project)

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	Work Description	Dollar Value
		Y / N		
		Y / N		
		Y / N		
		Y / N		
		Y / N		
		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 is required to be counted toward state participation goals.

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

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

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of_____, County of_____

Subscribed and sworn to before me this _____day of _____20_____

Notary Public_____

My commission expires _____

AFFIDAVIT D
Good Faith Efforts
(The University of North Carolina)

This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low 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:

County of _____

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	Work Description	Dollar Value
		Y / N		
		Y / N		
		Y / N		
		Y / N		
		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.

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 _____