

**NORTH CAROLINA STATE UNIVERSITY**

NCSU CENTENNIAL CAMPUS

RENOVATION TO LAB 167, 169, & 169A

PARTNERS BUILDING III

BUILDING: 713

ISSUED FOR CONSTRUCTION SET

NC STATE PROJECT ID: 202435062

SCO# 24-28212-01A

20 DECEMBER 2024

**HANBURY**

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

FOR

*North Carolina State University*

*Project Name:* \_\_\_\_\_

*Building/Location:* \_\_\_\_\_

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

**SCOPE OF WORK**

*Brief outline of work required:*

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**NOTICE TO BIDDERS**

Sealed bids for this work will be received by:

*Construction Manager:* \_\_\_\_\_

*North Carolina State University,*

\_\_\_\_\_, *Administrative Services*

*Building III, 2601 Wolf Village Way, Raleigh, NC 27695*

*Telephone:* \_\_\_\_\_

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:* \_\_\_\_\_ *Email:* \_\_\_\_\_

*Address:* \_\_\_\_\_ *Telephone:* \_\_\_\_\_

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, \_\_\_\_\_.

No bid may be withdrawn after the opening of bids for a period of 30 days.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/ACCEPTANCE form provided herein with all blank spaces for bids properly filled in and all signatures properly executed.

Please note on the envelope – **Bid: Attn:** \_\_\_\_\_

*Project Name:* \_\_\_\_\_

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

Building/Location: \_\_\_\_\_

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

**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 ( \_\_\_\_\_ ) consecutive calendar days, beginning on \_\_\_\_\_ and ending on, \_\_\_\_\_. For each day in excess of the above number of days, the Contractor shall pay the Owner the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) 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 20<sup>th</sup> 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.



# 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:

<p>Primary (Total Building) Power 10 working days Required Approval Power Systems/Zone Maintenance</p>	<p>Distilled Water Interruption 3 working days Required Approval Zone Maintenance</p>
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<p>Secondary Power Feeders 4 working days Required Approval Zone Maintenance</p>	<p>Steam Interruption 5 working days Required Approval Utilities Distribution/Zone Maintenance</p>
<p>Cold/Hot Water Interruption 4 working days Required Approval Zone Maintenance</p>	<p>Gas Interruption 5 working days Required Approval Utilities Distribution/Zone Maintenance</p>
<p>A/C/Heat Interruption 4 working days Required Approval Zone Maintenance</p>	<p>Lab Air Interruption 4 working days Required Approval Zone Maintenance</p>
<p>Fire Sprinkler Disconnect 3 working days *<a href="#">See Fire Alarm Disconnect</a>* Required Approval Zone Maintenance</p>	<p>Sanitary/Storm Sewer 3 working days Required Approval Utilities Distribution</p>

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.

# 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](mailto:efacmainppa@ncsu.edu), which notifies the Electronics Shop for review and action.

## FACILITIES DIVISION

**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 requestor 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 requestor shall contact the Facilities Electronics Shop and the Facilities Customer Service Center immediately by emailing [efacmainppa@ncsu.edu](mailto:efacmainppa@ncsu.edu).

## 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.

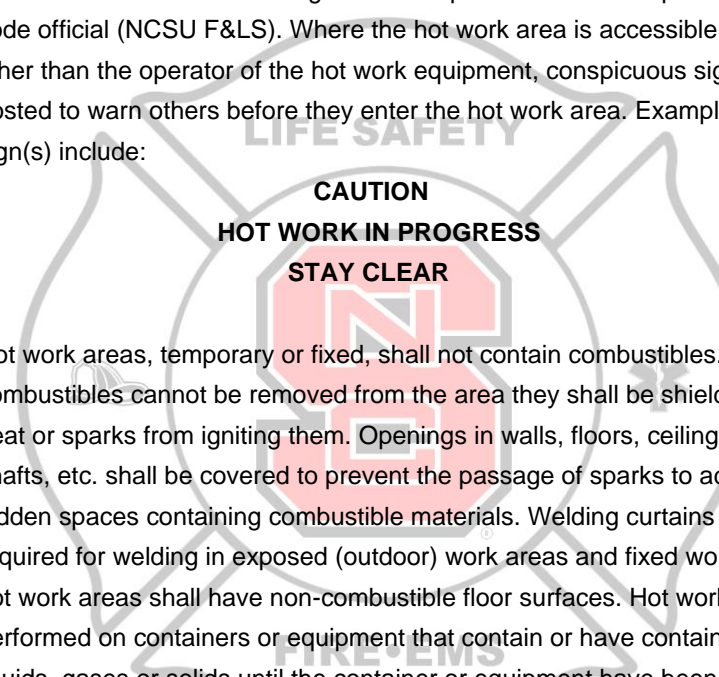
(3501.3: Restricted areas. Hot work shall only be conducted in areas designed or authorized for that purpose by the personnel responsible for the Hot Work Program. Hot work shall **NOT** be conducted in the following areas unless approval has been obtained from the fire code official (NCSU Fire & Life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

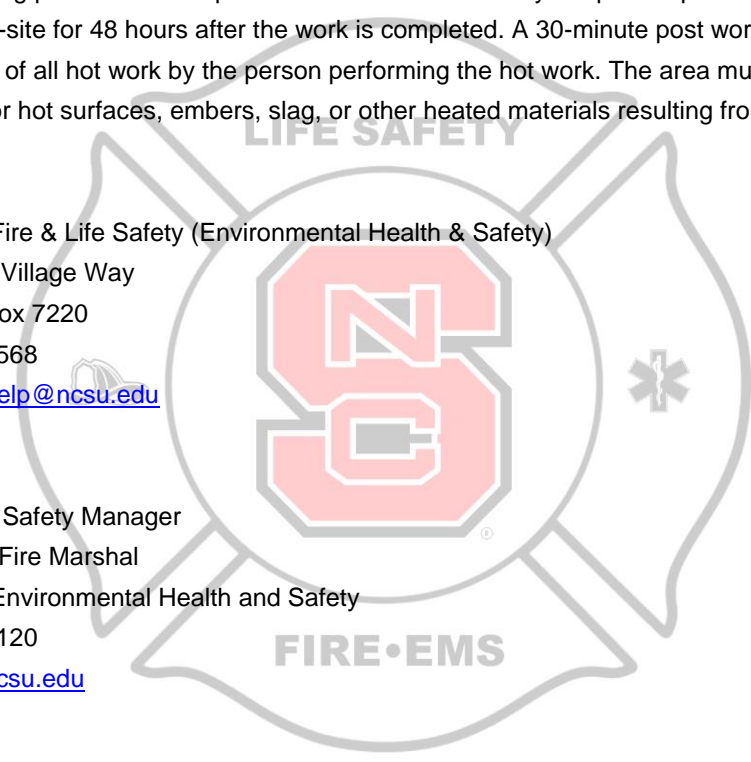
Hot work permits can be obtained the day of the hot work commencing by contacting the NC State Fire & Life Safety Office at 919-515-2568, alternatively an individual may call 919-515-3000 (NC State Univ. Police) and request a hot work permit response from the Fire & Life Safety Office. A representative 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](mailto:firesafetyhelp@ncsu.edu)

Jon Brann  
Fire & Life Safety Manager  
University Fire Marshal  
NC State Environmental Health and Safety  
919-513-2120  
[jbrann@ncsu.edu](mailto:jbrann@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: _____

<b>Attachment # 5</b>		<b>I</b>	<b>II</b>	<b>III</b>
<b>NC State University</b>				
<b>Sustainability Project Requirements</b>				
<b>Integrated Design</b>				
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	For all 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
<b>Indoor Air Quality</b>				
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 <a href="#">6 SMACNA guidelines</a> 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
<b>Materials</b>				
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
<b>Recycling and Reuse</b>				
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
<b>Efficiency</b>				
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
<b>Close out</b>				
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](mailto:recycling@ncsu.edu)
- Hours: Monday – Friday 7:00 am – 3:45 pm

# 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

# NC State University Design and Construction Guidelines

## Division 01 Contractor Safety Requirements

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.**

# NC State University Design and Construction Guidelines

## Division 01 Contractor Safety Requirements



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### 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

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- 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

# NC State University Design and Construction Guidelines

## Division 01 Contractor Safety Requirements

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

# NC State University Design and Construction Guidelines

## Division 01 Contractor Safety Requirements

- 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):

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## Division 01 Contractor Safety Requirements

- 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

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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](http://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

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## Division 01 Contractor Safety Requirements

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),

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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.



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- 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, thermitic 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

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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

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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 (OECF)
  - 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 CFR 1926.1427 (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

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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

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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

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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.

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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.

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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



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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

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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

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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.

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- SS. Vertical Lifts - All contractors' platforms or vertical lifts must meet OSHA and manufacturer requirements.

**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 permitted on state projects.

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

#### **SECTION 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.

### 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.

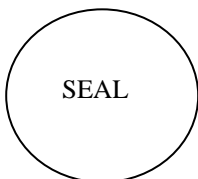
The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

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

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

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

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



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

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

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

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

Attach to bid (as appropriate)

Attach to bid (as appropriate)

Attach to bid (as appropriate)

**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.

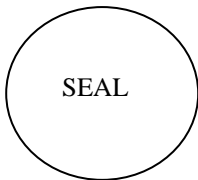
The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

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

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

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

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



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.

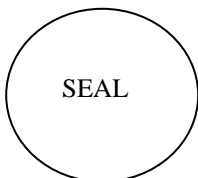
The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

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

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

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

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



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.

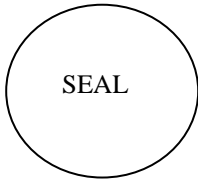
The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

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

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

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

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



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

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

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

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

**\*\*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.

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

\* 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.



# 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  $((C/D) \times 100)$ .



**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

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

3. 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

**Project Totals (Contractor to Calculate)**

5. Total Weight Landfill: **A** \_\_\_\_\_ Total Weight Diverted (Recycled + Salvaged): **C** \_\_\_\_\_ Percent of Project Waste Diverted from Landfill (Total Weight Diverted / Total Project Weight) x 100

Total Weight Recycled: **B** \_\_\_\_\_ Total Project Weight (Recycled + Salvaged + Landfilled): **D** \_\_\_\_\_ **E** \_\_\_\_\_%



# 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: \_\_\_\_\_

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 donation 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 acquisition 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](mailto:recycling@ncsu.edu)**

**Return completed form to Waste Reduction and Recycling. Campus Box 7516 or [recycling@ncsu.edu](mailto:recycling@ncsu.edu)**

**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.



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



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

## SECTION 010000 - GENERAL REQUIREMENTS

### PART 1 - GENERAL

- 1.1 Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section
- 1.2 This document is a minimum standard. The Consultant's standard form of general requirements can be used, provided the Consultant coordinates the document with North Carolina State University's Special Conditions, the Contract Administrator and the Project Office.
- 1.3 The Owner for this project is North Carolina State University. The term Owner means the Owner or his authorized representative. The Owner shall forward instructions to the Contractors through the Construction Manager, even when the Owner has direct Contracts with the same Contractors.
- 1.4 The Architect is Hanbury, 310 S West Street, Suite 100, Raleigh NC 27603. The Architect/Engineer is the person or entity lawfully licensed to practice architecture or engineering in the state having jurisdiction over the design or construction. The Architect/Engineer has been retained either by the Owner or Owner's Representative to prepare the Contract Documents, review submittals, respond to RFIs and provide general support activities during the construction phase of the project. Nothing contained in the Contract Documents shall create any contractual relationship between the Architect/Engineer and any Contractor. The Architect/Engineer will be the interpreter of the requirements of the Drawings and Specifications. All requests for interpretations shall be directed through the Construction Manager unless otherwise noted. The Architect/Engineer will review and approve or take other appropriate action upon Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for conformance with the design concept of the Work and with the information given in the Contract Documents. The Architect/Engineer's review shall not relieve the Contractor of the responsibility for any deviations of the Contract Documents or from errors and omissions in the data or drawings. Approval of a specific item shall not indicate approval of an assembly of which the item is a component. The Architect/Engineer may, at the Owner's request, determine the amount, quality, acceptability and fitness of all part of the Work. The Architect/Engineer will have authority to reject Work, which does not conform to the Contract Documents. The Architect/Engineer may, along with the Construction Manager, conduct inspections to determine the attainment of Substantial Completion and Final Completion. The Architect/Engineer will communicate with the Contractor through the Construction Manager unless otherwise directed
- 1.5 The Construction Manager for this project is TBD. The Construction Manager will be the Owner's construction representative, also referred to as the Owner's Representative, typically during construction until final Contractor payment and shall have the responsibility to monitor and coordinate the Work of all Trade Contractors. The Construction Manager is not the General Contractor, and unless otherwise expressly provided in the Contract Documents, does not have the responsibility to perform any of the traditional duties of a General Contractor. The Construction Manager will provide, as the Owner's Representative, the general administration of the Project as described herein and in the Contractor's Agreement. The Construction Manager is to direct and schedule the performance of all Work and the Contractors are expected to follow all such directions and schedules. Where the Construction Manager holds Construction

Contracts with the Contractors, the Owner is not a party to such Contracts. The Construction Manager shall have no authority to bind the Owner in any way with the Contractor, its Subcontractors, Material Suppliers, or any third parties. The Construction Manager shall have the authority to reject Work which does not conform to the Contract Documents and to require any Special Inspection and Testing in accordance with the Contractor's Agreement. The Construction Manager will prepare and issue amendments or Change Orders to the Contractors in accordance with Contractor's Agreement. The Construction Manager, along with the Architect/Engineer, will conduct Inspections to determine the attainment of Substantial Completion and Final Completion, and will receive and review written warranties and related documents required by the Contract and assembled by the Contractor.

- 1.6 The Owner may provide new or existing equipment for production processes as indicated on the Equipment list and designated as "Owner Furnished, Contractor Installed". The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and mechanical and electrical connections. The Owner will arrange and pay for delivery of Owner-furnished items in accordance with the Contractor's Construction Schedule and will inspect deliveries for damage. If Owner-furnished items are damaged, defective or missing, the Owner will arrange for replacement. The Owner will also arrange for manufacturer's field services and the delivery of manufacturer's warranties and bonds to the Contractor. The Contractor is responsible for designating the delivery dates of Owner-furnished items in the Contractor's Construction Schedule and for receiving, unloading, and handling Owner furnished items at the site. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements, and to repair or replace items damaged as a result of his operations.
- 1.7 The Contractor shall furnish the items indicated as "Contractor Furnished, Contractor Installed" or "Contractor Furnished, Owner Installed" as indicated on the Equipment list. Work includes receiving, unloading, handling, storing, protecting, and where responsible for installation, installing products and mechanical and electrical connections. The Contractor will arrange and pay for delivery of items in accordance with the Contractor's Construction Schedule and will inspect deliveries for damage. If items are damaged, defective or missing, the Contractor will arrange for replacement. The Contractor will also arrange for manufacturer's field services and the delivery of manufacturer's warranties and bonds to the Contractor. The Contractor is responsible for coordinating the delivery dates of Owner-installed items in the Contractor's Construction Schedule and for receiving, unloading, and handling items at the site. The Contractor is responsible for protecting Owner-installed items from damage, including damage from exposure to the elements, and to repair or replace items damaged as a result of his operations until turned over to the Owner. Owner installed items shall be turned over in good condition with all documentation.
- 1.8 General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. Only the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the project limits the Contractor's use of the premises. General: Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the public. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed. The driveways and entrances serving the premises should be clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site. Burial of

Waste Materials: Do not dispose of organic and hazardous material on site, either by burial or by burning. Use of the Existing Building: Maintain existing buildings in a weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period

- 1.9 Full Owner Occupancy: The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work. Contractor will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.
- 1.10 Comply with limitations on use of public streets and other requirements of authorities having jurisdiction. Limit work in existing buildings to normal business working hours of 7:00 a.m. to 5:00p.m., Monday through Friday, except as otherwise indicated. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under prior agreement and notification and then only after providing temporary utility services according to requirements indicated. Notify Owner not less than two days in advance of proposed utility interruptions. Obtain Owner's written permission before proceeding with utility interruptions. Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner. Notify Owner not less than two days in advance of proposed disruptive operations. Obtain Owners written permission before proceeding with disruptive operations. Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes. Use of controlled substances on the Project site is not permitted. Contractor to provide employee identification tags for Contractor personnel working on the Project site. Coordinate with Owner on type of tags acceptable. Require personnel to utilize identification tags at all times. Comply with Owner's requirements regarding drug and background screening of Contractor personnel working on the Project site. Maintain list of approved screened personnel with Owner's Representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 010000

## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Project information.
- 2. Work covered by Contract Documents.
- 3. Owner-furnished/Owner-installed (OFOI) products.
- 4. Coordination with occupants.
- 5. Work restrictions.

- B. Related Requirements:

- 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
- 2. Section 017300 "Execution" for coordination of Owner-installed products.

#### 1.3 DEFINITIONS

- A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

#### 1.4 PROJECT INFORMATION

- A. Project Identification: 22057.00.

- 1. Project Location: 851 Main Campus Dr., Raleigh, North Carolina, 27695-7907, United States.

- B. Owner: NC State University ,851 Main Campus Dr., Raleigh, United States.

- C. Architect: Hanbury.

- 1. Architect's Representative: Hanbury.

- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

- 1. MEP Engineering : McKim & Creed .

## 1.5 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
1. Existing building systems modified to support new equipment and exhaust needs. Architectural work including selective demolition of storefront glazing systems and the addition of a standard stud wall with door system. Finishes to be patched and repaired to match existing condition.
- B. Type of Contract:
1. Project will be constructed under a single prime contract.

## 1.6 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFICI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
  2. Provide for delivery of Owner-furnished products to Project site.
  3. Upon delivery, inspect, with Contractor present, delivered items.
    - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
  4. Obtain manufacturer's inspections, service, and warranties.
  5. Inform Contractor of earliest available delivery date for Owner-furnished products.
- B. Contractor's Responsibilities: The Work includes the following, as applicable:
1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
  2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
  3. Receive, unload, handle, store, protect, and install Owner-furnished products.
  4. Make building services connections for Owner-furnished products.
  5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
  6. Repair or replace Owner-furnished products damaged following receipt.

## 1.7 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

- A. The Owner will furnish and install products indicated.

## 1.8 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy Project site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

#### 1.9 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
  1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: The Contractor may establish a work schedule of their own choosing. 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. There are no restrictions regarding work hours. NC State reserves the right to limit the Contractor's activities when they conflict with NC State operations. These operations include but are not limited to the following: examination periods (typically for two weeks in December and two weeks in May), athletic events, and student move in/move out days. During these times, the Contractor may be required to cease all construction activities, limit activities to on-site only, modify working hours or restrict noise-making activities as determined by NC State. .
- C. Smoking and Controlled Substance Restrictions: Use of tobacco products , alcoholic beverages, and other controlled substances on Owner's property is not permitted.
- D. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- E. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
  1. Maintain list of approved screened personnel with Owner's representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Document 002600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
  - 2. Section 012100 "Allowances" for products selected under an allowance.
  - 3. Section 012300 "Alternates" for products selected under an alternate.
  - 4. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use form that is part of web-based Project management software .
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.



- b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
  - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES .
  - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

## 1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Substitution request is fully documented and properly submitted.
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after commencement of the Work . Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - b. Requested substitution does not require extensive revisions to the Contract Documents.
  - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - d. Substitution request is fully documented and properly submitted.
  - e. Requested substitution will not adversely affect Contractor's construction schedule.
  - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - g. Requested substitution is compatible with other portions of the Work.
  - h. Requested substitution has been coordinated with other portions of the Work.
  - i. Requested substitution provides specified warranty.

- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Digital project management procedures.
  - 5. Web-based Project management software package.
  - 6. Project meetings.
- B. Related Requirements:
  - 1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
  - 2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
  - 5. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

#### 1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: 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. Include the following information in tabular form:

1. Name, address, telephone number, and email address 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, 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, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

#### 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
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.

## 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated 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. 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 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 Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. 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. 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.
  3. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.

- d. Location of pull boxes and junction boxes, dimensioned from column center lines.
  4. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  5. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
  2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
  3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
  4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
  5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
  6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
  7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.
- D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format:
    - a. Same digital data software program, version, and operating system as original Drawings.
    - b. DWG DXF DGN , Version 2018 or later , operating in Microsoft Windows operating system.
  2. File Submittal Format: Submit or post coordination drawing files using PDF format.
  3. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    - b. Digital Data Software Program: Drawings are available in PDF, DWG, OR RVT .
    - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
  2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Owner name.
  3. Owner's Project number.
  4. Name of Architect.
  5. Architect's Project number.
  6. Date.
  7. Name of Contractor.
  8. RFI number, numbered sequentially.
  9. RFI subject.
  10. Specification Section number and title and related paragraphs, as appropriate.
  11. Drawing number and detail references, as appropriate.
  12. Field dimensions and conditions, as appropriate.
  13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  14. Contractor's signature.
  15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 5 business days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.



- d. Requests for coordination information already indicated in the Contract Documents.
  - e. Requests for adjustments in the Contract Time or the Contract Sum.
  - f. Requests for interpretation of Architect's actions on submittals.
  - g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect or Construction Manager of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly . Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number, including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's and Construction Manager's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within three days if Contractor disagrees with response.
- 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES
- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
  2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
  3. Digital Drawing Software Program: Contract Drawings are available in PDF and DWG .
  4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
    - a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

- B. Web-Based Project Management Software Package: Use Architect's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
1. Web-based Project management software includes, at a minimum, the following features:
    - a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    - c. Document workflow planning, allowing customization of workflow between project entities.
    - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    - e. Track status of each Project communication in real time, and log time and date when responses are provided.
    - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    - g. Processing and tracking of payment applications.
    - h. Processing and tracking of contract modifications.
    - i. Creating and distributing meeting minutes.
    - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    - k. Management of construction progress photographs.
    - l. Mobile device compatibility, including smartphones and tablets.
  2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
  3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## 1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long lead items.
    - e. Designation of key personnel and their duties.
    - f. Lines of communications.
    - g. Use of web-based Project software.
    - h. Procedures for processing field decisions and Change Orders.
    - i. Procedures for RFIs.
    - j. Procedures for testing and inspecting.
    - k. Procedures for processing Applications for Payment.
    - l. Distribution of the Contract Documents.
    - m. Submittal procedures.
    - n. Sustainable design requirements.
    - o. Preparation of Record Documents.
    - p. Use of the premises and existing building.
    - q. Work restrictions.
    - r. Working hours.
    - s. Owner's occupancy requirements.
    - t. Responsibility for temporary facilities and controls.
    - u. Procedures for moisture and mold control.
    - v. Procedures for disruptions and shutdowns.
    - w. Construction waste management and recycling.
    - x. Parking availability.
    - y. Office, work, and storage areas.
    - z. Equipment deliveries and priorities.
    - aa. First aid.
    - bb. Security.
    - cc. Progress cleaning.
  3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Sustainable design requirements.
    - i. Review of mockups.
    - j. Possible conflicts.
    - k. Compatibility requirements.
    - l. Time schedules.
    - m. Weather limitations.
    - n. Manufacturer's written instructions.
    - o. Warranty requirements.
    - p. Compatibility of materials.
    - q. Acceptability of substrates.
    - r. Temporary facilities and controls.
    - s. Space and access limitations.
    - t. Regulations of authorities having jurisdiction.
    - u. Testing and inspecting requirements.
    - v. Installation procedures.
    - w. Coordination with other work.
    - x. Required performance results.
    - y. Protection of adjacent work.
    - z. Protection of construction and personnel.
  3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 15 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned

- parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of Record Documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Procedures for completing and archiving web-based Project software site data files.
    - d. Submittal of written warranties.
    - e. Requirements for completing sustainable design documentation.
    - 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. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    - k. Submittal procedures.
    - l. Owner's partial occupancy requirements.
    - m. Installation of Owner's furniture, fixtures, and equipment.
    - n. Responsibility for removing temporary facilities and controls.
  4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Status of sustainable design documentation.
      - 5) Deliveries.
      - 6) Off-site fabrication.
      - 7) Access.

- 8) Site use.
  - 9) Temporary facilities and controls.
  - 10) Progress cleaning.
  - 11) Quality and work standards.
  - 12) Status of correction of deficient items.
  - 13) Field observations.
  - 14) Status of RFIs.
  - 15) Status of Proposal Requests.
  - 16) Pending changes.
  - 17) Status of Change Orders.
  - 18) Pending claims and disputes.
  - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings at biweekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site use.

- 8) Temporary facilities and controls.
  - 9) Work hours.
  - 10) Hazards and risks.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of RFIs.
  - 14) Proposal Requests.
  - 15) Change Orders.
  - 16) Pending changes.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

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

#### 1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from 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 waste 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 of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- G. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation into products or raw materials.
- H. Salvage: Recovery of demolition or construction waste for reuse in the existing facility, a different facility, subsequent sale as State Surplus property or other reuse efforts.



- I. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- J. Yard Waste: A solid waste consisting solely of vegetative matter resulting from landscaping and maintenance.

#### 1.4 MATERIALS OWNERSHIP

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

#### 1.5 ACTION SUBMITTALS

- A. The Contractor must provide a Waste Management Plan to NC State for approval prior to implementing work. The plan shall include details on how the hazardous and non hazardous 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.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Reporting Requirements
  - 1. Hazardous Waste
    - a. 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.
  - 2. Non-Hazardous C&D Waste
    - a. All reuse, recycling, and landfilled materials are to be tracked and complied on NC State's tracking forms, which can be found at <https://recycling.ncsu.edu/wp-content/uploads/sites/3/2018/04/CD-Tracking-forms-for-upload.pdf>. The completed form, with weight tickets/invoices attached, is considered a required close-out document and must be submitted before final payment is issued.
- B. Qualification Data: For Waste Reduction and Recycling Office .

PART 2 - PRODUCTS

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.

3.2 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, resin, 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 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: <https://go.ncsu.edu/demodebris>

- 1. Containers used for waste storage must be United State 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. 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 or all waste shipped.

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### 3.3 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 (ajbensle@ncsu.edu) for assistance with disposition. Examples of Salvageable 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. The materials include, but are not limited to ceiling tiles, carpet tiles, and cubical 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 a 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
3. 100% of the following materials must be recycled:
  - a. Cardboard
  - b. Bottles and cans
  - c. Scrap metal and wire
  - d. Concrete
  - e. Asphalt (pavement and shingles)
  - f. Aggregate
  - g. Brick and CMU

#### C. Priority 3 - Disposal of Construction and Demolition Waste

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1. If material/s cannot be salvaged for reuse or source separated and recycled, they must be sent to a C&D recycling facility. Materials are not to be sent directly to a landfill or a facility that does not sort and recycle.
- D. All solid waste management facilities must be permitted to operate by NCDEQ in accordance with 15A NCAC 13B .0201
- E. University Contract Pricing
1. When available, the contractor may utilize University contract pricing for related facility tip costs or recycling rebates. In order to utilize contracts, contractor must coordinate with the University project manager and Waste Reduction and Recycling office.
- F. University Rolloff Services
1. Depending upon the scale of the work, dumpster services can be provided for Informal or Formal construction projects. Coordinate with NCSU Waste Reduction and Recycling to provide 17-20 cubic yard rolloffs. Rental and contact information; <https://recycling.ncsu.edu/rentals/>

END OF SECTION 017419

## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final Completion procedures.
  - 3. List of incomplete items.
  - 4. Submittal of Project warranties.
  - 5. Final cleaning.
  
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
  - 2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
  - 3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 5. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

#### 1.2 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

#### 1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. 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.
  - a. 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.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

## 1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

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

## 1.8 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, , listed by room or space number.
  2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.
  4. Submit list of incomplete items in the following format:
    - a. MS Excel Electronic File: Architect will return annotated file.

## 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
1. Submit by email to Architect.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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



1. Use cleaning products that 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: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site 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 exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
    - i. Vacuum and mop concrete.
    - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.
    - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - l. Remove labels that are not permanent.
    - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    - p. Clean ducts, blowers, and coils.

- 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
  - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
  - r. Clean strainers.
  - s. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

### 3.2 CORRECTION OF THE WORK

- A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Emergency manuals.
  - 3. Systems and equipment operation manuals.
  - 4. Systems and equipment maintenance manuals.
  - 5. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

#### 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. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit on digital media acceptable to Architect or by email to Architect. Enable 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 and Commissioning Authority 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 Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. 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: Bookmark 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.

#### 1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: 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 Construction Manager.
  - 7. Name and contact information for Architect.
  - 8. Name and contact information for Commissioning Authority.

9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  10. 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. 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."
- 1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL
- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
  2. 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.
  3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- 1.8 EMERGENCY MANUALS
- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- C. 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. Water leak.
4. Power failure.
5. Water outage.
6. System, subsystem, or equipment failure.

D. 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.

E. 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.

#### 1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

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

B. 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. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. 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.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. 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.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

#### 1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

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

B. 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 warranties and bonds as described below.

C. 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.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
  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.
- E. 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.
- F. 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.
- G. 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.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. 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.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.



1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. 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.
- C. 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.
- D. 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.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

## SECTION 024119 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

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

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.

#### 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 store.
- 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.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site .

1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

#### 1.5 INFORMATIONAL SUBMITTALS

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

#### 1.6 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.
  1. Before selective demolition, Owner will remove the following items:
    - a. Any existing items not intended for demolition .
- 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. Hazardous materials will be removed by Owner before start of the Work.
  - 2. 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.

## 1.7 COORDINATION

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

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

### 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.

### 3.4 PROTECTION

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

### 3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 5. Maintain adequate ventilation when using cutting torches.
  - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  9. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Store items in a secure area until delivery to Owner.
  3. Protect items from damage during transport and storage.
- 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 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### 3.7 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 024119

## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section includes:

1. Interior custom hollow-metal doors and frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

C. General Requirements:

1. Doors in high-traffic areas, loading docks, operating rooms and corridors should be designed to include stainless door edge guards and protection plates on both sides. The frame and door hardware shall be designed to accept this additional weight. On all doors that are designed to include a door closer, specify on the hardware schedule the degree of opening desired. Identify special opening requirements as applicable. In rooms accessed by carts, beds and other items, offset-type hinges shall be installed to increase the size of the opening.
2. Electronic code locks shall be recessed in the wall to eliminate the potential of damage from rolling carts and equipment.
3. Double doors are not recommended because of the problems involved in securing these doors. Where double doors are required, a removable astragal should be used between the doors to provide safety. All exterior doors and jambs should be hollow metal (steel) or aluminum and glass (storefront and curtain wall systems). Steel doors shall be a minimum of 16 gauge; jambs shall be a minimum of 14 gauge. Aluminum doors in storefront and curtain wall systems shall be medium stile type; narrow stile doors are not acceptable. All exterior handicap door access operator switches must be completely protected from the weather.

#### 1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/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 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

#### 1.5 INFORMATIONAL SUBMITTALS

#### 1.6 CLOSEOUT SUBMITTALS

#### 1.7 QUALITY ASSURANCE

#### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and 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 doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Steelcraft; an Allegion brand.



## 2.2 PERFORMANCE REQUIREMENTS

### 2.3 INTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

- A. Hollow-Metal Doors and Frames: NAAMM-HMMA 860; ANSI/SDI A250.4, Physical Performance Level A. At locations indicated in the Door and Frame Schedule .
1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
    - d. Edge Construction: Continuously welded with no visible seam.
    - e. Core: Steel stiffened.
  2. Frames:
    - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
    - b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
    - c. Construction: Face welded .
  3. Exposed Finish: Prime.

### 2.4 FRAME ANCHORS

- A. Jamb Anchors:
1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
  2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
  3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

### 2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

## 2.6 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. 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. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with or mitered hairline joints.
  - 1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
  - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

## 2.7 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with ANSI/SDI A250.3.
  1. Color and Gloss: As selected by Architect from manufacturer's full range .

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 .
  1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
    - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    - b. Install frames with removable stops located on secure side of opening.
  2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
  3. Floor Anchors: Secure with postinstalled expansion anchors.
  4. Solidly pack mineral-fiber insulation inside frames.
  5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
  6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors.
  7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

- b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
- 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 .
  - 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
  - 3. Smoke-Control Doors: Install doors in accordance with NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "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.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

## SECTION 081416 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Five-ply flush wood veneer-faced doors for transparent finish.
- 2. Factory finishing flush wood doors.
- 3. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Requirements:

- 1. Section 088000 "Glazing" for glass view panels in flush wood doors.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:

- 1. Door core materials and construction.
- 2. Door edge construction
- 3. Door face type and characteristics.
- 4. Door louvers.
- 5. Door trim for openings.
- 6. Door frame construction.
- 7. Factory-machining criteria.
- 8. Factory- specifications.

- B. 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:

- 1. Door schedule indicating door location, type, size, fire protection rating, and swing.
- 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
- 3. Details of frame for each frame type, including dimensions and profile.
- 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
- 5. Dimensions and locations of blocking for hardware attachment.
- 6. Dimensions and locations of mortises and holes for hardware.
- 7. Clearances and undercuts.
- 8. Requirements for veneer matching.
- 9. Apply Program label to Shop Drawings.

- C. Samples for Initial Selection: For factory-finished doors.

1.4 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: Program certificates.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Certification: Licensed participant in.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.2 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Doors:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Lambton Doors.
    - b. Masonite Architectural.
    - c. VT Industries Inc.
  - 2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
  - 3. Performance Grade:
    - a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
  - 4. Architectural Woodwork Standards Grade: Premium.
  - 5. Faces: Single-ply wood veneer not less than 1/50 inch thick.
    - a. Species: White oak.
    - b. Cut: Plain sliced (flat sliced).
    - c. Match between Veneer Leaves: Book match.

- d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
  - e. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
  - f. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."
6. Exposed Vertical Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.
- a. 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: 550 lbf in accordance with WDMA T.M. 10.
7. Core for Non-Fire-Rated Doors:
- a. ANSI A208.1, Grade LD-1 particleboard.
  - b. Glued wood stave.
  - c. WDMA I.S. 10 structural composite lumber.
    - 1) Screw Withdrawal, Door Face: 475 lbf.
    - 2) Screw Withdrawal, Vertical Door Edge: 550 lbf 475 lbf.
  - d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

## 2.3 FABRICATION

- A. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
  - 3. Louvers: Factory install louvers in prepared openings.

## 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 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

- C. Install frames level, plumb, true, and straight.
1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
  2. Anchor frames to anchors or blocking built in or directly attached to substrates.
    - a. Secure with countersunk, concealed fasteners and blind nailing.
    - b. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
      - 1) For factory-finished items, use filler matching finish of items being installed.
  3. Install fire-rated doors and frames in accordance with NFPA 80.
  4. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:
1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
    - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
  2. Machine doors for hardware.
  3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  4. Clearances:
    - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    - d. Comply with NFPA 80 for fire-rated doors.
  5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416



## SECTION 087100 - DOOR HARDWARE

### PART 1 - PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes:

- 1. Mechanical and electrified door hardware for:
  - a. Swinging doors.

- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
- 2. Cabinets (casework), including locks in cabinets
- 3. Signage
- 4. Toilet accessories
- 5. Overhead doors

#### 1.3 REFERENCES

- A. UL - Underwriters Laboratories

- 1. UL 10B - Fire Test of Door Assemblies
- 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
- 3. UL 1784 - Air Leakage Tests of Door Assemblies
- 4. UL 305 - Panic Hardware

- B. DHI - Door and Hardware Institute

- 1. Sequence and Format for the Hardware Schedule
- 2. Recommended Locations for Builders Hardware
- 3. Key Systems and Nomenclature

- C. ANSI - American National Standards Institute

- 1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

#### 1.4 SUBMITTALS

- A. General:

- 1. Submit in accordance with Conditions of Contract and Division 01 requirements.

2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

**B. Action Submittals:**

1. **Product Data:** Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. **Riser and Wiring Diagrams:** After final approval of hardware schedule, submit details of electrified door hardware, indicating:
  - a. **Wiring Diagrams:** For power, signal, and control wiring and including:
    - 1) Details of interface of electrified door hardware and building safety and security systems.
    - 2) Schematic diagram of systems that interface with electrified door hardware.
    - 3) Point-to-point wiring.
    - 4) Risers.
3. **Samples for Verification:** If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
  - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. **Door Hardware Schedule:** Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
  - a. Door Index; include door number, heading number, and Architects hardware set number.
  - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
  - c. Type, style, function, size, and finish of each hardware item.
  - d. Name and manufacturer of each item.
  - e. Fastenings and other pertinent information.
  - f. Location of each hardware set cross-referenced to indications on Drawings.
  - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - h. Mounting locations for hardware.
  - i. Door and frame sizes and materials.
  - j. Name and phone number for local manufacturer's representative for each product.
  - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
    - 1) **Submittal Sequence:** Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
5. **Key Schedule:**
  - a. All keying shall be provided by NCSU Lockshop

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product Certificates for electrified door hardware, signed by manufacturer:
  - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
3. Certificates of Compliance:
  - a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
  - b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in "QUALITY ASSURANCE" article, herein.
  - c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
  - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
  - b. Catalog pages for each product.
  - c. Name, address, and phone number of local representative for each manufacturer.
  - d. Parts list for each product.
  - e. Final approved hardware schedule, edited to reflect conditions as installed.
  - f. Final keying schedule
  - g. Copies of floor plans with keying nomenclature
  - h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
  - i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
  1. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural

Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
  2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
  4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
    - a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
  2. Can provide installation and technical data to Architect and other related subcontractors.
  3. Can inspect and verify components are in working order upon completion of installation.
  4. Capable of producing wiring diagrams.
  5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.
- E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
  2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

- H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- I. Keying Conference:
  - 1. Owner to conduct keying conference inviting required attendees as needed.
- J. Pre-installation Conference: Conduct conference at Project site.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Inspect and discuss preparatory work performed by other trades.
  - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
  - 4. Review sequence of operation for each type of electrified door hardware.
  - 5. Review required testing, inspecting, and certifying procedures.
- K. Coordination Conferences:
  - 1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
    - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
    - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
  - 2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
    - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Architect and Contractor.
    - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
  - 1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
  - 1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
  - 2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Direct shipments not permitted, unless approved by Contractor.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Final Acceptance, for durations indicated.

a. Closers:

1) Mechanical: 30 years.

b. Exit Devices:

1) Mechanical: 3 years.

2) Electrified: 1 year.

c. Locksets:

1) Mechanical: 10 years.

2) Electrified: 1 year.

d. Continuous Hinges: Lifetime warranty.

e. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.9 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents in quantities as determined by Owner.

B. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.2 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

## 2.3 HINGES

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series
2. Acceptable Manufacturers and Products: Hager BB series, Stanley FBB Series

### B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
  - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
  - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
  - a. Exterior: Heavy weight, stainless steel, 4-1/2 inches (114 mm) high
  - b. Interior: Heavy weight, steel, 4-1/2 inches (114 mm) high
4. 2 inches or thicker doors:
  - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
  - a. Steel Hinges: Steel pins
  - b. Non-Ferrous Hinges: Stainless steel pins
  - c. Out-Swinging Exterior Doors: Non-removable pins
  - d. Out-Swinging Interior Lockable Doors: Non-removable pins
  - e. Interior Non-lockable Doors: Non-rising pins
7. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.

## 2.4 MORTISE LOCKS

### A. Manufacturers and Products:

1. Owner Preferred Manufacturer and Product: Best 45H Series, Schlage L9000 series
2. Acceptable Manufacturers and Products: Dorma ML 9000 series

### B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.



4. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
  - a. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

## 2.5 CYLINDERS

### A. Manufacturers:

1. Owner Preferred Manufacturer: Schlage

### B. Requirements:

1. Provide small format interchangeable core (SFIC) cylinders/cores zero bitted with uncut key blanks to match Owner's existing Schlage key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.
  - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
    - 1) 3 construction control keys
    - 2) 12 construction change (day) keys.
  - b. Provide and install construction cores for electronic wireless locks supplied by Security Contractor.
  - c. Provide permanent cores, zero bitted, to Owner as directed.
  - d. Owner will replace temporary construction cores with permanent cores.

## 2.6 KEYING

### A. Keying to be performed by Owner.

1. Provide Uncut keys with the following features:
  - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
  - b. Patent Protection: Keys and blanks protected by one or more utility patent(s) the year, 2029.
2. Quantity: Furnish in the following quantities.
  - a. 3 per cylinder/core.

## 2.7 DOOR CLOSERS

### A. Manufacturers and Products:

1. Owner Preferred Manufacturer and Product: LCN 4010/4110 series
2. Acceptable Manufacturers and Products: Sargent 281/281P10 series factory assembled (without PRV), Norton 9500/PR9500 series (without PRV).

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter, with 5/8 inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.8 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

## 2.9 PROTECTION PLATES

### A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

### B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges, with countersunk screw holes as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
  - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

## 2.10 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

### A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent

### B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

## 2.11 DOOR STOPS AND HOLDERS

### A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

### B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

## 2.12 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

### A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Reese

### B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
  - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
  - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

## 2.13 SILENCERS

### A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

### B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

## 2.14 FINISHES

### A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)

8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
  1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
  2. Field modify and prepare existing door and frame for new hardware being installed.
  3. When modifications are exposed to view, use concealed fasteners, when possible.
  4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
    - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

#### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  2. Custom Steel Doors and Frames: HMMA 831.
  3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  - 1. Provide construction cores for any lock provided by security provider.
  - 2. Furnish permanent cores zero bitted to Owner for keying.
- I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:
  - 1. Conduit, junction boxes and wire pulls.
  - 2. Connections to and from power supplies to electrified hardware.
  - 3. Connections to fire/smoke alarm system and smoke evacuation system.
  - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
  - 5. Testing and labeling wires with Architect's opening number.
- J. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- K. Closer/holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed on door and system headend details.
  - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

- N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- Q. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

### 3.4 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  - 1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.
  - 2. Owner will inspect door hardware and provide final punch list prior to Building Occupancy inspection.

### 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. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Final Acceptance, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, 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. Provide training for 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 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

END OF SECTION 087100



## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Non-load-bearing steel framing systems for interior partitions.
  2. Suspension systems for interior ceilings and soffits.
  3. Grid suspension systems for gypsum board ceilings.

#### 1.2 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For embossed, high-strength steel studs and tracks and , from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

#### 1.3 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association or the Supreme Steel Framing System Association.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- C. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.

- D. Design framing systems to accommodate deflection of primary building structure and construction tolerances.

## 2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with AISI S220 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C645 AISI S220 requirements for metal unless otherwise indicated
  - 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
    - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: AISI S220.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CEMCO; California Expanded Metal Products Co.
    - b. ClarkDietrich.
    - c. Jaimes Industries, Inc.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
  - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
  - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive

materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
  - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
  - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
  - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
  - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
  - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
  - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
  - 1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
1. Screw to wood framing.
  2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
  2. Carrying Channels (Main Runners): 48 inches o.c.
  3. Furring Channels (Furring Members): 24 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards .
  3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Do not attach hangers to steel roof deck.
  5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

- D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

#### 1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Gypsum ceiling board.

#### 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.
- 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. Gypsum Wallboard: ASTM C1396/C1396M.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Gypsum.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Thickness: 1/2 inch.
- B. Gypsum Board, Type X: ASTM C1396/C1396M.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Gypsum.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Thickness: 5/8 inch.
- C. Gypsum Ceiling Board: ASTM C1396/C1396M.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Gypsum.
    - b. National Gypsum Company.
    - c. USG Corporation.
  - 2. Thickness: 1/2 inch.
  - 3. Long Edges: Tapered.

## 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 ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. 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- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber,



including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM 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.
- K. 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. Wallboard Type: As indicated on Drawings .
- 2. Type X: As indicated on Drawings Where required for fire-resistance-rated assembly .
- 3. Ceiling Type: As indicated on Drawings .

- B. Single-Layer Application:

- 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
- 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
  - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
- 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

### 3.4 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 092900

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## SECTION 095123 - ACOUSTICAL TILE CEILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Acoustical tiles for interior ceilings.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
  - 2. Product Data: For adhesives, indicated VOC content.
- C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Ceiling suspension-system members.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
  - 5. Size and location of initial access modules for acoustical tile.
  - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
    - a. Lighting fixtures.
    - b. Diffusers.
    - c. Grilles.
    - d. Speakers.
    - e. Sprinklers.
    - f. Access panels.
    - g. Perimeter moldings.
  - 7. Show operation of hinged and sliding components adjacent to acoustical tiles.
  - 8. Minimum Drawing Scale: 1/8 inch = 1 foot .

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, 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 tiles, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile 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.
  - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations:
  - 1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Acoustical panel ceilings shall consist of panels with a maximum size of 2 feet x 4 feet x 1 1/2"inch thick. Tiles shall be non-directional with no less than one-half tile width at perimeters. Panels shall generally be a non-directional fissured design, unless special design is necessary to a feature area. Panels shall be smooth vinyl or mylar-faced when used in high-moisture locations such as food preparation and toilet areas. Ceiling tile and grid design where required shall be fire rated along with the total ceiling or roof assembly design. All corridors and exit areas shall have a minimum one hour design rating as required by building code.
- B. Concealed spline ceilings are not recommended but if necessary, they shall be provided with adequate access panels for use by maintenance personnel. Exposed grid shall be electro-galvanized steel with white enamel exposed surfaces, except in high-moisture areas where ceiling tile panels are not recommended (and plaster or gypsum board should be considered). Return air plenums above the ceiling are not recommended but where employed, hold-down clips shall be provided at ceiling panels. Ceiling cavity as return air plenums may not be used in institutional occupancy. Corner trim shall be provided where grid changes direction at wall. The Consultant shall carefully consider the placement of light fixtures in the ceiling tile pattern in

order to avoid cutting grid members and shall provide adequate support for the grid and light fixtures through the use of main support runners. Light fixtures, smoke detectors, sprinkler heads, speakers and fire horns shall be centered within tiles.

## 2.3 ACOUSTICAL TILES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Armstrong World Industries, Inc. or approved equal to match existing construction.
- B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide tiles as follows:
1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular .
  2. Pattern: Match existing construction at 2008 renovation.
- D. Color: As selected from manufacturer's full range .
- E. Light Reflectance (LR): Not less than 0.80 .
- F. Ceiling Attenuation Class (CAC): Not less than 25 40 .
- G. Recycled Content (RC): Not less than 71%
- H. Noise Reduction Coefficient (NRC): Not less than .80 .
- I. Edge/Joint Detail: As indicated by manufacturer's designation .
- J. Thickness: 5/8 inch .
- K. Modular Size: As indicated on Drawings .
- L. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.4 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong Ceiling & Wall Solutions.
  2. Rockfon; ROCKWOOL International.
  3. USG Corporation.

- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C 635/C 635M.
  - 1. ACT Grid: Galvanized steel 1-1/2" Deep x 15/16" flange.
  - 2. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.
- C. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.
  - 1. Structural Classification: Intermediate -duty system.
  - 2. Access: Upward and end pivoted or side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
    - a. Initial Access Opening: In each module, As indicated on Drawings .

## 2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.

## 2.6 MISCELLANEOUS MATERIALS

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles 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 tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles 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 OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. 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.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly 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.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. 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.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

- B. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

- E. Arrange directionally patterned acoustical tiles as follows:
  - 1. As indicated on reflected ceiling plans.
- F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.
  - 1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
  - 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.

### 3.4 INSTALLATION OF DIRECTLY ATTACHED ACOUSTICAL TILE CEILINGS

- A. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical units.
- B. Arrange directionally patterned acoustical tiles as indicated on Drawings .

### 3.5 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet , non-cumulative.

### 3.6 ADJUSTING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Thermoset-rubber base.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Environmental Product Declaration: For each product.
- C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- D. 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 long.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

#### 1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive resilient products during the following periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.



- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

### 2.2 THERMOSET-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flexco; Roppe Holding Company.
  - 2. Johnsonite; a Tarkett company.
  - 3. Roppe Corporation; Roppe Holding Company.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
  - 1. Style and Location:
    - a. Style A, Straight: Provide in areas with carpet .
    - b. Style B, Cove: Provide in areas with resilient floor coverings and As indicated on Drawings .
- C. Thickness: 0.125 inch.
- D. Height: 4 inches /.
- E. Lengths: Coils in manufacturer's standard length .
- F. Outside Corners: Job formed .
- G. Inside Corners: Job formed .
- H. Colors: As indicated on Drawings .

### 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. 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 Insert value> g/L or less.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. 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.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as 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: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
  - a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
  - a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Tightly adhere to substrates throughout length of each piece.
2. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 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 Substantial Completion.

END OF SECTION 096513

## SECTION 099123 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
  - 1. Concrete masonry units (CMUs).
  - 2. Gypsum board.

#### 1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.

1.5 QUALITY ASSURANCE

1.6 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.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore & Co.
  - 2. PPG Paints.
  - 3. Sherwin-Williams Company (The).
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

- A. Substrate preparation is of utmost importance. Surfaces shall be adequately prepared for painting by filling, scraping, sanding, caulking, priming, cleaning or brushing; the presence of any moisture in areas to be painted is unacceptable. The campus currently uses 1) Glidden, 2) Sherwin-Williams and 3) Pittsburg Paints, in this preferential order, as a basis of color and paint selection. Paint for use in renovation projects where the adjacent areas are occupied shall be low odor, low VOC emitting; ICI/Glidden Lifemaster 2000 or equivalent. Paint manufacturers with colors compatible with existing colors or paint types can be used with approval of the Owner. Although epoxy paint is desirable in high-moisture or high-traffic areas, its curing time and odor must be taken into account for use in potentially sensitive areas. Prefinished (factory finished) items shall not be painted. Fire protection devices shall not be painted.
- B. General areas and paint requirements for new surfaces (minimum requirements) are as follows:
  - 1. Elevator Machine Room, Hoistway and Pit Equipment shall be painted with one coat of primer and two alkyd resin semi-gloss or gloss finish coats.
  - 2. Telephone Rooms shall be painted with one coat of primer and one coat flat enamel or fire-retardant paint when required.

- C. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- D. Material Compatibility:
  - 1. Materials for use within each paint system shall be 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, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
  - 3. Exterior Ferrous Metal (rails or steel lintels) shall be painted with rust-inhibitive primer over shop primer and a minimum of two coats oil base gloss enamel.
  - 4. Door Frames shall be painted with rust-inhibitive primer (if metal) over shop coat and two coats semi-gloss enamel (alkyd or latex base, depending on area and use).
  - 5. Interior Plaster or Gypsum Wallboard (drywall) shall be painted with primer and two coats of eggshell or semi-gloss enamel, depending on area.
  - 6. Interior Ceilings (plaster or gypsum ceiling board) shall be painted with primer and two coats of eggshell enamel.
  - 7. Interior Masonry shall be painted with latex block filler and two coats of eggshell or semi-gloss enamel, depending on area.
  - 8. Interior Ferrous Metal shall be painted with primer over shop coat and two coats alkyd base semi-gloss enamel.
  - 9. Interior Wood Doors and Trim shall be natural or stained finish (Golden Oak preferred).
- E. Colors: As selected by Architect from manufacturer's full range .

### 2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
  - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  - 2. Testing agency will perform tests for compliance with product requirements.
  - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## 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. Gypsum Board: 12 percent.
2. Plaster: 12 percent.

- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. 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 Architectural Painting Specification Manual" 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 if any.
- C. Clean substrates of substances that could impair 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. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  1. Use applicators and techniques suited for paint and substrate indicated.
  2. 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.
  3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. 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.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. 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.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in equipment rooms:
    - a. .
  - 2. Paint the following work where exposed in occupied spaces:
    - a. .
  - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 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.

### 3.5 INTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
  - 1. Latex System MPI INT 4.2A:
    - a. Intermediate Coat: Latex, interior, matching topcoat.
    - b. Topcoat: Latex, interior, flat (MPI Gloss Level 1) , MPI #53.
    - c. Topcoat: Latex, interior (MPI Gloss Level 2) , MPI #44.
    - d. Topcoat: Latex, interior (MPI Gloss Level 3) , MPI #52.
    - e. Topcoat: Latex, interior (MPI Gloss Level 4) , MPI #43.
    - f. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5) , MPI #54.
    - g. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees) , MPI #114.
  - 2. High-Performance Architectural Latex System :
    - a. Block Filler: Block filler, latex, interior/exterior , MPI #4.



- b. Prime Coat: Primer, alkali resistant, water based , MPI #3.
- c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
- d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2) , MPI #138.
- e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3) , MPI #139.
- f. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4) , MPI #140.
- g. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5) , MPI #141.

**B. Gypsum Board and Plaster Substrates:**

- 1. Latex over Latex Sealer System MPI INT 9.2A:
  - a. Prime Coat: Primer sealer, latex, interior , MPI #50.
  - b. Intermediate Coat: Latex, interior, matching topcoat.
  - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1) , MPI #53.
- 2. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:
  - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC , MPI #149.
  - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
  - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1).  
1) .
  - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2).  
1) .
  - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3).  
1) .
  - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4).  
1) .
  - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5).  
1) .
  - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6).  
1) .

END OF SECTION 099123

DIVISION 21 – TABLE OF CONTENTS

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21 11 04	HANGERS AND SUPPORTS FOR FIRE PROTECTION PIPING AND EQUIPMENT
21 23 13	WET PIPE SPRINKLER SYSTEMS



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## SECTION 210501 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Drawings and general provisions of the contract documents including General and Supplementary Conditions and Division 00 and 01 Specification sections apply to all work in this section.
- B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 21 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 21 specifications contain statements more definitive or more restrictive.
- C. Nothing herein contained shall be so construed to relieve the Contractor from doing his work according to the true intent and meaning of these drawings and specifications. He will be held to provide and install all materials and equipment and shall furnish all labor necessary for the complete, prompt, and satisfactory execution of the work. He is also responsible for the proper coordination of his work with all other trades.
- D. The Contractor shall bear all expenses incidental to the satisfactory completion of the work contained in these specifications and drawings.

#### 1.2 SCOPE

- A. Perform work and provide material and equipment as shown on Drawings and/or as specified and/or indicated in this Section of the Specifications. Completely coordinate work of Divisions 21 with work of other trades and provide a complete and fully functional installation.
- B. Drawings and Specifications form complementary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices, and materials obviously necessary for a sound, secure and complete installation.
- C. It is the intent that these Specifications and Drawings are to establish minimum requirements for methods, products, and equipment and to provide electrical service, distribution and systems finished, tested and ready for operation. Incidental detail not usually shown or specified, but necessary for proper installation and operation shall be included in the work and this Contractor's estimate, the same as if specified. Locations of all equipment and material shall be adjusted at no extra cost to the Owner, to accommodate the work interferences anticipated and/or encountered. Prior to installation, determine the exact route and location of each raceway and piece of equipment to minimize conflicts with other trades.
- D. Give notices, file plans, obtain permits and licenses, pay fees and back-charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in

accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

- E. Division 21 Contractor shall furnish all motor starters and disconnect switches as required by NEC for motors, unless specifically noted otherwise in the specifications or on the drawings. Motor starters and disconnect switches shall be in accordance with Division 26 Specifications.
- F. Work consists of furnishing all labor, material, equipment, and services necessary and reasonably incidental to the proper completion and proper operation of the fire protection systems. The work shall consist of but shall not necessarily be limited to the following:
  - 1. Automatic wet pipe sprinkler systems in the buildings as indicated, including hydraulic calculations.
  - 2. Wet pipe automatic sprinkler systems as specified in Section 212313.
  - 3. Piping materials and installation instructions common to most piping systems.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
- G. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 21 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 21 specifications contain statements more definitive or more restrictive.
- H. Nothing herein shall be so construed to relieve the Contractor from doing his work according to the true intent and meaning of the drawings and specifications. He will be held to provide and install all materials and equipment, and shall furnish all labor necessary for the complete, prompt, and satisfactory execution of the work. Also, he is responsible for properly coordinating his work with all other trades.
- I. The contractor shall bear all expenses incidental to the satisfactory completion of the work contained in these specifications and drawings.
- J. The Contractor shall coordinate water service requirements in accordance with the local water utility regulations, including required permits, backflow preventers, meters, piping, valves, bypasses, supports and other accessories.
- K. The contractor shall perform a two-hydrant flow test on the portion of the public water system serving the project site. This flow test shall conform to the requirements defined in NFPA 13 and shall identify the location of the tested hydrants and their relationship to the location of the water supply tap. The elevation of the test hydrants as it related to the Project shall be included. The time of day of the test shall also be recorded. This test shall be coordinated with and conform to the requirements of the local authority having jurisdiction. This flow test shall be used as the hydraulic basis for all fire protection systems included in the Project. The flow test shall be made prior to the development of sprinkler system shop drawings and system hydraulic calculations. All cost associated with the flow test shall be paid by the contractor. The flow test shall be submitted to the Architect and Engineer within ninety (90) days of notice to proceed.
- L. The Contractor shall affix the seal of the registered professional engineer or the NICET Level III designer to all submitted system drawings and hydraulic calculations as required by the State of North Carolina General Statutes.

M. Related Sections:

1. Division 03 - Concrete Forming and Accessories.
2. Division 09 - Painting and Coating.

1.3 DEFINITIONS AS USED IN THESE SPECIFICATIONS

- A. "Provide," means "furnish and install".
- B. "Furnish" means "to purchase and deliver to the project site complete with every necessary appurtenance and support".
- C. "Install" means "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.
- D. "Architect" means the "Prime Design Consultant," and if United Engineering Group, Inc. is not the prime design consultant, the Architect may authorize United Engineering Group to act on the Architect's behalf in matters concerning the Division 21 series of specifications.
- E. "RFI" means Contractor's "Request for Information".
- F. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- G. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- H. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- I. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- J. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- K. The following are industry abbreviations for plastic materials:
1. Retain abbreviations that remain after this Section has been edited.
  2. ABS: Acrylonitrile-butadiene-styrene plastic.
  3. CPVC: Chlorinated polyvinyl chloride plastic.
  4. PE: Polyethylene plastic.
  5. PVC: Polyvinyl chloride plastic.
- L. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 CONTRACT DOCUMENTS

- A. Listing of Drawings does not limit responsibility of determining full extent of work required by these Contract Documents. Refer to Architectural, HVAC, Plumbing, Fire Protection, Electrical, Structural, Site Utility and all other Drawings and other Sections that indicate types of construction in which work shall be installed and work of other trades with which work of Division 21 must be coordinated.
- B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.
- D. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, the contractor shall provide all other components and materials necessary to make the systems fully complete and operational.
- E. Information and components shown on riser diagrams but not shown on plans, and vice versa, shall apply or be provided as if expressly required on both.
- F. Data that may be furnished electronically by the Architect (on computer tape, diskette, or otherwise) is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not substitute for Architect's sealed or stamped construction documents.

#### 1.5 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are ambiguous, the contractor shall advise the Architect in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or ambiguities thus resolved.
- B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Architect in writing before installation. Otherwise, make changes in installed work as Architect requires within Contract Price.
- C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specifications, this contractor shall provide that material, installation, or work which is of the higher, more stringent standard.
- D. It is a requirement of these Contract Documents to have the contractor provide systems and components that are fully complete, operational, and suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building

elements. In cases such as this, where the Contractor has failed to notify the Architect of the situation in accordance with Paragraph (A) above, the Contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.

- E. In cases covered by Paragraph (D) above, where the Contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Architect shall review and advise the contractor of the disposition.

#### 1.6 MODIFICATIONS IN LAYOUT

- A. Fire Protection Drawings are diagrammatic. They indicate general arrangements of fire suppression systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.
- B. In order to obtain the Architect's desired aesthetics in spaces used by building occupants, in all such spaces, prior to installation of visible material and equipment (including access panels) review Architectural Drawings for desired locations and where not definitely indicated, request information from Architect.
- C. Check Contract Documents, as well as Submittals and Shop Drawings of all subcontractors to verify and coordinate spaces in which work of Divisions 21 will be installed.
- D. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.
- E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C and D above. Systems shall be run in a rectilinear fashion.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.

#### 1.7 REQUESTS FOR INFORMATION (RFIs)

- A. If the RFI is a request to resolve a conflict or an ambiguity, or a request for additional detail, Contractor's RFI shall include a sketch or equivalent description of Contractor's proposed solution, in accordance with paragraphs 1.5 (E) and 1.6 (F) above.
- B. To expedite the flow of RFI's, for all RFI's under Divisions 21, Contractor shall submit the attached form, or similar form including the same information, to the Architect, with copy to United Engineering Group. Contractor shall include proposed solution in the indicated space on the form.

#### 1.8 REFERENCES

- A. The Contractor shall comply with all laws, ordinances, and regulations of all authorities having jurisdiction, including those of all applicable city, county, state, federal and public utility entities.

The Contractor shall obtain all licenses, permits, etc. and shall pay all associated connection fees, tapping fees, inspection fees, etc. This cost shall be included in the contract price.

B. The publications listed below form a part of this specification. All publications shall be the latest edition as adopted by the authority having jurisdiction. The publications are referred to in the text as necessary. The minimum standard of work under this contract shall be in accordance with the following model building codes and standards.

1. North Carolina State Building Codes:
  - a. Building Code – 2012 edition.
  - b. Fire Prevention Code – 2012 edition.
2. National Fire Protection Association:
  - a. NFPA 13 - Standard for the Installation of Sprinkler Systems. 2013.
  - b. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems, 2013.
  - c. NFPA 20 - Standard for the Installation of Centrifugal Fire Pumps, 2013.
  - d. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 2013.
  - e. NFPA 70 - National Electrical Code.
3. North Carolina Department of Insurance:
  - a. Requirements for Automatic Sprinkler Systems.
4. American Bearing Manufacturers Association:
  - a. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
5. Air Movement and Control Association International, Inc.:
  - a. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
6. American National Standards Institute (ANSI):
  - a. ANSI A21.4 / AWWA C104 – Cement Mortar Lining for Ductile-Iron Pipe.
  - b. ANSI A21.11 / AWWA C111 – Rubber Gasket Joints for Ductile-Iron Pipe.
  - c. ANSI A21.51 / AWWA C151 – Ductile-Iron Pipe.
  - d. ANSI B16.4 – Cast Iron Screwed Fittings.
  - e. ANSI B16.12 – Cast Iron Drainage Fittings, Threaded.
  - f. ANSI B16.15 – Pipe Fittings, Bronze, and 250 lb. Cast.
  - g. ANSI B16.18 – Cast Copper Alloy Solder-Joint Pressure Fittings.
  - h. ANSI B16.22 – Solder-Joint Fittings, Pressure Wrought Copper and Copper Alloy.
  - i. ANSI B16.23 – Cast Copper Alloy Solder-Joint Drainage Fittings.
  - j. ANSI B16.24 – Bronze Pipe Flanges and Flanged Fittings.
  - k. ANSI B16.29 - Solder-joint fittings, Drainage, DWV Wrought Copper and Copper Alloy.
  - l. ANSI S1.4 - Sound Level Meters.
  - m. ANSI S1.8 - Reference Quantities for Acoustical Levels.
  - n. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
  - o. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.
7. Air-Conditioning and Refrigeration Institute:



- a. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.
8. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
- a. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
  - b. ASHRAE Handbook - HVAC Applications.
9. American Society of Mechanical Engineers (ASME):
- a. ASME A13.1 - Scheme for the Identification of Piping Systems.
  - b. ASME B31.9 - Building Services Piping.
  - c. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
  - d. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
  - e. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
  - f. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - g. ASME B16.25 - Butt-welding Ends.
  - h. ASME B16.3 - Malleable Iron Threaded Fittings.
  - i. ASME B16.4 - Gray Iron Threaded Fittings.
  - j. ASME B16.5 - Pipe Flanges and Flanged Fittings.
  - k. ASME B16.9 - Factory-Made Wrought Steel Butt-welding Fittings.
  - l. ASME B31.1 - Power Piping.
  - m. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
  - n. ASME B40.1 - Gages - Pressure Indicating Dial Type - Elastic Element.
  - o. ASME - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels.
  - p. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
10. American Society of Testing and Materials (ASTM) International:
- a. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - b. ASTM A106 - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
  - c. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
  - d. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
  - e. ASTM A795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
  - f. ASTM B32 - Standard Specification for Solder Metal.
  - g. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
  - h. ASTM B247 - Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
  - i. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  - j. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.
  - k. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
  - l. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - m. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
  - n. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.

- o. ASTM E596 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures.
  - p. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
  - q. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
11. American Welding Society:
- a. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
  - b. AWS D1.1 - Structural Welding Code – Steel.
12. American Water Works Association (AWWA):
- a. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
  - b. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - c. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
13. International Electrical Testing Association:
- a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
14. Intertek Testing Services (Warnock Hersey Listed):
- a. WH - Certification Listings.
15. Manufacturers Standardization Society of the Valve and Fittings Industry:
- a. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  - b. MSS SP 67 - Butterfly Valves.
  - c. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
  - d. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
  - e. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - f. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
  - g. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
  - h. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
  - i. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
16. National Electrical Manufacturers Association:
- a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - b. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
  - c. NEMA MG 1 - Motors and Generators.
17. National Fire Protection Association:
- a. NFPA 13 - Installation of Sprinkler Systems.
  - b. NFPA 13R - Standard for Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height.
  - c. NFPA 14 - Standard for the Installation of Standpipe, Private Hydrants and Hose Systems.
  - d. NFPA 20 - Standard for the Installation of Centrifugal Fire Pumps.

- e. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
  - f. NFPA 70 - National Electrical Code.
  - g. NFPA 72 - National Fire Alarm Code.
  - h. NFPA 99 - Standard for Health Care Facilities.
  - i. NFPA 2001 - Clean Agent Fire Extinguishing Systems.
18. Underwriter Laboratories, Inc.:
- a. UL 263 - Fire Tests of Building Construction and Materials.
  - b. UL 393 - Indicating Pressure Gages for Fire-Protection Service.
  - c. UL 404 - Gages, Indicating Pressure, for Compressed Gas Service.
  - d. UL 448 - Pumps for Fire Protection Service.
  - e. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
  - f. UL 778 - Motor Operated Water Pumps.
  - g. UL 1478 - Fire Pump Relief Valves.
  - h. UL 1479 - Fire Tests of Through-Penetration Firestops.
  - i. UL 1887 - Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.
  - j. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
  - k. UL - Fire Protection Equipment Directory.
  - l. UL - Fire Resistance Directory.
  - m. Warnock Hersey - Certification Listings.

#### 1.9 SUBMITTALS

- A. Section 210502 – Fire Protection Shop Drawings and Submittals, Substitutions and O&M Manuals.
- B. The Contractor shall submit Certificates of Compliance for the following:
  - 1. Schedule of UL listed through penetration assemblies.

#### 1.10 ELECTRICAL EQUIPMENT

- A. Refer to Section 210503 of this manual for the requirements relating to electrical equipment.

#### 1.11 CONTROL WIRING

- A. Refer to Section 210503 of this manual for the requirements relating to wiring.

#### 1.12 QUALITY ASSURANCE

- A. The Contractor shall coordinate his work with that of the other trades. Where interference with other trades occurs, the Contractor shall present his solutions to the Professional. The Professional shall make the final decision regarding changes to be made in the work.
- B. The Contractor shall thoroughly familiarize himself with all specifications and drawings for the project so that he clearly understands his responsibility in relationship to the work to be performed.

The Contractor shall plan and perform his work so as to permit the use of the building at the earliest possible date.

- C. The Contractor shall guarantee all work, materials, and equipment, furnished against defects, leaks, performance and non-operation for a period of one (1) year after the date of the Owner's final acceptance. Defects shall be interpreted as defective materials or equipment or unsatisfactory installation and are not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by these defects within the period covered by the guarantee, including all incidental work required to correct the deficiency.
- D. The Contractor shall expressly and completely follow all manufacturers' instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance, and adjustments of the equipment.
- E. The Contractor is responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the contract documents.
- F. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code—Steel".
- G. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications":
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- H. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.13 CLOSEOUT SUBMITTALS

- A. Division 01- Execution and Closeout Requirements.
- B. Project Record Documents: Record actual locations of components and tag numbering.
  - 1. Changes from the contract drawings necessary to coordinate the work with other trades, to conform to the building conditions or to conform to the rules and regulations of authorities having jurisdiction shall be made only after obtaining written permission from the Professional.
  - 2. The Contractor shall keep a record of construction changes and deviations from the original contract drawings. All changes shall be recorded on a separate set of prints, which shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed. Documentation shall include the following:
    - a. Location and elevation of new and existing utility lines.
    - b. Points of connection to existing utility lines.
    - c. Changes in pipe routing location.
    - d. Valve locations.
    - e. Equipment locations, etc.

- f. Actual capacities and values of equipment provided as indicated in equipment schedules.
- 3. The marked up record set of drawings shall be delivered to the Professional before final acceptance of the fire protection contract work.
- 4. Operation and Maintenance Data: Submit spare parts lists.

1.14 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code - Steel".
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Fire Protection Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Maintain one copy of each document on site.

1.15 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.
- C. The Contractor shall be licensed by the North Carolina State Board of Examiners of Plumbing, Heating, and Fire Sprinkler Contractors. The contractor may be required to furnish evidence of satisfactory performance on previous sprinkler system installations of equivalent size, type, and complexity.

1.16 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.
- C. The Contractor is responsible to verify the location of any and all existing underground utilities in the vicinity of his work. When it has been indicated that these utilities are to remain in place, the Contractor shall provide adequate means of support and protection during excavation operations.

- D. Before ordering any equipment and material, or performing any work, the Contractor shall verify all measurements and dimensions at the job site. The Contractor is responsible for the correctness of this information.
- E. No extra compensation will be considered based on differences between actual dimensions and measurements and those indicated on the drawings.
- F. Any differences identified by the Contractor shall be submitted to the Professional for consideration before proceeding with the work.

1.17 DELIVERY, STORAGE AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Deliver and store valves in shipping containers, with labeling in place.
- C. At his own expense, the Contractor shall protect his work, materials or equipment that is subjected to damage during the project duration. All openings into any piping, ducts or equipment shall be securely covered, or otherwise protected, to prevent injury due to carelessly or maliciously dropped tools or materials, grit, dirt, or any foreign material. The Contractor is responsible for all damage until his work is fully and finally accepted.
- D. The Contractor is responsible to provide protection for motors, pumps, electrical equipment, and all similar items of equipment from dirt, grime, plaster, water, etc. during all phases of construction. This protection shall be provided by covering equipment with transparent plastic sheeting and/or locating the materials and equipment in an area free from the elements.
- E. Furnish cast iron and steel valves with temporary protective coating.
- F. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.18 COORDINATION

- A. All existing service utilities shall remain active during the construction. Any service underground, aboveground, interior, or exterior damaged, broken, or otherwise rendered inoperative during the course of construction due to activities on the part of the Contractor shall be properly repaired by the Contractor, at his own expense. The method used in repairing, replacing, or maintaining the services shall be submitted to the Professional for review and approval.
  - 1. The Contractor shall schedule his work to avoid any major interruption of any utility services.
  - 2. Existing utilities serving occupied facilities shall not be interrupted except when such interruptions have been authorized in writing by the Owner or the Professional. Interruptions may occur only after acceptable, temporary utility services have been provided. The Contractor shall provide a minimum of ten (10) working days' notice to the Professional and receive written notice to proceed before interrupting any utility.

- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 - Access Doors and Frames.

1.19 PAINTING

- A. All exposed piping within finished areas shall be painted to match the adjacent surfaces. Refer to the architectural finish schedules for color selections.
- B. Properly prepare all surfaces before applying paint. Remove all foreign material and clean surface to be painted according to the paint manufacturer's recommendations.
- C. Apply proper primers and sealers as recommended by paint manufacturer.
- D. Refer to Division 09 – Painting for additional information regarding materials and requirements.
- E. All sprinkler heads installed in the piping system to be painted shall be covered with protective baggies by the fire sprinkler contractor as they are installed. Once the painting is complete the baggies shall be removed as directed by the contractor. Any painted or damaged sprinkler heads shall be replaced at no additional cost to the Owner.
- F. Refer to Division 21 Sections for additional information regarding the painting of piping.

1.20 RELATED WORK

- A. All work related to providing complete fire protection systems and equipment is the responsibility of the Contractor. The following related work shall be provided as indicated in other specification divisions, unless noted otherwise, but shall remain the responsibility of the Contractor for workmanship and completeness.
  - 1. General Contractor:
    - a. Installation of access panels.
    - b. Final painting of existing walls, floors, and ceilings where the surfaces are being refinished and remodeled under the General Contract. Refer to General Construction Drawings.
  - 2. Mechanical Contractor:
    - a. Coordinate equipment, ducts, and pipes for interference with fire protection system installation and performance.
  - 3. Electrical Contractor:
    - a. Verification of the proper rotation of three-phase equipment, and making modifications as required correcting improper rotation.

- b. Installation of all combination starters/disconnects and overload protectors.
- c. Coordinate equipment, ducts, and pipes for interference with fire protection system installation and performance.

1.21 MISCELLANEOUS STEEL AND ACCESSORIES

- A. The Contractor shall provide all necessary steel angles, channels, pipe, rods, nuts, bolts, etc., as shown on plans, as specified, or as may be required for complete and proper installation of plumbing fixtures, systems, and equipment. All material and workmanship shall be of the best quality and shall be installed in accordance with the best practices of the trade.

1.22 CLEANUP

- A. The Contractor shall maintain buildings, grounds, and public properties free from accumulations of waste materials, debris, and rubbish. At reasonable intervals during the progress of work, and when directed by the Owner's authorized representative, the site and public properties shall be cleaned. All waste materials, debris, and rubbish shall be disposed of in appropriate manner. The Contractor shall provide containers for collection of waste materials, debris, and rubbish. Waste materials, debris, and rubbish shall be removed from the job site and legally disposed of at a landfill area in accordance with all applicable regulations. Burning or burying waste materials, debris, or rubbish on project site is prohibited.
- B. At the completion of the project, the Contractor shall remove waste materials, rubbish, tools, equipment, machinery, surplus materials, etc., and clean all sight exposed fire protection fixtures and equipment. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight exposed fire protection fixtures and equipment. Broom clean paved and concrete surfaces. Rake clean other ground surfaces. Repair, patch and touch up marred surfaces to the specified finish or to match adjacent surfaces.

1.23 INSPECTION AND TESTING

- A. New fire protection systems and parts of existing systems, which have been altered, extended, or repaired, shall be tested to disclose leaks and defects.
- B. The Contractor shall develop a written test procedure for the Project. This procedure shall meet the requirements defined in NFPA 13. The test procedure shall be submitted to the Design Team for review a minimum of four (4) weeks before any testing begins.
- C. The sprinkler system testing shall include all of the system components including flow switches and tamper switches. The system shall be complete including the interfaces with the building fire alarm system prior to any system demonstrations.
- D. The Contractor shall notify the Professional a minimum of five (5) working days prior to testing to coordinate the testing and inspection procedures.
- E. If the Professional determines that the fire protection systems do not pass the prescribed tests, then the Contractor shall be required to make the necessary repairs, at his own expense, and the Contractor shall re-inspect and re-test the systems. Repairing, inspection, and testing shall be continued until all systems pass as determined by the Professional.



- F. All new, altered, extended, or replaced fire protection shall be left uncovered and unconcealed until it has been inspected, tested and accepted by the Professional. Where such work has been covered or concealed before it has been inspected, tested, and accepted, it shall be uncovered by the Contractor, at his own expense as directed by the Professional.
- G. All equipment, material, labor, etc. required for testing the fire protection systems shall be furnished by the Contractor.

1.24 INSTRUCTION OF THE OWNER

- A. After acceptance of the Project, the Contractor shall furnish the services of personnel thoroughly familiar with the completed installation to instruct the Owner in the proper operation and maintenance of all equipment and appurtenances provided.
- B. The Contractor shall provide the Owner with two weeks advance notice before the instruction session.

1.25 CUTTING, PATCHING, FINISHING

- A. Unless otherwise noted, the Contractor shall cut, patch, and finish all chases and openings required for the installation of work to be performed under this Contract. All patching and finishing shall match existing adjacent undisturbed surfaces.
- B. Cutting shall not cause damage to the building or leave unsightly surfaces. The Contractor is responsible for the repair of these conditions.
- C. The Contractor shall contact the holder of the roofing guarantee and obtain his written approval before cutting the roofing membrane.
- D. No structural member shall be cut.
- E. Penetrations made in existing fire rated chases, partitions, floors, etc. shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.
- F. All materials and methods to be used for patching and repairing shall be subject to the approval of the Professional and the Owner's Authorized Representative.
- G. The Contractor shall set all sleeves, hangers, and anchors required for the Fire Protection Contract work and shall be responsible for their proper and permanent location.
- H. No cutting shall be done which may affect the building structurally or architecturally without first securing the approval of the Professional. Cutting shall be accomplished in such a manner as not to cause damage to the building or leave unsightly surfaces, which cannot be concealed by plates, escutcheons, or other construction. Where such unsightly conditions are caused, the Contractor shall be required, at his own expense, to repair the damaged areas.
- I. Cutting of the construction excessively or carelessly done shall be repaired to match the original work by the Contractor and to the satisfaction of the Professional who will make the final decision with respect to excessive or careless cutting work. The Contractor shall seal all openings he has made in plenum spaces, fire rated floors, ceilings or partitions after his work has been installed.

The material used for sealing the openings shall have a fire rating equal to or greater than the rating of the floor, ceiling, or partition material.

- J. Where present equipment is removed and unused openings remain in walls, floors, partitions, etc., the Contractor shall properly patch all such openings except as specified under "Work by Others." All patching and repairing shall be done by workmen skilled in this type of work and shall match present or new finishes.
- K. Cutting, patching, and repairing of openings in the existing exterior walls and roof shall be by the General Contractor.

#### 1.26 CHASES AND OPENINGS

- A. All chases and openings required for the installation of the work shall be coordinated with the other trades. The Contractor shall provide the other trades with sufficient time (one (1) week minimum) for coordination of all chases and openings. The Contractor shall be responsible for all work required cutting and patching the required openings. The work shall be performed to the satisfaction of the Professional.
- B. Penetrations made in fire rated chases, partitions, floors, etc. shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.
- C. The Contractor shall provide all sleeves, hangers, and anchors required for installation of the work in chases and openings.

### PART 2 - PRODUCTS

#### 2.1 PIPE, TUBE, AND FITTINGS

- A. All materials used on fire protection systems shall meet the requirements of applicable codes, standards, and requirements of local authorities having jurisdiction and the Owner's insurance carrier.
- B. Refer to individual Division 21 Sections for pipe, tube, and fitting materials and joining methods.

#### 2.2 SLEEVES, MECHANICAL SLEEVE SEALS, ESCUTCHEONS, AND GROUT

- A. Refer to individual Division 21 Sections.

#### 2.3 PIPE HANGERS AND SUPPORTS

- A. Refer to Section 211104 – HANGERS AND SUPPORTS.

### PART 3 - EXECUTION

### 3.1 GENERAL

- A. All materials, equipment and accessories specified in this section shall be installed in strict accordance with NFPA 13, NFPA 14, NFPA 20, and North Carolina Department of Insurance.
- B. All piping in finished areas shall be run concealed. The Contractor shall furr in piping or provide soffit as required and in accordance with the Professional's instructions. All piping shall be installed as required to suit space available in building structure, above suspended ceilings, and other locations found necessary for installation. Install piping as high as possible.
- C. The Contractor shall not install any piping that will interfere with any lights, openings, doors, windows, ductwork, equipment, and existing or special conditions. Headroom in front of openings, doors, or windows shall not be less than the top of the opening. Provide all piping offsets necessary to avoid interference with other work. Piping offsets shall include all devices and assemblies necessary to accommodate the change in direction of the piping.
- D. All piping shall run straight with no more couplings and joints than necessary, shall be grouped wherever practical and shall be carefully installed to provide for proper alignment slope and expansion.
- E. Pipes carrying fluids shall not be installed in transformer vaults, electrical equipment rooms, elevator hoistways, elevator equipment rooms, or similar areas having a collection of electrical equipment. Pipes shall not be installed over, around, in front of, in back of, or directly below, electrical controls, panels, switches, terminals, boxes, or similar electrical equipment.
- F. All materials and equipment used shall be installed in strict accordance with the Standards under which the materials are accepted and approved, and in strict accordance with the manufacturer's instructions.
- G. The contract documents are not intended to indicate every bend, offset, change in direction or appurtenance required to provide a complete and workable system.
- H. The contract drawings are diagrammatic and are indicative of the work to be performed. It is not intended that they show every pipe, fitting or apparatus required for a complete installation.
- I. Except where otherwise indicated, minimum cover of exterior piping shall not be less than three (3) feet.

### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. All piping shall be installed with not less than 2-inches between finish covering of pipe and all other work or piping.
- E. Reduction in sizes of pipes shall be made with reducing fittings. Bushings will not be permitted.

- F. Bullhead connections in any piping service are prohibited.
- G. All screwed joints shall be made with a non-corrosive, non-hardening compound or Teflon tape applied on the male thread only. All compounds must be approved for the pipe on which they are used. Pipe ends shall be reamed or filed out to size of bore and all chips and cuttings removed. Ends of pipe must be cut square so as to seat in the bottom of the recess in drainage fittings. In making joints in chromium plated brass pipe no more than one thread shall remain exposed when joint is completed. Caulking of screwed joints is not permitted. Pipe joint cement and paint will be permitted only on external threads.

### 3.3 INSTALLATION

- A. Install piping in accordance with NFPA 13 for sprinkler systems, NFPA 14 for standpipe and hose systems, NFPA 20 for fire pump, and NFPA 24 for service mains.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install pipe sleeve at piping penetrations through footings, partitions, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping. Riser clamps at exposed locations shall be of such design as to avoid creating a hazardous or unsightly condition and stay within space limitations. Pipe supports are required at the base of all vertical risers and shall be of riser size.
- H. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.

### 3.4 SLEEVES

- A. Sleeves shall be provided for all pipes passing through walls, partitions, floor slabs or roof slabs. Sleeves shall be cut flush with wall, floor or ceiling surfaces except that sleeves through waterproofed roof or floor slabs shall extend above the finished surface. Sleeves shall be sufficient size to allow a sealable annular space between the sleeve and the pipe or between the sleeve and the pipe insulation. All exposed piping passing through floors, walls or ceiling shall be provided with a chrome escutcheon plate securely fastened around the pipe. The annular space around the pipe in non-water-proof sleeves shall be filled with penetration sealant and smoothed out flush with all surfaces.
- B. All pipe, tube, conduit, or similar through-penetrations of all fire rated walls, floor-ceiling, or roof-ceiling assemblies shall be provided with a fire stopping system to achieve a tight seal that will maintain the fire-resistant rating of the assembly containing the through-penetration. Fire stopping system may be sealant or mechanical type.

- C. Sleeves are not required for core-drilled holes.
- D. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2-inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2-inches above finished floor level. Refer to Division 07 – “Sheet Metal Flashing and Trim” for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 - "Joint Sealants" for materials and installation.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Refer to Division 07 - "Penetration Fire-stopping" for materials.

### 3.5 PAINTING AND IDENTIFICATION

- A. Painting:
  - 1. All painting shall be done in a careful, neat and workmanlike manner, with particular care being exercised to protect building equipment and finishes. All surfaces shall be thoroughly cleaned of rust, scale, dirt, grease, dust, and like items, and sanded so as to provide a bond for new paint. All painted surfaces under this Contract shall be finished in an acceptable manner.
  - 2. All steel piping, equipment, supports, hangers and other iron and steel work in crawl spaces that is not factory painted, coated, or galvanized, installed under this Contract, shall be painted with two (2) coats of Rust-Oleum rust preventative paint, or approved equal. First coat shall be Rust-Oleum No. X-60 red primer, or accepted substitute. The second coat shall be Rust-Oleum No. 634 black gloss, or accepted substitute.
- B. Pipe Identification:
  - 1. All piping shall be provided with identification markers. Markers shall be provided as follows:
    - a. On straight runs of piping at intervals not exceeding 20-feet.

- b. Within 2-feet of all elbows.
- c. Within 2-feet of all piping as it passes through partitions (markers provided on both sides of partitions).

C. Ceiling Panel Identification:

- 1. Provide colored plastic buttons and secure to lay-in ceiling tiles to identify access points for valves.

### 3.6 INTERFACE WITH OTHER PRODUCTS

A. Inserts:

- 1. Install inserts for placement in concrete forms.
- 2. Install inserts for placement in concrete forms.
- 3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4-inches.
- 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

### 3.7 PENETRATIONS AND ESCUTCHEONS

A. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

- 1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
- 2. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
- 3. Insulated Piping: One-piece, stamped-steel type with spring clips.
- 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- 5. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
- 6. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
- 7. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
- 8. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
- 9. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
- 10. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

### 3.8 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Clean entire system after other construction is complete.

END OF SECTION 210501

SECTION 210502 - FIRE PROTECTION SHOP DRAWINGS AND SUBMITTALS, SUBSTITUTIONS  
AND O&M MANUALS

PART 1 - GENERAL

1.1 REQUIREMENTS

- A. Drawings and general provisions of the contract documents including General and Supplementary Conditions and Division 00 and 01 Specification sections apply to all work in this section.
- B. All catalog data, shop drawings, calculations and certificates of compliance shall be submitted as a single package. Failure of the Contractor to provide a complete submittal package may result in delay in processing time. All such delays to the project resulting from the Contractor's failure to provide submittals at one time will be the responsibility of the Contractor.
- C. Fire Sprinkler Contractor: The Contractor shall submit working shop drawings, hydraulic calculations, and product data to the design engineer of record – quantities as listed in the General Conditions or as otherwise indicated in the Division 21 Specifications. Shop drawings should include and be in accordance with working plan requirements of chapter 22 of NFPA 13. Product data should include and identify all material, equipment, and accessory selections to be installed. The hydraulic calculations and shop drawings should be signed by the fire sprinkler designer and include the NC Fire Sprinkler Contractor (FS) license number.
- D. Project Engineer: The specifying engineer (PE) has primary responsibility for review and approval of fire suppression system shop drawings and hydraulic calculations. Specifying Engineer review shall determine compliance with applicable codes and standards and the project contract documentation. After completing this review, the Specifying Engineer sends one (1) copy with a signed cover letter, including printed reviewer name, summarizing the outcome to the State Construction Office for approval. If comments by the design engineer are minor in nature, the engineer may, at their discretion, forward the shop drawings to this office in parallel with comment resolution by the fire sprinkler contractor. All comments made by the designer should be forwarded to this office with the review package including comments from previous review iterations, if any.
  - 1. For mail by US Postal Service:
    - a. Assistant Director  
Design Review  
State Construction Office  
1307 Mail Service Center  
Raleigh, NC 27699-1307
  - 2. For Mail by UPS, FedEx, etc.
    - a. Assistant Director  
Design Review  
State Construction Office  
301 N. Wilmington Street, Suite 450  
Raleigh, NC 27601

- E. Once all comments are resolved and approved by SCO, an approval letter releasing this part of project to enter into construction will be sent to the Specifying Engineer. No other reviews are required after the receipt of this approval letter.

## 1.2 DEFINITIONS

- A. **Shop Drawings:** Project shop drawings and other data prepared specifically for fulfillment of the project requirements. Shop drawings include fabrication, layout, setting, installation, coordination and similar drawings and diagrams, and include performance data associated therewith, including weights, capacities, speeds, outputs, consumption, efficiencies, voltages, amperages, cycles, phases, noise levels, operating ranges, and similar information.
- B. **Samples:** Units of typical work, materials, or equipment items, showing the workmanship, pattern, trim and similar qualities proposed for the work to be provided, as designated.
- C. **Manufacturer's Data:** Product manufacturer's standard printed product information, including promotional brochures, product specifications, installation instructions and diagrams, statements of compliance with standard performance charts or curves, and similar information concerning the standard portions of the manufacturer's products.
- D. **Test Reports:** Specific reports prepared by independent testing laboratories and others, showing the results of specified testing on either the material/equipment provided or on identical material/equipment, and on installed electrical systems.
- E. **Industry Standards:** Printed copies of the current standards recognized in the industry. Current means the latest issue as of the date of these specifications, unless otherwise indicated; within the text of these specifications the date-suffix frequently shown with identification numbers has been omitted.
- F. **Manufacturer's Product Warranties:** Manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the Manufacturer, when and if the product fails within certain operational conditions and time limits.
- G. **Operating Instructions:** The written instructions by the manufacturers, fabricators, or installer of equipment or systems, detailing the procedures to be followed by the Owner in operation, control, and shutdown of each operating item of the equipment and each electrical system.
- H. **Maintenance Manuals:** The compiled information provided for the Owner that certain acts of restitution will be performed when and if certain portions of electrical work fail within certain operational conditions and time limits.
- I. **Final Inspection:** At the final inspection, the fire sprinkler contractor should have for review and closeout documentation all pertinent NFPA paperwork properly filled out on NFPA forms as applicable (NFPA 13, 14, 20, 24). The shop drawing approval letter from this office should be available. A set of as-built fire sprinkler shop drawings and hydraulic calculations shall be placed in a white PVC tube marked 'Fire Sprinkler Shop Drawings' and securely fixed in the fire sprinkler riser room.

## 1.3 SUBMITTAL FORM AND PROCEDURES



- A. General: Comply with Division 1 requirements for identification, quantities processing, scheduling, and similar general requirements, except as otherwise indicated. Submittals shall be complete, in one package, clearly identified and cross-referenced to the appropriate specification section defining the submitted item. Partial submissions will not be addressed. The Contractor is responsible for any delays caused by incomplete submittal packages.
- B. Quantities: Provide quantities as listed in the General Conditions or as otherwise indicated in the Division 21 Specifications.
- C. Presentation: Submittals shall be assembled in three ringed binders with each specification section separated by a tab on which the specification section is noted. The submittals shall be clearly marked indicating which specific item is being considered and all its related information. Submittals not complying with these requirements are subject to being returned without being reviewed.
- D. Should Contractor desire to substitute another manufacturer's equipment for one specified by name, the contractor shall apply in writing at least ten (10) days prior to bid date for such permission. He shall provide supporting data and samples for Engineers consideration. No substitution shall be made for any material, article, or process required under the contract unless approved by the Engineer.
- E. Any time that is required by the Engineer for a request to review submittals for substitute equipment after the award of bids will be billed to the contractor at the Engineer's current hourly billing rate. The Engineer's review time will be billed to the contractor whether the proposed substitution is accepted or rejected.
- F. Operating Instructions: The written instructions by the manufacturer, fabricator, or installer of equipment or systems, detailing the procedures to be followed by the Owner in operation.
- G. Response to Submittals: Where standard product data have been submitted in fulfillment of project requirements, it is recognized that the submitter has already determined that the products fulfill the specified requirements, and that the submittals are for the Architects' or Engineers' information only but will be returned without action where observed to be non-complying with the requirements. Where uniquely prepared information is submitted, it is recognized to represent the preparer's interpretation or solution to the specified requirements, subject to the Architects', or Engineers' concurrence and appropriate action as indicated in Division 01.
- H. Shop Drawings and Samples: After checking and verifying all field measurements, the Contractor shall submit to the Engineer for review, in accordance with the accepted schedule of shop drawings submissions, copies of all shop drawings, which shall have been checked by and stamped with the approval of the Contractor and identified as the Engineer may require. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable the Engineer to review the information as required.
- I. The Contractor shall also submit to the Engineer for review, with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples shall have been checked by and stamped with the approval of the Contractor, identified clearly as to material, manufacturer, any pertinent catalog numbers, and the use for which intended.
- J. At the time of each submission, the Contractor shall in writing call the Engineer's attention to any deviations that the shop drawings or sample may have from the requirements of the Contract Documents.

- K. No work requiring a shop drawing or sample submission shall be commenced until the submission has been reviewed by the Engineer. A copy of each shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.
- L. The Engineer's review of shop drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the Engineer's attention to such deviation at the time of submission and the Engineer has given written approval to the specific deviation, nor shall any review by the Engineer relieve the Contractor from responsibility for errors or omissions in the shop drawings.
- M. The Contractor's shop drawing stamp shall indicate that the shop drawings have been checked for conformity to the Contract Documents and appropriate means have been taken to ensure that the material and /or equipment will fit into the space available. Shop drawings will be returned without review if the submittals do not have the Contractor's stamp, or the submittals have not been reviewed by the Contractor.
- N. The Engineer's review of shop drawings is for general conformance with design concept only. The Contractor is responsible for all quantities, dimensions, and coordination of the work of all trades. Corrections or comments made on the shop drawing during this review do not relieve the contractor from compliance with requirements of the contract documents. The Contractor is responsible for selecting fabrication processes and techniques of construction and for performing all work in a safe and satisfactory manner.
- O. The Contractor shall stamp the shop drawings and submittals and verify by his/her signature that the shop drawings and submittals have been checked for compliance with the contract documents.
- P. The Contractor shall provide TABLE A as a cover letter with the submittals. The "Date Submitted" column shall be filled in by the Contractor. The remaining three columns are for the Engineer's use.

#### 1.4 GENERAL SUBMITTAL REQUIREMENTS

- A. Applicability: Wherever it is indicated that a shop drawing, sample, manufacturer's brochure, certification, test, copy of standard operating instruction, manual, extra stock, guarantee, or warranty is required, the appropriate submittal is required regardless of whether it is specified as a "submittal"; the Architects' or Engineers' decision shall be final. Include SCO ID number on all submittals including hydraulic calculations and product data.

#### 1.5 SUBSTITUTIONS

- A. Refer to the General Conditions for the requirements relative to substitutions.
- B. Substitutions: Fire Protection submittals are not opportunities for gaining acceptance of substitutions. Where three or more manufacturers are specified by name, or by catalog reference, Contractor shall select for use any of those so specified.
- C. Should Contractor desire to substitute another manufacturer's equipment for one specified by name, the contractor shall apply in writing at least ten (10) days prior to bid date for such

permission. He shall provide supporting data and samples for Engineers consideration. No substitution shall be made for any material, article, or process required under the contract unless approved by the Engineer.

- D. Any time that is required by the Engineer for a request to review submittals for substitute equipment after the award of bids will be billed to the contractor at the Engineers current hourly billing rate. The Engineers review time will be billed to the contractor whether the proposed substitution is accepted or rejected.

#### 1.6 OPERATION AND MAINTENANCE MANUALS

- A. Submit two (2) sets of 8-1/2" x 11" text as well as full-size drawings sixty (60) days prior to operator training/pre-final inspection bound in three D side ring capacity expansion binders with durable plastic covers for review by the Professional.
- B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed, or printed on thirty (30) pound white paper.
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Professional, Contractor, Subcontractors, and equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions arranged by system or process flow and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Maintenance instructions for equipment and systems.
    - e. Maintenance instructions for finishes, including recommended cleaning methods and materials and Operating instructions.
    - f. Special precautions identifying detrimental agents.
    - g. Special Requirements of other sections of this specification noted to be included in the operating and maintenance manual.
  - 3. Part 3: Project documents and certificates, including the following:
    - a. All approved Submittals.
    - b. Certificates of Compliance.
    - c. Photocopies of warranties and bonds.
    - d. Material safety data sheets.
- E. Submit five (5) copies of completed volumes in final form fifteen (15) days prior to owner training. These copies will include Professional's previous review comments.
- F. Submit eight final volumes revised, within ten (10) days after pre-final observation.

PART 2 - PRODUCTS (This Part Not Used)

PART 3 - EXECUTION (This Part Not Used)

END OF SECTION 210502

TABLE A - Shop Drawings Required

Shop Drawings and Submittals Required for this Project	Date Submitted by Contractor	Date Received by Engineer	Date Returned by Engineer	Status
21 05 01 – Common Work for Fire Suppression				
21 05 53 – Identification				
21 11 01 – Fire Protection Piping and Fittings				
21 11 04 – Hangers and Supports				
21 23 13 – Wet Pipe Sprinkler Systems				

I have reviewed the shop drawings and submittals listed above for compliance with the contract documents.

\_\_\_\_\_  
Contractor's Signature

## SECTION 211104 - HANGERS AND SUPPORTS FOR FIRE PROTECTION PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 00 and 01 are a part of these Specifications.

#### 1.2 SUMMARY

- A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Sleeves.
5. Mechanical sleeve seals.
6. Formed steel channel.
7. Firestopping relating to fire protection work.
8. Firestopping accessories.

- B. Related Sections:

1. Division 03 - Concrete Forming and Accessories.
2. Division 03 - Cast-In-Place Concrete.
3. Division 07 - Fire-stopping.
4. Division 07 - Joint Protection.
5. Division 09 - Painting and Coating.
6. Section 210501 - Common Work Results for Fire.
7. Section 211101 - Fire Protection Piping.

#### 1.3 REFERENCES

- A. Refer to Section 210501 for complete listing of references.

#### 1.4 DEFINITIONS

- A. Fire-stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

#### 1.5 SYSTEM DESCRIPTION

- A. Fire-stopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479, to achieve fire ratings of adjacent construction in accordance with FM or UL requirements.
- B. Surface Burning: ASTM E84 UL 723 with maximum flame spread / smoke developed rating of 25/50.
- C. Fire-stop interruptions to fire rated assemblies, materials, and components.

1.6 PERFORMANCE REQUIREMENTS

- A. Fire-stopping: Conform to applicable code (FM or UL) for fire resistance ratings and surface burning characteristics.
- B. Fire-stopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.7 SUBMITTALS

- A. Section 210502 – Fire Protection Shop Drawings and Submittals, Substitutions and O&M Manuals: Submittal procedures.
- B. Shop Drawings:
  - 1. Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers, metal framing systems, pipe stands and/or equipment supports.
  - 2. Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations.
- C. Product Data:
  - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
  - 2. Fire-stopping: Submit data on product characteristics, performance, and limitation criteria.
- D. Fire-stopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Manufacturer's Installation Instructions:
  - 1. Hangers and Supports: Submit special procedures and assembly of components.
  - 2. Firestopping: Submit preparation and installation instructions.
- F. Welding certificates.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.8 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code—Steel".
  - 2. AWS D1.2, "Structural Welding Code—Aluminum".
  - 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel".
  - 4. ASME Boiler and Pressure Vessel Code: Section IX.
- B. Through Penetration Fire-stopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
  - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
  - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.
- G. Perform Work in accordance with State, Federal and local standards approved by the Authority Having Jurisdiction.
- H. Maintain one copy of each document on site.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with a minimum three years' experience.

1.10 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.12 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply fire-stopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3-days after installation of fire-stopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.

1.13 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.14 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Install in accordance with NFPA 13 for sprinkler systems.
- B. Install hangers to with minimum ½-inch space between finished covering and adjacent work.
- C. Where hanger rods are longer than 18-inches, provide lateral bracing at every fourth hanger. Do not support piping by wire, rope wood or other makeshift device. Provide additional steel supports where building construction does not permit the hanger spacing as specified in the schedules. Location and details shall be submitted to the Professional for review.
- D. Roller type supports shall be used for pipes subject to axial movement. Brace so movement occurs in roller rather than support rod.



- E. Where loading exceeds the safe allowable limit for any single insert, then multiple inserts shall be installed spaced no less than 12-inches on centers. The multiple inserts shall be connected with suitable size steel angles and locking bolts.
- F. Place hangers within 12-inches of each horizontal elbow.
- G. Use hangers with 1½-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
- H. Where fastenings are required in steel stud, wire lath or other non-masonry construction, a "J" hook and holding lock washer and nut shall be used which shall fasten to the opposite stud edge to which the item will abut. If the location of the fastening is not a steel stud, a structural steel shape shall be fastened to the wall with bolt and holding nut, with the fastening extension through the wall. The use of toggle bolts will not be permitted.
- I. Prime coat exposed steel hangers and supports. Refer to Division 09 - Painting. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Division 09 – Painting.
- K. Do not penetrate building structural members unless indicated.
- L. The Contractor shall furnish and install all supports, hangers, inserts and fasteners for the items incidental to the work in the construction of the project. Supports and hangers shall be provided to suit specific conditions for the type of construction. The method adopted shall be subject to the approval of the Professional.
- M. Supports shall secure pipes in place, prevent swaying and vibration, maintain required grading, provide free expansion, and shall have a neat appearance. Supports shall be selected for strength and service and installed in a manner, which will not stress building construction. A five (5) to one (1) safety factor relative to the gross weight of piping system including fluid shall be used in the selection of the supports.
- N. Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing. Only use inserts for suspending hangers from concrete slabs. Use beam clamps for suspending hangers from building steel. Do not hang one pipe from another. Do not use perforated band iron, wire, or chain as hangers. Do not use vertical expansion shields. Do not hang from joist bridging.
- O. Fastenings installed in masonry walls shall be galvanized u-bolts set in the construction during erection.
- P. Steel frame Construction:
  - 1. Support piping systems, devices, and equipment from structural steel members or secondary fabricated supports. Hanging from corrugated metal deck is prohibited.
  - 2. Where metal tabs integral with the metal deck are provided, support of piping, ductwork, devices, and equipment from system to the maximum of the equivalent of a 10-foot length of 4- inch diameter, Schedule 40 section of pipe filled with water, or 6-inch diameter cast iron drainage pipe. Where tabs projecting down from the metal deck

system are not available, inserts for concrete deck construction shall be installed. Inserts in poured concrete slabs shall be iron, fabricated galvanized iron or steel of the type to receive a machine bolt head or nut after installation and shall permit adjustment of this bolt in one horizontal direction.

Q. Reinforced Concrete Construction:

1. Where concrete members support concrete roof or floor construction, support piping systems, devices, and equipment from roof to floor construction by use of concrete slab inserts.
2. Inserts in poured concrete slabs shall be iron or fabricated galvanized iron or steel of the type to receive a machine bolt head or nut after installation and shall permit adjustment of this bolt in one (1) horizontal direction. Inserts shall be accurately located before the concrete is poured.
3. Piping, tanks, and equipment shall be adequately supported either by suspension from the construction above or by means of struts or brackets to the construction below or to the side.
4. Before drilling any concrete for attachments, installer shall carefully check concrete drawings and shop drawings and shall locate drilled holes to avoid reinforcing by at least 1 inch.
5. Hangers shall be installed in accordance with the HANGER AND ROD SCHEDULE.

HANGER AND ROD SCHEDULE

Nominal Pipe Diameter (Inches)	Steel Pipe Spacing (Feet)	Rod Size (Inches)	CPVC Pipe Spacing (Feet)	Rod Size (Inches)
1/2	5	3/8	5	3/8
3/4	6	3/8	5'-6"	3/8
1	7	3/8	6	3/8
1 ¼	8	3/8	6'-6"	3/8
1 ½	10	3/8	7	3/8
2	10	3/8	8	3/8
2 ½ and 3	10	1/2	9-10	3/8
4 and 5	10	5/8	NA	NA
6	10	3/4	NA	NA
8, 10, and 12	10	7/8	NA	NA

HANGER AND ROD SCHEDULE NOTES

Where unusual, concentrated loads of valves and fittings occur, closer spacing shall be required. Submit specific cases for review and comment.

Where piping changes direction, supports shall be placed in each direction adjacent to joints and no more than 12-inches from the joint.

Piping larger than 16-inches shall be supported according to the details on the drawings.

- R. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.
- S. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil, or other non-toxic joint compound applied to male threads only.
- T. All components of the hanger system shall UL listed, and FM approved for use in fire protection systems.
- U. All hangers shall comply with the requirements of NFPA 13, The Standard for the Installation of Automatic Sprinkler Systems.
- V. Provide all steel required for support of pipes and equipment other than steel shown on Structural Engineer's drawings.
- W. All hanger materials including clevis hangers, rods, inserts, clamps, stanchions, brackets, shall have a factory applied finish of electro-plated zinc, unless noted otherwise.
- X. Hangers, clamps and supports for use on un-insulated copper piping shall be provided with inserts to isolate the copper piping from the hanger. Inserts shall be made of felt or plastic and shall be as manufactured by the hanger manufacturer.
- Y. Manufacturers:
  - 1. B-Line Systems, Inc.
  - 2. Carpenter & Paterson Inc.
  - 3. ERICO/Michigan Hanger Co.
  - 4. Globe Pipe Hanger Products Inc.
  - 5. Grinnell Corp.
  - 6. Tolco Inc.
  - 7. Unistrut Corp.; Tyco International, Ltd.
- Z. Hanger Materials:
  - 1. Horizontal Fire Protection Piping:
    - a. 2-inch and smaller:
      - 1) B-Line B3100.
      - 2) Grinnell 260.
      - 3) PHD 450.
    - b. 2-1/2 inch and larger:
      - 1) B-Line B3100.
      - 2) Grinnell 260.
      - 3) PHD 450.
  - 2. Vertical Piping (Riser Clamps):
    - a. Steel Pipe:
      - 1) B-Line B3373.

- 2) Grinnell 261.
- 3) PHD 550.

3. Connectors:

a. Beam Clamps:

- 1) B-Line B3033, B3050, B3291-B3297.
- 2) Grinnell 88, 133, 134 or 292S.
- 3) PHD 360, 620.

b. Concrete inserts:

- 1) B-Line B2500, B3014.
- 2) Grinnell 282, 285.
- 3) PHD 950.

c. Welded beam attachments:

- 1) B-Line B3083.
- 2) Grinnell 66.
- 3) PHD 900.

d. Piping adjacent to walls or steel columns, brackets:

- 1) B-Line
- 2) Grinnell
- 3) PHD

e. Base supports:

- 1) B-Line
- 2) Grinnell
- 3) PHD

4. Hanger Rods:

a. Hanger rod:

- 1) B-Line
- 2) Grinnell
- 3) PHD

b. Continuous threaded rod:

- 1) B-Line
- 2) Grinnell
- 3) PHD

c. Eye Rods:

- 1) B-Line
- 2) Grinnell

3) PHD

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Metraflex Co.
- d. Pipeline Seal and Insulator, Inc.
- e. Thunderline/Link-Seal.

2. Sealing Elements: Fire resistive silicone rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
- E. Under-deck Clamp: Clamping ring with set screws.

## 2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- D. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. All materials, equipment and accessories specified in this section shall be installed in strict accordance with NFPA 13, North Carolina Department of Insurance and the manufacturers' recommendations.

### 3.2 EXAMINATION

- A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive fire-stopping.

### 3.3 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing materials to arrest liquid material leakage.
- D. Obtain permission from the Professional before using powder-actuated anchors.
- E. Do not drill or cut structural members.

### 3.4 INSTALLATION – INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4-inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

### 3.5 INSTALLATION – PIPE HANGERS AND SUPPORTS

- A. The Contractor shall furnish and install all supports, hangers, inserts and fasteners for the items incidental to the work in the construction of the project. Supports and hangers shall be provided to suit specific conditions for the type of construction. The method adopted shall be subject to the approval of the Professional.
- B. Supports shall secure pipes in place; prevent swaying and vibration; maintain required grading; provide free expansion and shall have a neat appearance. Supports shall be selected for strength and service and installed in a manner, which will not stress building construction. A five (5) to one (1) safety factor relative to the gross weight of piping system including fluid shall be used in the selection of the supports.
- C. Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing. Only use inserts for suspending hangers from concrete slabs. Use beam clamps for suspending hangers from building steel. Do not hang one pipe from another. Do not use perforated band iron, wire or chain as hangers. Do not use vertical expansion shields. Do not hang from joist bridging.
- D. Fastenings installed in masonry walls shall be galvanized u-bolts set in the construction during erection.
- E. Where hanger rods are longer than 18-inches, provide lateral bracing at every fourth hanger. Do not support piping by wire, rope wood or other makeshift device. Provide additional steel supports where building construction does not permit the hanger spacing as specified in the schedules. Location and details shall be submitted to the Professional for review.
- F. Where loading exceeds the safe allowable limit for any single insert, then multiple inserts shall be installed spaced no less than 12-inches on centers. The multiple inserts shall be connected with suitable size steel angles and locking bolts.
- G. Where fastenings are required in steel stud, wire lath or other non-masonry construction, a "J" hook and holding lock washer and nut shall be used which shall fasten to the opposite stud edge to which the item will abut. If the location of the fastening is not a steel stud, a structural steel shape shall be fastened to the wall with bolt and holding nut, with the fastening extension through the wall. The use of toggle bolts will not be permitted.
- H. Steel frame Construct:
  - 1. Support piping systems, devices, and equipment from structural steel members or secondary fabricated supports. Hanging from corrugated metal deck is prohibited.

2. Where metal tabs integral with the metal deck are provided, support of piping, ductwork, devices and equipment from system to the maximum of the equivalent of a 10-foot length of 4- inch diameter, Schedule 40 section of pipe filled with water, or 6-inch diameter cast iron drainage pipe. Where tabs projecting down from the metal deck system are not available, inserts for concrete deck construction shall be installed. Inserts in poured concrete slabs shall be iron, fabricated galvanized iron or steel of the type to receive a machine bolt head or nut after installation and shall permit adjustment of this bolt in one horizontal direction.

I. Reinforced Concrete Construction:

1. Where concrete members support concrete roof or floor construction, support piping systems, devices, and equipment from roof to floor construction by use of concrete slab inserts.
2. Inserts in poured concrete slabs shall be iron or fabricated galvanized iron or steel of the type to receive a machine bolt head or nut after installation and shall permit adjustment of this bolt in one (1) horizontal direction. Inserts shall be accurately located before the concrete is poured.
3. Piping shall be adequately supported either by suspension from the construction above or by means of struts or brackets to the construction below or to the side.
4. Before drilling any concrete for attachments, installer shall carefully check concrete drawings and shop drawings and shall locate drilled holes to avoid reinforcing by at least 1-inch. Before drilling any concrete for attachments, installer shall carefully check concrete drawings and shop drawings and shall locate drilled holes to avoid reinforcing by at least 1-inch.
5. Hangers shall be installed in accordance with the HANGER AND ROD SCHEDULE. (See SCHEDULES below).

3.6 INSTALLATION – SLEEVES

- A. Set sleeves in position in forms. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors 1½-inches above finished floor level. Caulk sleeves. Extend sleeves through floors 3-inches above finished floor level in Kitchen or wet-areas.
- D. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with fire-stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel or stainless-steel escutcheons at finished surfaces.

3.7 INSTALLATION – FIRE STOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring fire-stopping.



- B. Apply primer where recommended by manufacturer for type of fire-stopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply fire-stopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.
- E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
- F. Place intumescent coating in sufficient coats to achieve rating required.
- G. Remove dam material after fire-stopping material has cured.
- H. Fire Rated Surface:
  - 1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1-inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
    - c. Pack void with backing material.
    - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
- I. Non-Rated Surfaces:
  - 1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof openings as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1-inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
    - c. Install type of fire-stopping material recommended by manufacturer.
  - 2. Install escutcheons, floor plates, or ceiling plates where exposed piping penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
  - 3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
  - 4. Interior partitions: Seal pipe penetrations at computer rooms, electrical panel rooms, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

### 3.8 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements or Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed fire-stopping for compliance with specifications and submitted schedule.

3.9 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of fire-stopping materials.

3.10 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.11 HANGER AND ROD SCHEDULE NOTES

- A. Where unusual, concentrated loads of valves and fittings occur, closer spacing shall be required. Submit specific cases for review and comment.
- B. Where piping changes direction, supports shall be placed in each direction adjacent to joints and no more than 12-inches from the joint.
- C. Piping larger than 16-inches shall be supported according to the details on the drawings.

END OF SECTION 211104

## SECTION 212313 - WET-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 00 and 01 are a part of these Specifications.

#### 1.2 SUMMARY

- A. Drawings and general provisions of the contract documents including General and Supplementary Conditions and Division 00 and 01 Specification sections apply to all work in this section.
- B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 21 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 21 specifications contain statements more definitive or more restrictive.
- C. Section includes wet-pipe sprinkler system, system design, installation, and certification.
- D. Related Sections:
  - 1. Section 210503 - Electrical Work for Fire Protection Systems: Execution requirements for electric connections to equipment specified by this section.

#### 1.3 REFERENCES

- A. Refer to Section 210501 for complete listing of references.

#### 1.4 SYSTEM DESCRIPTION

- A. System to provide coverage for the entire building as noted.
- B. Provide hydraulically designed system to NFPA 13 Ordinary Hazard, Group 1 occupancy requirements unless otherwise noted on the drawings.
- C. The Contractor shall obtain flow test data for the design of the hydraulic calculations. Design shall be based on flow test data and submitted to the Professional with the hydraulic calculations.
- D. Interface system with the building fire and smoke alarm system.
- E. Provide fire department connections as indicated on Drawings.

1.5 SUBMITTALS

- A. All submittals shall be reviewed and accepted by the General Contractor and prior to submittal to the Professional.
  - 1. The Specifying Engineer (PE) has primary responsibility for review and approval of fire suppression system shop drawings and hydraulic calculations. Specifying Engineer shall review and determine compliance with applicable codes and standards and the project contract documentation. After completing this review, the Engineer sends one (1) copy with a signed cover letter, including printed reviewer name, summarizing the outcome to the State Construction Office for approval.
- B. Section 210502 - Fire Protection Shop Drawings and Submittals, Substitutions and O&M Manuals: Submittal procedures.
- C. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
- D. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- E. Design Data: Submit design calculations; signed and sealed by a Professional Engineer.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 13, State, Federal, local code and the Authority Having Jurisdiction.
- B. Maintain one (1) copy of each document on site.

1.8 QUALIFICATIONS

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

- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.
- C. Design system under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of North Carolina.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Store products in shipping containers until installation.
- C. Furnish piping with temporary inlet and outlet caps until installation.

1.11 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.12 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish extra sprinklers under provisions of NFPA 13.
- C. Furnish suitable wrenches for each sprinkler type.
- D. Furnish metal sprinkler head storage cabinet(s) in location designated by the Owner.

PART 2 - PRODUCTS

2.1 LISTING / APPROVAL

- A. All sprinkler system materials and components must be UL Listed and FM Approved and used in strict conformance to the conditions of their Listing or Approval.
- B. All sprinklers shall be quick response type.
- C. Recessed pendant sprinkler head escutcheons shall be listed.

- D. Freezers with wet systems shall have dry pendant heads. The drops shall extend at least 12-inches above the freezer and be provided with insulating wrap to prevent sweating.
- E. Suspended Ceiling: Semi-recessed, pendant type with matching push-on escutcheon trim, chrome finish with glass bulb type or fusible link. Temperature rating of sprinkler head shall be suitable for specific area hazard.
- F. Exposed Areas: Standard upright type, brass finish with glass bulb type or fusible link. Temperature rating of sprinkler head shall be suitable for specific area hazard.
- G. Sidewall: Semi-recessed, quick response, chrome plated brass finished with glass bulb type or fusible link with matching push-on escutcheon trim. Temperature rating of sprinkler head shall be suitable for specific area hazard.

## 2.2 SPRINKLERS

### A. Manufacturers:

1. Viking Corp.
2. AFAC Inc.
3. Central Sprinkler Corp.
4. Firematic Sprinkler Devices, Inc.
5. Globe Fire Sprinkler Corporation.
6. Grinnell Fire Protection.
7. Reliable Automatic Sprinkler Co., Inc.
8. Star Sprinkler Inc.
9. Venus Fire Protection, Ltd.
10. Victaulic Co. of America.

### B. Suspended Ceiling Type:

1. Type: Recessed, Semi-recessed and Concealed pendant type with matching push on escutcheon plate.
2. Finish: Coordinate sprinkler and escutcheon finish and color with the Project Architect.
3. Fusible Link: Fusible solder link type or Glass bulb type; temperature rated for specific area hazard.

### C. Exposed Area Type:

1. Type: Standard upright type with guard where required.
2. Finish: Brass.
3. Fusible Link: Fusible-solder link type or Glass bulb type; temperature rated for specific area hazard.

### D. Side wall Type:

1. Type: Standard horizontal side wall type with matching push on escutcheon plate.
2. Finish: Coordinate sprinkler and escutcheon finish and color with the Project Architect.
3. Fusible Link: Fusible-solder link type or Glass bulb type; temperature rated for specific area hazard.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with NFPA 13.
- B. Place pipe runs to minimize obstruction to other work.
- C. All piping in finished areas shall be run concealed. The Contractor shall furr in piping or provide soffiting as required and in accordance with the Professional's instructions. All piping shall be installed as required to suit space available in building structure, above suspended ceilings, and other locations found necessary for installation. Install piping as high as possible.
- D. The Contractor shall not install any piping that will interfere with any lights, openings, doors, windows, ductwork, equipment, and existing or special conditions. Headroom in front of openings, doors, or windows shall not be less than the top of the opening. Provide all piping offsets necessary to avoid interferences with other work. Piping offsets shall include all devices and assemblies necessary to accommodate the change in direction of the piping.
- E. All piping shall run straight with no more couplings and joints than necessary and shall be carefully installed to provide for proper alignment and slope.
- F. All piping shall be installed with not less than 2-inches between piping and all other work or piping.
- G. Reduction in sizes of pipes shall be made with reducing fittings. Bushings will not be permitted.
- H. Piping shall be properly arranged and graded to low points where the entire system can be emptied through a drain.
- I. Drain valves shall be provided to drain all sections of the piping system.
- J. Automatic sprinklers in the finished ceilings shall be located in accordance with the criteria defined in NFPA 13. These heads locations shall be reviewed and approved by the Project Architect before the contractor begins his hydraulic calculations.
- K. Install guards on sprinklers where required by NFPA 13.
- L. Hydrostatically test entire system.
- M. Require test be witnessed by Fire Marshal, State Construction Office Representatives, Owner, and Architect/Engineer.

### 3.2 INSTALLATION, TEST, AND CERTIFICATION

- A. Provide an auxiliary drain for each location where the piping pitch prevents complete drainage through the main drain valve. If the capacity of the trapped section exceeds five (5) gallons, a valve must be provided, and the outlet piped to a drain or convenient location acceptable to the Authority Having Jurisdiction.

3.3 CONTACTOR'S INSPECTION OF SYSTEM

- A. The Contractor shall thoroughly inspect the completed system to assure compliance with this document, project plans and specs, and all applicable Codes and Standards. This must include an operational test of each water flow alarm switch and all system supervisory devices (valve tamper, hi-low air pressure, fire pump status, etc, where provided). This testing shall be performed in coordination with the fire alarm system contractor.
- B. At the final inspection, the fire sprinkler contractor should have for review and closeout documentation all pertinent NFPA paperwork properly filled out on NFPA forms as applicable (NFPA 13, 14, 20, 24). The shop drawing approval letter from this office should be available. A set of as-built fire sprinkler shop drawings and hydraulic calculations shall be placed in a white PVC tube marked "Fire Sprinkler Shop Drawings" and securely fixed in the fire sprinkler riser room.

3.4 CONTACTOR'S MATERIAL AND TEST CERTIFICATES

- A. Prior to requesting the Professional to set up the final inspection, complete and submit copies of the MATERIAL AND TEST CERTIFICATES to the following:
  - 1. Professional.
  - 2. Owner.
  - 3. NCDOT – State Property Insurance Fund Division.

3.5 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. Flush entire piping system of foreign matter.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 - Execution and Closeout Requirements: Protecting installed construction.
- B. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting.
- C. Replace inadvertently painted sprinklers with new.

END OF SECTION 212313



DIVISION 22 – PLUMBING SPECIFICATIONS

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22 11 04	HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
22 60 00	GAS PIPING FOR LABORATORY FACILITIES



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## SECTION 220501 - COMMON WORK RESULTS FOR PLUMBING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Drawings and general provisions of the contract documents including General and Supplementary Conditions and Division 00 and 01 Specification sections apply to all work in this section.
- B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 22 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 22 specifications contain statements more definitive or more restrictive.
- C. Nothing herein contained shall be so construed to relieve the Contractor from doing his work according to the true intent and meaning of these drawings and specifications. He will be held to provide and install all materials and equipment and shall furnish all labor necessary for the complete, prompt, and satisfactory execution of the work. He is also responsible for the proper coordination of his work with all other trades.
- D. The Contractor shall bear all expenses incidental to the satisfactory completion of the work contained in these specifications and drawings.

#### 1.2 SCOPE

- A. Perform work and provide material and equipment as shown on Drawings and/or as specified and/or indicated in this Section of the Specifications. Completely coordinate work of Divisions 22 with work of other trades and provide a complete and fully functional installation.
- B. Drawings and Specifications form complementary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices, and materials obviously necessary for a sound, secure and complete installation.
- C. It is the intent that these Specifications and Drawings are to establish minimum requirements for methods, products, and equipment and to provide electrical service, distribution and systems finished, tested and ready for operation. Incidental detail not usually shown or specified, but necessary for proper installation and operation shall be included in the work and this Contractor's estimate, the same as if specified. Locations of all equipment and material shall be adjusted at no extra cost to the Owner, to accommodate the work interferences anticipated and/or encountered. Prior to installation, determine the exact route and location of each raceway and piece of equipment to minimize conflicts with other trades.
- D. Give notices, file plans, obtain permits and licenses, pay fees and back-charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in

accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

- E. Division 22 Contractor shall furnish all motor starters and disconnect switches as required by NEC for equipment motors, unless specifically noted otherwise in the specifications or on the drawings. Motor starters and disconnect switches shall be in accordance with Division 26 Specifications.
- F. If a Guaranteed Maximum Price (GMP) has been prepared using documents prior to the issuance of the 100% Bid Documents, the Contractor shall identify any and all changes to the documents (both drawings and specifications) that are affecting the GMP, either increasing or decreasing the GMP amount. All changes shall be numbered and circled, in both drawings and specifications. The Contractor shall also provide detailed cost back-up for all items noted above.
- G. Work consists of furnishing all labor, material, equipment, and services necessary and reasonably incidental to the proper completion and proper operation of the plumbing systems. The work shall consist of but shall not necessarily be limited to the following:
  - 1. Modifications to existing plumbing systems, equipment, fixtures, and accessories as indicated and as specified.
  - 2. Removal of plumbing systems, equipment, piping, etc., no longer required as a part of the revised installations.
  - 3. General Service Compressed Air Systems as defined in the Contract Documents.
  - 4. Sanitary drainage systems as defined in the Contract Documents.
- H. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 22 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 22 specifications contain statements more definitive or more restrictive.
- I. Nothing herein shall be so construed to relieve the Contractor from doing his work according to the true intent and meaning of the drawings and specifications. He will be held to provide and install all materials and equipment, and shall furnish all labor necessary for the complete, prompt and satisfactory execution of the work. Also, he is responsible for properly coordinating his work with all other trades.
- J. The contractor shall bear all expenses incidental to the satisfactory completion of the work contained in these specifications and drawings.
- K. Related Sections:
  - 1. Division 03 - Concrete Forming and Accessories: Execution requirements for inserts and sleeves specified by this section.
  - 2. Division 07 - Firestopping: Execution and material requirements for fire proofing of penetrations of rated construction.
  - 3. Division 09 - Painting and Coating: Execution requirements for piping painting specified by this section.

### 1.3 DEFINITIONS AS USED IN THESE SPECIFICATIONS

- A. "Provide," means "furnish and install".

- B. "Furnish" means "to purchase and deliver to the project site complete with every necessary appurtenance and support".
  - C. "Install" means "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.
  - D. "Architect" means the "Prime Design Consultant," and if McKim & Creed is not the prime design consultant, the Architect may authorize McKim & Creed to act on the Architect's behalf in matters concerning the Division 22 series of specifications.
  - E. "RFI" means Contractor's "Request for Information".
  - F. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
  - G. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
  - H. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
  - I. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
  - J. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
  - K. The following are industry abbreviations for plastic materials:
    - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
    - 2. CPVC: Chlorinated polyvinyl chloride plastic.
    - 3. PE: Polyethylene plastic.
    - 4. PP: Polypropylene plastic.
    - 5. PVC: Polyvinyl chloride plastic.
  - L. The following are industry abbreviations for rubber materials:
    - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
    - 2. NBR: Acrylonitrile-butadiene rubber.
- 1.4 CONTRACT DOCUMENTS
- A. Listing of Drawings does not limit responsibility of determining full extent of work required by these Contract Documents. Refer to Architectural, HVAC, Plumbing, Fire Protection, Electrical, Structural, Site Utility and all other Drawings and other Sections that indicate types of construction in which work shall be installed and work of other trades with which work of Divisions 22 must be coordinated.

- B. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.
- D. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify or to show every offset, fitting, and component. The purpose of the drawings is to indicate a systems concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, the contractor shall provide all other components and materials necessary to make the systems fully complete and operational.
- E. Information and components shown on riser diagrams but not shown on plans, and vice versa, shall apply or be provided as if expressly required on both.
- F. Data that may be furnished electronically by the Architect (on computer tape, diskette, or otherwise) is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not substitute for Architect's sealed or stamped construction documents.

#### 1.5 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are ambiguous, the contractor shall advise the Architect in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or ambiguities thus resolved.
- B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Architect in writing before installation. Otherwise, make changes in installed work as Architect requires within Contract Price.
- C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specifications, this contractor shall provide that material, installation, or work which is of the higher, more stringent standard.
- D. The Contract Documents require the Contractor to provide systems and components that are fully complete, operational, and suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component or its coordination with other building elements. In cases such as this, where the Contractor has failed to notify the Architect of the situation in accordance with Paragraph (A) above, the Contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- E. In cases covered by Paragraph (D) above, where the Contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Architect shall review and advise the contractor of the disposition.

1.6 MODIFICATIONS IN LAYOUT

- A. Plumbing Drawings are diagrammatic. They indicate general arrangements of plumbing systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet Architectural requirements.
- B. In order to obtain the Architect's desired aesthetics in spaces used by building occupants, in all such spaces, prior to installation of visible material and equipment (including access panels) review Architectural Drawings for desired locations and where not definitely indicated, request information from Architect.
- C. Check Contract Documents, as well as Submittals and Shop Drawings of all subcontractors to verify and coordinate spaces in which work of Division 22 will be installed.
- D. Maintain maximum headroom at all locations. All piping, duct, conduit, and associated components to be as tight to underside of structure as possible.
- E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C and D above. Systems shall be run in a rectilinear fashion.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Architect for review and approval.

1.7 REQUESTS FOR INFORMATION (RFI)

- A. If the RFI is a request to resolve a conflict or an ambiguity, or a request for additional detail, Contractor's RFI shall include a sketch or equivalent description of Contractor's proposed solution, in accordance with paragraphs 1.5 (E) and 1.6 (F) above.
- B. To expedite the flow of RFI's, for all RFI's under Divisions 22, Contractor shall submit the attached form, or similar form including the same information, to the Architect, with copy to United Engineering Group. Contractor shall include proposed solution in the indicated space on the form.

1.8 REFERENCES

- A. The Contractor shall comply with all laws, ordinances, and regulations of all authorities having jurisdiction, including those of all applicable city, county, state, federal and public utility entities. The Contractor shall obtain all licenses, permits, etc. and shall pay all associated connection fees, tapping fees, inspection fees, etc. This cost shall be included in the contract price.
- B. The publications listed below form a part of this specification. All publications shall be the latest edition with Amendments as adopted by the authority having jurisdiction. The minimum standard of work under this contract shall be in accordance with the following model building codes:
  - 1. North Carolina State Building Code:

- a. Building, 2009 edition.
  - b. Plumbing, 2009 edition.
  - c. Mechanical, 2009 edition.
  - d. National Electric Code, 2011 edition.
  - e. Fire Prevention, 2009 edition.
  - f. Fuel Gas, 2009 edition.
  - g. Energy Conservation Code, 2009 edition.
- C. The minimum design and construction parameters of the work shall be in accordance with the following standards:
1. AABC - National Standards for Total System Balance.
  2. Air-Conditioning and Refrigeration Institute:
    - a. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.
    - b. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.
  3. American Bearing Manufacturers Association:
    - a. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
  4. American National Standards Institute:
    - a. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
    - b. ANSI S1.4 - Sound Level Meters.
    - c. ANSI S1.8 - Reference Quantities for Acoustical Levels.
    - d. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.
    - e. ANSI Z21.10.1 - Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
    - f. ANSI Z21.10.3 - Gas Water Heaters - Vol. III Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.
    - g. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
    - h. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.
    - i. ANSI Z124.1 - Plastic Bathtub Units.
    - j. ANSI Z124.2 - Plastic Shower Units.
    - k. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.
  5. American Society of Mechanical Engineers:
    - a. ASME A13.1 - Scheme for the Identification of Piping Systems.
    - b. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
    - c. ASME A112.14.1 - Backwater Valves.
    - d. ASME A112.14.3 - Grease Interceptors.
    - e. ASME A112.14.4 - Grease Removal Devices.
    - f. ASME A112.18.1 - Plumbing Fixture Fittings.
    - g. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
    - h. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
    - i. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
    - j. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.

- k. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.
  - l. ASME A112.21.1 - Floor Drains.
  - m. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
  - n. ASME B16.3 - Malleable Iron Threaded Fittings.
  - o. ASME B16.4 - Gray Iron Threaded Fittings.
  - p. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
  - q. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - r. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
  - s. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
  - t. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 – 2).
  - u. ASME B31.1 - Power Piping.
  - v. ASME B31.5 - Refrigeration Piping.
  - w. ASME B31.9 - Building Services Piping.
  - x. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
  - y. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
  - z. ASME PTC 25 - Pressure Relief Devices.
  - aa. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
  - bb. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
6. American Society of Sanitary Engineering:
- a. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
  - b. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
  - c. ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.
  - d. ASSE 1013 - Performance Requirements for Reduced Pressure Principal Backflow Preventers and Reduced Pressure Fire Protection Principal Backflow Preventers.
  - e. ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.
  - f. ASSE 5013 - Performance Requirements for Reduced Pressure Principal Backflow Preventers (RP) and Reduced Pressure Fire Protection Principal Backflow Preventers (RFP).
7. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
- a. ASHRAE Handbook - HVAC Applications.
  - b. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
  - c. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
8. ASTM International:
- a. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
  - b. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - c. ASTM A74-09 - Standard Specification for Cast Iron Soil Pipe and Fittings.
  - d. ASTM A135/A135M-06 - Standard Specification for Electric-Resistance-Welded Steel Pipe.



- e. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- f. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- g. ASTM A395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
- h. ASTM A536 - Standard Specification for Ductile Iron Castings.
- i. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
- j. ASTM A795/A795M-08 - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.
- k. ASTM B32 - Standard Specification for Solder Metal.
- l. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
- m. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
- n. ASTM B75 - Standard Specification for Seamless Copper Tube.
- o. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- p. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- q. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
- r. ASTM B302 - Standard Specification for Threadless Copper Pipe.
- s. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
- t. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
- u. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- v. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- w. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- x. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- y. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- z. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- aa. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
- bb. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
- cc. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- dd. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
- ee. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
- ff. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
- gg. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- hh. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- ii. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

- jj. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
- kk. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor.
- ll. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- mm. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- nn. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- oo. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters.
- pp. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- qq. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
- rr. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- ss. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- tt. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- uu. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
- vv. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
- ww. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
- xx. ASTM D2662 - Standard Specification for Polybutylene (PB) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
- yy. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
- zz. ASTM D2666 - Standard Specification for Polybutylene (PB) Plastic Tubing.
- aaa. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- bbb. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- ccc. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
- ddd. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- eee. ASTM D3000 - Standard Specification for Polybutylene (PB) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- fff. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- ggg. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
- hhh. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- iii. ASTM D3262 - Standard Specification for Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
- jjj. ASTM D3309 - Standard Specification for Polybutylene (PB) Plastic Hot- and Cold-Water Distribution Systems.

- kkk. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.
  - lll. ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.
  - mmm. ASTM D3840 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Non-pressure Applications.
  - nnn. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.
  - ooo. ASTM E1 - Standard Specification for ASTM Thermometers.
  - ppp. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
  - qqq. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - rrr. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
  - sss. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
  - ttt. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
  - uuu. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
  - vvv. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
  - www. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
  - xxx. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
  - yyy. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
  - zzz. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
  - aaaa. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - bbbb. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
  - cccc. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
  - dddd. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
  - eeee. ASTM F845 - Standard Specification for Plastic Insert Fittings for Polybutylene (PB) Tubing.
  - ffff. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
  - gggg. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
  - hhhh. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
9. American Welding Society:
- a. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
  - b. AWS D1.1 - Structural Welding Code – Steel.
  - c. AWS D1.2 - Structural Welding Code—Aluminum.
  - d. AWS D1.4 - Structural Welding Code--Reinforcing Steel.
10. American Water Works Association:

- a. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - b. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - c. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3-inches. through 48-inches, for Water and Other Liquids.
  - d. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - e. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - f. AWWA C651 - Disinfecting Water Mains.
  - g. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
  - h. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
  - i. AWWA C702 - Cold-Water Meters - Compound Type.
  - j. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
  - k. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
  - l. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
  - m. AWWA C950 - Fiberglass Pressure Pipe.
  - n. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
11. Cast Iron Soil Pipe Institute:
- a. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
  - b. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
12. FM Global:
- a. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
13. International Electrical Testing Association:
- a. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
14. Intertek Testing Services (Warnock Hersey Listed):
- a. WH - Certification Listings.
15. Manufacturers Standardization Society of the Valve and Fittings Industry:
- a. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  - b. MSS SP 67 - Butterfly Valves.
  - c. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
  - d. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
  - e. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - f. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

- g. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
  - h. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
  - i. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
  - j. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
16. National Electrical Manufacturers Association:
- a. NEMA MG 1 - Motors and Generators.
  - b. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
17. National Fire Protection Association:
- a. NFPA 31 - Standard for the Installation of Oil-Burning Equipment.
  - b. NFPA 54 - National Fuel Gas Code.
  - c. NFPA 58 - Liquefied Petroleum Gas Code.
  - d. NFPA 70 - National Electrical Code.
  - e. NFPA 72 - National Fire Alarm Code.
  - f. NFPA 99 - Standard for Health Care Facilities.
18. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
19. Plumbing and Drainage Institute:
- a. PDI WH201 - Water Hammer Arrester Standard.
20. Underwriter Laboratories, Inc.:
- a. UL 263 - Fire Tests of Building Construction and Materials.
  - b. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
  - c. UL 842 - Valves for Flammable Fluids.
  - d. UL 1479 - Fire Tests of Through-Penetration Firestops.
  - e. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
  - f. UL - Fire Resistance Directory.
21. United States Department of Energy:
- a. DOE 10 CFR - Uniform Test Method for Measuring the Energy Consumption of Furnaces.

1.9 SUBMITTALS

- A. Section 220502 – Plumbing Shop Drawings and Submittals, Substitutions and O&M Manuals: Submittal procedures.
- B. The Contractor shall submit Certificates of Compliance for the following:
  - 1. Schedule of UL listed through penetration assemblies.

1.10 QUALITY ASSURANCE

- A. The Contractor shall coordinate his work with that of the other trades. Where interference with other trades occurs, the Contractor shall present his solutions to the Professional. The Professional shall make the final decision regarding changes to be made in the work.
  - B. The Contractor shall thoroughly familiarize himself with all specifications and drawings for the project so that he clearly understands his responsibility in relationship to the work to be performed. The Contractor shall plan and perform his work so as to permit the use of the building at the earliest possible date.
  - C. The Contractor shall guarantee all work, materials and equipment, furnished against defects, leaks, performance and non-operation for a period of one (1) year after the date of the Owner's final acceptance. Defects shall be interpreted as defective materials or equipment or unsatisfactory installation and are not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by these defects within the period covered by the guarantee, including all incidental work required to correct the deficiency.
  - D. The Contractor shall expressly and completely follow all manufacturers' instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance, and adjustments of the equipment.
  - E. The Contractor is responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the contract documents.
  - F. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code—Steel".
  - G. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
    - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".
    - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
  - H. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- 1.11 CLOSEOUT SUBMITTALS
- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
  - B. Project Record Documents: Record actual locations of components and tag numbering.
    - 1. Changes from the contract drawings necessary to coordinate the work with other trades, to conform to the building conditions or to conform to the rules and regulations of authorities having jurisdiction shall be made only after obtaining written permission from the Professional.
    - 2. The Contractor shall keep a record of construction changes and deviations from the original contract drawings. All changes shall be recorded on a separate set of prints, which shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed. Documentation shall include the following:

- a. Location and elevation of new and existing utility lines.
  - b. Points of connection to existing utility lines.
  - c. Changes in pipe routing location.
  - d. Valve locations.
  - e. Equipment locations, etc.
  - f. Actual capacities and values of equipment provided as indicated in equipment schedules.
3. The marked-up record set of drawings shall be delivered to the Professional before final acceptance of the fire protection contract work.
  4. Operation and Maintenance Data: Submit spare parts lists.

#### 1.12 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code—Steel".
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
  1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Maintain one copy of each document on site.

#### 1.13 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience approved by manufacturer.

#### 1.14 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.
- C. The Contractor is responsible to verify the location of any and all existing underground utilities in the vicinity of his work. When it has been indicated that these utilities are to remain in place, the

Contractor shall provide adequate means of support and protection during excavation operations.

- D. Before ordering any equipment and material, or performing any work, the Contractor shall verify all measurements and dimensions at the job site. The Contractor is responsible for the correctness of this information.
- E. No extra compensation will be considered based on differences between actual dimensions and measurements and those indicated on the drawings.
- F. Any differences identified by the Contractor shall be submitted to the Professional for consideration before proceeding with the work.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Product storage and handling requirements.
- B. Deliver and store valves in shipping containers, with labeling in place.
- C. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.16 COORDINATION

- A. The Contractor shall coordinate his work with that of the other trades. Where interference with other trades occurs, the Contractor shall present his solution to the Professional. The Professional shall make the final decision regarding changes to be made in the work.
- B. The Contractor shall thoroughly familiarize himself with all specifications and drawings for the project so that he clearly understands his responsibility in relationship to the work to be performed. The Contractor shall plan and perform his work so as to permit the use of the building at the earliest possible date.
- C. The Contractor shall guarantee all work, materials and equipment furnished against defects, leaks, performance and non-operation for a period of one (1) year after the date of the Owner's final acceptance, or as indicated in the General Conditions. Defects shall be interpreted as defective materials or equipment or unsatisfactory installation and are not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by these defects within the period covered by the guarantee, including all incidental work required to correct the deficiency.
- D. The Contractor shall expressly and completely follow all manufacturers' instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance, and adjustments of the equipment.
- E. The Contractor is responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the contract documents.



- F. Prepare coordination drawings at a scale of  $\frac{1}{4}'' = 1'-0''$  or larger, detailing major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work. The Mechanical Contractor will administer the effort of coordination between various trades. The Plumbing Contractor will use the coordination drawings prepared by the Mechanical Contractor to show equipment and materials for coordination between trades. The coordination drawings will be prepared before installation of any plumbing, sprinkler, mechanical or electrical work and will be shown as a task on the Project Schedule to be prepared by the General Contractor.
- G. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 - Access Doors and Frames.
- H. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- I. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

1.17 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Refer to individual Division 22 Sections for specific materials and/or products.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 Sections for pipe, tube, and fitting materials and joining methods.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 Sections for special joining materials not listed below.

2.3 MECHANICAL SLEEVE SEALS

- A. Refer to Section 221104.

2.4 SLEEVES

- A. Refer to Section 221104.

2.5 ESCUTCHEONS

- A. Refer to individual Division 22 Sections for material requirements.

2.6 GROUT

- A. Refer to individual Division 22 Sections for material requirements.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS – COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following.
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

- c. Insulated Piping: One-piece, stamped-steel type with spring clips.
  - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
  - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
  - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece Split-casting One-piece or split-casting, cast-brass type with polished chrome-plated finish.
  - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
  - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
2. Existing Piping: Use the following:
- a. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
  - b. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with rough-brass finish.
  - c. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
  - d. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
  - e. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
- a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2-inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide ¼-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials.
- a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
  - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
  - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2-inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

- 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire-stop materials. Refer to Division 07 Section "Penetration Fire-stopping" for materials.
  - R. Verify final equipment locations for roughing-in.
  - S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded 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. Join pipe fittings and valves as follows.
  1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846 Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Non-pressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.
7. Plastic Pressure Piping, Gasketed Joints: Join according to ASTM D 3139.
8. Plastic Non-pressure Piping, Gasketed Joints: Join according to ASTM D 3212.
9. Plastic-Piping Electrofusion Joints: Make polyolefin drainage-piping joints according to ASTM F 1290.

### 3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2½ and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.4 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting".
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.8 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 220501

## SECTION 220502 - PLUMBING SHOP DRAWINGS, SUBMITTALS, AND SUBSTITUTIONS

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 00 and 01 are a part of these Specifications.
- B. All catalog data, shop drawings, calculations and certificates of compliance shall be submitted as a single package. Failure of the Contractor to provide a complete submittal package may result in delay in processing time. All such delays to the project resulting from the contractor's failure to provide submittals at one time will be the responsibility of the contractor.

#### 1.2 DEFINITIONS

- A. Shop Drawings: Project shop drawings and other data prepared specifically for fulfillment of the project requirements. Shop drawings include fabrication, layout, setting, installation, coordination and similar drawings and diagrams, and include performance data associated therewith, including weights, capacities, speeds, outputs, consumption, efficiencies, voltages, amperages, cycles, phases, noise levels, operating ranges, and similar information.
- B. Samples: Units of typical work, materials, or equipment items, showing the workmanship, pattern, trim and similar qualities proposed for the work to be provided, as designated.
- C. Manufacturer's Data: Product manufacturer's standard printed product information, including promotional brochures, product specifications, installation instructions and diagrams, statements of compliance with standard performance charts or curves, and similar information concerning the standard portions of the manufacturer's products.
- D. Test Reports: Specific reports prepared by independent testing laboratories and others, showing the results of specified testing on either the material/equipment provided or on identical material/equipment, and on installed electrical systems.
- E. Industry Standards: Printed copies of the current standards recognized in the industry. Current means the latest issue as of the date of these specifications, unless otherwise indicated; within the text of these specifications the date-suffix frequently shown with identification numbers has been omitted.
- F. Manufacturer's Product Warranties: Manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be

performed for the Purchaser or Owner by the Manufacturer, when and if the product fails within certain operational conditions and time limits.

- G. Operating Instructions: The written instructions by the manufacturers, fabricators, or installer of equipment or systems, detailing the procedures to be followed by the Owner in operation, control and shutdown of each operating item of the equipment and each electrical system.
- H. Maintenance Manuals: The compiled information provided for the Owner that certain acts of restitution will be performed when and if certain portions of electrical work fail within certain operational conditions and time limits.

### 1.3 SUBMITTAL FORMS AND PROCEDURES

- A. General: Comply with Division 1 requirements for identification, quantities processing, scheduling and similar general requirements, except as otherwise indicated. Submittals shall be complete, in one package, clearly identified and cross-referenced to the appropriate specification section defining the submitted item. Partial submissions will not be addressed. The Contractor is responsible for any delays caused by incomplete submittal packages.
- B. Submittal Tracking: The Contractor shall refer to 22 05 02 - Table A for a listing of the required submittals. The Schedule shall be included as part of his submission with those portions of the schedule for which he is responsible filled out. The Schedule will be used to track the submittal through the review process.
- C. Quantities: Provide quantities as listed in the General Conditions or as otherwise indicated in the Division 22 Specifications.
- D. Presentation: Submittals shall be assembled in three ringed binders with each specification section separated by a tab on which the specification section is noted. The submittals shall be clearly marked indicating which specific item is being considered and all its related information. Submittals not complying with these requirements are subject to being returned without being reviewed.
- E. Substitutions: Plumbing submittals are not opportunities for gaining acceptance of substitutions. Where three or more manufacturers are specified by name, or by catalog reference, Contractor shall select for use any of those so specified.
- F. Should the Contractor desire to substitute another manufacturer's equipment for one specified by name, the contractor shall apply in writing at least ten (10) days prior to bid date for such permission. He shall provide supporting data and samples for Engineers consideration. No substitution shall be made for any material, article, or process required under the contract unless approved by the Engineer.



- G. Any time that is required by the Engineer for a request to review submittals for substitute equipment after the award of bids will be billed to the contractor at the Engineers current hourly billing rate. The Engineers review time will be billed to the contractor whether the proposed substitution is accepted or rejected.
- H. Operating Instructions: The written instructions by the manufacturer, fabricator, or installer of equipment or systems, detailing the procedures to be followed by the Owner in operation.
- I. Response to Submittals: Where standard product data have been submitted in fulfillment of project requirements, it is recognized that the submitter has already determined that the products fulfill the specified requirements, and that the submittals are for the Architects' or Engineers' information only but will be returned without action where observed to be non-complying with the requirements. Where uniquely prepared information is submitted, it is recognized to represent the preparer's interpretation or solution to the specified requirements, subject to the Architects', or Engineers' concurrence and appropriate action as indicated in Division 1.
- J. Shop Drawings and Samples: After checking and verifying all field measurements, the Contractor shall submit to the Engineer for review, in accordance with the accepted schedule of shop drawings submissions, copies of all shop drawings, which shall have been checked by and stamped with the approval of the Contractor and identified as the Engineer may require. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable the Engineer to review the information as required.
- K. The Contractor shall also submit to the Engineer for review, with such promptness as to cause no delay in work, all samples required by the Contract Documents. All samples shall have been checked by and stamped with the approval of the Contractor, identified clearly as to material, manufacturer, any pertinent catalog numbers, and the use for which intended.
- L. At the time of each submission, the Contractor shall in writing call the Engineer's attention to any deviations that the shop drawings or sample may have from the requirements of the Contract Documents.
- M. No work requiring a shop drawing or sample submission shall be commenced until the submission has been reviewed by the Engineer. A copy of each shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.
- N. The Engineer's review of shop drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the Engineer's attention to such deviation at the time of submission and the Engineer has given written approval to the specific deviation, nor shall any review by the Engineer relieve the Contractor from responsibility for errors or omissions in the shop drawings.

- O. The Contractor's shop drawing stamp shall indicate that the shop drawings have been checked for conformity to the Contract Documents and appropriate means have been taken to ensure that the material and /or equipment will fit into the space available. Shop drawings will be returned without review if the submittals do not have the Contractor's stamp, or the submittals have not been reviewed by the Contractor.
- P. The Engineer's review of shop drawings is for general conformance with design concept only. The Contractor is responsible for all quantities, dimensions, and coordination of the work of all trades. Corrections or comments made on the shop drawing during this review do not relieve the contractor from compliance with requirements of the contract documents. The Contractor is responsible for selecting fabrication processes and techniques of construction and for performing all work in a safe and satisfactory manner.
- Q. The Contractor shall stamp the shop drawings and submittals and verify by his/her signature that the shop drawings and submittals have been checked for compliance with the contract documents.
- R. The Contractor shall provide TABLE A as a cover letter with the submittals. The "Date Submitted" column shall be filled in by the Contractor. The remaining three columns are for the Engineer's use.

#### 1.4 GENERAL SUBMITTAL REQUIREMENTS

- A. Applicability: Wherever it is indicated that a shop drawing, sample, manufacturer's brochure, certification, test, copy of standard operating instruction, manual, extra stock, guarantee, or warranty is required, the appropriate submittal is required regardless of whether it is specified as a "submittal"; the Architects' or Engineers' decision shall be final.

#### 1.5 SUBSTITUTIONS

- A. Substitutions: Plumbing submittals are not opportunities for gaining acceptance of substitutions. Where three or more manufacturers are specified by name, or by catalog reference, Contractor shall select for use any of those so specified.
- B. Should the Contractor desire to substitute another manufacturer's equipment for one specified by name, the Contractor shall apply in writing at least ten (10) days prior to bid date for such permission. He shall provide supporting data and samples for Engineers consideration. No substitution shall be made for any material, article, or process required under the contract unless approved by the Engineer.
- C. Any time that is required by the Engineer for a request to review submittals for substitute equipment after the award of bids will be billed to the Contractor at the Engineers current hourly billing rate. The Engineers review time will be billed to the Contractor whether the proposed substitution is accepted or rejected.

1.6 OPERATION AND MAINTENANCE MANUALS

- A. Submit two (2) sets of 8½" x 11" text sixty (60) days prior to operator training/pre-final inspection bound in three D side-ring capacity expansion binders with durable plastic covers for review by the Professional.
- B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on thirty (30) pound white paper.
- E.
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Professional, Contractor, Subcontractors, and equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions arranged by system or process flow and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - 3.
      - a. Significant design criteria.
      - b. List of equipment.
      - c. Parts list for each component.
      - d. Maintenance instructions for equipment and systems.
      - e. Maintenance instructions for finishes, including recommended cleaning methods and materials and operating instructions.
      - f. Special precautions identifying detrimental agents.
      - g. Special Requirements of other sections of this specification noted to be included in the operating and maintenance manual.
      - h.
    - 4. Part 3: Project documents and certificates, including the following:
      - 5.
        - a. All approved Submittals.
        - b. Certificates of Compliance.
        - c. Photocopies of warranties and bonds.
        - d. Material safety data sheets.

- F. Submit five (5) copies of completed volumes in final form fifteen (15) days prior to owner training. These copies will include Professional's previous review comments.
- G. Submit eight final volumes revised, within ten (10) days after pre-final observation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 220502

PLUMBING SUBMITTALS

TABLE A - Shop Drawings Required

Shop Drawings and Submittals Required for this Project	Date Submitted by Contractor	Date Received by Engineer	Date Returned by Engineer	Status (Approved, Approved as Noted, Rejected, etc...)
22 05 01 – Plumbing General				
22 05 03 – Common Electrical Requirements for Plumbing Equipment				
22 05 19 – Domestic Hot Water Balancing				
22 05 48 – Seismic and Wind Controls for Plumbing Piping and Equipment				
22 05 49 –Vibration and Sound Control for Plumbing Piping and Equipment				
22 05 53 – Identification for Plumbing Piping and Equipment				
22 11 01 – Plumbing Piping				
22 11 02 – General Duty Valves for Plumbing Piping				
22 11 03 – Plumbing Insulation				
22 11 04 – Hangers and Supports for Plumbing Piping and Equipment				
22 11 16 – Expansion Fittings and Loops for Plumbing Piping				
22 24 01 – Domestic Water System and Specialties				
22 24 03 - General Service Compressed Air System				
22 24 13 - High Purity Water System and Specialties				
22 24 23 – Natural Gas System and Specialties				
22 25 01 – Sanitary Waste and Vent System and Specialties				
22 25 02 – Storm Water Collection System and Specialties				

22 25 03 – Chemical Waste Systems and Specialties				
22 31 30 – Sump Pumps and Sewage Ejectors				
22 31 50 – Plumbing Pumps				
22 33 23 - Sanitary Waste Interceptors				
22 34 01 – Domestic Water Heaters				
22 40 01 – Plumbing Fixtures				
22 40 02 - Laboratory Safety Device System				
22 60 01 - Medical Gas and Vacuum Piping Systems				
22 60 02 - Medical Gas and Vacuum Source Equipment				
22 70 01 - Emergency Generator Fuel Oil Supply Piping				
22 70 02 - Emergency Generator Exhaust Piping				

I have reviewed the shop drawings and submittals listed above for compliance with the contract documents.

\_\_\_\_\_

CONTRACTOR'S SIGNATURE

## SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 00 and 01 are a part of these Specifications.
- B. 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.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Nameplates.
  - 2. Valve Tags.
  - 3. Warning Tags.
  - 4. Stencils.
  - 5. Pipe markers.
  - 6. Ceiling markers.
- B. Related Sections:
  - 1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

#### 1.3 REFERENCES

- A. Refer to Section 220501 for complete listing of references.

#### 1.4 SUBMITTALS

- A. Section 220502 – Plumbing Shop Drawings and Submittals, Substitutions and O&M Manuals: Submittal procedures.
- B. Product Data: Submit manufacturers catalog literature for each product required.
- C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

- D. Samples: Submit two (2) of each valve tag, label, pipe marker, and ceiling marker, size used on project.
- E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

#### 1.6 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- B. Maintain one copy of each document on site.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

#### 1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one (1) week prior to commencing work of this section.

#### 1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

#### 1.10 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

### PART 2 - PRODUCTS

#### 2.1 GENERAL



A. Manufacturers:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.
4. Brady Worldwide.

2.2 VALVE TAGS

A. Plastic Tags:

1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1½-inches in diameter or 1½-inches square.
2. Fasteners: Brass beaded chain.

B. Metal Tags:

1. Brass, Aluminum, or Stainless Steel with stamped letters; tag size minimum 1½-inches in diameter or 1½-inches square with finished edges and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

2.3 WARNING TAGS

A. Information Tags:

1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3¼ x 5-5/8-inches with grommet and self-locking nylon ties.

2.4 SCHEDULES

A. Typewritten letter size list of applied labels, tags and location in anodized aluminum frame or plastic laminated.

1. Equipment Nameplate Schedule: For each item of equipment to be labeled, on 8½ by 11-inch bond paper. Tabulate equipment identification number(s) and identify where equipment is located, plus the Specification Section number and title where equipment is specified.
  - a. Equipment schedule shall be included in operation and maintenance data.
2. Valve Tag Schedules: For each piping system, on 8½ by 11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - a. Valve-tag schedule shall be included in operation and maintenance data.

2.5 STENCILS

- A. Stencils: With clean, die-cut symbols and letters of following size:
  - 1. Up to 2-inches Outside Diameter of Insulation or Pipe: ½-inch high letters.
  - 2. 2½ to 6-inches Outside Diameter of Insulation or Pipe: 1-inch-high letters.
  - 3. Over 6-inches Outside Diameter of Insulation or Pipe: 1¾-inches high letters.
  - 4. Equipment: 1¾-inches high letters.
- B. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors and lettering size, conforming to ASME A13.1.

## 2.6 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1:
  - 1. Preprinted, color-coded, with lettering indicating service, and showing flow direction.
  - 2. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 3. Lettering Size: At least 1½-inches high.
- B. Plastic Pipe Markers:
  - 1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers:
  - 1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

## 2.7 CEILING MARKERS

- A. Description: Laminated three-layer plastic with 1/8-inch minimum engraved black letters on white background or color matching lay-in ceiling grid.
  - 1. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
  - 2. Match description used on Equipment Label or Valve Tag.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Verify all piping has been insulated, painted and/or installed prior to beginning of identification installation.
- B. Coordinate pipe service and direction of flow with installing contractor.
- C. Degrease and clean surfaces to receive adhesive for identification materials.
- D. Prepare surfaces in accordance with Division 09 for stencil painting.

### 3.2 INSTALLATION

- A. Apply stencil painting in accordance with Division 09. All painting shall be done in a careful, neat, and workmanlike manner, with particular care being exercised to protect building equipment and finishes. All surfaces shall be thoroughly cleaned of rust, scale, dirt, grease, dust, and like items, and sanded so as to provide a bond for new paint. All painted surfaces under this Contract shall be finished in an acceptable manner.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners.
- D. Install tags using corrosion resistant chain. Number tags consecutively by location.
- E. Install underground plastic pipe marker tape below finished grade, directly above buried pipe. Install detectable utility marking tape above all non-metallic, outside pipelines.
- F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags:
  - 1. In buildings where existing piping systems are modified, the new valve tag numbers and list shall be coordinated with existing valve tag numbers and lists; and, those supplied under other contracts, if applicable.
- I. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure (where applicable). Install in clear view and align with axis of piping:
  - 1. On straight runs of piping at intervals not exceeding 20-feet.
  - 2. Within 2-feet of all elbows.
  - 3. Within 2-feet of all piping as it passes through partitions (markers provided on both sides of partitions).
- J. Provide ceiling markers to locate valves and equipment. Above T-bar type panel ceilings locate on ceiling grid closest to equipment. At access panels locate on frame or door of access.

END OF SECTION 220553

SECTION 221104 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL

- A. General Conditions of the Contract, Special Conditions, Instructions to Bidders, and other General Requirements contained in Division 00 and 01 are a part of these Specifications.
- B. 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.

1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe hangers and supports.
  - 2. Hanger rods.
  - 3. Inserts.
  - 4. Flashing.
  - 5. Sleeves.
  - 6. Escutcheons
  - 7. Mechanical sleeve seals.
  - 8. Formed steel channel.
  - 9. Grout
  - 10. Firestopping relating to plumbing work.
  - 11. Firestopping accessories.
- B. Related Sections:
  - 1. Division 03 - Concrete Forming and Accessories
  - 2. Division 03 - Cast-In-Place Concrete
  - 3. Division 07 – Fire-stopping
  - 4. Division 07 - Joint Protection
  - 5. Division 07 - Installation requirements for roof flashing installation.

6. Division 09 - Painting and Coating
7. Section 22 05 01 - Common Work Results for Plumbing
8. Section 22 24 03 – General Service Compressed Air Systems and Specialties
9. Section 22 25 01 - Sanitary Waste and Vent System and Specialties

### 1.3 REFERENCES

- A. Refer to Section 22 05 01 for complete listing of references.

### 1.4 DEFINITIONS

- A. Fire-stopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

### 1.5 SYSTEM DESCRIPTION

- A. Fire-stopping Materials: ASTM E119, ASTM E814, UL 263, UL 1479, to achieve fire ratings of adjacent construction in accordance with FM or UL requirements.
- B. Surface Burning: ASTM E84 UL 723 with maximum flame spread / smoke developed rating of 25/50.
- C. Fire-stop interruptions to fire rated assemblies, materials, and components.

### 1.6 PERFORMANCE REQUIREMENTS

- A. Fire-stopping: Conform to applicable code (FM or UL) for fire resistance ratings and surface burning characteristics.
- B. Fire-stopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

### 1.7 SUBMITTALS

- A. Section 22 05 02 – Plumbing Shop Drawings and Submittals, Substitutions and O&M Manuals: Submittal procedures.
- B. Shop Drawings:
  1. Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers, metal framing systems, pipe stands and/or equipment supports.
  2. Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations.
- C. Product Data:
  1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Fire-stopping: Submit data on product characteristics, performance and limitation criteria.
- D. Fire-stopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.
  2. Firestopping: Submit preparation and installation instructions.
- F. Welding certificates.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.
- 1.8 QUALITY ASSURANCE
- A. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
  2. AWS D1.2, "Structural Welding Code--Aluminum."
  3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  4. ASME Boiler and Pressure Vessel Code: Section IX.
- B. Through Penetration Fire-stopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
  2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/50 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to

building structure.

- G. Perform Work in accordance with State of North Carolina and State Construction Requirements.
- H. Maintain one (1) copy of each document on site.

#### 1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three (3) years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

#### 1.10 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one (1) week prior to commencing work of this section.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

#### 1.12 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements: Environmental conditions affecting products
- B. Do not apply fire-stopping materials when temperature of substrate material and ambient air is below 60-degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3-days after installation of fire-stopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.

#### 1.13 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

#### 1.14 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

### PART 2 - PRODUCTS

#### 2.1 PIPE HANGERS AND SUPPORTS

- A. Provide all miscellaneous steel required for support of pipes and equipment other than steel shown on Structural Engineer's drawings.
- B. Pipe hanger design, materials, and manufacturer shall conform to the requirements defined in MSS SP58-88.
- C. The selection and spacing of pipe hangers shall comply with the data included in MSS SP69-91.
- D. All hanger materials including clevis hangers, rods, inserts, clamps, stanchions, brackets, shall have a factory applied finish of electro-plated zinc, unless noted otherwise.
- E. Hangers, clamps and supports for use on un-insulated copper piping shall be provided with inserts to isolate the copper piping from the hanger. Inserts shall be made of felt or plastic and shall be as manufactured by the hanger manufacturer.
- F. Insulated piping shall be provided with insulation shields. Hanger shall be sized to include piping diameter and insulation thickness.
- G. Manufacturers:
  - 1. B-Line Systems, Inc.
  - 2. Carpenter & Paterson Inc.
  - 3. ERICO/Michigan Hanger Co.
  - 4. Globe Pipe Hanger Products Inc.
  - 5. Grinnell Corp.
  - 6. MIRO Industries, Inc.
  - 7. PHD Manufacturing, Inc.
  - 8. Tolco Inc.
  - 9. Unistrut Corp.; Tyco International, Ltd.
- H. Hanger Materials:
  - 1. Horizontal Sanitary, Waste and Vent Piping and Storm water Piping:
    - a. 3-inch and smaller:
      - 1) B-Line                      B3100
      - 2) Anvil                        260
      - 3) PHD                         450
    - b. 4-inch and larger:



- 1) B-Line B3102
- 2) Anvil 590
- 3) PHD 420

2. Piping:

a. 2-inch and smaller:

- 1) B-Line B3100
- 2) Anvil 260
- 3) PHD 450

b. 2½-inch and larger:

- 1) B-Line B3100
- 2) Anvil 260
- 3) PHD 450

c. AWWA piping:

- 1) B-Line B3102
- 2) Anvil 590
- 3) PHD 420

3. Connectors:

a. Beam Clamps:

- 1) B-Line B3033, B3050, B3291-B3297
- 2) Anvil 88, 133, 134 or 292S
- 3) PHD 360, 620

b. Concrete inserts:

- 1) B-Line B2500, B3014
- 2) Anvil 282, 285
- 3) PHD 950

c. Welded beam attachments:

- 1) B-Line B3083

- 2) Anvil 66
- 3) PHD 900
- d. Piping adjacent to walls or steel columns, brackets:
  - 1) B-Line
  - 2) Anvil No. 194, 195, or 199 depending on weight to be supported.
  - 3) PHD
- e. Base supports:
  - 1) B-Line
  - 2) Anvil Figure No. 259, or 264.
  - 3) PHD
- 4. Hanger Rods:
  - a. Hanger rod:
    - 1) B-line
    - 2) Anvil Figure No. 140.
    - 3) PHD
  - b. Continuous threaded rod:
    - 1) B-line
    - 2) Anvil Figure No. 146.
    - 3) PHD
  - c. Eye Rods:
    - 1) B-line
    - 2) Anvil Figure No. 248
    - 3) PHD
- 5. Trapeze Hangers:
  - a. Direct Mounting Hangers:
    - 1) B-line

2) Anvil                      Figure No. 46

3) PHD

## 2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

## 2.3 INSERTS

- A. Inserts: Malleable iron case of [galvanized] steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## 2.4 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Sleeve in paragraph below is available with many end variations.
- D. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

## 2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated and rough brass.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.6 FORMED STEEL CHANNEL

- A. Manufacturers:
  - 1. Allied Tube & Conduit Corp.
  - 2. B-Line Systems

3. Midland Ross Corporation, Electrical Products Division

4. Unistrut Corp.

B. Product Description: Galvanized 12-gage thick steel. With holes 1½-inches on center.

## 2.7 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and non-metallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

B. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive fire-stopping.

### 3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Obtain permission from the Professional before using powder-actuated anchors.

E. Do not drill or cut structural members.

### 3.3 INSTALLATION – INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4-inches and larger.

### 3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, and/or MSS SP 89.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum ½-inch space between finished covering and adjacent work.
- D. Place hangers within 12-inches of each horizontal elbow.
- E. Use hangers with 1½-inch minimum vertical adjustment.
- F. Support horizontal cast iron pipe adjacent to each hub, with 5-foot maximum spacing between hangers.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Provide copper plated hangers and/or support or isolation packing between hanger and/or support] and bare copper piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- K. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 11 03.

### 3.5 INSTALLATION – SLEEVES

- A. Set sleeves in position in forms. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors 1½-inches above finished floor level. Caulk sleeves. Extend sleeves through floors 3-inches above finished floor level in Kitchen or wet-areas.
- D. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with fire-stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces where located below ceiling.

### 3.6 INSTALLATION – FIRE-STOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring fire-stopping.
- B. Apply primer where recommended by manufacturer for type of fire-stopping material and substrate involved, and as required for compliance with required fire ratings.

- C. Apply fire-stopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.
- E. Remove dam material after fire-stopping material has cured.] [Dam material to remain.
- F. Fire Rated Surface:
  - 1. Seal opening at floor wall as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1-inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
    - c. Pack void with backing material.
    - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
- G. Non-Rated Surfaces:
  - 1. Seal opening through non-fire rated **wall** as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1-inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1-inch void between sleeve and building element.
    - c. Install type of fire-stopping material recommended by manufacturer.
  - 2. Install escutcheons where piping, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
  - 3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
  - 4. Interior partitions: Seal all pipe penetrations. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

### 3.7 FIELD QUALITY CONTROL

- A. Division 01 - Quality Requirements or - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed fire-stopping for compliance with specifications and submitted schedule.

### 3.8 CLEANING

- A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

- B. Clean adjacent surfaces of fire-stopping materials.

3.9 PROTECTION OF FINISHED WORK

- A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.10 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
Aluminum (All sizes)	10	1/2
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
Fiberglass	4	1/2
Glass	8	1/2
Polybutylene	2.67	3/8
Polypropylene	4	3/8
PVC (All Sizes)	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION 22 11 04

SECTION 226000 - GAS AND VACUUM SYSTEMS FOR LABORATORY & HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 GENERAL

- A. Furnish and test the following systems:
  - 1. Nitrogen (N<sub>2</sub>)
- B. Work includes outlets, valves, and miscellaneous accessories for complete systems.
- C. Work also includes pressure testing, precertification testing and final testing, including purging and analyzing.
- D. Work described in this section does not include electrical wiring for alarms and electrical accessories associated with the system.
- E. All equipment must be supported directly by structural members with adequate load-bearing capacity and material integrity, using appropriate anchoring/connection hardware. Under no circumstances may equipment be supported by connections to finish materials. For example, equipment hung from toggle bolts through plaster-on-lath, gypsum board or ACT ceilings is not acceptable.

1.2 CODE COMPLIANCE / QUALITY ASSURANCE

- A. Comply with local, state and federal codes applicable in this jurisdiction.
- B. Employ only qualified journeymen for this work. Employ a competent qualified mechanic/piping foreman who has satisfactorily completed at least five other similar installations for this work.

1.3 COORDINATION

- A. Coordinate with other trades to assure timely installations and to avoid conflicts and interference.
- B. Work closely with the metal stud partition installer and/or mason to assure that anchors, sleeves, and similar items are provided in sufficient time to avoid delays; chases and openings are properly sized and prepared.
- C. Coordinate layout of medical gas systems in all spaces and identify all piping accurately and in accordance with Section 9 of this guideline.

PART 2 - PRODUCTS

2.1 COPPER PIPING MATERIALS



- A. Piping: Seamless Type K (ASTM 819) copper tubing, in accordance with NFPA 99 Chapter 4. Piping shall be precleaned and plugged by supplier before shipment to jobsite. Piping shall be labeled according to NFPA 99.
- B. Fittings: Wrought copper, designed expressly for brazed connection. Brazing alloy: Melting point of at least 1000°F.
- C. Flux: Do not use for copper-to-copper joints. Use flux for joining copper to brass or bronze. In those cases where flux is used, exercise particular care in applying the flux to avoid leaving any excess inside the completed joints.
- D. Isolation of copper tubing from dissimilar metal shall be accomplished either through use of copper tear drop hangers or plastic isolators. Duct tape shall not be used. Vibra-clamps or tube clamps shall be used with Unistruts (with appropriate isolator).

## 2.2 VALVES

- A. Ball Valves
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Healthcare Products Inc.; Chemetron Division.
    - b. Apollo
    - c. Amico Corporation.
    - d. BeaconMedaes.
    - e. Conbraco Industries, Inc.
    - f. Marwin Valve; a division of Richards Industries.
    - g. NIBCO INC.
    - h. Ohio Medical Corporation.
    - i. Tri-Tech Medical Inc.
  - 2. Standard: MSS SP-110.
  - 3. Description: Three-piece body, brass or bronze.
  - 4. Pressure Rating: 300 psig minimum.
  - 5. Ball: Full-port, chrome-plated brass.
  - 6. Seats: PTFE or TFE.
  - 7. Handle: Lever.
  - 8. Stem: Blowout proof with PTFE or TFE seal.
  - 9. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
- B. Pressure Regulators
  - 1. Manufacturers: Concoa 425 Series or equal
    - a. Stainless-steel body and trim.
    - b. Spring-loaded, diaphragm-operated, relieving type.
    - c. Manual pressure-setting adjustment.
    - d. Rated for 250-psig minimum inlet pressure.
    - e. Capable of controlling delivered gas pressure within 0.5 psig for each 10-psig inlet pressure.
    - f. Provide with manufacturer outlet valve, pressure gauge, and wall mount bracket.

## PART 3 - EXECUTION

3.1 GAS IDENTIFICATION

- A. gas labels shall contain flow arrows and be color coded according to NFPA. piped gases shall be labeled at 10 foot intervals. Piping shall contain labels before and after all wall penetrations and all piping turns. Piping shall be labeled at least once in each room.

3.2 PIPED GAS INSTALLATION

- A. Pre-clean and prepare copper pipe, tubing, valves and fittings for medical gas service in accordance with Chapter 4 of NFPA 99, except those supplied especially prepared for such service by the manufacturer and received sealed on the job. Copper tubing shall be pre-cleaned, degreased and delivered sealed to the jobsite.
- B. Joints in the piping, except those at equipment requiring screwed connections, shall be made with silver brazing alloy or similar high melting point (at least 1000°F) brazing metal.
- C. Silver brazing material: Stay-Silv-15, Silvaloy-15, Aircosil No. 15 or Phos-Si Iver-15.
  - 1. Silver brazing alloy composition: 15% silver, 80% copper and 5% phosphorus. No cadmium.
  - 2. Minimum of 1000°F liquid melting point with ASTM rating of "BCuP5".
  - 3. The use of flux is prohibited for the making of joints between copper-to-copper pipes and fittings. Appropriate flux similar to "Stay-Silv-Black Flux" or "Stay-Silv-White Flux" is required between dissimilar metals such as copper to brass or bronze material, when parts are heated over a prolonged period.
- D. During the brazing of pipe connections, the interior of the pipe shall be purged continuously with oil-free, dry nitrogen. The outside of the tube and fittings shall be cleaned by washing with hot water after assembly.
- E. Threaded joints in piping systems shall be made up with polytetrafluorethylene (such as Teflon) tape or other thread sealants suitable for oxygen service. Apply sealants to the male threads only.
- F. Support piping with pipe straps or hangers at appropriate intervals and do not support from other piping. Piping shall be supported from the building structure. Under no circumstances shall piping or other equipment be suspended from finish materials such as dropped ACT ceilings or plaster lath.
  - 1. Isolate copper piping from dissimilar metals. Duct tape shall not be used as an isolation material.
- G. Threaded joints in distribution piping shall be limited to the connection of gauges, switches and similar devices.
- H. Use flux with a silver (BAG series) brazing filler material. Some flux may contain compounds objectionable for oxygen service and shall not be employed.
- I. Pipe shall be prepared, fit together and brazed within the same 24-hour period to avoid contamination of the pipe. During intervals within the work where work is incomplete, end caps (sized according to pipe) shall be installed over the ends of the pipe and taped to avoid contamination.

- J. Fittings, valves and other components shall remain sealed until installation onto the system. Bags shall remain closed and sealed when not in use.
- K. On-site cleaning: Shall be limited to re-cleaning surfaces in the immediate vicinity of the joints that have become contaminated prior to brazing. Surfaces shall be cleaned by washing in a clean, hot water/alkaline solution, such as sodium carbonate or tri-sodium phosphate (1 lb to 3 gal of potable water). Interior surfaces shall be thoroughly scrubbed and rinsed with clean, hot, potable water.
  - 1. Any on-site cleaning shall be supervised by university personnel.
  - 2. Clean brushes, rubber gloves, towels and bags shall be used. After rinsing and drying the surfaces, the fittings, valves, etc. shall be placed in a clean bag until installation (to avoid recontamination).
- L. After installation of the piping but before installation of the outlet valves, blow lines clear by means of oil-free, dry nitrogen.
- M. Piping exposed to physical damage shall be adequately protected.
- N. While being brazed, joints shall be purged with inert gas (nitrogen NF) per NFPA 99.
- O. Uninstalled piping shall be kept on a pipe rack. This piping shall also be kept separate from other copper piping to avoid incorrect usage.

### 3.3 INSTALLER PERFORMANCE TESTING

- A. Testing shall be performed with oil-free, dry nitrogen. The installing Contractor shall perform the following steps:
  - 1. Blow Down
    - a. NFPA 99, 1999 4-3.4.1.2(a)
  - 2. Initial Pressure Test
    - a. NFPA 99, 1999 4-3.4.1.2(b)
  - 3. Cross-Connection Test
    - a. NFPA 99, 1999 4-3.4.1.2(c)
  - 4. Piping Purge Test
    - a. NFPA 99, 1999 4-3.4.1.2(d)
  - 5. Standing Pressure Test
    - a. NFPA 99, 1999 4-3.4.1.2(e)
    - b. Due to time schedules during construction, sections of piping systems can be tested so that walls can be closed-in. When sections of piping have been tested, the entire system must again be tested before final precertification and certification of the system.
    - c. Test apparatus shall be leak tested and found leak free before the start of the 24-hour test.
- B. All items in this section shall be documented in a report by Contractor per NFPA 99.

### 3.4 System VERIFICATION AND CERTIFICATION

- A. Testing shall be performed with oil-free, dry nitrogen. The installing Contractor shall perform the following steps: Cross connection testing and precertification of the medical gas system must be

performed by a party technically competent and experienced in the field of medical gas pipeline testing. A party other than the installing Contractor shall perform the following testing:

1. Cross-connection Test
    - a. NFPA 99, 1999 4-3.4.1.3(a)
  2. Valve Test
    - a. NFPA 99, 1999 4-3.4.1.3(b)
  3. Outlet Flow Test
    - a. NFPA 99, 1999 4-3.4.1.3(c)
  4. Alarm Testing
    - a. NFPA 99, 1999 4-3.4.1.3(d)
  5. Piping Purge Test
    - a. NFPA 99, 1999 4-3.4.1.3(e)
  6. Piping Purity Test
    - a. NFPA 99, 1999 4-3.4.1.3(f)
- B. Medical gas system shall be tested in accordance with NFPA 99, latest edition and these specifications.
- C. Obtain and present to the Owner a complete bond report of pipeline precertification from the equipment manufacturer. This letter of precertification shall indicate:
1. That the system is free of crossed connections.
  2. That all system components perform to the manufacturer's design specifications.
  3. That all system components, particularly the alarm system, have been installed in accordance with the manufacturer's recommendations.
- D. This report must be submitted to Engineering and Operations (E&O) a minimum of 48 hours before the desired date of the tie-in. E&O, Administration and Respiratory Therapy will coordinate the tie-in with the contractor.

END OF SECTION 226000

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## SECTION 230100 - HVAC GENERAL

### PART 1 - GENERAL REQUIREMENTS

#### 1.1 DEFINITIONS

- A. Piping: Pipe, fittings, flanges, valves, controls, hangers, supports, traps, drains, gauges, insulation, vents, and items customarily required in connection with the transfer of fluids.
- B. Ductwork: All air distribution, re-circulation, and exhaust ducts, whether of sheet metal or other material, and includes all connections, hanger, supports, damper controls, insulation, accessories, fire and smoke control devices, and appurtenances necessary for and incidental to a complete system.
- C. Provide: Furnish and install complete ready for use.
- D. Furnish: Purchase and deliver to the project site complete with every necessary appurtenance and for installation.
- E. Install: Unload at the delivery point and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.
- F. Concealed: Embedded in masonry or other construction, installed behind wall furring, above ceilings, in crawl spaces, in shafts or otherwise not visible.
- G. Exposed: Not concealed.
- H. By other Trades: Shall mean by persons or parties who are not anticipated to be the Subcontractor for this trade working together with the Prime Contractor. In this context the words "by other trades" shall be interpreted to mean not included in the overall contract.
- I. Contractor: As used in this Division of the specification refers to the Mechanical Contractor unless specifically noted otherwise.

#### 1.2 INTERPRETATION OF CONTRACT DOCUMENTS

- A. This section of the specifications and related drawings describe general provisions applicable to every section of Division 23.
- B. Attention is directed to General Conditions, which is binding in its entirety, on this portion of the work and in particular to paragraphs concerning materials, workmanship, and substitutions.
- C. Mention in these specifications, indications, and reasonable implications on drawings, whereby articles, materials, operation or methods related to execution of the mechanical work are noted, specified, drawing or described, thereby requires execution of each such item of work and provision of all labor, materials, equipment and appurtenances required for execution thereof.

- D. Particular attention is directed to the drawings and other contract documents for information pertaining to required items or work which are related to and usually associated with the work of this Division of the specifications, but which are to be provided as part of the work of other Divisions of the specifications.
  - E. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenance or accessories necessary to complete any required system or item of equipment are to be omitted.
  - F. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded. When abbreviations appear on the drawings or specification in lower case letter with or without periods, their meanings shall be the same as stated above.
  - G. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.
  - H. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.
  - I. The use of words in the singular shall be considered as limited where other indications denote that more than one item is referred to.
  - J. Submission of a proposal and ultimate acceptance of an agreement or contract for execution of this section of work will be construed as evidence that the Prime Contractor, Subcontractor and Vendor has carefully read and accepts all conditions set forth in each division. Insofar as such conditions may affect both the bidding for and execution of this section of work.
  - K. Where compliance with drawings or specifications is in apparent conflict with the applicable building codes or applicable UL listings then contractor shall contact the engineer of record. Generally building codes and UL compliance will take precedence over the specifications and drawings.
- 1.3 QUALITY ASSURANCE AND WARRANTY
- A. The Contractor shall guarantee all work, materials and equipment furnished against defects, leaks, performance, and non-operation for a period of one (1) year after the date of the Owner's final acceptance, or as indicated in the General Conditions. Warranties to extend past this date are defined in individual equipment specification sections. Defects shall be interpreted as defective materials or equipment or unsatisfactory installation and are not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by these defects within the period covered by the guarantee, including all incidental work required to correct the deficiency.
  - B. All equipment and materials required for installation under these specifications shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories

approval where subject to Underwriters Laboratories label service. Where no specific indication as to the type or quality of material or equipment is indicated, a first-class standard article shall be furnished. All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacturers of said equipment a minimum of three (3) years and, if directed by the Designer, be able to furnish proof of their ability to deliver this equipment by submitting affidavits supporting their claim.

- C. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. UL or other label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.
- D. All equipment of one type (such as fans, pumps, valves, grilles, etc.) shall be the products of one manufacturer unless specifically stated otherwise.
- E. Where the specifications do not list a specific model number for a manufacturer, the construction of a product shall be equal to those models specifically listed.
- F. All welders shall be certified by the National Certified Pipe Welding Bureau for the appropriate service and shall perform all welding in accordance with Welding Bureau's procedures and the ASA Code for pipe welding. Welding and welder qualifications shall be in accordance with ASME Section IX.

#### 1.4 REQUIREMENTS OF REGULATORY AGENCIES

- A. Contractors shall submit to the appropriate Regulatory Agencies all items necessary to obtain all required permits obtain such required permits and pay all required fees.
- B. All work shall conform to the following Standards and Codes (applicable edition):
  - 1. North Carolina State Building Code.
  - 2. National Fire Protection Association.
  - 3. Uniform Boiler and Pressure Vessel Act of N.C. (Boiler Code).
  - 4. State Construction Manual
- C. Where applicable, all fixtures, equipment, and materials shall be as approved or listed by the following:
  - 1. Underwriters Laboratories, Inc. (UL).
  - 2. CSA.
  - 3. ETL.
  - 4. AGA.
  - 5. AWWA.

#### 1.5 STANDARDS AND PROCEDURES

- A. ADC: Air Diffusion Council.
- B. AMCA: Air Moving and Conditioning Association, Inc.



- C. ANSI: American National Standards Institute.
- D. API: American Petroleum Institute.
- E. ARI: American Refrigeration Institute.
- F. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
- G. ASME: American Society of Mechanical Engineers.
- H. ASTM: American Society of Testing and Materials.
- I. IBR: Institute of Boiler and Radiator Manufacturers.
- J. MSS: Manufacturers Standardization Society.
- K. NEMA: National Electrical Manufacturer's Association.
- L. OSHA: Occupational Safety and Health Administration.
- M. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.
  - 1. Where reference is made to ASA Standards it shall be understood that this reference is to the standards published by ANSI.
  - 2. Include all items of labor and materials required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

#### 1.6 EQUIVALENT PRODUCTS

- A. Notwithstanding any reference in the specifications to any article, device, product, materials, fixture, form or type of construction by name, make, or catalog number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition and the Contractor, in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction which, in the judgment of the Designer, expressed in writing, is equal to that specified.
- B. Requests for written approval to substitute materials or equipment considered by the contractor as equal to those specified shall be submitted for approval, to the Engineer, in accordance with SUBSTITUTIONS section.

#### 1.7 VERIFICATION OF DIMENSIONS AND LOCATIONS

- A. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work, working conditions, verify all dimensions in the field, advise the Designer of any discrepancy, and submit shop drawings of any changes he proposes to make, in quadruplicate for approval, before starting the work. Contractor shall install all equipment in a manner to avoid building interference.

- B. The location of duct, pipe, fixture, equipment, and appurtenances for existing facilities are shown on plans to indicate the extent of work required. Exact condition shall be field verified.

#### 1.8 COORDINATION WITH OTHER TRADES

- A. Coordinate all work of each section with work of other sections to avoid interference. Bidders are cautioned to check their equipment against space available as indicated on drawings and shall make sure that proposed equipment can be accommodated. If interferences occur and clearances cannot be maintained as recommended by manufacturer and as required for maintenance and inspection of equipment, Contractor shall bring them to the attention of Designer, in writing, prior to signing of contract; or Contractor shall, at his own expense, provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interferences.
- B. Prepare composite coordination drawings at a scale of  $\frac{1}{4}'' = 1'-0''$  or larger, detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components (For all floor levels including all mechanical areas, penthouses, and roof plans. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the work. The Mechanical Contractor will administer the effort of coordination between various trades. The coordination drawings will be prepared and reviewed approved by Engineer of Record and CxA before installation of any plumbing, sprinkler, mechanical or electrical work and will be shown as a task on the Project Schedule to be prepared by the General Contractor.

#### 1.9 WORKMANSHIP

- A. Workmen to be thoroughly experienced and fully capable of installing assigned work. Work to be in accordance with the best standard practice of the trade. Work that is not of good quality will require removal and reinstallation at no additional expense to Owner and as approved.
- B. All material and equipment to be installed in accordance with manufacturer's printed recommendations (using recommended accessories) and/or as approved by the Designer. Retain a copy on job site and submit others for approval when required.

### PART 2 - PRODUCTS

This Part Not Used.

### PART 3 - EXECUTION

#### 3.1 SURFACE CONDITIONS

- A. Inspection:

1. Prior to any work, the Contractor shall carefully inspect the installed Work of all other Trades and verify that all such Work is complete to the point where his installation may properly commence.
2. Verify that all equipment may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

### 3.2 INSTALLATION

- A. Install all equipment and appurtenances in strict accordance with the manufacturer's recommendations.

### 3.3 REQUIREMENTS FOR OPERATING HVAC EQUIPMENT DURING CONSTRUCTION

- A. If return air is to be used then all exhaust and return ducts/grilles shall be covered with temporary filter media, minimum MERV 8, to prevent dust infiltration into the ducting.
- B. All chilled water piping shall be insulated.
- C. Pump and fans shafts shall be aligned prior to operation. Laser alignment shall be provided for pumps, and reports shall be furnished prior to operation.
- D. All main supply ductwork shall be insulated.
- E. All safety circuits and basic control functions shall be active and fully functional. If the equipment may operate without a fully functional BAS, then means to prevent damage to ducting due to closed dampers and means to prevent damage to freezing coils shall be provided. Blow-out doors may be used to protect ducting. Until TAB activities commence, fans and pumps shall operate at no more than 70% of estimated design capacity.
- F. Conditioning (cooling & dehumidifying) of the building shall remain once started.
- G. The contractor shall perform all required preventative maintenance on mechanical equipment operated during construction and provide documentation in the operation and maintenance manuals of preventative maintenance activities completed during this period.

### 3.4 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

- A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. In the event of damage prior to final inspections, the Contractor shall repair or replace damaged items as determined by the Architect/Engineer, at no cost to the Owner.
- B. Damage from rain, dirt, sun, and ground water shall be prevented by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid or flexible waterproof coverings.
- C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.
- D. During construction cap the top of all ductwork and piping installed vertically.

- E. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris. All adjacent occupied areas shall be cleaned daily to remove dirt and debris resulting from this work.

### 3.5 SUBSTITUTION OF EQUIPMENT

- A. Requests for substitutions of products may be made during the bidding period by submitting completed substitution request accompanied by information sufficient for the Engineer to make a determination as to the equivalency of a product.
- B. The Engineer will consider requests utilizing this section for substitution of products in place of those specified.
- C. Refer to Division 00 for additional details..
- D. Complete data substantiating compliance of proposed substitutions with requirements stated in Contract Documents:
  - 1. Product identification, including manufacturer's name and address.
  - 2. Manufacturer's literature, identifying:
    - a. Product description
    - b. Reference standards.
    - c. Performance and test data.
  - 3. Name and address of similar projects on which product has been used and date of each installation.
  - 4. Itemized comparison of the proposed substitution with product specified, listing significant variations.
  - 5. Data relating to changes in construction schedule, if any.
  - 6. All effects of substitution on separate contracts.
  - 7. List of changes required in other work or products.
  - 8. Designation of availability of maintenance services and sources of replacement parts.
- E. Substitutions will not be considered for acceptance when:
  - 1. Acceptance will require substantial revision of Contract Documents.
  - 2. In judgment of Engineer, substitution request does not include adequate information for a complete evaluation.
  - 3. Requests for substitutions not submitted by a Prime Bidder.
  - 4. Where the effect on the schedule will be negative.
- F. In making formal request for substitution, the Prime Bidder represents that:
  - 1. The Prime Bidder has investigated proposed product and has determined that it is equivalent to or superior in all respects to that specified.
  - 2. The Prime Bidder will provide the same warranties or bonds for substitution as for product specified.
  - 3. The Prime Bidder will coordinate installation of accepted substitution into the Work and will make such changes as may be required for the Work to be complete in all respects.

3.6 SUBMITTALS

- A. Refer to Division 1, as available, for information on submittal requirements. When conflicts exist, Division 1 shall apply.
- B. The terms "Submittals" can generally be used to indicate any information which is required to be reviewed by the A/E before further action on that product can be taken by the Contractor. This may include product data sheets, shop drawings, and schedules.
- C. Submittals generally not required when equipment is purchased exactly as specified and scheduled. Submit list of such equipment only. Equipment data sheets must be included in project manual prepared for Owner.
- D. Submittals shall be searchable format, preferably pdf.

3.7 PRODUCT SUBMITTALS

- A. The following product data information shall be submitted:

Section	Title
230500	FIRESTOPPING AND WATERPROOFING
230510	GAGES AND METERS
230529	SUPPORTS AND ANCHORS
230553	MECHANICAL IDENTIFICATION
230593	TESTING, ADJUSTING, AND BALANCING
230700	INSULATION
230923	BUILDING AUTOMATION SYSTEM
232113	HYDRONIC PIPING
232116	HYDRONIC SPECIALTIES
232123	PUMPS
233100	DUCTWORK
233300	DUCTWORK ACCESSORIES
233600	AIR TERMINAL UNITS
233700	AIR OUTLETS AND INLETS

3.8 TEST AND REPORT SUBMITTALS

- A. The following list may be used as a checklist for the contractor and A/E. All tests may not be listed:

- 1. Test:
  - a. Underground and Aboveground HVAC piping
  - b. Duct pressure test.
  - c. System start up.
  - d. Test and Balance Agency Construction Report.
  - e. All required test reports.
  - f. Boiler inspection.
  - g. Gas piping pressure test.
  - h. Required Pressurization Systems.

3.9 FIRE PENETRATION SYSTEMS SUBMITTAL

- A. Each type of system penetrating a fire rated assembly shall be identified by the Contractor. The Contractor shall demonstrate his understanding of fire stop systems by the following.
- B. Submit 3/4-inch scale drawings of each assembly indicating type penetrations, slab, floor, wall or roof system, fire stop materials used, thickness and all other pertinent details. Submittal shall be neatly and accurately drafted.
- C. Each type of system penetrating a fire rated assembly shall be identified by the Contractor. Provide approved installation details with agency approval indicated thereon.

3.10 RECORD DRAWINGS

- A. The Contractor shall keep a record set of drawings on the job and, as construction progresses, shall show the actual installed location of all items, material, and equipment of these job drawings.
- B. At the time of final inspection, two corrected sets of prints and sepias shall be delivered to the Designer. All drawing costs to be paid by the Contractor.
- C. Sepias shall be corrected deleting incorrect locations and showing installed locations in accordance with information transferred from job drawing.
- D. Qualified draftsmen shall perform this task.

3.11 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall compile and bind three (3) sets of all manufacturer's instructions and descriptive literature on all items of equipment furnished under this work. An electronic PDF copy of the O&M manuals shall also be provided and shall have searchable text.
- B. The manuals shall comply with specifications in this section in addition to specifications in other mechanical specifications as well.
- C. Binder shall be hard cover, three-ring notebook, 11" x 8-1/2" with heavy duty rings. Maximum binder size shall be 2-1/2".
- D. The front of the binder shall be titled "Mechanical Operating and Maintenance Instructions," with the name of the job and documents date under the title.
- E. Operating and Maintenance Instructions shall include the following:
  - 1. A sheet in each binder listing the architect, engineer, and all contractors. List addresses and phone numbers.
  - 2. List name, address, and phone number of organization responsible for warranty work if other than contractor and the specific work for which he is responsible.
  - 3. List name, address and phone number of the nearest sales and the nearest service organization for each product.

4. Schedules of all equipment indicating identification number shown on plans cross referenced to field applied identification tag number.
  5. Performance Curves: For pumps, balance valves and similar equipment at the operating conditions.
  6. Lubrication Schedule: Indicating type and frequency of lubrication required.
  7. List of Spare Parts: Recommended for normal service requirements. Each piece of equipment shall have this list clearly marked or attached to this submittal.
  8. Parts List: Identifying the various parts of the equipment for repair and replacement purposes.
  9. Instruction Books: May be standard booklets but shall be clearly marked to indicate applicable equipment and characteristics.
  10. Wiring Diagrams: Generalized diagrams are not acceptable; submittal shall be specifically prepared for this Project.
  11. Automatic Controls: Diagrams and functional descriptions.
  12. Test and Balance Reports.
  13. Valve tag list: Identifying valve type, size, service, and general location.
  14. Filter schedule: Identifying filter type, size efficiency, manufacturer, and equipment number.
  15. Ceiling marker schedule.
- F. The following diagrams, schematics and lists shall be framed under glass and hung adjacent to equipment, in mechanical rooms, or where directed by Owner:
1. Automatic control diagrams.
  2. Sequence of operation.
  3. Valve Tag List.

### 3.12 OPERATIONAL AND MAINTENANCE INSTRUCTION

- A. After all final tests and adjustments have been complete, a competent employee of the Contractor shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed. Supply qualified personnel to operate equipment for sufficient length of time after instructions to assure that Owner's Representative is qualified to take over operation and maintenance procedures. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Minimum instruction periods shall be as follows:
1. Air distribution system and chilled water loop (1/2 working day).
- B. Instruction period shall be performed during the forty-five (45) days following substantial completion at time periods as approved by Owner.

### 3.13 CONTROLS OPERATION AND MAINTENANCE INSTRUCCION

- A. Upon completion of Operation and Maintenance instructions, competent employees of the Control Contractor shall be provided to instruct the Owner's representative in all details of operation and maintenance for the controls installed. Supply qualified personnel to operate system for sufficient length of time after instructions to assure the Owner's Representative is qualified to take over operation and maintenance procedures.

- B. Controls Operation and Maintenance Instruction shall include the entire control system including control sequences that are inherent to equipment provided by the Equipment Manufacturer including economizer cycles, burner operation, low ambient operation, freezstats and similar sequences. Contractor shall provide sufficient personnel equipment walkie-talkies, gauges, and other accessories for this work.
- C. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Minimum instruction periods shall be one (1) working day for on-site training.
- D. Instructional period shall be performed during the forty-five (45) days following substantial completion at time periods as approved by Owner. One (1) day of instructions shall be in a formal classroom setting as determined by the owner.
- E. Classroom instructions shall be videotaped by the Contractor. A copy of each tape shall be provided to the Owner. Contractor shall be responsible for all equipment, tapes, and accessories required.

3.14 GENERAL COMPLETION AND DEMONSTRATION

- A. Results Expected:
  - 1. All systems and controls shall be complete, tested, and operational.
  - 2. All start-up and testing and balancing shall be complete.
  - 3. All equipment shall be thoroughly cleaned. All excess materials and all debris shall be removed from the site.
  - 4. All walls, floors, ceilings, and other surfaces marred or otherwise damaged as a result of execution of this contract shall be cleaned and repaired to the satisfaction of the Designer and Owner.

END OF SECTION 230100



## SECTION 230200 - MECHANICAL RELATED WORK

### PART 1 - GENERAL REQUIREMENTS

#### 1.1 DRAWINGS AND SPECIFICATIONS

- A. Provide all materials called for in these specifications and accompanying drawings and provide the apparatus complete in every respect. Anything called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications must be provided.
- B. Where there is a discrepancy between drawings and specifications, the worst case shall be assumed.
- C. Drawings show arrangements of system desired and shall be followed as closely as practical. Because of the small scale of the drawings not all offsets and bends can be shown, and these shall be provided as required, to fully complete the intent of plans. Should conditions and substitutions of equipment necessitate a rearrangement, prepare, and submit for review scaled drawings of such rearrangement, before beginning work.
- D. Verify and check all measurements in the field.
- E. Review architectural, structural, and electrical plans, and cooperate and coordinate work with other trades to the extent that interference shall be avoided. Discrepancies shown on different plans, or between plans and specifications, shall promptly be brought to the attention of the Designer.

#### 1.2 CONCEALMENT OF PIPE AND DUCTS

- A. Chases and Holes: Unless otherwise indicated, all piping and ductwork shall be run in concealed spaces between floor and ceilings or in chases. Ductwork and piping areas without ceilings shall be installed, exposed and as high as practical. This Contractor shall be responsible for the location and size of holes required for pipe, ducts and other equipment and shall advise of chase spaces and holes required as building progresses. Failure to do so shall require this Contractor to provide or cut same.

#### 1.3 CUTTING AND PATCHING

- A. This Contractor must have an experienced Mechanic upon the job before concrete floors, concrete or masonry walls are set in place, whose duty it shall be to locate the exact position of any and all sleeves and holes for the future installation of his pipe or duct work. This Contractor shall locate and size all openings required for his equipment in time to not delay the building construction.
- B. If it becomes necessary to cut holes in concrete floors or concrete or other masonry walls, this Contractor shall call the General Contractor or his superintendent of Construction and inform him of the position and size of the hole or other opening to be provided and the General

Contractor shall determine how this will be done. Under no condition shall this Contractor make any cuts without permission from the General Contractor, nor shall he cut any green floors or walls.

- C. This Contractor shall arrange proper openings in the building to admit his equipment. If it becomes necessary to cut any portion of the building to admit any equipment or install mechanical systems, this Contractor shall be responsible for cutting and patching. The portions cut must be restored to their former condition by this Contractor.
- D. All cutting of structure shall be done using best method to minimize noise and cracking of structure. The method of cutting shall be approved by the Project Expediter (Prime Contractor) before work is started.
- E. All drilled holes required for equipment or supports shall be done by this Contractor. Holes for piping shall be core drilled only.

#### 1.4 EQUIPMENT STANDS, FOUNDATIONS AND MISCELLANEOUS STEEL FOR HANGERS AND SUPPORTS

- A. Provide all equipment stands and supports for equipment as shown or required. Provide miscellaneous steel for hanging piping, ducts or other items of equipment as shown as required.
- B. All concrete foundations, curbs and pads for equipment, ductwork, piping, etc. shall be provided by this Contractor, unless otherwise indicated. Pads shall be provided for all floor standing equipment.
- C. All stands shall be adequately cross braced to provide rigid supporting foundation. All stands shall be adequately anchored to wall or floor as required. All miscellaneous steel shall have one coat of shop paint and two finished coats of rust resistant paint.

#### 1.5 SITE EXAMINATION

- A. Contractor, prior to submitting a bid, shall visit the site and thoroughly acquaint himself with the conditions under which the work will be performed.

#### 1.6 PAINTING

- A. Work to be Painted:
  - 1. All piping, ductwork, conduit, steel supports, hangers, and other mechanical items exposed to view in occupied areas shall be painted under Division 09 by General Contractor.
  - 2. All insulated piping as noted in Section 230700, uninsulated piping, ductwork, supporting steel and hangers for piping, ductwork and equipment (except made of galvanized steel) shall be shop coated with rust proof primer and shall be field painted by Mechanical Contractor except where installed above ceilings or where concealed in building construction. Concealed supports and hangers do not require painting.
  - 3. All exposed insulated and uninsulated piping and ductwork in Mechanical Room shall be painted by Mechanical Contractor with (2) coats of paint.

4. All areas where cutting and patching are required the mechanical contractor shall paint to match adjacent surfaces.
- B. Work not requiring Painting:
1. Piping and ductwork above solid (lay-in, gypsum board, etc.) ceilings do not require painting.
  2. All exposed items specified to be finished by manufacturer will not be painted. See "Manufacturers' Finished Products".
- C. Manufacturers' Finished Products:
1. All manufacturer finished products, such as water pumps, fans, air handling units, control panels, etc., shall have factory standard finish except where otherwise specified on the drawings or in other sections of this specification.
  2. Contractor providing finished products shall be required to touch up any minor damages or scratches due to shipment, installation, or exposure to weather on all equipment with baked enamel or equivalent finish, Prime coated equipment shall be cleaned and touched up. Large areas of damaged finish shall be painted to match factory painting.
- D. Refer to Division 09 for painting requirements

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT SUPPORTS

- A. See notes on plans for supports provided by others.

## PART 3 - EXECUTION

### 3.1 None

END OF SECTION 230200

## SECTION 230300 - ELECTRICAL WORK FOR MECHANICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES:

- A. 120V and 24V control Wiring.
- B. Electrical wiring.
- C. Starters and controllers.

#### 1.2 CODES, STANDARDS, AND QUALIFICATIONS

- A. All work shall conform to all sections of the most current North Carolina State Building Codes.
- B. All work shall conform to all North Carolina Department of Administration State Construction Office Guidelines.
- C. Electrical equipment shall be listed and/or labeled by an independent testing agency approved by the State Building Code.
- D. Enclosure for electrical equipment and enclosed switches shall meet NEMA standards.

### PART 2 - PRODUCTS

#### 2.1 WIRING

- A. All wiring and conduit shall be in accordance with the requirements of Division 26. This includes wiring requirements from variable frequency drives to equipment motors (refer to VFD cable requirements in Division 26).
- B. Low voltage control wiring shall be not less than #18-gauge copper wire run in metallic conduit.
- C. Low voltage shall be defined as a circuit operating at less than 30 volts and meeting the requirements of NEC Section 720 for Class I, power limited circuits.

#### 2.2 MOTORS

- A. Allowable manufacturers:
  - 1. Baldor Super-E EM/XE (general purpose family) with optional cast iron frame.
  - 2. TECO/Westinghouse ASHH or Max-PE, WEG W22.
  - 3. Toshiba.

- B. Substitutions:
1. Must be pre-approved in compliance with procedures outlined in 23 01 00 Mechanical General Specification.
- C. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of ASA C50 and conform thereto for insulation resistance and dielectric strength. Motors shall be provided with conduit terminal box, adequate starting and protective equipment as specified or required. Size shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least shall be the horsepower indicated or specified. Motors shall be selected for quiet operation.
- D. Motors less than 3/4 HP shall be single phase, PSC/capacitor start-induction run, open type, splashproof. Motors 3/4 HP and larger shall be induction, open 3-phase multi tap unless otherwise indicated. Voltage for 3-phase motors is noted in schedules. Coordinate electrical service requirements with Electrical Contractor.
- E. Motors shall be provided with overload protection. On 3-phase motors overload protection shall be in the starters. Single-phase motors shall have built-in thermal overload protection.
- F. Motors shall be sufficient size for the duty to be performed, not less than that indicated on the drawings, and shall not exceed their full rated load when the driven equipment is operating at specified capacity under the most severe conditions likely to be encountered. All motors shall be for continuous duty classification based on 40 degrees C ambient temperature unless otherwise indicated.
- G. Motors less than 1 HP shall have efficiencies that comply with the current N.C. Building Code. Efficiency shall be determined in accordance with IEEE Standard 112, method B.
- H. All vertically mounted motors shall be provided with thrust bearings.
- I. Motors shall be open drip proof (ODP) for indoor use where satisfactorily housed, guarded drip proof when exposed to contact by employees or building occupants, TEFC (totally enclosed fan cooled) for outdoor use.
- J. Motors that are specified to cycle on and off automatically under control of a device shall be capable of making starts as frequently as the device may demand. Other motors shall be capable of being started 4 times per hour without damage.
- K. Motors that are to be used with adjustable frequency drives shall be approved by the motor manufacturer for that service.
- L. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque. Class "B" insulation shall be provided.
1. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
  2. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
  3. Service Factor: The service factor shall be at least 1.15 for polyphase motors and 1.35 for single phase motors.

4. Provide solid shaft grounding rings (Aegis SGR or approved equal). Soft carbon brushes and split shaft grounding rings shall not be accepted.
- M. The opposite shaft end bearing shall be clamped to secure the bearing in the housing. Electrical characteristics and horsepower shall be as specified on the project schedule.

## 2.3 STARTERS AND CONTROLLERS

- A. Controllers and Control: Where controllers and controls are specified to be provided by the Contractor, they shall conform to the requirements specified below:
1. Controllers shall conform to adopted standards and recommended practices of the Industrial Control Standards of National Electrical Manufacturer's Association and the standard for Industrial Control Equipment of the Underwriters' Laboratories, Inc. Motors 93 W (1/8 hp) or larger and shall be provided with thermal overload protection. Manually reset type. Overload protective device shall be provided, mounted in separate enclosure. Single or double-pole tumbler heavy duty switches may be used as manual controllers for motors of 186 W (1/4 hp) or less in rating. Manual controllers for motors larger than 186 W (1/4 hp) shall be designed for purpose and shall have horsepower rating adequate for motor. Two speed motors shall have 2 winding type controllers unless otherwise specified.
  2. Manual starters shall be provided with a manually operated trip free switch, horsepower rated with a separate fused disconnect.
  3. Contractor providing the starters shall be responsible for all motors to be protected with proper size heater or thermal elements. All starters and enclosures shall be NEMA Standard, Type 1 unless otherwise specified. In wet locations, enclosures shall be NEMA 3R.
  4. All starters and pushbutton stations shall be provided with labels as specified under identification designating service for which starter is used. Plate shall be firmly attached to starter or wall mounted adjacent to the starter.
  5. All cabinets provided for the installation of motor starters, control transformers, relays, and appurtenant items shall be provided with gravity or forced ventilation at the option of the manufacturer. Openings shall be placed at bottom and top of the cabinet or high-low in the door if recessed and of sufficient size to limit the temperature rise through the enclosure or ambient compensated heater elements shall be provided.
  6. All controllers and starters shall be rated for the same voltage as the motor which it serves. If the voltage is not indicated on the HVAC drawings, the Contractor shall provide the units at the voltage listed on the electrical drawings.
  7. Provide interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division 23 Controls sections.
  8. Provide built-in 120 volts control circuit transformer, fused from line side, where service voltage exceeds 240 volts.
  9. Provide externally operated manual reset.
  10. Motor connections shall be in waterproofed sealtite flexible conduit, maximum length of 457 mm (18"), except where plug-in electrical cords are specifically indicated.

## 2.4 SAFETY SWITCHES

- A. All safety switches specified in Division 23 or on mechanical plans shall be heavy-duty type, NEMA 1 for indoor and NEMA 3R for outdoor use unless specifically stated specifically otherwise on plans. They shall be fused type unless specifically indicated otherwise on plans.

Fused type shall be equipped with the following: Service Entrance and Feeder Circuits over 600A – Class L, UL Listed, current limiting with 200K interrupting rating; Service Entrance and Feeder Circuits 600A and less – Class RK1 or J, UL Listed, current limiting with 200K interrupting rating; Motor, Motor Controller and Transformer Circuits – Class RK5, UL Listed, current limiting time delay with 200K interrupting rating; and Individual Equipment where fault current does not exceed 50kA – Class K5, UL Listed, with 50K interrupting rating. Fusible safety switches with short circuit withstand rating of 100K or 200K shall include Class R or Class J rejection fuse block feature. Switches shall be equipped with defeatable door interlocks and padlocking provisions in the on and off positions. Padlocks shall be provided for switches located in public areas. Switches shall be by Square D, Cutler-Hammer, General Electric Co., or equivalent by others.

- B. Contractor shall furnish one spare set of fuses for each piece of equipment.
- C. All safety switches, motor starters, or other boxes or panels, designated as NEMA 3R or otherwise intended for outdoor use or use in wet areas, shall use raintight conduit hub fittings with bonding screw.
- D. Control wiring shall not be installed in the same raceways as power wiring.

### PART 3 - EXECUTION

#### 3.1 WIRING

- A. Regardless of voltage, furnish and install all temperature control wiring, and all interlock wiring and equipment control wiring for the equipment furnished.
- B. Electrical Contractor will furnish and install all power wiring to line side of starters (see details on plans). The mechanical contractor shall furnish disconnects for equipment. Mechanical contractor shall provide all load side power wiring (see details on plans) and temperature control and interlock wiring. Controllers and controls shall be provided by the Mechanical Contractor.
- C. Check with Electrical Contractor on service outlets provided to determine that service, circuit protection, switches and wiring provided are of adequate size to meet Code requirements for equipment provided. Discrepancies shall be brought to the attention of the Designer before work is installed. Cost for changes not so noted shall be at the expense of this Contractor. Electrical cost increase due to equipment substitution of different electrical characteristics shall be this Contractor's expense.
- D. Provide necessary electrical data for all equipment to the Electrical Contractor for proper coordination.
- E. Control and interlock wiring shall be run in conduit. Conduit shall be minimum 3/4" in size.
- F. Provide control circuit disconnect for all motor starters as required by Section 430-74 of NEC.
- G. Unless otherwise noted or specified, all low voltage and line voltage control and instrumentation wiring and devices for equipment furnished under Division 23 shall be provided as part of this Division 23. Control wiring is considered to be the portion of the wiring which carries the electric signal directing or indicating the performance of a starter, relay, or contactor generally installed

between starters, indicators, and remote-control devices. All wiring from indicated or available electrical source in the electrical room and/or mechanical room to direct digital control panels shall be provided as part of this Division.

- H. Examine the drawings, and in cooperation with the Electrical Contractor, confirm the final location of all electrical equipment to be installed in the vicinity of piping. Plan and arrange all overhead piping to be no closer than 24" from the vertical line to electric motor controllers, switchboards, panelboards, or similar equipment. If the vertical line is less than 24", the installation of piping shall be relocated.

END OF SECTION 230300



## SECTION 230500 - FIRESTOPPING

### PART 1 - GENERAL REQUIREMENTS

#### 1.1 SCOPE OF WORK

##### A. General:

1. Furnish all labor, materials, tools, and equipment and perform all operations in connection with the patching and repair of building structure, finishes and building assemblies as specified hereinafter.
2. Furnish all labor, materials, tools, and equipment and perform all penetrations in connection with the installation of fire stopping and smoke stopping systems required to seal all penetrations of required rated partitions, walls, or assemblies for Division 23 work.

##### B. Descriptions:

1. Patch and repair all building finishes, structural components, or other appurtenances that are removed or damaged as a result of the performance of this contract. Patch and repair work shall include finishes, components, substructure, and materials required for the installation of such work in accordance with standard practices.
2. All penetrations through exterior walls, floors, and roof systems shall be sealed watertight.
3. Firestop all existing openings in walls, roofs, slabs, and similar assemblies remaining as a result of removing existing pipes, ducts, conduit, equipment appurtenances.
4. Firestop and Smokestop as required for assembly type all new openings in walls, roofs, slabs and similar assemblies at pipe, duct, conduits, equipment, and appurtenances.
5. Patched and repaired work shall be finished to match existing or adjacent construction and conditions.

#### 1.2 QUALITY ASSURANCE

##### A. Materials:

1. Materials shall be new, unused, properly stored and matching existing in colors, texture, finish, appearance, and function.
2. Fire stopping and smoke stopping materials shall be delivered to the job site ready to install and require no critical mixing procedures or precise installation time constraints.
3. Materials shall be delivered to the site in sealed containers, fully identified with manufacturer's name, brand, type, grade and U.L. and FM labels. Store materials in a dry space under cover and off the ground.
4. Products shall be applied in strict accordance with their listing and manufacturers' application requirements.

##### B. Code and Standards: All work shall meet or exceed the standards and procedures (latest editions) of the following:

1. ASTM E814, Fire Tests of Through-Penetration Firestop Systems.

2. UL 1479, Through-Penetration Firestop Systems.

C. Manufacturer: The following firestopping and waterproofing sealant manufacturers are acceptable:

1. Nelson.
2. Thomas & Betts.
3. 3M.
4. Hilti.
5. GE.
6. Frye Putty.

D. The following smoke stopping manufacturers are acceptable:

1. Nelson.
2. Thomas & Betts.
3. 3M.

## PART 2 - PRODUCTS

### 2.1 FIRESTOPPING

- A. Firestopping material shall maintain its dimension and integrity while preventing the passage of flame, smoke, and gases under conditions of installation and use when exposed to the ASTM E119 time-temperature rating of the assembly penetrated.
- B. All material shall be listed by U.L.

### 2.2 SMOKESTOPPING

- A. Smoke-stop shall provide an effective barrier against the spread of smoke.
- B. All material shall be listed by U.L.

### 2.3 SUBMITTAL

- A. Provide U.L. approval assembly detail for specific application of the product.
- B. Provide installation detail of the product.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Exercise care in the performance of this contract so as not to damage any existing building components and finishes, outside components, shrubs, or other appurtenances.

- B. Clean and prepare joints for sealant application in accordance with manufacturer's recommendations. Ensure that joint forming materials are compatible with sealant.
- C. Openings larger than required for proper installation of pipe or duct shall be patched or repaired.
- D. Protect the roof at all times. Provide planking, plywood, supports, and other materials and means to ensure damage is not incurred.
- E. Firestopping and smoke stopping will meet the U.L. approved assembly detail for the product used.

END OF SECTION 230500

## SECTION 230510 - GAUGES AND METERS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Pressure gauges and Pressure Gauge taps.
- B. Thermometers and thermometer wells.

#### 1.2 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

### PART 2 - PRODUCTS

#### 2.1 PRESSURE GAUGES

- A. Glycerin-Filled Pressure Gauge: 4-1/2" dial with snubber and stainless steel or cast aluminum case, gasketed Plexiglas Lens, stainless steel movement, Polypropylene blow-out back plate, White scale with black divisions and numerals, Plastic lens, Manufactured in accordance with ASME specification B40.1, Grade 2A.
- B. Acceptable Manufacturers:
  - 1. Dwyer.
  - 2. Weiss.
  - 3. Weksler.
  - 4. Terice.
- C. All gauges shall have brass valve. Graduation in feet.

#### 2.2 PRESSURE GAUGE TAPPINGS

- A. Gauge Valve: Brass 1/4" ball valve.
- B. 1/4-inch NPT for minimum 150 psig.

#### 2.3 STEM TYPE THERMOMETERS

- A. Acceptable manufacturers:
  - 1. Terice.

2. Weksler.
3. Weiss.

B. Thermometer: ASTM E1, adjustable angle, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device. Temperature ranges shall be appropriate for water service type and shall be submitted to Engineer for approval prior to installation.

1. Size: 9-inch scale.
2. Window: Clear glass.
3. Stem: 3/4-inch NPT brass.
4. Accuracy: 1 percent.
5. Calibration: Degrees F., 2 degrees per graduation.

#### 2.4 THERMOMETER SUPPORTS

A. Pipe Socket: Brass separable sockets with insulation extensions as required.

#### 2.5 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2-inch brass or stainless-steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide where noted on plans and details.
- C. Install pressure gauges with pulsation dampers. Provide valves to isolate each Gauge. Extend nipples to allow clearance from insulation.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation. Dip thermometer stems in heat conducting paste before installing in wells. Provide thermometers at each inlet, outlet of coils, condenser and evaporator connections to each chiller, boiler.
- E. Install thermometer sockets adjacent to controls systems transmitter.
- F. Provide instruments with scale ranges selected according to service.
- G. Install gauges and thermometers in locations where they are easily read from normal operating level.

- H. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- I. Locate test plugs adjacent thermometers and thermometer sockets adjacent to pressure gauges and pressure Gauge taps adjacent to control device sockets.

END OF SECTION 230510

## SECTION 230529 - SUPPORTS AND ANCHORS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Pipe and equipment hangers and supports.
- B. Sleeves and seals.

#### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Placement of inserts sleeves in existing walls and slabs.

#### 1.3 REFERENCES

- A. ASME B31.1 - Power Piping.
- B. ASME B31.2 - Fuel Gas Piping.
- C. ASME B31.5 - Refrigeration Piping.
- D. ASME B31.9 - Building Services Piping.
- E. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- F. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- G. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- H. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- I. NFPA 13 - Installation of Sprinkler Systems.
- J. NFPA 14 - Installation of Standpipe and Hose Systems.
- K. UL 203 - Pipe Hanger Equipment for Fire Protection Service.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide manufacture's catalog data including load capacity.
- C. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

- D. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

## 1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable code for support of hydronic piping.

## PART 2 - PRODUCTS

### 2.1 PIPE HANGERS AND SUPPORTS

- A. Pipe hangers for insulated piping shall be sized to fit around the pipe covering. Contractor shall provide at each hanger a galvanized insulation protection shield formed to fit the outside of the covering. Shield shall extend above center line on both sides. Shield to be #18 gauge up to 3" pipe, #16 gauge up to 6" pipe and #14 gauge for 8" and larger. Provide rigid insulation under all hangers. See Section 23 07 00, Insulation.
- B. Hydronic Piping:
  - 1. Conform to MSS SP58.
  - 2. Hangers for Pipe Sizes 1/2 to 1 1/2 Inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
  - 3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 5. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
  - 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

### 2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

### 2.3 SLEEVES

- A. Sleeves for Pipes Through Non-Fire Rated Floors: 18 gage (1.2 mm thick) galvanized steel.
- B. Sleeves for Pipes Through Non-Fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage galvanized steel.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- D. Sleeves for Round Ductwork: Galvanized steel.
- E. Sleeves for Rectangular Ductwork: Galvanized steel.



## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

### 3.2 INSERTS

- A. Provide inserts for placement in concrete walls and slabs as noted on plans.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

### 3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1 1/2 inch (38 mm) minimum vertical adjustment.
- E. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- F. Provide copper plated hangers and supports for copper piping.
- G. Design hangers for pipe movement without disengagement of supported pipe.
- H. Prime coat exposed steel hangers and supports. Refer to Division 9. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

### 3.4 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors one inch above finished floor level. Calk sleeves.
- D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping material and calk as per UL approved detail. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

- E. Install chrome plated steel escutcheons at finished surfaces.

3.5 SCHEDULES

	Pipe Size <b>Inches</b>	Max Hanger Spacing <b>Feet (m)</b>	Hanger Rod Diameter <b>Inches (mm)</b>
1.	1/2 to 1-1/4	6.5 (2)	3/8 (9)
2.	1-1/2 to 2	10 (3)	3/8 (9)
3.	2-1/2 to 3	10 (3)	1/2 (13)
4.			
5.			

END OF SECTION 230529

## SECTION 230553 - MECHANICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES:

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Ceiling Tacks.

#### 1.2 REFERENCES

- A. ASME A13.1 Scheme for the Identification of Piping Systems.

### PART 2 - PRODUCTS

#### 2.1 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

#### 2.2 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1 1/2-inch diameter.
- B. Chart: Typewritten letter size list in 3-ring notebook.

#### 2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
  - 1. 3/4 to 1 1/4 inch Outside Diameter of Insulation or Pipe: 8-inch-long color field, 1/2-inch-high letters.
  - 2. 1 1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8-inch-long color field, 3/4-inch-high letters.
  - 3. 2 1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12-inch-long color field, 1 1/4-inch-high letters.
  - 4. Ductwork and Equipment: 2 1/2-inch-high letters.
- B. Stencil Paint: Semi-gloss enamel, black on white background conforming to ASME A13.1.

## 2.4 CEILING TACKS

- A. Description: Steel with 3/4-inch diameter color coded head; In addition, provide clear plastic label adjacent to ceiling tack indicating specific equipment identification tag.
- B. Color code as follows:
  - 1. Yellow - HVAC equipment.
  - 2. Green - Plumbing valves.
  - 3. Blue - Heating/cooling valves.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Reference division 9 for surface preparation.

### 3.2 INSTALLATION

- A. All equipment requiring periodic maintenance or testing located in concealed spaces shall be clearly identified on an adjacent finished surface to identify the location of equipment. For equipment mounted above ceilings, provide an ID label on the ceiling below the equipment. Typical concealed equipment includes air terminals, air valves, PRVs, mixing valves, duct and pipe differential pressure sensors, steam traps, fire smoke dampers, etc. Labels shall be clear or white with 0.375" high black letters.
- B. Install plastic nameplates with corrosive resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- C. Install tags with corrosion resistant chain.
- D. Provide flow direction arrows on process chilled water loop piping to lab equipment.
- E. Reference division 9 for surface preparation. Black on white background or color as coordinated with Engineer and Owner prior to beginning work.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify thermostats relating to terminal boxes or valves with nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify air terminal units and associated valves with numbered tags.
- J. Tag automatic controls, instruments, and relays. Key to control schematic.

- K. Identify piping, concealed, or exposed, with stencils. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- L. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- M. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 230553

SECTION 230593 - TAB

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic steam systems.
- C. Measurement of final operating condition of HVAC systems.

1.2 ALLOWANCES

- A. Work is included in this section and is part of the Contract Sum/Price.

1.3 REFERENCES

- A. AABC - National Standards for Total System Balance.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.4 PROJECT RECORD DOCUMENTS

- A. Record actual locations of flow and pressure measuring stations and balancing valves.

1.5 QUALIFICATIONS

- A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum five years documented experience certified by AABC.
- B. Perform Work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, or registered Professional Engineer experienced in performance of this Work and licensed in the State of North Carolina.

1.6 PRE-BALANCE CONFERENCE

- A. Convene one month prior to commencing work. Include all pertinent contractors and designers.

#### 1.7 SEQUENCING

- A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.
- B. The test and balance report shall be completed, reviewed, and approved by project engineer prior to final inspection and occupancy. Preliminary/rough draft reports are not acceptable.

#### 1.8 SCHEDULING

- A. Schedule and provide assistance in final adjustment and test of life safety and lab exhaust system.

PART 2 - PRODUCTS – This Part Not Used.

#### PART 3 - EXECUTION

##### 3.1 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - 5. Duct systems are clean of debris.
  - 6. Fans are rotating correctly.
  - 7. Fire and volume dampers are in place and open.
  - 8. Air coil fins are cleaned and combed.
  - 9. Access doors are closed, and duct end caps are in place.
  - 10. Air outlets are installed and connected.
  - 11. Duct system leakage is minimized.
  - 12. Hydronic systems are flushed, filled, and vented.
  - 13. Pumps are rotating correctly.
  - 14. Proper strainer baskets are clean and in place.
  - 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies noted.
- C. Beginning of work means acceptance of existing conditions.

##### 3.2 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make technician and instruments available to Designer to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

3.3 INSTALLATION TOLERANCES – CHECK AND SELECT APPROPRIATE TAB TOLERANCES HERE.

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for air conditioning systems and plus or minus 5 percent of design for exhaust systems.
- B. Hydronic Systems: Adjust to within plus or minus 10 percent of design.
- C. Where pressure relationship between adjacent spaces is called for, document compliance.

3.4 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

- A. For laboratory spaces, the transfer airflow rates listed on the plans are preliminary values. The Contractor shall adjust as necessary such that laboratory spaces are pressurized (either positive or negative) according to the intent shown on the drawings.
- B. Adjust air handling and distribution systems to provide required air quantities.
- C. Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.
- D. Measure air quantities at air inlets and outlets.
- E. Adjust distribution system to obtain uniform space temperatures control.



- F. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct mounted devices.
- G. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- H. Provide system schematic with required and actual air quantities recorded at each outlet or inlet. Provide summary report with all test and equipment data included.
- I. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- J. Adjust automatic, outside air, return air, and exhaust dampers for design conditions.
- K. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- L. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- M. Measure building and/or system static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximate positive static pressure called for.
- N. Check all motorized dampers for leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- O. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

### 3.6 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on suitable temperature difference.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

### 3.7 SCHEDULES

#### A. Equipment Requiring Testing, Adjusting, and Balancing:

1. Pumps.
2. Air Terminal Units.
3. Air Inlets and Outlets.

#### B. Report Forms:

##### 1. Title Page:

- a. Name of Testing, Adjusting, and Balancing Agency.
- b. Address of Testing, Adjusting, and Balancing Agency.
- c. Telephone number of Testing, Adjusting, and Balancing Agency.
- d. Project name.
- e. Project location.
- f. Project Architect.
- g. Project Engineer.
- h. Project Contractor.
- i. Project altitude.
- j. Report Date.

##### 2. Summary Comments:

- a. Design versus final performance.
- b. Notable characteristics of system.
- c. Description of systems operation sequence.
- d. Summary of outdoor and exhaust flows to indicate amount of building pressurization.
- e. Nomenclature used throughout report.
- f. Test conditions.

##### 3. Instrument List:

- a. Instrument.
- b. Manufacturer.
- c. Model number.
- d. Serial number.
- e. Range.
- f. Calibration date.

##### 4. Pump Data:

- a. Identification number.
- b. Manufacturer.
- c. Size/Model.
- d. Impeller.
- e. Service.
- f. Design flow rate, pressure drop, BHP.
- g. Actual flow rate, pressure drop, BHP.
- h. Discharge pressure.

- i. Suction pressure.
- j. Total operating head pressure.
- k. Shut off, discharge, and suction pressure.
- l. Shut off, total head pressure.

5. Terminal Unit Data:

- a. Manufacturer.
- b. Type, constant, variable, single, dual duct.
- c. Identification/number.
- d. Location.
- e. Model number.
- f. Size.
- g. Minimum static pressure.
- h. Minimum design air flow.
- i. Maximum design air flow.
- j. Maximum actual air flow.
- k. Inlet static pressure.

6. Air Distribution Test Sheet:

- a. Air terminal number.
- b. Room number/location.
- c. Terminal type.
- d. Terminal size.
- e. Area factor.
- f. Design velocity.
- g. Design air flow.
- h. Test (final) velocity.
- i. Test (final) air flow.
- j. Percent of design air flow.

END OF SECTION 230593

## SECTION 230700 - INSULATION

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. Work required under this section consists of insulation for piping and duct system and equipment specified in Division 23.
- B. Provide all necessary labor, materials, tools, and equipment to perform work required on the drawings and specified herein.
- C. All pipe fittings, valves, and strainers to be insulated.
- D. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials to be as specified in applicable sections of the specifications.

#### 1.2 DEFINITIONS

- A. Thermal resistance "R" values are expressed in units of "Hour-Degrees F-sq. ft./Btu per inch of Thickness" on a flat surface at a mean temperature of 75 degrees F unless noted otherwise.
- B. Thermal conductivity (K), the reciprocal of "R", btu per inch thickness/hr/ft<sup>2</sup>/degree.
- C. Insulation to consist of insulating material, jacket, mastic, and adhesive, either as a "system" or as an individual component when used separately.

#### 1.3 QUALITY ASSURANCE / CERTIFICATION

- A. Unless noted otherwise, all insulation, adhesives, coatings, sealers, and tapes to have a flamespread rating of 25 or less and smoke development of 50 or less when tested in accordance with ASTM E-84, NFPA 225 AND UL 723.
- B. Apply insulation in a workmanlike manner using experienced, qualified tradesmen.
- C. Do not apply insulation until all pressure testing has been completed, inspected, and released or insulation application.
- D. Clean and dry surfaces prior to insulation application.
- E. Butt insulation joints firmly together; smoothly and securely install all jackets and tapes.
- F. Insulation jacket for duct, pipe, and equipment exposed to weather to be certified as self-extinguishing in less than 53 seconds when tested in accordance with ASTM D1692.
- G. Certify that all duct and piping insulation meets the minimum requirements of the current State Energy Code for New Building Construction.

## PART 2 - PRODUCTS

### 2.1 MATERIALS FOR PIPE AND EQUIPMENT

- A. Provide factory premolded or shop mitered segment type insulation for pipe, fittings, and valves, unless otherwise noted.
- B. Fitting insulation to be of same thickness and material as adjoining pipe insulation.
- C. Cellular Glass (Foamglass):
  - 1. Product to be guaranteed by manufacturer to have continuous operational temperature limit of not less than 90 degrees F and minimum "R" value of 2.63.
  - 2. Provide Pittsburgh Corning "Foamglass" noncombustible factory-molded material.
  - 3. Provide factory applied pre-sized glass cloth jacket having an inside vapor barrier and white exterior color equivalent to Johns-Manville "Flame-Safe type "GVB".
  - 4. Provide for the following services:
    - a. Under pipe saddles where compressible piping insulation is used (Fiberglass, flexible elastomeric).
    - b. At all penetrations of rated walls and floors with insulated piping services.
- D. Flexible Elastomeric:
  - 1. Provide AP Armaflex manufactured by Armstrong or equivalent.
  - 2. Provide 2-pound density, fire-retardant polyolefin, flexible type insulation, pre-formed tubular for piping and sheet for equipment.
  - 3. Maximum water vapor transmission rate of 0.03 perms per inch and UV stabilized with a guaranteed outdoor life of 10 years.
  - 4. Product to have continuous operational temperature limit of not less than 210 degrees F and a minimum "R" value of 3.71.
  - 5. Provide white, self-seal Armaflex 2000 manufactured by Armstrong for 1/2-inch application thickness.
  - 6. Provide insulation for the following services:
    - a. Copper or steel moisture condensate drains: 1/2-inch thick.
    - b. Pump casings below 60o service: 1-1/2" thick.
- E. Rigid Foam Insulation:
  - 1. Insulation shall be polyisocyanurate foam or Styrafoam with a K value (90 days aged) of .20 at a mean temperature of 75 degrees F. Density shall be 2#/cu. ft., flame spread less than 30 and smoke density less than 150 in 4" thickness. Insulation shall not be used in plenums. All joints and seams shall be neatly sealed in place with Foster 95-50 vapor barrier adhesive.
  - 2. Valves and fittings shall be insulated with same material and to the same thickness as adjoining pipe. When insulating flanges and valve bodies, insulation shall extend a minimum of 1" beyond the end of the flange bolts and the bolt area shall be filled with fiberglass before molded insulation is applied.
  - 3. Fill small voids with approved sealer before finish is applied.
  - 4. Provide a one-piece Zeston type fitting jacket as recommended by the manufacturer for the applicable design conditions.

5. Clean and apply bitumen coating prior to applying rigid foam insulation.
6. Apply on:
  - a. Chilled Water piping: 1-1/2" thick.
  - b. Chilled water specialties, except those insulated with flexible foam: 1-1/2" thick.

## 2.2 MATERIALS FOR DUCTS

### A. Blanket Type Insulation:

1. Provide minimum 1 pound per cubic foot density, flexible, factory reinforced glass fiber blanket with foil-faced, glass-fiber reinforced kraft vapor barrier jacket. Provide 1.5 pcf with vinyl jacket where noted.
2. Insulation to have a minimum installed "R" value of 3.92.
3. Product to be manufactured by Manville, or equivalent by Certainteed, Knoff, or Owens-Corning.
4. Provide glass fiber blanket insulation for the following:
  - a. Unlined hot air or cold air supply ducts concealed from view (except where noted otherwise): 2 inch thick.

### B. Glass fiber Board Type Insulation:

1. Provide minimum 3 pound per cubic foot density semi-rigid insulation with factory applied reinforced foil faced kraft vapor barrier glass fiber board "system" type insulation.
2. Insulating board to have a minimum "R" value of 4.34.
3. Product to be manufactured by Manville, or equivalent by Certainteed, Knoff, or Owens Corning.
4. Provide glass fiber board insulation for the following:
  - a. Ducts within equipment rooms and exposed to view: 1-1/2 inch thick.
  - b. Ductwork located outside of building or outside of building insulation system: 2-inch thick.
  - c. Unlined apparatus casing: 1-1/2 inch thick.

### C. Exhaust ductwork shall not be insulated.

## 2.3 MATERIALS FOR FITTINGS AND VALVES

### A. Premolded or mitered and fitted insulation and one-piece PVC insulated fitting covers.

### B. Provide factory pre-molded one-piece PVC insulated fitting covers, precut insulation inserts and installation materials for the following services.

1. All pipe fittings and valves.
2. All grooved coupling installations.

### C. Materials to be equal to Foster Seaglass PVC fitting cover, UNI-Fit inserts and accessories, or equivalent by Molded Acoustical Products, Inc., Hamfab, Zeston division of Mansfield; or Armstrong Products.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. All surfaces to be clean and dry (and painted where noted above) when covering is applied. Covering to be dry when installed and during application of any finish.
- B. All adhesives, cements, and mastics to be compatible with materials applied without attacking materials in either wet or dry state.
- C. Insulation Exposed to view to have a well-tailored appearance.
- D. Do not insulate expansion tanks or heads of hot water pumps.
- E. Install all insulation in accordance with manufacturer's instructions.

### 3.2 PENETRATION OF RATED WALLS, PARTITIONS, AND FLOORS

- A. Do not pass pipe insulation through fire rated partitions or floors unless firestopping system is listed for insulated pipe. Stop and properly terminate insulation at each side of partition.
- B. Install foamglass insulation on chilled water piping where lines pass through rated partitions.
- C. Stop all duct coverings including jacket and insulation at all penetrations of rated walls. Flare-out or extend insulation jacket at least 2-inches beyond angle frames of fire dampers and seal to structure.
- D. Maintain vapor barrier.
- E. Install covering over damper and smoke detector access doors readily removable and identifiable.

### 3.3 INSTALLATION OF DUCT INSULATION

- A. Install in accordance with TIMA National Insulation Standards.
- B. Insulated ductwork conveying air below ambient temperature:
  - 1. Provide insulation with vapor barrier jacket.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
  - 1. Provide with or without standard vapor barrier jacket.
  - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. Blanket type insulation:

1. Apply jacketed blanket type glass fiber pulled snug to ducts but not more than 1/2-inch compression at corners.
2. Use insulation having 2-inch tab or cut insulation long enough to allow for "peel-off" of insulation from jacket to affect a minimum overlap tab of 2-inch.
3. Staple lap with flare type staples on 1-inch centers.
4. Cover standing seams, stiffeners, and braces with an insulation blanket, using 2-inch jacket lap and staple lap.
5. Cover and seal all staples and attachment pins with foster 30-35 reinforced with glass cloth or FSK tape.
6. Apply insulation with approved adhesive and weld pins at 18" o.c. on the bottom of ducts 16" or wider. Provide pins at 18" o.c. on sides of ducts 20" or more. Vertical ducts that are larger than 16" shall have weld pins on all sides. Overlap facing 3" and seal with approved adhesive or apply reinforced aluminum tape. Seal punctures and breaks with aluminum tape.

E. Jacketed Board Type Insulation:

1. Apply jacketed board type insulation to ducts using adhesive and weld pins or nylon "Stick-clip" plates having self-locking, coated metal or nylon discs.
2. If insulation is grooved for corners, pin as required to hold insulation tight to duct.
3. Seal pins and joints with Foster 30-56 reinforced with glass cloth or FSK tape.
4. Insulation shall be applied to the ductwork using approved adhesive and mechanical fasteners such as weld pins or stick clips located not less than 3" from each edge or corner of the board. Pin spacing along the duct not greater than 12" o.c. Additional fasteners used on the sides and bottom of all ducts at a maximum spacing of approximately 18" o.c. All edges and joints sealed with 5" wide aluminum vapor barrier tape applied with Foster 85-20 adhesive. All punctures in the vapor barrier facing likewise sealed.
5. Cover all joints, rips, tears, punctures, disc heads, staples, or breaks in vapor barrier jacket with 4-inch-wide woven glass fabric tape embedded in equivalent of Childers CP-82 or Benjamin-Foster No. 85-20 "Sparkfast" vapor barrier fire resistant adhesive. Pressure sensitive tape permitted if recommended by manufacturer.
6. Cover all board type insulation with 8 oz. canvas jacket applied with fire retardant logging adhesive.

F. Rigid Foam Insulation:

1. Apply with adhesive as recommended and weld pins or "Stock-clips" having self-locking metal or nylon discs.
2. Place pins 3" from edges and not more than 18" O.C.
3. Seal all joints and pin penetrations with 3" wide aluminum tape or as recommended by the manufacturer.
4. Finish insulation with 2 coats of Armaflex white paint.

### 3.4 INSTALLATION OF PIPE INSULATION

- A. Install in accordance with TIMA National Insulation Standards.



- B. Exposed Piping: Cover insulation with 8 oz canvas or factory jacket as noted above. Locate seams in least visible locations. Size canvas for painting. Paint (color as noted herein or as required by owner) canvas and PVC fitting covers.
  - C. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
  - D. Glass fiber insulated pipes conveying fluids below ambient temperature:
    - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
    - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe and PVC fitting covers.
  - E. Glass fiber insulated pipes conveying fluids above ambient temperature:
    - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
    - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
  - F. Insulation above furred ceiling and in chases requires no finish beyond factory jacket.
  - G. Inserts and Shields:
    - 1. Shields: Galvanized steel between pipe hangers or hanger rolls and insulation.
    - 2. Insert location: Between support shield and piping and under the finish jacket.
    - 3. Insert configuration: Minimum 12" inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
    - 4. Insert material: Hydrous calcium silicate or foamglas insulation material suitable for the planned temperature range.
  - H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire and smoke separations, refer to Section 23 05 00.
- 3.5 INSTALLATION OF EQUIPMENT COVERING
- A. Factory Insulated Equipment: Do not insulate, except as otherwise noted.
  - B. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands as appropriate.
  - C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
  - D. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

- E. Fiber glass insulated equipment containing fluids below ambient temperature: Provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.
- F. Finish insulation at supports, protrusions, and interruptions.
- G. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.
- H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed for inspection.

3.6 INSTALLATION OF ONE-PIECE PVC INSULATED FITTING COVERES

- A. Premolded fitting covers to be precisely cut or mitered to fit or be tucked snugly into the throat of fitting and edges adjacent to pipe covering and taped to form a fully insulated pipe covering.
- B. Use adhesive and/or tape specified for type of insulation to insure a thorough vapor barrier.
- C. Tape ends securely to adjacent pipe covering. Tape to extend over adjacent pipe insulation with an overlap of at least 2-inch on both sides.

END OF SECTION 230700

## SECTION 230923 - BUILDING AUTOMATION SYSTEM

### PART 1 - GENERAL

#### 1.1 TABLE OF CONTENTS

##### A. General:

1. Definitions.
2. BMS System Description.
3. Quality Assurance.
4. References.
5. Submittals.
6. Record Documentation.
7. Warranty.

##### B. Products:

1. General Description.
2. Programmable Equipment Controllers.
3. Network Thermostats.
4. Field Bus Network.
5. Field Bus System Architecture.

##### C. Execution:

1. BMS Specifics.
2. Installation Practices.
3. Training.
4. Commissioning Requirements.

#### 1.2 RELATED DOCUMENTS

- A. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.
- B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.
- C. The work of this Division shall be as required by the Specifications, Point Schedules, and Drawings.
- D. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

#### 1.3 DEFINITIONS

- A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.
- B. Binary: A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level.
- C. Building Management System (BMS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.
- D. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner, and ongoing service provider for the BMS work.
- E. Control Sequence: A BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
- F. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative, and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.
- G. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices, and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN, or the like.
- H. Node: A digitally programmable entity existing on the BMS network.
- I. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards, and ordinances so as to provide a single coherent BMS as required by this Division.
- J. Provide: The term “Provide” and its derivatives, when used in this Division, shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.
- K. PC: Personal Computer from a recognized major manufacturer.
- L. Furnish: The term “Furnish” and its derivatives, when used in this Division, shall mean supply at the BMS Contractor’s cost to the designated third-party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.
- M. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.
- N. Install: The term “Install” and its derivatives, when used in this Division, shall mean receive at the jobsite and mount.

- O. Protocol: The term “protocol” and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.
- P. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.
- Q. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.
- R. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds, and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.
- S. The following abbreviations and acronyms may be used in describing the work of this Division:
1. ADC: Analog to Digital Converter.
  2. AHJ: Authority Having Jurisdiction.
  3. AI: Analog Input.
  4. AN: Application Node.
  5. ANSI: American National Standards Institute.
  6. AO: Analog Output.
  7. ASCII: American Standard Code for Information Interchange.
  8. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
  9. AWG: American Wire Gauge.
  10. BTL: BACnet Testing Laboratories.
  11. CPU: Central Processing Unit.
  12. CRT: Cathode Ray Tube.
  13. DAC: Digital to Analog Converter.
  14. DDC: Direct Digital Control.
  15. DI: Digital Input.
  16. DO: Digital Output.
  17. EEPROM: Electronically Erasable Programmable Read Only Memory.
  18. EM I: Electromagnetic Interference.
  19. FAS: Fire Alarm Detection and Annunciation System.
  20. GUI: Graphical User Interface.
  21. HOA: Hand-Off-Auto.
  22. ID: Identification.
  23. IEEE: Institute of Electrical and Electronics Engineers.
  24. I/O: Input/Output.
  25. IT: Information Technology.
  26. LAN: Local Area Network.
  27. LCD: Liquid Crystal Display.
  28. LED: Light Emitting Diode.
  29. MCC: Motor Control Center.
  30. NC: Normally Closed.
  31. NIC: Not in Contract.
  32. NO: Normally Open.
  33. OWS: Operator Workstation.
  34. OAT: Outdoor Air Temperature.

- 35. PC: Personal Computer.
- 36. RAM: Random Access Memory.
- 37. RF: Radio Frequency.
- 38. RFI : Radio Frequency Interference.
- 39. RH: Relative Humidity.
- 40. ROM: Read Only Memory.
- 41. RTD: Resistance Temperature Device.
- 42. SPDT: Single Pole Double Throw.
- 43. SPST: Single Pole Single Throw.
- 44. XVGa: Extended Video Graphics Adapter.
- 45. TBA: To Be Advised.
- 46. TCP/IP: Transmission Control Protocol/Internet Protocol.
- 47. TTD: Thermistor Temperature Device.
- 48. UPS: Uninterruptible Power Supply.
- 49. VAC: Volts, Alternating Current.
- 50. VAV: Variable Air Volume.
- 51. VDC: Volts, Direct Current.
- 52. WAN: Wide Area Network.

#### 1.4 BMS DESCRIPTION

- A. Intent of this design is to use the existing BMS and extend communication wire as necessary to new controllers detailed on the plans.
- B. The Building Management System (BMS) shall be a complete system designed for scalable implementation from small use to large, networked systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.
- C. All components of the BMS that are connected via field bus or IP network, including the BMS server, supervisory controllers, equipment controllers, user interface software, system and controller programming tools and software applications shall be designed, engineered, and tested to work together as a complete building management system.
- D. BMS system architecture shall support integration of third-party devices using industry accepted protocols such as BACnet, LonWorks, and MODBUS.
- E. All points of operator user interface shall be on standard PCs, laptops, or mobile computing platforms such as tablets and smart phones that do not require the purchase of any special software from the BMS manufacturer. The primary point of interface on these devices will be a standard web browser.
- F. Where necessary and as dictated elsewhere in these Specifications, BMS servers shall be used for providing a location for extensive archiving of historical point and alarm and operator transactions. All data stored will be using a standard data base platform: Microsoft SQL Server Express or Microsoft SQL Server as dictated elsewhere in this specification.

- G. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division specification together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.
- H. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.
- I. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards, and configurations to be provided for this Project.
- J. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- K. The BMS as provided shall incorporate, at minimum, the following integrated features, functions, and services:
  - 1. Operator information, alarm management and control functions.
  - 2. Enterprise-level information and control access.
  - 3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
  - 4. Diagnostic monitoring and reporting of BMS functions.
  - 5. Offsite monitoring and management access.
  - 6. Energy management.
  - 7. Standard applications for terminal HVAC systems.
  - 8. Indoor Air Quality monitoring and control.

## 1.5 QUALITY ASSURANCE

- A. General:
  - 1. The Building Management System Contractor shall be a BMS manufacturer-owned branch office, or an independent controls contractor who is factory trained and authorized by the BMS manufacturer to sell, service and support the Building Management System specified herein.
  - 2. The BMS Contractor shall have a facility within a 40-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. The BMS Contractor shall have at this facility factory trained, directly employed and full-time technical staff, spare parts inventory, and all necessary test and diagnostic equipment.
  - 3. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last five (5) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.

4. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems and shall be the manufacturer's latest standard of design at the time of bid.

B. Workplace Safety and Hazardous Materials:

1. Provide a safety program in compliance with the Contract Documents.
2. The BMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades shall comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA rules that have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor, or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage, and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program:

1. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manager shall be empowered to make technical, scheduling, and related decisions on behalf of the BMS Contractor. At minimum, the Project Manager shall.
  - a. Manage the scheduling of the work to ensure that adequate materials, labor, and other resources are available as needed.
  - b. Manage the financial aspects of the BMS Contract.
  - c. Coordinate as necessary with other trades.
  - d. Be responsible for the work and actions of the BMS workforce on site.

## 1.6 REFERENCES

A. All work shall conform to the following Codes and Standards, as applicable:

1. National Electric Code (NEC) and applicable local Electric Code.
2. Underwriters Laboratories (UL) listing and labels.
3. UL 864 UUKL Smoke Control.
4. UL 268 Smoke Detectors.
5. UL 916 Energy Management.



6. NFPA 70 - National Electrical Code.
7. NFPA 90A - Standard for The Installation of Air Conditioning and Ventilating Systems.
8. American National Standards Institute (ANSI).
9. National Electric Manufacturer's Association (NEMA).
10. American Society of Mechanical Engineers (ASME).
11. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
12. Air Movement and Control Association (AMCA).
13. Institute of Electrical and Electronic Engineers (IEEE).
14. American Standard Code for Information Interchange (ASCII).
15. Electronics Industries Association (EIA).
16. Occupational Safety and Health Administration (OSHA).
17. American Society for Testing and Materials (ASTM).
18. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
19. Americans Disability Act (ADA).
20. ANSI/EIA 909.1-A-1999 (LonWorks).
21. ANSI/ASHRAE Standard 135 (BACnet).

## 1.7 SUBMITTALS

### A. Shop Drawings, Product Data, and Samples:

1. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
3. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS work.
4. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
5. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
6. The BMS Contractor shall correct any errors or omissions noted in the first review.
7. At a minimum, submit the following:
  - a. BMS network architecture diagrams including all nodes and interconnections.
  - b. Systems schematics, sequences, and flow diagrams.
  - c. Device schedule listing each BMS server, supervisory controller, equipment controller and any other networked devices in the BMS, including device name, device type, network identifier, and device identifier (address).
  - d. Points schedule listing each point in each of the networked devices listed in the device schedule, including point name, point type, point description, and point identifier (address).
  - e. Samples of Graphic Display screen types and associated menus.
  - f. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
  - g. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including Code

Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.

- h. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address.
- i. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
- j. Details of all BMS interfaces and connections to the work of other trades.
- k. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

## 1.8 RECORD DOCUMENTATION

### A. Operation and Maintenance Manuals:

- 1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished electronically, and include the following for the BMS provided:
  - a. Table of contents.
  - b. As-built system record drawings. Drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
  - c. Manufacturer's product data sheets or catalog pages for all products including software.
  - d. System Operator's manuals.
  - e. Archive copy of all site-specific databases and sequences.
  - f. BMS network diagrams.
  - g. Interfaces to all third-party products and work by other trades.
- 2. The Operation and Maintenance Manual shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

- B. On-Line documentation: After completion of all tests and adjustments the contractor shall provide a copy of all as-built information and product data to be installed on a customer designated computer workstation or server.

## 1.9 WARRANTY

### A. Standard Material and Labor Warranty:

- 1. Provide a one-year labor and material warranty on the BMS.
- 2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship, or materials, it shall be replaced, repaired, or adjusted at the option of the BMS Contractor at no expense to the Owner.
- 3. Maintenance of computer Software Programs: The BMS Contractor shall maintain all software during the standard first year warranty period. In addition, all factory or sub-vendor upgrades to software during the first-year warranty period shall be added to the systems, when they become available, at no additional cost. In addition to first year standard warranty, software provided by BMS Contractor shall come with a 5 Year Software Maintenance license. All SNC and BAS

Servers are included in this coverage. Labor to implement upgrades in years two through five are not included in standard warranty.

4. The Owner shall grant to BMS Contractor reasonable access to the BMS during the warranty period. Remote access to the BMS (for diagnostics and troubleshooting, via the Internet, during the warranty period) will be allowed.

## PART 2 - PRODUCTS

### 2.1 GENERAL DESCRIPTION

- A. The BMS shall be a complete system designed for scalable implementation from small stand-alone use to large, networked systems. This functionality shall extend into the equipment rooms. Devices residing on the enterprise IT network shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BAS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.
- B. The Building Management System shall consist of the following:
  1. Programmable equipment controllers, for directly operating and controlling mechanical equipment.
  2. Network thermostats, for directly operating and controlling mechanical equipment.
  3. Field bus network, for exchanging data between equipment controllers and between equipment controllers and supervisory controllers.
  4. Supervisory controller(s), for managing networks of equipment controllers and providing supervisory control services.
  5. Automation network, for exchanging data between supervisory controllers, distributed user interface(s), and BMS server.
  6. Distributed user interface(s), for providing operational access to the BMS.
  7. BMS server (optional), for managing networks of supervisory controllers, equipment controllers and providing additional supervisory control services.
  8. Application software, for defining the sequence of operation of the BMS.
  9. Other components required for a complete and working BMS, including network processing, data storage and communications equipment.
- C. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers, and operator devices, while re-using existing controls equipment.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
  1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
  2. The System shall maintain all settings and overrides through a system reboot.
  3. The System shall comply with the following International Code Council (ICC) Codes:

- a. Building Officials and code Administrators International (BOMA) model code.
- b. International Conference of Building Officials (ICBO) model code.
- c. Southern Building Code Congress International (SBCCI) regulations.

E. Acceptable Manufacturers:

1. Siemens.
2. JCI Metasys.
3. Schneider I/A Series.
4. Automatic Logic Corp.

## 2.2 PROGRAMMABLE EQUIPMENT CONTROLLERS

- A. Programmable equipment controllers shall include direct wired input interfaces for monitoring analog and binary signals from field devices.
- B. Programmable equipment controllers shall include direct wired output interfaces for controlling field equipment.
- C. Programmable equipment controllers shall include a BACnet MS/TP, IP field bus network interface.
  1. Programmable equipment controllers shall be BACnet Testing Labs (BTL) certified and be marked with the BTL Label.
  2. PROGRAMMABLE equipment controllers shall be tested and certified as a BACnet Application Specific Controller (B-ASC) or as BACnet Advanced Application Controller (B-AAC), to, at a minimum, BACnet Protocol Revision 9.
  3. A BACnet Protocol Implementation Conformance Statement shall be provided for the programmable equipment controllers 10 days prior to bidding.
- D. Programmable equipment controllers shall include an expansion sensor and actuator bus (SA Bus) network interface, for interfacing up to 9 of the following types of devices.
  1. Expansion input/output modules.
  2. Network sensors (NS-xxx), of the following types and characteristics.
    - a. Network room temperature and humidity sensor(s).
      - 1) The network room temperature and humidity sensors shall be suitable for mounting in an occupied space.
      - 2) The network room temperature and humidity sensor(s) shall be available in either surface mount or wall mount packaging.
      - 3) The network room temperature and humidity sensor(s) shall include either screw terminals or 6-pin RJ-style modular jack for SA Bus wiring connections.
      - 4) The network room temperature and humidity sensor(s) shall have the ability to monitor the following variables as required by the system's sequence of operations.
        - a) Zone temperature.
        - b) Zone humidity.
        - c) Zone setpoint.

- 5) The network room temperature and humidity sensor(s) shall include the following operator controls:
    - a) A backlit Liquid Crystal Display (LCD) to indicate the temperature, humidity and setpoint.
    - b) An LED to indicate the status of the Override feature.
    - c) A button to toggle the temperature display between Fahrenheit and Celsius.
    - d) A button to program the display for temperature or humidity.
    - e) A button to initiate a timed override command.
    - f) A dial to change the setpoint or warmer/cooler adjustment.
  - 6) Network discharge air temperature sensor(s):
    - a) The network discharge air temperature sensor(s) shall be suitable for mounting in supply or discharge air duct.
    - b) The network discharge air temperature sensor(s) shall include a 4 inch or 8-inch duct insertion probe.
    - c) The network discharge air temperature sensor(s) shall include 10-foot pigtail type wiring lead.
  - 7) The network sensor(s) shall transmit the information back to the controller on the sensor-actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.
    - a) The network sensor(s) shall be BACnet Testing Labs (BTL) certified and be marked with the BTL label.
    - b) The network sensor(s) shall be tested and certified as a BACnet Smart Sensors (B-SS).
    - c) A BACnet Protocol Implementation Conformance Statement shall be provided for the network sensor(s).
    - d) The Conformance Statement shall be submitted 10 days prior to bidding.
3. Local display/keypad with the following characteristics:
- a. The local display/keypad shall allow the user to view monitored points without logging into the system.
  - b. The local display/keypad shall allow the user to view and change setpoints, modes of operation, and parameters.
  - c. The local display/keypad shall provide password protection with user adjustable password timeout.
  - d. The local display/keypad shall be menu driven with separate paths for:
    - 1) Input/Output.
    - 2) Parameter/Setpoint.
    - 3) Overrides.
  - e. The local display/keypad shall use easy-to-read English text messages.
  - f. The local display/keypad shall allow the user to select the points to be shown and in what order.
  - g. The local display/keypad shall support a back lit Liquid Crystal Display (LCD) with adjustable contrast and brightens and automatic backlight brightening during user interaction.
  - h. The local display/keypad shall be a minimum of 4 lines and a minimum of 20 characters per line.
  - i. The local display/keypad shall have a keypad with no more than 6 keys.
  - j. The local display/keypad shall be panel mountable.

4. Air balancing tool.
5. One-to-one wireless room sensor receiver with the following capabilities.
  - a. The one-to-one wireless room sensor receiver shall receive wireless radio frequency (RF) signals containing temperature, humidity and occupancy data from multiple wireless room sensors and communicate this information to programmable equipment controllers via the Sensor Actuator (SA) Bus.
  - b. The one-to-one wireless room sensor receiver shall use direct sequence spread spectrum RF technology.
  - c. The one-to-one wireless room sensor receiver shall operate on the 2.4 GHZ ISM Band.
  - d. The one-to-one wireless room sensor receiver shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
  - e. The one-to-one wireless room sensor receiver shall be FCC compliant to CFR Part 15 subpart B Class A.
  - f. The one-to-one wireless room sensor receiver shall operate as a bidirectional transceiver with the sensors to confirm and synchronize data transmission.
  - g. The one-to-one wireless room sensor receiver shall be capable of communication with from one to five wireless room sensors up to 200 Feet.
  - h. The one-to-one wireless room sensor receiver shall be assembled in a plenum rated plastic housing with flammability rated to UL94-5VB.
  - i. The one-to-one wireless room sensor receiver shall have LED indicators to provide information regarding the following conditions:
    - 1) Power.
    - 2) SA Bus - Receiver Activity/No Activity.
    - 3) Wireless RF - Transmission from sensors/No Transmission.
    - 4) Wireless Rapid Transmit Mode - No transmission/ weak signal/Adequate signal/Excellent signal.
  - j. The one-to-one wireless room sensor receiver shall receive room temperature, humidity, and occupied information from the wireless room sensors, which shall include the following capabilities.
  - k. The wireless room sensors shall use direct sequence spread spectrum RF technology.
  - l. The wireless room sensors shall operate on the 2.4 GHZ ISM Band.
  - m. The wireless room sensors shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
  - n. The wireless room sensors shall be FCC compliant to CFR Part 15 subpart B Class A.
  - o. The wireless room sensors shall be available with:
    - 1) Warmer/Cooler Set Point Adjustment.
    - 2) No Set Point Adjustment.
    - 3) Set Point Adjustment Scale - 55 to 85° F.
  - p. The wireless room sensors shall be assembled in NEMA 1 plastic housings.
- E. Programmable equipment controllers shall have the capability to execute complex control sequences involving direct wired input/output points as well as input and output devices communicating over the FC Bus or the SA Bus.
- F. Programmable equipment controllers shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational

sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

- G. Programmable equipment controllers shall employ a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
- H. Programmable control logic shall utilize a proportional plus integration (PI) algorithm for the space temperature control loops.
- I. Programmable equipment controllers shall be fully programmable and definable using a software tool with the following characteristics.
  - 1. A simple, check-the-box or selection-type wizard method, with selections for the most popular HVAC equipment and control strategy options.
  - 2. A graphical, functional logic block editor for creating new or editing existing programming logic.
- J. Programmable equipment controllers shall provide the ability to be downloaded and uploaded either locally or using the communications network. Programmable equipment controllers shall support being loaded individually or as a group using a zone schedule generated spreadsheet of controller parameters.
- K. Control setpoint changes initiated over the network shall be written to programmable equipment controllers' non-volatile memory to prevent loss of setpoint changes and to provide consistent operation in the event of communication failure.
- L. Programmable equipment controllers' firmware shall be flash-upgradeable remotely via the communications bus to minimize costs of feature enhancements.
- M. Programmable equipment controllers shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB or the controller is designed and suitable for use in other environmental air space (plenums) in accordance with Section 300.252(C) of the National Electrical Code.
- N. The programmable equipment controllers shall include troubleshooting LED indicators to identify the following conditions:
  - 1. Power On.
  - 2. Power Off.
  - 3. Download or Startup in progress, not ready for normal operation.
  - 4. No Faults.
  - 5. Device Fault.
  - 6. Field Controller Bus - Normal Data Transmission.
  - 7. Field Controller Bus - No Data Transmission.
  - 8. Field Controller Bus - No Communication.
  - 9. Sensor-Actuator Bus - Normal Data Transmission.
  - 10. Sensor-Actuator Bus - No Communication.
- O. Models of programmable equipment controllers dedicated to controlling variable air volume (VAV) boxes shall be provided with the following characteristics.

1. The programmable VAV box controller shall provide both standalone and networked direct digital control of pressure-independent or pressure-dependent variable air volume terminal units, for either single or dual duct applications.
2. The programmable VAV box controller shall include an integrated differential pressure transducer and VAV box damper actuator, all connected and housed as a single assembly that can be mounted and removed as one piece.
3. The integral VAV box damper actuator shall be a 4 Nm, non-spring return, fast-response actuator capable of stroking 90 degrees in 60 seconds for quick damper positioning to expedite commissioning and troubleshooting tasks.
4. The programmable VAV box controller shall measure airflow using an integrated, digital, non-flow pressure sensor providing 14-bit resolution with bidirectional flow operation that supports automatic correction for polarity on high- and low-pressure DP tube connections to eliminate high- and low-pressure connection mistakes.
5. The programmable VAV box controller shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature / humidity effects.
6. The programmable VAV box controller shall include input interface(s) to monitor the following analog signals, without the addition of equipment outside the terminal controller cabinet.
  - a. 0-10 VDC sensors.
  - b. 0-2k ohm resistive temperature detector (RTDs).
  - c. 10k Type L and 2.252k type 2 NTC thermistors.
7. The programmable VAV box controller shall include input interface(s) to monitor dry contact closures, with filtering to eliminate false signals resulting from input "bouncing".
8. The programmable VAV box controller input interfaces shall be internally isolated from power, communications, and output circuits, for noise immunity.
9. The programmable VAV box controller shall include output interface(s) with the following characteristics:
  - a. 0-10 VDC analog output.
  - b. SPST triac output rated for 500mA at 24 VAC.
10. The programmable VAV box controller's output interfaces shall be internally isolated from power, communications, and other output circuits for noise immunity.
11. The programmable VAV box controller shall continuously, adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle, to reduce commissioning costs, and to eliminate the maintenance costs of manually re-tuning loops to compensate for seasonal or other load changes.
12. The programmable VAV box controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.
13. The programmable VAV box controller shall interface with air balancer tools that allow automatic recalculation of box flow pickup gain ("K" factor), and the ability to directly command the airflow control loop to the box minimum and maximum airflow setpoints.
14. The programmable VAV box controller shall have on-board diagnostics, including control loop performance measurements executing at each control loop's sample interval, which may be used to continuously monitor and document system performance. The programmable VAV box controller shall calculate exponentially weighted moving averages (EWMA) for each of the following, and these metrics shall be available to the end user for efficient management of the VAV terminals:
  - a. Absolute temperature loop error.
  - b. Signed temperature loop error.



- c. Absolute airflow loop error.
  - d. Signed airflow loop error.
  - e. Average damper actuator duty cycle.
15. The programmable VAV box controller shall detect system error conditions to assist in managing the VAV zones. The error conditions shall include.
- a. Unreliable space temperature sensor.
  - b. Unreliable differential pressure sensor.
  - c. Starved box.
  - d. Actuator stall.
  - e. Insufficient cooling.
  - f. Insufficient heating.
16. The programmable VAV box controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user to check damper position. The programmable VAV box controller would also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.
17. The programmable VAV box controller shall provide a compliant interface for ASHRAE Standard 62-1989 (indoor air quality) and shall be capable of resetting the box minimum airflow based on the percent of outdoor air in the primary air stream.
18. The programmable VAV box controller shall comply with ASHRAE Standard 90.1 (energy efficiency) by preventing simultaneous heating and cooling, and where the control strategy requires reset of airflow while in reheat, by modulating the box reheat device fully open prior to increasing the airflow in the heating sequence.
- P. Models of programmable equipment controllers dedicated for general purpose shall be provided with the following characteristics:
- 1. The general-purpose programmable equipment controllers shall support, but not be limited to, the following applications:
    - a. Terminal units.
    - b. Packaged rooftop units and heat pumps.
    - c. Built-up air handling units.
    - d. Chilled water/central plants.
    - e. Heating central plants.
    - f. Special applications as required for systems control.
  - 2. The general-purpose programmable equipment controllers shall include input interface(s) to monitor the following analog signals, without the addition of equipment outside the controller cabinet:
    - a. 0-10 VDC sensors.
    - b. 4-20 mA sensors.
    - c. 0-2k ohm resistive temperature detector (RTDs).
    - d. 10k Type L and 2.252k type 2 NTC thermistors.
  - 3. The general-purpose programmable equipment controllers shall include input interface(s) to monitor the following binary signals.
    - a. Dry contact closures, with filtering to eliminate false signals resulting from input "bouncing".
    - b. Pulse Counter/Accumulator Mode (high speed), 100 Hz.

4. The general-purpose programmable equipment controllers' input interfaces shall be internally isolated from power, communications, and output circuits, for noise immunity.
  5. The general-purpose programmable equipment controllers shall include output interface(s) with the following characteristics:
    - a. 0-10 VDC analog output.
    - b. 4-20 mA analog output.
    - c. SPST triac output rated for 500mA at 24 VAC.
  6. The general-purpose programmable equipment controllers' output interfaces shall be internally isolated from power, communications, and other output circuits for noise immunity.
  7. The general-purpose programmable equipment controllers shall support an optional, display/keypad integrated into the controller's housing face, with the following characteristics.
    - a. The integrated display/keypad shall allow the user to view monitored points without logging into the system.
    - b. The integrated display/keypad shall allow the user to view and change setpoints, modes of operation, and parameters.
    - c. The integrated display/keypad shall provide password protection with user adjustable password timeout.
    - d. The integrated display/keypad shall be menu driven with separate paths for:
      - 1) Input/Output.
      - 2) Parameter/Setpoint.
      - 3) Overrides.
      - 4) The integrated display/keypad shall use easy-to-read English text messages.
      - 5) The integrated display/keypad shall allow the user to select the points to be shown and in what order.
      - 6) The integrated display/keypad shall support a back lit Liquid Crystal Display (LCD) with adjustable contrast and brightness and automatic backlight brightening during user interaction.
      - 7) The integrated display/keypad shall be a minimum of 4 lines and a minimum of 20 characters per line.
      - 8) The integrated display/keypad shall have a keypad with no more than 6 keys.
- Q. Models of programmable equipment controllers dedicated for advanced control applications shall be provided with the following characteristics.
1. The advanced application equipment controllers shall support, but not be limited to, the following applications:
    - a. Packaged rooftop units and heat pumps.
    - b. Built-up air handling units.
    - c. Chilled water/central plants.
    - d. Heating central plants.
    - e. Special applications as required for systems control.
    - f. Chilled water/central plant optimization applications including but not limited to:
      - 1) Selection and sequencing of up to eight chillers of different sizes.
      - 2) Selection and sequencing of up to eight (each) primary and secondary chilled water pumps of varying pumping capacities.

- 3) Selection and sequencing of up to eight condenser water pumps.
  - 4) Selection and sequencing of cooling towers and bypass valve, including single speed, multi-speed, and Vernier control.
  - 5) Selection and sequencing of up to four heat exchangers of different capacities.
  - 6) A proven and documented central cooling plant optimization program that incorporates custom equipment efficiency profiles, without rewriting software code, in order to meet the building load using the least amount of energy as calculated.
  - 7) The use of advanced control algorithms that apply equipment specific parameters, including operational limits and efficiency profiles, in order to determine equipment start and runtime preferences.
  - 8) Identification of the most efficient equipment combination and automatic control of state and speed of all necessary equipment to balance runtime, optimize timing and sequencing and ensure the efficiency and stability of the central cooling plant.
2. The advanced application equipment controllers shall include an integral real-time clock which enables them to locally provide the following time-based application services:
    - a. Scheduling.
    - b. Alarming.
    - c. Trending.
  3. The advanced application equipment controllers shall continue time-based monitoring when offline from a supervisory controller for extended periods of time.
  4. The advanced application equipment controllers shall include input interface(s) to monitor the following analog signals, without the addition of equipment outside the controller cabinet:
    - a. 0-10 VDC sensors.
    - b. 4-20 mA sensors.
    - c. 0-2k ohm resistive temperature detector (RTDs).
    - d. 10k Type L and 2.252k type 2 NTC thermistors.
  5. The advanced application equipment controllers shall include input interface(s) to monitor the following binary signals.
    - a. Dry contact closures, with filtering to eliminate false signals resulting from input "bouncing".
    - b. Pulse Counter/Accumulator Mode (high speed), 100 Hz.
  6. The advanced application equipment controllers shall be internally isolated from power, communications, and output circuits, for noise immunity.
  7. The advanced application equipment controllers shall include output interface(s) with the following characteristics.
    - a. 0-10 VDC analog output.
    - b. 4-20 mA analog output.
    - c. SPST triac output rated for 500mA at 24 VAC.
    - d. SPST relay outputs.
    - e. SPDT relay outputs.
  8. The advanced application equipment controllers' output interfaces shall be internally isolated from power, communications, and other output circuits for noise immunity.

## 2.3 NETWORK THERMOSTATS

- A. The network thermostat shall be capable of controlling the following applications:
1. Two- or four-pipe fan coils.
  2. Cabinet unit heaters.
  3. Pressure dependent variable air volume box.
  4. Zoning systems employing reheat including local hydronic reheat valves, or other similar equipment.
  5. Split air or packaged units of the following types:
    - a. Cooling only.
    - b. Cooling units with gas or electric heat.
    - c. Heat pumps.
    - d. Units with economizers.
- B. The network thermostat shall communicate over the FC Bus using BACnet Standard protocol SSPC-135, Clause 9.
1. Communications shall be selectable locally at thermostat through the touchscreen display.
- C. The network thermostat shall be BACnet Testing Labs (BTL) certified and be marked with the BTL Label.
1. The network thermostat shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
  2. A BACnet Protocol Implementation Conformance Statement shall be provided for the network thermostat.
- D. The network thermostat shall include a (minimum) 4.0-inch LED backlit touch screen with the following configurable icons:
1. Home screen configurable icons include:
    - a. On/Off icon.
    - b. Fan override icon.
    - c. Zone temperature icon.
    - d. Hold temperature icon.
    - e. Zone humidity (on applicable models) icon.
    - f. Occupancy status (on applicable models) icon.
    - g. Temperature setpoint icon.
    - h. Alarm icon.
    - i. Unit status icon.
    - j. Date/Time icon.
    - k. Fan override icon.
  2. Home screen non-configurable icon includes:
    - a. Menu icon.
- E. The network thermostat shall provide the flexibility to support any one of the following inputs:
1. Integral indoor air temperature sensor.

2. Analog input for remote air temperature sensing that supports the following sensor types:
    - a. Nickel.
    - b. Platinum.
    - c. A99B PENN.
    - d. 2.25k ohm NTC.
    - e. 10k ohm NTC.
    - f. 10k ohm NTC Type 3.
  3. Universal input that supports the following configurations:
    - a. Analog sensor.
    - b. Cooling when switch is closed.
    - c. Heating when switch is closed.
  4. Remote indoor air temperature sensor.
  5. Analog input that supports the following configurations:
    - a. Supply temperature sensor.
  6. Two configurable binary inputs with the following configurations:
    - a. Disabled.
    - b. Occupancy.
    - c. Override.
    - d. Remote PIR.
    - e. Dirty filter.
    - f. Service.
    - g. Fan Lock.
    - h. Open door.
    - i. Open window.
- F. The network thermostat shall provide the flexibility to support any one of the following fan outputs:
1. Binary start/stop.
  2. Three speed fan control.
  3. Proportional speed fan control configurable from 0 to 10V.
- G. The network thermostat shall provide 4-digit passcode security.
- H. Where required by application and indicated on plans or room schedules provide the network thermostat with an integral Passive Infra-Red (PIR) occupancy sensor model.
- I. Where required by application and indicated on plans or room schedules provide the network thermostat with an integral relative humidity sensor model.
- J. The network thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.
- K. The network thermostat shall have a temperature accuracy of  $\pm 0.9^{\circ}\text{F}/\pm 0.5^{\circ}\text{C}$  at  $70.0^{\circ}\text{F}/21.0^{\circ}\text{C}$  typical calibrated.

- L. The network thermostat shall have a humidity accuracy of  $\pm 5\%$  RH from 20 to 80% RH at 50 to 90°F (10 to 32°C).
- M. The network thermostat shall provide user equipment visibility from a mobile device through the Mobil Access Portal (MAP) release 4.0 or later.

## 2.4 FIELD BUS NETWORK

- A. The field bus network shall support communications and data exchange between the equipment controller(s) and the supervisory controller(s).
- B. The field bus network shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
- C. The field bus network cabling shall be 22 AWG, stranded, 3-wire twisted, shielded cable.
- D. End of line (EOL) termination shall be used on the two devices located at either end of each field bus network segment.
- E. The field bus network shall support a maximum 3 bus segments.
- F. A field bus network segment shall support a maximum of 32 devices.
- G. The field bus network shall support a maximum of 64 total devices.
- H. Each field bus network segment shall be up to 1,220 m (4,000 ft) in length.
- I. Each field bus network shall be up to 3,660 m (12,000 ft) in length.
- J. End of line (EOL) termination shall be used on the two devices located at either end of each field bus network segment.

## 2.5 SUPERVISORY CONTROLLER(S)

- A. Supervisory controller(s) shall provide network management services between itself and the equipment controllers which are connected to its communications trunks, between itself and other supervisory controllers, and between itself and any user interface clients that are part of the BMS.
- B. Supervisory controller(s) shall be enabled to support and shall be licensed with drivers (client and server) compatible with existing client systems.
- C. Supervisory controller(s) shall perform control and operating strategies for the system based on information from any equipment controller connected to the BMS, including but not limited to the following:
  - 1. Scheduling, including calendar functions.
  - 2. Historical data collection, management, and visualization.
  - 3. Alarm initiation, routing, and notification.
  - 4. Time synchronization.

5. Managing the exchange of data between itself and equipment controllers.
  6. Closed loop control and interlocking.
- D. Supervisory controllers shall be capable of peer-to-peer communications with other supervisory controllers and with any user interface client connected to the BMS, whether the user interface client is directly connected, connected via cellular modem, or connected via the Intranet or Internet.
- E. The communication protocols utilized for peer-to-peer communications between supervisory controllers shall be Niagara 4 Fox, BACnet TCP/IP, or SNMP. Use of a different communication protocol for peer-to-peer communications between supervisory controllers is not allowed.
- F. The supervisory controller(s) shall employ a device count capacity license model that supports expansion capabilities.
- G. The supervisory controller(s) shall provide the following hardware features as a minimum:
1. Two 10/100 Mbps Ethernet ports.
  2. Two isolated RS-485 ports with biasing switches.
  3. 1 GB RAM.
  4. 4 GB Flash Total Storage / 2 GB user storage.
  5. Wi-Fi (Client or WAP).
  6. USB flash drive.
  7. High speed field bus expansion.
  8. -20-60 degrees C ambient operating temperature.
  9. Integrated 24 VAC/DC global power supply.
  10. MicroSD memory card employing Encrypted Safe Boot Technology.
- H. The supervisory controller(s) shall include an embedded web server to support standard web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.
- I. The supervisory controller(s) shall provide alarm generation, storage, routing, management, and analysis to data sourced from equipment controllers, network thermostats, and direct field inputs, including the following capabilities.
1. Alarming capability shall support being added to any data point in the supervisory controller's database.
  2. User-defined criteria shall be used to define when the point meets an alarm condition (is in an alarmed state), including, but not limited to the following:
    - a. For numeric-type data points: when the data point's value falls outside a user-defined range.
    - b. For Boolean or enumerated type data points: when the data point's state matches a user defined alarm state.
    - c. For string-type data points, when the data point's string text includes or excludes a user-defined string text.
    - d. For commanded points, when the data point's actual value does not match its commanded value after an appropriate (user-defined) time delay.
  3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements, including but not limited to:
    - a. To alarm.
    - b. Return to normal.

- c. To default.
  - 4. Each alarm record shall include at a minimum, the following information:
    - a. Name of source data point.
    - b. Time and date of alarm occurrence.
    - c. Acknowledge time, date, and user who issued acknowledgement.
  - 5. Routing of alarms shall be user-defined, and may include one or more of the following destinations:
    - a. A dynamically updated alarm console on the distributed user interface screen.
    - b. A bound, animated symbol on the distributed user interface screen.
    - c. Email.
    - d. Pagers, using paging services that initiate a page-on receipt of email message.
    - e. SMS text message.
    - f. Line printer.
    - g. Another supervisory controller or a BMS Server for alarm centralization and/or archival.
  - 6. Alarms that have gone unacknowledged by the specified contact for a specified time shall be re-routed to the next specified contact.
  - 7. Alarms shall support customized text instructions to be assigned to them, so that any time an alarm is generated, the instructions are included and presented along with the alarm notification to guide the operator on how to recover from the alarm condition.
  - 8. Authorized operators shall be allowed (and optionally required) to add a note to one or more alarm records simultaneously to provide historical context for the event that triggered the alarm.
  - 9. Authorized operators shall be allowed to acknowledge alarms using the alarm console on the user interface.
  - 10. Authorized operators shall be allowed to silence the audible alarm sound on the alarm console.
  - 11. Authorized operators shall be allowed to delete alarm records from the alarm database but only after the alarms have been acknowledged and the source data point is in a normal (no longer in alarm) state.
- J. The supervisory controller(s) shall support the following security functions to prevent unauthorized access:
- 1. The supervisory controller(s) shall use module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
  - 2. The supervisory controller(s) shall use Role-Based Access Control (RBAC) for managing user roles and permissions.
  - 3. The supervisory controller(s) shall require strong user passwords.
  - 4. All data in motion and sensitive data at rest in the supervisory controller(s) shall be encrypted.
  - 5. The supervisory controller(s) shall support LDAP and Kerberos integration of access management.
- K. The supervisory controller(s) shall support tagging to utilize Search, Hierarchy, and User Permission functionality.



- L. The supervisory controller(s) shall provide scheduling capabilities being added to any writable data point in the supervisory controller's database, sourced from any equipment controllers, network thermostats, and direct field inputs, including the following capabilities:
  - 1. The supervisory controller(s) shall support scheduling on a weekly and special event basis:
    - a. Authorized operators shall be allowed to view and adjust the exact start/stop time and dates for the weekly schedule and special events from the user interface.
    - b. The supervisory controller(s) shall support sharing schedule configurations with other supervisory controller(s), with the BMS server, and with scheduling enabled BACnet devices.
  
- M. The supervisory controller(s) shall support data logging capabilities being added to any data point in the supervisory controller's database, sourced from any equipment controllers, network thermostats, and direct field inputs, including the following capabilities:
  - 1. Data logs shall be organized into ordered collections of timestamped records, herein called histories.
  - 2. Each history record shall include at a minimum, the following information:
    - a. History name.
    - b. Date point value.
    - c. Time and date when data point was logged.
  - 3. User-defined criteria shall be used to define when the data point is logged, including, but not limited to the following:
    - a. When the data point's value, state, or string changes by a user-defined amount.
    - b. At a regular, repeating, user-defined time intervals.
  - 4. The supervisory controller shall support user-specified local storage capacity for the history records. The data logging behavior upon reaching the specified capacity shall be user-selectable from the following options:
    - a. Stop: terminate recording.
    - b. Roll: overwrite older records with newer ones.
  - 5. Histories shall support being viewed by operators in a table or chart format on the user interface.
  - 6. The supervisory controller shall support the automatic exporting of one or more histories to the BMS server for long term archival.
  
- N. The supervisory controller's configuration software shall be embedded into the supervisory controller, enabling an authorized user to access the configuration software using a web browser.
  
- O. The supervisory controller shall be provided with a 5-year software maintenance license. Labor to implement not included.

## 2.6 AUTOMATION NETWORK

- A. The automation network shall be compatible with and integrate with the existing building BAS.

- B. The BMS shall network multiple user interface clients, supervisory controllers, and equipment controllers. Provide BMS server as required for systems operation.
- C. All BMS devices on the automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
- D. Supervisory controllers and BMS server shall reside on the automation network.
- E. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

## 2.7 BMS SERVER

- A. Where necessary and as dictated elsewhere in these Specifications, a BMS Server shall reside on the automation network and be used for:
  - 1. Providing a location for extensive archiving of historical data, alarms, and operator transactions sourced from all supervisory controllers on the automation network.
  - 2. Centralizing the user interface for all supervisory controllers on the automation network.
  - 3. Centralizing the scheduling for all supervisory controllers on the automation network.

## 2.8 MISCELLANEOUS DEVICES

- A. Local Control Panels:
  - 1. All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance.
  - 2. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.
  - 3. Control panels shall include keyed lock.
  - 4. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
  - 5. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
  - 6. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
  - 7. All wiring shall be neatly installed in plastic trays or tie wrapped.
  - 8. A 120-volt convenience outlet, fused on/off power switch, and required transformers shall be provided. Transformers shall be UL certified and compliant per State Construction Office Construction Manual.
- B. Power Supplies:
  - 1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
  - 2. Input: 120 VAC +10%, 60Hz.

3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10%-line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.
9. Transformers shall be UL certified and compliant per State Construction Office Construction Manual.

## PART 3 - EXECUTION

### 3.1 BMS SPECIFIC REQUIREMENTS

#### A. Graphic Displays:

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.

#### B. Custom Reports:

1. Provide custom reports as required for this project.

#### C. Actuation / Control Type:

1. Primary Equipment:
  - a. Controls shall be provided by equipment manufacturer as specified herein.
  - b. All damper and valve actuation shall be electric.
2. Terminal Equipment:
  - a. Terminal Units (VAV, UV, etc.) shall have electric damper and valve actuation.
  - b. All Terminal Units shall be controlled with HVAC-DDC Controller).

### 3.2 INSTALLATION PRACTICES

#### A. BMS Wiring:

1. All conduit, wiring, accessories, and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.
2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.

3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
  4. Class 2 Wiring:
    - a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
    - b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
  5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
  6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.
- B. BMS Line Voltage Power Source:
1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 26.
  2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
  3. DDC terminal unit controllers may use AC power from motor power circuits.
- C. BMS Raceway:
1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size ½".
  2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
  3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
  4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.
- D. Penetrations:
1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
  2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
  3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
  4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
- E. BMS Notification Standards:

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
2. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

F. BMS Panel Installation:

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

G. Input Devices:

1. All Input devices shall be installed per the manufacturer recommendation.
2. Locate components of the BMS in accessible local control panels wherever possible.

H. HVAC Input Devices – General:

1. All Input devices shall be installed per the manufacturer recommendation.
2. Locate components of the BMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
5. Outside Air Sensors:
  - a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
  - b. Sensors shall be installed with a rain proof, perforated cover.
6. Water Differential Pressure Sensors:
  - a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
  - b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
  - c. The transmitters shall be installed in an accessible location wherever possible.
7. Medium to High Differential Water Pressure Applications (Over 21" w.c.):
  - a. Air bleed units, bypass valves and compression fittings shall be provided.
8. Building Differential Air Pressure Applications (-1" to +1" w.c.):
  - a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
  - b. The interior tip shall be inconspicuous and located as shown on the drawings.
9. Air Flow Measuring Stations:
  - a. Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct.

- b. Station flanges shall be two-inch to three-inch to facilitate matching connecting ductwork.
10. Duct Temperature Sensors:
- a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
  - b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
  - c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
  - d. The sensor shall be mounted to suitable supports using factory approved element holders.
11. Space Sensors:
- a. Shall be mounted per ADA requirements.
  - b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
12. Low Temperature Limit Switches:
- a. Install on the discharge side of the first water or steam coil in the air stream.
  - b. Mount element horizontally across duct in a serpentine pattern ensuring each square foot of coil is protected by 1 foot of sensor.,
  - c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
13. Air Differential Pressure Status Switches:
- a. Install with static pressure tips, tubing, fittings, and air filter.
14. Water Differential Pressure Status Switches:
- a. Install with shut off valves for isolation.
- I. HVAC Output Devices:
- 1. All output devices shall be installed per the manufacturer's recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc/
  - 2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
  - 3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
  - 4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.
  - 5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel) or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide

ground plane isolation between systems. Signals shall provide optical isolation between systems.

3.3 TRAINING

A. The BMS contractor shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

END OF SECTION 230923

## SECTION 232113 - HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES:

- A. Pipe and pipe fittings for:
  - 1. Chilled water piping system.
- B. Valves:
  - 1. Ball valves.
  - 2. Check valves.

#### 1.2 GENERAL REQUIREMENTS

- A. Where more than one piping system material is utilized, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
- C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded connections to valve bodies, equipment or other apparatus.
- D. Except where shown otherwise, use ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Use ball or butterfly valves for throttling, bypass, or manual flow control requirements for water systems if special valves or fittings are not indicated.
- F. Use spring loaded check valves on discharge of pumps when piped in parallel.
- G. Use lug type butterfly valves to isolate equipment.
- H. Use 3/4-inch ball valve with cap for drains at low points of piping, bases of vertical risers, and at equipment.
- I. All piping and fittings to be made in USA.

#### 1.3 REFERENCES

- A. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brasing Operators.



- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- C. ASME B31.9 - Building Services Piping.
- D. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc coated Welded and Seamless.
- E. ASTM A234 - Piping Fitting of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- F. ASTM B32 - Solder Metal.
- G. ASTM B88 - Seamless Copper Water Tube.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers. Protect machined surfaces.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

#### 1.6 SUBMITTAL

- A. Restrained joint calculations; submit complete calculations for all underground ductile iron pipe joints indicating the requirements for restrained and push-type joints. Unless submitted, all joints shall be restrained type. Submission of output data from an approved vendor computer selection/calculation program will be required to justify the use of push-type joints in certain locations. This program shall utilize the depth of cover of a minimum of 3 feet, the specified test pressure for the system, a 1.5 safety factor and ANSI/AWWA C150/A21.50 Type 4 laying condition.

### PART 2 - PRODUCTS

#### 2.1 REQUIREMENTS:

- A. All piping material shall be manufactured in the USA.

#### 2.2 CHILLED WATER, ABOVE GROUND

- A. Steel Pipe: ASTM A53, Schedule 40, (0.375-inch (10 mm) wall for sizes 2-1/2 inch (300 mm) and over,) black.
  - 1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding typed fittings.
  - 2. Joints: Threaded or welded.
- B. Copper Tubing: ASTM B88, Type L hard drawn for pipe sizes 2" and smaller.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder, wrought copper.
2. Joints: Solder, lead free 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

## 2.3 UNIONS, FLANGES, AND COUPLING

- A. Union for Pipe 2 inches and Under:
1. Ferrous Piping: 150 psig malleable iron, threaded.
  2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 inches:
1. Ferrous Piping: 150 psig forged steel, slip-on.
  2. Copper Piping: Bronze.
  3. Gaskets: 1/16-inch-thick preformed neoprene.

## 2.4 VALVES

- A. Furnish and install all valves as called for, shown on drawings or as required for proper operation and servicing of the equipment. Valves shall be of manufacturer as noted or equivalent.
- B. Ball Valves - 600# W.O.G., 3-piece, full port:
1. Body – Bronze.
  2. Seat – Teflon.
  3. Ball - 304 or 316 stainless steel.
  4. Stem - 304 or 316 stainless steel.
  5. O-Ring - Viton or Teflon.
  6. Hammond 8303, Victaulic, Nibco 595-Y-66 or equivalent.
  7. Valves in insulated piping; 2" extended neck.
- C. Swing Check Valves 0 - 2" - 150# bronze:
1. Body – Bronze.
  2. Disc – Bronze.
  3. Hammond IB 904, Nibco T-433 or Victaulic equivalent.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Make piping connections to equipment with flanges or unions.

- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems. Refer to Section 232500.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. All chilled, hot, and condenser water piping shall be hydrostatically tested for pressure of 1-1/2 times the working pressure of the line, but not less than 150 psig for a minimum period of 24 hours, unless noted below. This hydrostatic test shall be witnessed by the Engineer.
  - 1. Chilled water loop for process chiller serving specialized equipment (Cryostat, E-beam) shall be tested at 75 psi.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space, and not interfere with use of space and other trades.
- E. Group piping whenever practical at common elevations.
- F. Sleeve pipe passing through masonry partitions, walls, and floors.
- G. Slope piping and arrange to drain at low points.
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- I. Inserts:
  - 1. Provide inserts for placement in concrete formwork.
  - 2. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
  - 3. Where inserts are omitted, drill concrete slab from below and provide expansion anchor or use an appropriate powder driven stud where permitted.
- J. Pipe Hangers and Supports:
  - 1. Install in accordance with ASTM B31.9.
  - 2. Support horizontal piping as scheduled.
  - 3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
  - 4. Place hangers within 30 inches of each horizontal elbow or tee.
  - 5. Use hangers with 1-1/2-inch minimum vertical adjustment. Arrange hangers for pipe movement without disengagement of supported pipe.
  - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 7. Where several pipes can be installed insulated parallel and at same elevation, provide trapeze hangers.
  - 8. Prime coat exposed steel hangers and supports and prepare for finish painting. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

- K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- L. Provide access where valves and fittings are not exposed.
- M. Slope piping and arrange system to drain at low points. Use eccentric reducers to maintain proper grade.
- N. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Pipe Joints: Unless otherwise specified, join pipes as follows:
  - 1. Steel pipe 2-1/2" to 4", screwed or welded joints.
  - 2. Steel pipe 4" and larger, welded, or flanged joints.
  - 3. For welded joints, use only welding type fittings and welding neck flanges with the following exception:
    - a. "Weldolet" or "Threadolet" type of welding fittings for intersection welding of small branches to mains may be used where branch is two-pipe sizes smaller than the main.
- Q. Do not make direct welded connections to valves, expansion joints, strainers, apparatus, or any other units which are intended to be removable.
- R. Copper tube, Type "K" and "L" shall have soldered joints with sweat joint type bronze or copper fittings up through 1-1/2" size. Fitting sizes 2" and larger shall be brazed joints. Flared joints with flare type bronze fittings may be used where approved for specific service.
- S. For screwed joints, use Teflon tape or approved pipe joint compound; apply only on male threads.

### 3.3 SCHEDULES

- A. Pipe Hanger Spacing:

Pipe Size Inches	Max Hanger Spacing Feet	Diameter Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8
8 to 12	12	7/8
14 and Over	12	1
Non-metallic (All Sizes)	6	3/8

END OF SECTION 232113

## SECTION 232116 - HYDRONIC SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES:

- A. Air vents.
- B. Strainers.
- C. Balancing valve

#### 1.2 QUALIFICATIONS

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

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### PART 2 - PRODUCTS

#### 2.1 AIR VENTS

- A. Manual Type: Short vertical sections of 2-inch diameter pipe to form air chamber, with one-piece, 1/4" ball valve at top of chamber.

#### 2.2 STRAINERS

- A. Size 2 inch and Under:
  - 1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32-inch stainless steel perforated screen, unless otherwise noted.

2.3 COMBINATION BALANCING FITTING (WITH FLOW READ OUT)

- A. Manufacturers:
  - 1. Bell & Gossett.
  - 2. Taco.
  - 3. Armstrong.
- B. Construction: Bronze body/brass ball construction with glass and carbon filled TFE seat rings.
- C. Functions: 1/4" Pressure/temperature readout ports.
  - 1. Flow measurement.
  - 2. Flow balancing.
  - 3. Positive shut-off.
  - 4. Drain port.
- D. Control Mechanism: Calibrated ball valve with hand wheel indicating balance positions and memory stop.
- E. Working Pressure: 200 PSI.

2.4 FLEXIBLE COUPLINGS & VIBRATION ISOLATION

- A. Piping connections to process chillers shall be provided with isolators to prevent transmission of vibration or noise to building structure. Flexible metal hose shall be of approved design.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide manual air vents at system high points and as indicated.
- C. Provide valved drain and hose connection on strainer blow down connection.

END OF SECTION 232116

## SECTION 233100 - DUCTWORK

### PART 1 - GENERAL

#### 1.1 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes permitted for job conditions. Size ducts installed in accordance with ASHRAE table of equivalent rectangular and round ducts.

#### 1.2 REFERENCES

- A. NFPA 90A - Installations of Air Conditioning and Ventilating Systems.
- B. SMACNA – HVAC Air Duct Leakage Test Manual.
- C. SMACNA – HVAC Duct Construction Standards – Metal and Flexible.
- D. SMACNA – Fibrous Glass Duct Construction Standards.
- E. UL 181 – Factory-Made Air Ducts and Connectors.

#### 1.3 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A, NFPA 96 and SMACNA standards.

#### 1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants or adhesives when temperatures are less than those recommended by manufacturer.
- B. Maintain temperatures during and after installation of duct sealants.

#### 1.5 SUBMITTALS

- A. Product Data:
  - 1. Provide the following information for each sealant system furnished on the Project:
    - a. Sealant name and type.
    - b. Sealant system design pressure.
    - c. Duct material.
    - d. Duct gage.
    - e. Transverse joint methods.
    - f. Longitudinal seam type.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Galvanized Steel Ducts: ASTM A623 and ASTM A623M galvanized steel sheet, lock-forming quality, having G60 zinc coating in conformance with ASTM A90.
- B. Stainless Steel: ASTM A480, Type 304, sheet form, with No. 1 finish.
- C. Insulated Low Pressure Flexible Ducts:
  - 1. Manufacturer: Flexmaster Type 8M.
  - 2. UL-181, Class I: coated, woven glass fiber mesh liner bonded permanently to corrosion resistant, galvanized steel helix, thick glass fiber insulation and low-perm vapor barriers of glass fiber reinforced metalized laminate with 3 plg standing seam and brass grommets.
  - 3. Pressure rating: 4" positive, 2" negative.
  - 4. Maximum Velocity: 3500 fpm.
  - 5. Operating Temperature: 0° to 180°F.
  - 6. Thermal Conductance: .23 @ 75°F.
- D. Insulated Medium Pressure Flexible Ducts:
  - 1. Manufacturer: Flexmaster Type 4M.
  - 2. UL-181, Class I: a heavy coated fiberglass cloth locked permanently to a galvanized steel helix, glass fiber insulation with fiberglass scrim on the outside; polyolefin vapor barrier jacket.
  - 3. Pressure rating: 10" positive.
  - 4. Maximum Velocity: 5000 fpm.
  - 5. Operating Temperature: -20° to 200°F.
  - 6. Thermal Conductance: .23 @ 75°F.
- E. Fasteners: Rivets, bolts, or sheet metal screws; stainless steel for stainless steel ductwork.
- F. Sealants:
  - 1. Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.
  - 2. Sealant shall be water based latex UL 181A-M, B-M reinforced sealant conforming to the product specifications.
  - 3. Sealant shall be water based latex UL 181 B-M non-reinforced sealant conforming to the product specifications.
  - 4. All ductwork in a UL classified rolled mastic duct sealant rated tape system shall be comprised of:
    - a. Rolled Mastic Sealant 2 mil foil faced with 15 mils of butyl adhesive/sealant conforming to the product specifications for UL classified sealants.
    - b. Rolled Mastic Sealant 2 mil foil faced with 15 mils of modified butyl mastic/sealant meeting UL-181 BFX (pressure sensitive tapes for use with flexible air ducts) for UL listed sealants.



- G. Hanger Rod: ASTM A36; steel, threaded both ends, threaded one end, or continuously threaded.

## 2.2 SPECIAL EXHAUST DUCTS

- A. The laboratory exhaust systems shall be fabricated from 18 gage stainless steel with all joints and seams welded.
- B. Ductwork shall be watertight.

## 2.3 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated. Unless noted otherwise, pressure class shall be determined by fan rating.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Fabricate continuously welded round and oval duct fittings two (2) gages heavier than duct gages indicated in SMACNA Standard. Prime coat welded joints with zinc-rich paint.
- E. Provide standard 45-degree lateral wye takeoffs or 90-degree conical tee connections.
- F. Uninsulated panels of ducts over 12 inches wide shall be cross broken, except plenum casings, which shall be braced with angle iron as called for.
- G. All ductwork must present a smooth interior and joints must be air tight.
- H. Manual volume and splitter dampers to be furnished and installed where shown and where necessary for proper regulation of the air distribution. A quadrant and set screw equal to "Ventlock" #641 shall be installed for all dampers which are accessible.
- I. When the system is in operation, the ductwork shall be free from rattles and air noises caused by unsecure duct construction.
- J. All ductwork, low pressure supply, medium pressure supply, return, exhaust, and outside air ductwork shall be constructed to meet SMACNA seal class A.
- K. Refer to section 3.3 for ductwork pressure class schedule.

## 2.4 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated in paragraph 3.3.
- B. Round or oval ducts upstream of terminal units shall be prefabricated spiral lock seam conduit with fabricated fittings. All ells shall be 5-piece type. Take-offs shall be formed conical “T”, or 45 degree “Y”.
- C. Double wall insulated round ducts downstream of terminal boxes: Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 1” thick fiberglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.
- D. Round Ducts:
  - 1. Manufacturers:
    - a. United Sheet Metal.
    - b. Semco.
    - c. Hamlin Sheet Metal.
  - 2. Machine made from round spiral lockseam duct with reinforcing corrugations; fittings manufactured of at least two (2) gages heavier metal than duct.
- E. Transverse Duct Connection System:
  - 1. Options:
    - a. Prefabricated: Duct Mate.
    - b. SMACNA “E” rated rigid connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

## 2.5 ACCESS DOORS

- A. All access doors shall close with air pressure. Small doors for access to dampers, etc., shall be 16” x 16” minimum. They need not be hinged but shall be held in place with sash type locks. They shall have a flanged frame that overlaps liner or insulation.
- B. Ultra-low leakage doors. Nailor Model 0800 Type M1 Double Flange Frame for rectangular duct and Model 0895 for round duct, or equivalent. Knock-over tab frames are not permitted. Maximum leakage must not exceed British Standard DW144 Class A, B, and C.
- C. Provide a safety chain for doors accessed by ladder. Provide grab handles for doors 18” x 10” and larger when there is a positive pressure greater than 3 i.w.c.
- D. Provide long-life closed-cell gaskets.
- E. Provide access door at all locations requiring service access.

## 2.6 DUCT LINER

- A. "Nosing" sheet metal strip shall be installed on leading edge of all internal duct liner.
- B. See section 230700 Insulation for liner specification.

## PART 3 - EXECUTION

### 3.1 INSTALLATION DUCTWORK

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible. It is essential that all air ductwork be practically air tight. Before being insulated or concealed, all medium pressure air ducts and lab exhaust ducts, including the terminal connections, shall be tested for leakage. Each duct, under an air pressure test shall have no noticeable leaks. The total amount of leakage in the medium pressure supply ductwork of any system shall not exceed 1% of the total cfm of that system as measured by a manometer and a calibrated orifice. Test pressure for medium pressure systems shall be 8" WG and 6" WG for lab exhaust system.
- C. Duct sealant installation shall be in accordance with manufacturer's published recommendations. Allow duct sealant system to cure minimum 48 hours before pressure testing for the fluid applied mastics. Rolled mastic sealants can be tested immediately. All low, medium, and high-pressure duct systems (positive or negative) shall be pressure tested according to SMACNA test procedures (HVAC Air Duct Leakage Test Manual). Notify Owner minimum seven (7) calendar days in advance of leakage testing.
- D. Duct sizes on plans are inside clear dimensions.
- E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Connect terminal units to supply ducts with maximum length of flexible duct as detailed on plans. Do not use flexible duct to change direction unless shown on drawings.
- I. Connect diffusers to low pressure ducts with maximum length of flexible duct as detailed on plans. Duct to be held in place with strap or clamp.
- J. Connect flexible ducts to metal ducts with adhesive and draw bands. Use sheet metal screws for positive pressure over 2".
- K. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

- L. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust or weather from entering ductwork system.
- M. Manufactured casings shall be assembled and installed as noted in paragraph 3.1 A above.

3.2 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean duct in sections of size approved by the Designer. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Clean new plenums and accessible ducts in Mechanical/Equipment Rooms with high power vacuum machines. Clean existing plenums and accessible ducts in Mechanical/Equipment Rooms where indicated with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 DUCTWORK PRESSURE CLASS SCHEDULE

Air System	Pressure Class Inch
Low Pressure Supply (HVAC Systems and downstream of terminal units)	2
Medium Pressure Supply (upstream of terminal units)	6
High Pressure Supply	10
Space Exhaust	2
Lab Exhaust	6

END OF SECTION 233100

## SECTION 233300 - DUCTWORK ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Flexible duct connections.
- B. Volume control dampers.

#### 1.2 REFERENCES

- A. NFPA 90A - Installation of Air conditioning and Ventilating Systems.
- B. NFPA 92A - Smoke Control Systems.
- C. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- D. UL 33 - Heat Responsive Links for Fire-Protection Service.
- E. UL 555 - Fire Dampers and Ceiling Dampers.
- F. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

### PART 2 - PRODUCTS

#### 2.1 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA Medium Pressure Duct Construction Standards, and as indicated.
- B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz. per sq. yd., approximately 2 inches wide, crimped into metal edging strip.

#### 2.2 VOLUME CONTROL DAMPERS

- A. Manufactures:
  - 1. Ruskin Manufacturing Co.
  - 2. Arrow.

3. United Emertech.

- B. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.
- C. Fabricate splitter dampers of material same gage as duct to 24 inches size in either direction, and tow gages heavier for sizes over 24 inches.
- D. Fabricate splitter of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/4-inch diameter rod in self aligning, universal joint action flanged bushing with set screw.
- E. Fabricate single blade dampers for duct sizes to 12 x 48 inch.
- F. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 122 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- G. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- H. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
- I. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

#### 3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- D. Provide duct test holes where indicated and required for testing and balancing purposes. Neoprene plugs.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

- F. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

SECTION 233700 - AIR OUTLETS & INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Diffusers.
- B. Registers/grilles.

1.2 REFERENCES

- A. ARI 650 Air Outlets and Inlets.
- B. ASHRAE 70 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- C. SMACNA HVAC Duct Construction Standard - Metal and Flexible.

1.3 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

PART 2 - PRODUCTS

2.1 SEE PLANS FOR GRILLE AND DIFFUSER SCHEDULE

- A. Basis of Design – Price. Equals by Metal-Aire, Nailor, Tuttle & Bailey, and Titus.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and structural limitations.
- C. Connect diffusers to ductwork with airtight connection.
- D. Provide balancing dampers on duct take off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, grille or register assembly.



- E. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION 233700

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## SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

### PART 1 GENERAL

#### 1.1 REQUIREMENTS

- A. General Conditions of the Contract, Supplementary General Conditions, Instructions to Bidders, and General Requirements sections contained in the contract documents are a part of these Specifications.

#### 1.2 EXTENT OF THE WORK

- A. This Contractor shall furnish all labor, materials, and equipment, and perform all operations necessary for installation of complete electrical work within the intent of, and as indicated on, the drawings and as herein specified.

#### 1.3 REGULATIONS AND COMPLIANCE

- A. Latest editions of the National Electrical Code and the North Carolina State Building Code govern this work. All of their requirements shall be satisfied.
- B. This Contractor shall secure and pay for all permits, fees, inspections, and licenses required. The electrical contractor shall notify the Office of the State Electrical Inspector at the State Construction Office (SCO) (authority having jurisdiction), to schedule required electrical inspections including, but not limited to, rough-in, above ceiling, and final inspections. Upon completion of the job he shall present to the Engineer a certificate of inspection and approval from the inspection authorities.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. All materials shall be new, with required Underwriter's Laboratories (or other agency approved by the State) label, and with manufacturer's label or nameplate giving complete electrical data.
- B. Where a manufacturer's catalog number is used, all parts shall be furnished to make it complete and to fit the construction intended.
- C. Within ten days after award, Contractor shall submit to Engineer a complete list in triplicate of all materials he proposes to use. List shall show a single manufacturer with not only major materials and equipment, but also such items as conduit fittings, raceway supports, conductive pipe thread compound, asphaltum, sealing material, clamps, anchors, outlet boxes, gutters, terminal cabinets, wire-pulling compound, splice connectors, tape, wire markers, lamps, etc.

- D. Material shall be the make and number given in these Specifications or shown on Drawings, or equivalent where specifically stated as being allowed. Equivalent items or materials will be subject to acceptance by the Engineer at submittal stage. If Contractor wishes to furnish a substitute for the item(s) specified (or equivalent where allowed), he shall furnish complete, detailed data and obtain approval of the substitution in writing from the Engineer no later than ten (10) days prior to bid. In some cases, at the request of the Engineer, samples of the substitute items shall be submitted for review. Data (and sample if required) shall be submitted in a timely manner such that approval by Engineer can be returned to Contractor no later than 10 days prior to bid date. Data or sample not submitted in sufficient time to allow evaluation by Engineer will be automatically rejected.
- E. Engineer's review of samples, cut sheets, shop drawings, and other matter submitted by the Contractor shall not relieve the Contractor of responsibility for full compliance with the Drawings and Specifications. If a submitted item does not comply in any way (color, style, quality, function, or performance), Contractor shall call the specific non-compliance to the attention of the Engineer in writing in a cover letter to the submittals requesting a deviation from specifications. This does not imply that approval of requested deviation will be given, only that it will be reviewed.
- F. Engineer's review of submittals is not intended to confirm quantity counts of materials and equipment made by Contractor. Contractor is required to provide quantities of items as necessary for systems to function as described and shown on the plans and in these specifications.
- G. Specialty systems such as fire alarm systems, etc., that are included as part of the Electrical Contract shall be furnished and installed by an authorized representative of the manufacturer of the equipment supplied. This includes use of factory trained and authorized installers where required to fulfill manufacturer's warranty provisions.
- H. Submit cuts of fixtures, shop drawings on panels, and other descriptive materials requested, in six copies, or as required by the General Requirements section. Submittals will not be accepted or reviewed by the Engineer unless the electrical contractor's stamp signifying his review and approval is evident on the submittals.
- I. Materials should be inspected upon their arrival at the site to be sure they are correct. No extension of time for completion will be allowed because materials received are wrong. Completely adequate housing shall be provided on the site for orderly and careful storage of all materials and equipment. Nothing shall be stored outside except conduit, which may be stored in racks so it is at least twelve (12) inches above ground and not subject to mud being spattered on it.

## 2.2 PAINTING

- A. Suitable finish coatings shall be provided under this section of the Specifications on all items of electrical equipment and wiring which are exposed. This shall consist of either an approved factory applied finish or an acceptable finish applied during or after installation. Equipment which is furnished in finishes such as stainless steel or satin aluminum is not to be painted. Exposed equipment and/or wiring in finished areas such as panel covers or surface raceway shall be supplied with factory applied prime coat and shall be professionally painted or enameled as directed to result in a completely coated and attractively finished manner. All such finishing shall be as directed by and shall be satisfactory to the Architect and Engineer.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION

- A. The electrical drawings are diagrammatic only, and are intended to explain system function and define quality of materials and installation. They are not intended to define construction methods.
- B. Contractor shall keep on the site at all times one set of electrical drawings and specifications, and one (1) set of drawings and specifications on the work of other trades. In addition, one (1) complete set of all electrical submittals and shop drawings shall be maintained at the site by the electrical contractor.
- C. The electrician shall check other trades' drawings, specifications, and shop drawings to see if there are any conflicts or discrepancies. If so, he shall contact the Engineer for instructions.
- D. The Contractor shall properly protect his work against damage by weather or other trades. All work shall be left well cleaned, and damaged finishes shall be restored to original condition.
- E. The Contractor shall place his own sleeves and notify other trades of chases and openings far enough ahead so they can be properly built in. Where any raceways, supports, etc., installed under the contract pierce the roof, suitable pitch pockets shall be provided and coordinated with the roofing contractor as necessary to be acceptable to the Engineer. Provide suitable fittings where any raceways or equipment cross expansion joints.
- F. This contractor shall be responsible for all trenching, backfilling, cutting, core drilling, and patching related to his work.
- G. Contractor shall provide firestops and smoke seals per Project Specifications and UL Details shown on drawings. All penetrations shall be sealed accordingly.
- H. Contractor should not scale drawings for outlet and equipment locations. Unless specifically dimensioned on drawings or defined in specifications, outlets and equipment shall be located as evidently intended or as detailed on Architectural drawings. Lighting outlets are to be centered or spaced symmetrically unless they are dimensioned. Any dimensions shown on the drawings shall be verified in the field by the contractor prior to roughing. All outlet and equipment locations shall be coordinated with the other trades. If any doubt arises, contact the Engineer prior to roughing.
- I. Contractor shall keep premises free of debris resulting from this work.

### 3.2 TESTS AND GUARANTEES

- A. All current-carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. Each fixture and item of equipment for connection under the Contract shall be tested for insulation resistance from its conductors to its grounded surface or contact. These tests shall be done with a 500 volt (minimum) high voltage "megger."
  - 1. Minimum readings shall be one million (1,000,000) or more ohms for #6 AWG and smaller wire, 250,000 ohms or more for #4 AWG and larger wire, between conductors and between conductor and the grounding conductor.
  - 2. After all fixtures, devices, and equipment are installed and all connections completed to each panel, the contractor shall disconnect the neutral feeder conductor from the neutral bar and

take a megger reading between the neutral bar and the grounded enclosure or ground bar. If this reading is less than 250,000 ohms, the contractor shall disconnect the branch circuit neutral wires from this neutral bar. He shall then test each one separately to the panel and until the low readings are found. The contractor shall correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

3. The Contractor shall send a letter to the engineer certifying that the above has been done and showing the tabulation of the megger readings for each panel or feeder. This shall be done at least four (4) days prior to final walk-through by engineer and SCO.
  4. At final walk-through by the engineer and SCO, the contractor shall furnish a megger and demonstrate that the panels comply with the above requirements. He shall also furnish a clamp-on type ammeter and a voltmeter to take current and voltage readings as directed by the engineer, or SCO representatives.
- B. Validity of the ground path shall be assured by constant and careful attention to the thorough tightening of all couplings, connectors, locknuts, screws, bolts, etc., and by frequent checking of the path resistance with a quality low-range ohmmeter. Resistance of the path should not exceed one ohm between any two points. If a reading in excess of this is observed, it shall be discussed with the Engineer for an appraisal of the condition.
- C. Contractor shall guarantee that the work is done in accordance with drawings and specifications, and that it is free of imperfect materials or defective workmanship. Anything unsatisfactory shall be corrected immediately and at Contractor's expense.
- D. For the period of one (1) year after acceptance by the Owner, the Contractor shall replace, without any expense to the Owner, any imperfect materials or defective workmanship.

### 3.3 RECORD DRAWINGS/MANUALS

- A. Upon completion of the installation, Contractor shall submit to the Engineer marked prints of Drawings showing any changes made in circuits, location of equipment, panelboards, or any other revision in the Contract Drawings, for the Owner's use in maintenance work and for future additions and expansions. Marked changes shall also include changes due to change orders unless already recorded by revised drawing or bulletin drawing.
- B. These record drawings shall be submitted in one (1) of two (2) formats: either a clean, legible, marked set of prints with all markings in distinguishable colored pencil such as red; or a set of reverse-run reproducible sepia prints marked in soft pencil so that blue-line prints can be reproduced as required. The format to be used shall be as defined in the General Requirements section of the contract documents. If no format is defined, the marked blue-line prints shall be submitted.
- C. Operation and Maintenance manuals shall be submitted to the Engineer at the end of the project prior to closeout of the project. Information included shall be a copy of all submittal data, shop drawings, and necessary operating and maintenance instructions and wiring diagrams on all major items of equipment and all special systems (fire alarm, intercom, etc.). Submit these manuals in the quantities and format described in the General Requirements Section.

END OF SECTION 260500

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 REQUIREMENTS

- A. All material shall be U.L. listed and shall be installed in conformance with the National Electrical Code.

1.2 SUBMITTALS

- A. Shop drawings for:
  - 1. Wiring
  - 2. Cabling
- B. Provide list of wiring and cabling types indicating where each type is used.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufactured by Southwire, Rome, or Triangle, or as otherwise noted in the specifications and drawings.
- B. Normal trade standard "building wire" of copper.
- C. Power and lighting circuits #10 AWG and smaller shall have solid copper conductors. Conductor sizes #8 AWG and larger shall have Class B stranded copper conductors. Maximum conductor size shall be 500 kCMIL.
- D. All sizes shall bear easily readable size and insulation grade marking along entire length.
- E. Insulation on #6 and smaller shall be suitably colored in manufacturing. Conductors #4 and larger may be identified with bands of proper color plastic tape near each termination and in each junction box.
- F. Insulation on service and feeders shall be 600 volt Type XHHW or THHN/THWN unless shown otherwise on the drawings.
- G. Branch circuits shall be a minimum of #12, with 600 volt THHN/THWN insulation unless noted otherwise in the specifications, specifically noted on the drawings, or Code requires another type. Circuit wires carried through rows of luminaires shall be at least Type THHN.
- H. Conductors in any location subject to temperatures higher than 60°C shall have insulation of a type approved by NEC for temperature encountered.
- I. Control and signal conductors shall be type and size indicated in those sections of the Specifications, or as indicated on drawings.



- J. Conductors for branch circuits shall be sized to prevent a voltage drop exceeding three percent (3%) at the farthest outlet of power, heating and lighting loads, or any combination of such loads. The maximum total voltage drop on both feeders and branch circuits combined to the farthest outlet shall not exceed five percent (5%). Where the conductor length from the panel to the first outlet on a 277V circuit exceeds 125 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG. Where the conductor length from the panel to the first outlet on a 120 volt circuit exceeds 50 feet, the branch circuit conductors from panel to the first outlet shall not be smaller than #10 AWG. Where ungrounded conductors are increased in size from the minimum size that has sufficient ampacity for the intended installation, wire-type equipment grounding conductors shall be increased in size proportionately according to the circular mil area of the ungrounded conductors.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. All wiring shall be color coded:
1. On 120/208 volt, 3 phase, 4 wire systems - phase A, black; phase B, red; phase C, blue; neutral, white. On 277/480 volt, 3 phase, 4 wire systems - phase A, brown; phase B, orange; phase C, yellow; neutral, natural gray. Ground conductor on all systems shall be green.
  2. Unless noted or accepted otherwise, busses in panels and switchgear shall be considered "A", "B", and "C" from left to right, top to bottom, or front to back when facing equipment.
  3. Control wiring shall not use black, red, or blue; but shall use white for neutrals and green for grounding. Any other colors may be used but the coding shall provide same color between any two terminals being joined.
  4. Switchlegs, including "travelers" in 3-way and 4-way switching systems, shall be same color as phase leg.
- B. Joints in #10 and smaller wire may be either made with approved twist-type connectors such as Ideal, Buchanan, T&B, Scotch, etc. "Stakon" or other permanent type crimp connectors shall not be used for branch circuit wiring.
- C. Joints in #8 and larger wire shall be made with approved Burndy, T&B, or O.Z. Manufacturing Co., mechanical pressure type connectors or lugs along with their UL approved insulating covers.
- D. Manufactured insulators for connectors may be used, provided they cover completely and securely all exposed metal. If joints and splices are taped, they shall be carefully covered with top-grade Okonite, Scotch Brand, or approved equivalent plastic or rubber and friction, laid on with half laps to result in a joint insulation equivalent to that of the conductor insulation.
- E. Circuit joints shall not be made on twin screws of convenience receptacles. Make joints as described above and run single leads to receptacle.
- F. All wiring lugs throughout the project, including, but not limited to, breakers, panelboard/switchboard lugs, safety switch lugs, and transformers lugs, shall be rated for use with 75 degree conductors sized in accordance with NEC Table 310.15(B)(16).

- G. Wm. Brady Co., or approved equivalent, labels or the type made with a punch on plastic tape, giving the circuit number, shall be securely fastened to each branch circuit conductor within panelboards. They shall also be installed on all conductors within junction boxes, pull boxes, gutters, wireways, cabinets, or equipment where two or more wires of the same color occur.
- H. Where connected under screw or bolt heads, stranded wire shall be fitted with a lug of proper size. Make solid conductor loops clockwise so as to be forced closed as screw is tightened. Only one solid wire loop may be held under a single screw.
- I. Make all connections tight.
- J. Wires within panelboards, terminal cabinets, and similar equipment shall be neatly squared.
- K. Where paralleling of conductors is shown for feeders or service entrance, it is absolutely required they be exactly the same length between points of bonding together. Lay out side by side and cut to same length before drawing into raceways. Provide for each end of run a Burndy Q2A or W3A lug, or approved equal, and terminate parallels in these without cutting.
- L. Individual branch circuits shall not to have shared neutrals.

END OF SECTION 260519

SECTION 26 05 23 – CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 GENERAL

1.1 REQUIREMENTS

- A. All material shall be U.L. listed and shall be installed in conformance with the National Electrical Code Articles 700 and 725 of NEC.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Shall also conform with the following unless noted otherwise on drawings or in other sections of these Specifications:
1. Conductors shall be run in metal conduit, unless specifically stated otherwise. These shall be complete with outlet boxes, junction boxes, fittings, etc., conforming in all respects with Section 26 05 33.
  2. Conductors shall be #14 AWG minimum, stranded copper, and insulated with type THHN thermoplastic insulation rated for 600 volts unless noted otherwise in the specifications, specifically noted on the drawings, or Code requires another type.
  3. Conductors shall be colored in manufacture. Black, red, and blue shall be used only for connections of these wiring systems to proper phase in main wiring system. Color code throughout remainder of system shall be other colors selected by This Contractor, but same color shall be used between points of connection. In other words - do not change color at splices, in junction boxes, etc. White shall be reserved for neutral and green for grounding.
  4. In lieu of color coding, or in conjunction with, this Contractor shall identify each conductor using a label system, such as Brady labels, or equal. Each conductor shall be individually labeled with a distinctive number or number/letter combination at each termination point, including wire nut connections. A table shall be made identifying each conductor, its function, its origin, its final termination, etc. This table shall be typewritten and included in the final Operation and Maintenance Manuals and with a copy left in the main point of origin cabinet (such as fire alarm panel).
- B. Joints and connections shall be made as specified in Section 26 05 19.

PART 3 EXECUTION

THIS SECTION NOT USED

END OF SECTION 260523

## SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1 REQUIREMENTS

- A. All systems and equipment shall be grounded in accordance with NEC Article 250.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Manufactured by Thomas & Betts, Harger Lightning Protection, Lightning Master Corporation or approved equivalent.
- B. Bonding shall be done with #3800 series insulated bonding bushings and compression type lugs.
- C. Grounding conductor shall be THHN/THWN run in heavy wall conduit, and of size shown on drawings or required by NEC.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Any raceway anywhere in the system which enters a box or cabinet through part of a concentric or oversized knockout shall be fitted with an insulated bonding bushing and jumper. These bushings shall also be used wherever conduits stub into switchboards or transformer cabinets. Grounding type insulated bushings shall always be used on both ends of conduits feeding panelboards. The bonding jumper shall be sized by NEC Section 250 and lugged to the box.
- B. EMT couplings and connectors shall be compression-gland type of malleable steel, galvanized or sherardized. Connectors shall be insulated-throat type. Set screw, indenter, or cast type fittings are not acceptable.
- C. Attach rigid metal conduits with double locknuts - one inside and one outside - and fiber bushing, or in a threaded hub.
- D. The raceway system shall not be relied on for ground continuity. A green grounding conductor, properly sized per NEC Table 250.122, shall be run in ALL raceways except for telecommunications, data and audio conductors raceway.
- E. Ground all fixed and portable appliances and equipment connected under this Contract with a green grounding conductor. This wire shall be carried inside the raceway and flex from equipment to nearest grounded portion of raceway system. Connect at both ends with suitable lugs.
- F. All grounding type receptacles shall have a green wire jumper from their grounding terminal to box in which mounted. Attach jumper to box, not plaster ring, with a bolt or grounding clip. Jumper shall

be sized by NEC with #12 minimum.

END OF SECTION 260526

## SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1 REQUIREMENTS

- A. All material shall be UL listed and shall be installed in conformance with the National Electrical Code.

#### 1.2 SUBMITTALS

- A. Shop drawings for:
1. Conduits
  2. Couplings and fittings
  3. Boxes
  4. Conduit seals
- B. Provide list of conduit types indicating where each type is used.

### PART 2 PRODUCTS

#### 2.1 RACEWAYS

- A. Galvanized Steel Rigid Metal Conduit (RMC):
1. Heavy wall tubing with hot dipped galvanized coating
  2. Connections shall be made with double locknuts and bushings. Bushings to be steel with integral insulator except conduits 2" and below may have high impact thermoplastic Phenolic insulating bushings.
- B. Electrical Metallic Tubing (EMT):
1. Thin wall tubing with hot dipped galvanized coating.
  2. Couplings and connections shall be threaded steel, watertight gland compression type.
  3. All connectors shall have insulated throat.
- C. Flexible Metal Conduit (FMC):
1. Electro-galvanized single strip steel.
- D. Liquid Tight Flexible Metal Conduit (LFMC):
1. Electro-galvanized single strip steel with PVC coating.

## 2.2 BOXES

- A. Manufactured by Midland Ross/Steel City, T&B, Raco, or Appleton.
- B. Galvanized or aluminum of gauge required by NEC.
- C. All junction and pull boxes shall be 4 inch square by 2-1/8 inch deep minimum.
- D. Stamped steel boxes with knockouts are not acceptable for surface mounting in finished spaces in the building.

## 2.3 FASTENINGS AND SUPPORTS

- A. Shall be of good quality, galvanized steel, stainless steel, or other non-corroding material

# PART 3 EXECUTION

## 3.1 RACEWAY INSTALLATION

- A. All wire and cable shall be run in raceway.
- B. Minimum raceway size shall be 3/4" (interior) and 1" (below grade) unless noted otherwise. Half inch flexible conduit may be used from junction box to above ceiling light fixtures (6' maximum length).
- C. All runs of empty conduit only shall have a 100# nylon pull rope installed in the conduit.
- D. Rigid metal conduit shall be made up with full threads to which T&B "Kopre-Shield" compound has been applied, and butted in couplings.
- E. Z. Split or "Erickson" couplings where necessary.
- F. No conduit shall be run in poured concrete floors or slabs. Conduit runs shall normally be run overhead. Where it is necessary to run underneath a concrete slab poured on-grade, conduit shall be buried in trench beneath gravel base and turned up through slab. Where it is necessary to run underneath a floor above a crawl space or another floor, conduit shall be run along ceiling space under floor and stubbed through floor using appropriate methods, such as "poke-through" devices or other means U.L. approved for such purpose.
- G. Underground runs, except under concrete floor slabs, shall be encased by a minimum of three (3) inches of concrete on all sides and shall have a minimum of eighteen (18) inch (non-roadway) and twenty-four (24) inch (roadway) cover, except for raceways containing circuits above 600V, which shall have a minimum cover of 30". Backfill shall be made in six (6) inch layers - tamping each layer to a density of 95% of maximum possible. Red dye shall be applied to the top of freshly placed concrete in all underground duct banks as a warning of electrical hazard in the event of future excavation. In addition, all underground raceway shall be identified by underground line marking tape located directly above the raceway at six (6) to eight (8) inches below finish grade.

Tape shall be permanent, bright-colored, continuous printed, plastic tape compound for direct burial not less than 6" wide and 4 mils thick. Printed legend shall be indicative of general type of underground line below.

- H. Where passing through a below grade wall from a conditioned interior building space, raceways shall be sealed utilizing fittings similar and equal to OZ/Gedney type "FSK" through wall fitting with "FSKA" membrane clamp adapter if required.
- I. Attach rigid metal conduits with double locknuts - one inside and one outside - and fiber bushing.
- J. Grounding type insulated bushings shall be used where raceway enters boxes with concentric or oversized knockouts. These bushings shall also be used wherever conduits stub into switchboards or transformer cabinets. Grounding type insulated bushings shall always be used on both ends of conduits feeding panelboards.
- K. Provide suitable fittings where raceway crosses building expansion joints.
- L. Securely fasten in place using approved strap or hanger within three feet of each termination and not over ten feet apart in runs.
- M. Run concealed in finished areas unless otherwise noted.
- N. Make all cuts square with hacksaw. Remove any burrs or shoulders by reaming.
- O. All runs exposed and all runs above accessible ceilings shall be neat and square with building structure such as walls and ceiling/roof structures. Multiple parallel runs shall use trapeze supports where possible.
- P. "Flex" and "Sealtite" connections with T&B "Tite-Bite" and "Super-Tite" or approved equivalent fittings. Shall have insulated throats.
- Q. Where installing raceway on interior surface of exterior walls. Mount raceway ¼" from wall with clamp-backs or strut.

### 3.2 APPLICATION

- A. Galvanized Steel Rigid Metal Conduit (RMC) required:
  - 1. Installations below grade (and in or under slabs where approved), except where specifically noted otherwise.
  - 2. Below 6 ft AFF in exposed areas of mechanical equipment rooms, except where specifically noted otherwise.
  - 3. Installations exposed to atmosphere (including breezeways and similar locations).
- B. Electrical Metallic Tubing (EMT) Conduit required:
  - 1. Interior partitions.
  - 2. Above suspended ceilings.
  - 3. Above 6'-0" AFF in exposed areas of mechanical equipment rooms, except where specifically noted otherwise.



4. Sizes 2" and smaller except where specifically noted otherwise.
- C. Liquid Tight Flexible Metal Conduit required, not over 4'-0" in length, for final connections to:
1. Equipment in wet locations (including fire protection tamper and flow switches).
  2. Equipment with vibration isolation mounting.
  3. Equipment housing ferromagnetic cores or with integral moving components, capable of generating noise or vibrations including transformers and motors.
  4. Pumps and associated equipment.
  5. Instruments and control devices.
  6. All flexible connections to equipment in fire pump room below 60" AFF.
- D. Flexible Metal Conduit required, not over 4'-0" in length, for final connections to:
1. Equipment in dry locations.
  2. Equipment in dry locations with vibration isolation mounting.

### 3.3 BOX INSTALLATION

- A. Attach EMT with connector only.
- B. Outlet boxes shall be sized in accord with NEC Section 314. All lighting outlet boxes shall have fixture studs. Device boxes shall be sectional type or 4" square equipped with plaster rings as required to mount the device. Set edge flush with finished surface. Boxes may be installed at top or bottom of a masonry course. Raco, or approved equivalent, masonry boxes in sawed block. 1-1/4" and deeper plaster rings may be of die-cast aluminum of Steel City make, or approved equivalent.
- C. Where installed in metal stud partitions, wall boxes shall be supported from two adjacent studs using a system such as Caddy Bar Hanger Assembly, or approved equivalent. Support on a single stud is not acceptable.
- D. Fixtures weighing more than six pounds shall be supported from the fixture stud.
- E. Where not shown differently on the drawings, mount:
1. Switch boxes 46" from finished floor to center. Boxes beside doors shall be mounted so edge of trim plate is 2" from edge of door trim on strike side.
  2. Telephone boxes 18" from finished floor to center and vertical. Boxes for wall phones shall be 46" from finished floor and vertical.
  3. Bracket light boxes as indicated on plans or as directed by Engineer.
  4. Clock outlet boxes 7'-0" from finished floor, or 6" below finished ceiling, to center.
  5. Panel cans 6'-4" ( $\pm 4$ " in concrete block construction) from finished floor to top of can.
  6. Fire alarm pull stations 46" from finished floor to center.
  7. Fire alarm chimes, horns, strobes, etc., 80" above finished floor or 6" below finished ceiling, whichever is lower, and shall comply with ADA requirements.

- F. Where not shown differently on the drawings, mount boxes for receptacles to receive device in a vertical position and be:
1. Centered 18" above finished floor.
  2. Centered 6" above counters, shelves, or cabinets where apparently intended to be so placed.
  3. Centered 4" above high edge of backsplashes.
  4. Where devices are to be ganged, provide boxes to receive devices trimmed with a gang plate.
- G. As soon as installed, all raceway openings shall be closed with plastic inserts to prevent entrance of foreign matter during construction. All enclosures shall be kept clean of any foreign matter. Install Jordan "Kover-All" plastic covers over outlet boxes ahead of plastering or painting.
- H. Conduit(s) from all boxes installed on exterior walls or in areas going from conditioned to unconditioned space shall have conduit(s) sealed with duct seal or equivalent to prevent moisture formation. Duct seal or equivalent shall also be installed in all raceways entering from exterior of building.

#### 3.4 FASTENINGS AND SUPPORTS INSTALLATION

- A. Inserts in masonry shall be lead, fiber, or plastic types installed in drilled holes. Wooden plugs shall not be used. Lead only shall be used on all exterior masonry or interior masonry subject to permanent moisture. Hung raceways shall be supported from the structure with rod supports at least 5/16" in diameter.
- B. All equipment and flat raceways attached to outside wall or interior walls subject to permanent moisture shall be shimmed out with non-corrodible material so as to provide 1/4" air space between wall and equipment or raceway.
- C. All materials, whether exposed or concealed, shall be firmly and adequately held in place. Fastening and support shall afford safety factor of three or higher.
- D. All fixtures, raceways, and equipment shall be supported from the structure. Nothing may be supported on suspended ceilings, including the hanger wires, unless definitely noted so on the drawings or specifically permitted by the Engineer.
- E. Recessed fixtures shall be supported at the two (2) opposite ends to the structure. Supports shall be provided with the same type of wire as used to support the lay-in ceiling track. Attach one end of the wire to one corner of the fixture and the other end to the building's structural system. Lay-in fixtures shall also be screwed to the main runners of the lay-in ceiling track at all four corners using sheet metal screws.
- F. Recessed ceiling speakers, where specified with an enclosure, shall have the enclosure supported directly from the structure with a minimum of two 10 gauge wires run perpendicular to the ceiling and not pulling to one side. If recessed ceiling speaker is specified without an enclosure and is mounted in a suspended ceiling, the speaker shall be supported using T-Bar bridges such as Soundolier No. 81-8, or other device specifically designed for such support. In addition, each of the four corners of the ceiling grid block enclosing the speaker shall be supported from the structure

using 10 gauge steel wire run perpendicular to the ceiling plane.

- G. Other devices using octagonal or 4" square ceiling boxes, such as smoke detectors, dome lights, exit signs, etc., where installed in suspended ceilings shall be supported from the ceiling system using Caddy, or other, hangers specifically designed for such support. In addition, each of the four corners of the grid block enclosing the box shall be supported from the structure using 10 gauge steel wires run perpendicular to the ceiling plane.
- H. Support for pipe straps or clamps shall be toggle bolts on hollow masonry; metal expansion shields and machine screws, or standard pre-set inserts, on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. The resulting fastening shall be completely secure.

END OF SECTION 260533

## SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1 NAMEPLATES

- A. Furnish and install engraved laminated phenolic nameplates for all safety switches, panelboards, transformers, switchboards, motor control centers and other electrical equipment supplied for the project for identification of equipment controlled or served, phase, voltage, etc.
- B. Furnish and install permanently mounted label on each device plate for receptacles indicating its panelboard and circuit number. Labels shall be made using electronic labeling system with black letters on clear background. Write-on labels are prohibited.

### PART 2 PRODUCTS

#### 2.1 NAMEPLATE MATERIALS

- A. Nameplate material colors shall be (conforms with State Construction Office requirements):
  - 1. Blue surface with white core for 120/208 volt equipment.
  - 2. Black surface with white core for 277/480 volt equipment.
  - 3. Bright red surface with white core for all equipment related to fire alarm system.
  - 4. Green surface with white core for all equipment related to "Emergency" systems.
  - 5. Brown surface with white core for all equipment related to data systems.
- B. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by phenolic tags with wire attached to conduit or outlet.
- C. All concealed outlet boxes, junction boxes and pull boxes shall have their covers and exterior visible surfaces painted with colors to match color scheme outlined above. This includes covers on boxes above all type ceilings.

### PART 3 EXECUTION

#### 3.1 NAMEPLATE INSTALLATION

- A. Nameplates shall be securely attached to equipment with self-tapping stainless steel screws, if sharp end is protected; otherwise, rivets shall be used. Nameplates shall identify equipment controlled, attached, etc. Letters shall be ½" high minimum for panel identification. Letters for other information shall be ¼" high minimum. Embossed, self-adhesive plastic tape is NOT acceptable for marking equipment.
- B. Nameplates for legally required and optional standby electrical systems shall follow the nameplate color convention for the applied voltage noted above in 2.A.1. The text that defines component identification should also include the system application. For example, in an electrical distribution

system with utility service and a generator having three (3) output breakers designated for emergency, legally required, and standby electrical systems, assuming Automatic Transfer Switch ATS-2 is part of the legally required system, then its nameplate should state:

LEGALLY REQUIRED ATS-2  
FED BY GEN-1 AND MDP

END OF SECTION 260553

## SECTION 26 05 93 – ELECTRICAL SYSTEMS FIRESTOPPING

### PART 1 GENERAL

#### 1.1 REFERENCE

- A. The work under this section is subject to the Contract Documents including General Conditions, Supplementary Conditions, and under Division 1 – General Requirements.

#### 1.2 SCOPE

- A. Furnish and install work under this section including, but not limited to the following:
  - 1. Penetrations through fire-resistance-rated floor, roof, walls and partitions including openings containing conduits, cables, cable bundles, cable tray and other penetrating items.

#### 1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Firestopping systems shall be UL Classified for the application and correspond to those indicated by reference to designations listed by UL Fire Resistance Directory.
- B. Firestopping systems and installation shall meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide fire rating equal to that of construction being penetrated.
- C. Proposed firestop materials and methods shall conform to applicable code authority having local jurisdiction.

#### 1.4 SUBMITTALS

- A. Manufacturer's specifications and technical data for each material including composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions.
- B. Material safety data sheets provided with product delivered to job-site.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed firestopping that is similar in material, design and intent to that indicated for Project and that has performed successfully.
- B. A manufacturer's direct representative to be on-site during initial installation firestop systems to train appropriate contractor personnel in proper selection and installation procedures.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product, type and UL label where applicable.
- B. Store materials to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes.

- C. Handle with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

#### 1.7 PROJECT CONDITIONS

- A. Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturer or when substrates are wet due to rain, frost, condensation or other causes.
- B. Ventilate firestopping per manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Do not cover up those fire stopping installations that will become concealed behind other construction until authorities having jurisdiction, if required, have examined each installation.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. 3M, Hilti, Tremco, Nelson Firestop Products, Specified Technologies, Inc, or Rectorseal Corp.

#### 2.2 MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire-rating involved for each separate instance.
- B. Materials shall not contain flammable solvents.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions, for compliance with requirements for opening configurations, penetrating items and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.2 PREPERATION

- A. Clean out openings immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer.
- B. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- C. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

- D. Do not proceed until unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

- A. Comply with “System Performance Requirements” article in Part 1 and manufacturer's installation instructions and drawings.
- B. Install forming/backing materials and other accessories of types required to support fill materials during application as required. After installing fill materials, remove forming materials and other accessories no indicated as permanent components of firestop systems.
- C. Avoid multiple penetrations of common fire barrier opening. When possible, seal each penetration in accordance with project details. When multiple penetrations are unavoidable, seal openings with appropriate UL Classified firestopping systems.

### 3.4 FIELD QUALITY CONTROL

- A. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.
- B. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

### 3.5 CLEANING

- A. Clean surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION 260593



## SECTION 26 24 16 – PANELBOARDS

### PART 1 GENERAL

#### 1.1 REQUIREMENTS

- A. Equipment shall be built to NEMA Standards where such standards exist.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. GE by ABB are specified as a basis for design. Equivalents by Cutler-Hammer or Square D may also be quoted.
- B. Types, sizes, capacities and characteristics shall be as shown on riser diagram or in schedules. Service equipment shall be labeled "UL Approved for Service Entrance Use".
- C. Branch circuit panelboards shall be bolt-on type, GE by ABB, or equivalent. Distribution panelboards shall be GE/ABB Spectra Series, as indicated on plans, or equivalent.
- D. All breakers shall be fully rated. Series rating are not acceptable.
- E. Feed through panels shall not be used.

#### 2.2 CONSTRUCTION FEATURES

- A. Housing shall be constructed of Code gauge galvanized sheet steel and shall be securely fabricated with screws, bolts, rivets or by welding. Housings for branch circuit panelboards shall be 20" wide and 5-3/4" deep. Housings for distribution panelboards shall be no larger than the panelboard specified as shown on the plans or the Contractor shall verify larger panelboard will fit and still maintain the proper Code clearances because space is at a premium.
- B. Top or bottom gutter space shall be increased six inches where feeder loops through panel. End plates shall be galvanized Code gauge (minimum) and shall be supplied without knockouts.
- C. Covers shall be constructed of high grade flat sheet steel of Code gauge minimum with the following:
1. Door-in-Door (Hinged) Trim Front.
  2. Door flush with face and closed against a full inside trim stop. Hinges shall be inside type.
  3. Combination flush latch(es) and Yale, Corbin or equivalent, tumbler-type lock(s), so panel door(s) may be held closed without being locked. All such locks on same job shall be keyed alike. Plastic lock type trims are not acceptable.

4. Finish of manufacturer's standard color of top-grade enamel over a phosphatized or other approved rust inhibitor treatment and prime coat, or as specified in Section 26 05 00.
  5. Four (4) or more cover fasteners of a type which will permit mounting plumb on box. Cover shall also have inside support studs to rest on lower edge of can while being fastened.
- D. A means of readily adjusting projection of panel interior assembly with all connections in place shall be provided. A method requiring stacking of washers is not acceptable.
- E. Interior trim shall fit neatly between interior assembly and cover - leaving no gaps between the two.
- F. Circuit breakers:
1. Circuit breakers shall be by the same manufacturer as the panel in which mounted unless specifically stated otherwise on the plans.
  2. Breakers shall be equipped with specific accessories, such as shunt trip, handle lock, etc., as indicated on plans.
  3. Individual breakers shall be securely and tightly mounted on their supporting structure so they do not depend upon the current-carrying bus for support, unless a combination support/bus is considered adequately strong by the Engineer.
  4. Breakers in lighting and branch circuit panels shall be "Quicklag" type bolted to the supply bus. Plug-in types are not acceptable.
  5. Breakers in distribution panels shall be molded-case thermal-magnetic type unless specifically indicated otherwise on plans. Multi-pole breakers shall have common tripping of all poles.
  6. Breakers shall have factory installed mechanical type lugs to accept solid or stranded type conductors and shall be rated for use with wire rated at 75 degrees C.
  7. All molded-case circuit breakers shall be labeled as meeting U.L. 489.
  8. Circuit breakers 400A and greater shall be electronic trip type, molded case, individually mounted breakers, listed under U.L. 489. Breakers shall be 80% rated (unless noted as 100% rated in schedule) with field interchangeable rating plugs as stated on the drawings. U.L. listed interrupting rating shall be the same as for the main breaker.
- G. Supply lugs shall be installed on busses and neutral bar so they may be readily and securely tightened from the front with panel in place and wired. A suitable arrangement shall limit their movement out of plumb. It shall not be possible to move the lugs so that metal parts between phases are closer than 3/8".
- H. All panels shall have 100% rated copper busses and neutral bar, with substantial connections where breakers bolt to busses.
- I. All wiring lugs in panelboards and all breakers shall be rated for use with 75 degree conductors sized in accordance with NEC Table 310.15(B)(16).

- J. All branch circuit panels shall be equipped with 100% rated copper ground busses.
- K. Breakers in lighting or branch circuit power panelboards shall be physically arranged in locations shown in panel schedules and be connected to the phases shown. Any deviation shall be approved by the engineer in advance. Panelboards shall be equipped with directory cards mounted behind heavy clear plastic shields in substantial frames attached to inside face of doors. Cards shall be a minimum of three (3) inches wide.
- L. Panelboard manufacturer shall determine the flash protection boundary and the incident energy for the electrical equipment in accordance with IEEE 1584 and NFPA 70E requirements and shall provide labels for each panel with the required information accordingly.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Flush-mounted panel housings shall be flush with finished wall.
- B. Mount equipment plumb and level.
- C. Openings in boxes, cabinets, or gutters shall be cut or sawed. Burning of openings is prohibited.
- D. Each lighting or branch circuit panelboard mounted flush in a wall shall have a minimum of five empty 3/4" conduits stubbed out into the ceiling space above panel for future use unless all circuits in a panel are assigned. Seal ends of conduit with caps or with UL approved fire stopping material.
- E. Only one (1) solid wire is allowable under a screw. Use lug for connecting stranded wire or more than one solid conductor.
- F. Label all equipment in conformance with Section 26 05 53.
- G. Panelboard directory card shall be neatly typed with circuits assigned as shown on schedules. Space typing on card so all is visible when inserted into frame. Use room names and numbers as provided by Owner, not those shown on schedule. Names and numbers on schedule relate to plans only for construction. Indicate spare breakers in pencil (not typed) so that owner can erase and change as necessary in the future.
- H. Next to each breaker within main or distribution panelboards, attach a phenolic label indicating what it feeds. Wording shall be as shown on its diagram or schedule. Labeling shall also be attached to separately-mounted breakers, switches, transformers, wiring gutters and controllers of all types.
- I. Centered above door on panel cover attach a label indicating panel designation - for example, "PANEL A"; voltage - "120/208 VOLTS"; and from where served - "FED FROM PANEL MDP". See Section 26 05 53 for details.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

PART 1 GENERAL

1.1 WIRING METHOD FOR BRANCH CIRCUITS

- A. Outlets in the same general area are circuited together. Circuit numbers are shown as noted in symbol schedule.
- B. Unless shown differently, 120 or 277 volt branch circuits on single or three phase systems shall be limited to three (3) phase conductors per raceway. Three phase circuits shall be limited to one circuit per raceway (three (3) different phase wires and neutral(s) if needed).
- C. Individual neutral wires shall be provided for each circuit (no sharing of neutrals between circuits). Install individual neutral(s) where existing circuit(s) are extended.
- D. The neutral carrying all or any part of the current of any specific load or run shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current. No split neutrals permitted.
- E. Circuits shall be connected to panels as shown in the panel schedule. Any deviation shall be approved in advance by the engineer.
- F. Under the above requirements and with required color coding system no feeder or branch circuit raceway will contain more than one wire of the same color, except for switch legs and control circuits.
- G. Conductors feeding lighting outlets may be combined in the same raceway with conductors feeding convenience receptacles; but lighting outlets and convenience receptacles shall not be put on the same circuit unless specifically indicated.
- H. Toggle switches shall be single pole, three-way, or four-way as indicated on drawings. Switches shall be of grounding type, with hex-head grounding screw, rated 20A, 120/277V, AC only. All switches shall have quiet operating mechanisms without the use of mercury switches. All switches shall be listed by an “approved” third party agency, approved for the voltage and amperage indicated.
- I. Duplex receptacles shall be of the grounding type, arranged for back and side wiring, with separate single and double grounding terminals. Receptacles shall be straight blade, rated 20A, 125V and the face configuration shall conform to the NEMA Standard WD-1, NEMA WD-6, DSCC W-C-596G and UL-498, and shall be “approved” third party listed. Self-grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.
- J. Receptacles shall be industrial specification grade or heavy duty grade, mounted vertically. Receptacles mounted over counters, back-splashes and where specifically noted otherwise shall be mounted horizontally.
- K. Receptacles shall not be mounted back to back.

## PART 2 PRODUCTS

### 2.1 WIRING DEVICES

A. Switches considered equivalent are as follows:

- |                 |              |
|-----------------|--------------|
| 1. Single Pole: | Hubbell 1221 |
|                 | Bryant 4901  |
|                 | P & S 20AC1  |
|                 | Leviton 1221 |
|                 | Eagle 2221   |

B. Duplex receptacles considered equivalent are as follows:

- |                                    |              |
|------------------------------------|--------------|
| 1. Heavy Duty Specification Grade: | Hubbell 5362 |
|                                    | Bryant 5362  |
|                                    | P & S 5362   |
|                                    | Leviton 5362 |
|                                    | Eagle 5362   |

C. Indoor occupancy sensors considered equivalent are as follows:

Hubbell  
Leviton  
Legrand  
Touch-Plate, Inc.  
Wattstopper

D. The color of all devices shall be verified with Architect. Samples will be required prior to acceptance of any proposed equivalents not specifically mentioned above. All like devices shall be by the same manufacturer (i.e.; all switches, all duplex receptacles, etc.).

E. Unless noted or specified otherwise, device trim plates shall be type 302 stainless steel to suit device. All plates in the job shall be same make and match throughout.

F. Ground fault interrupter type duplex receptacles shall be heavy duty specification grade. Where used outdoors, they shall be the weather-resistant type, as well as ground fault unless otherwise indicated. They shall have extra duty rated weather proof while-in-use protective covers.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Devices shall be mounted tightly to boxes and be adjusted plumb and level.

B. Receptacles are to be installed in the vertical position with the ground terminal on top.

C. Two or more devices ganged shall be trimmed with gang plate.

END OF SECTION 262726

## SECTION 26 29 00 – MOTORS, CONTROLLERS, AND EQUIPMENT CONNECTIONS

### PART 1 GENERAL

#### 1.1 REQUIREMENTS

- A. Motors, controllers, and other special equipment are sometimes provided and installed by other trades. This section specifies typical connections to that equipment.
- B. All individual motor starters or VFD's for plumbing & mechanical equipment (fans, pumps, etc.) shall be furnished and installed under Divisions 22 & 23 (Plumbing & Mechanical Contractors) unless indicated as a part of a motor control center. Motor starters for mechanical equipment provided in motor control centers shall be furnished under Division 26 (Electrical Contractor). Under Division 26, power wiring shall be provided up to a termination point consisting of a junction box, trough, starter, VFD or disconnect switch. Under Division 26 line side terminations shall be provided. Wiring from the termination point to the plumbing or mechanical equipment, including final connections shall be provided under Divisions 22 & 23.
- C. Where electrical wiring is required by trades other than covered by Division 26, the installer shall refer to the wiring materials and methods as specified under Division 26.

### PART 2 PRODUCTS

#### 2.1 EXHAUST FANS

- A. Exhaust fans are indicated by special symbol on plans. Unless otherwise noted, they will be furnished and set by others and connected by the Mechanical Contractor. Controller will be provided by others unless controller is specified on electrical drawings. Electrical contractor shall provide a local disconnect switch at fan if unit is not provided with one. Where indicated as controlled from several double pole switches, the second pole of each switch shall be connected in parallel so fan will run when any one or more of the switches is on.

#### 2.2 UNIT HEATERS

- A. Unit heater, ventilator, cooler, or similar outlets - designated by special symbol - are located approximately on drawings. Exact location of outlet shall be obtained from Heating, Ventilating, and Air Conditioning Contractor. Unless indicated otherwise, outlet shall be a 4" box fitted with an oversized blank cover with 1/2" center knockout, mounted in wall or ceiling, and fed on circuit shown beside symbol. These outlets shall be located behind or within equipment cabinets where possible and still be accessible. Provide local disconnect switch if one is not provided with unit. Unless specified otherwise herein or on drawings, power connection from outlet to equipment will be by Mechanical Contractor. Control wiring will be done by the Mechanical Contractor.

#### 2.3 TROUGHS

- A. Electrical troughs, junction boxes, switches, or breakers for air conditioning, heating, or plumbing equipment are indicated on drawings. Exact locations shall be obtained from Heating and Air Conditioning or Plumbing Contractors but Code clearances shall be maintained. Unless specifically noted otherwise, all power wiring for equipment and controllers beyond these points will

be done by Heating and Air Conditioning or Plumbing Contractors. Control wiring will be by Heating and Air Conditioning or Plumbing Contractors.

#### 2.4 OTHER

- A. Other equipment connections are generally indicated on drawings by a circled black triangle with a letter suffix. These are then defined in notes or details. Where catalog numbers, models, or types, and manufacturer's name are given, these items of equipment shall be furnished and installed by the Electrical Contractor, unless specifically noted otherwise.
- B. Junction box - designated as a circled J. Size of such boxes is generally noted on drawings. Where this is not done, they shall be sized in accord with NEC and purpose evidently intended.
- C. Where unscheduled junction boxes are used by Contractor to facilitate wiring or to comply with limits of elbows and bends, they shall be concealed if at all possible to do so and still be left accessible. If this is impossible, they shall be recessed in walls or ceilings and provided with an oversized cover which shall be painted out to match adjacent surfaces. If it is necessary to mount such boxes exposed, the location shall be approved by the Engineer.
- D. All contactors, motor starters and combination type starters specified under this contract shall be equipped with Hand-Off-Automatic switches, pilot (run indicating) light, 120 volt control transformer, and two sets of auxiliary contacts. The switch and light shall be located on the unit cover. Starters shall be Square D, Cutler-Hammer, General Electric Co., or equivalent by others.
- E. All safety switches shall be heavy-duty type, NEMA 1 for indoor and NEMA 3R for outdoor use unless specifically stated otherwise. They shall be fused type unless specifically indicated otherwise on plans. Fused type (600 volts or less) shall be equipped with the following: Service Entrance and Feeder Circuits over 600A – Class L, UL Listed, current limiting with 200K interrupting rating; Service Entrance and Feeder Circuits 600A and less – Class RK1 or J, UL Listed, current limiting with 200K interrupting rating; Motor, Motor Controller and Transformer Circuits – Class RK5, UL Listed, current limiting time delay with 200K interrupting rating; and individual Equipment where fault current does not exceed 50kA – Class K5, UL Listed, with 50K interrupting rating. Fusible safety switches with short circuit withstand rating of 100K or 200K shall include Class R or Class J rejection fuse block feature. Switches shall be equipped with defeatable door interlocks and padlocking provisions in the on and off positions. Padlocks shall be provided for switches located in public areas. Switches shall be by Square D, Cutler-Hammer, General Electric Co., or equivalent by others. In addition, safety switches shall be provided with the following requirements or features:
  - 1. Safety switches shall be third party listed.
  - 2. Switches shall have door interlocks that prevent the door from opening when the operating handle is in the “on” position.
  - 3. Switches shall have handles whose positions are easily recognizable in the “on” or “off” position. For safety reasons, padlock shall be provided for switches unless they are located in a locked electrical room.
  - 4. Switches shall have positive quick make-quick break mechanisms.
  - 5. Switches shall be properly labeled. Refer to Specification 260553.
  - 6. The Electrical contractor is to provide to the Owner as spares, 10% of the quantity of fuses used of each type and rating, with a minimum of one (1) set of each type.



- F. All safety switches, motor starters, or other boxes or panels, designated as NEMA 3R or otherwise intended for outdoor use or use in wet areas, shall use rain-tight conduit hub fittings with bonding screw.
- G. Control wiring shall not be installed in the same raceways as power wiring.

END OF SECTION 262900

SECTION 26 50 00 – LIGHTING

PART 1 GENERAL

1.1 REQUIREMENTS

- A. The following specification applies to the general building lighting system.
- B. Lighting systems shall comply with the 2018 NC Energy Code and NC Senate Bill 668.
- C. Types and manufacturers are scheduled on the drawings. Equivalent luminaires by others may be submitted only as indicated on the plans and are subject to the conditions in Section 26 05 00.
- D. All luminaires shall be UL listed and labeled.

PART 2 PRODUCTS

2.1 MATERIALS

- A. A complete lighting system will be provided consisting of area, emergency egress, and emergency exit lighting. These systems will include LED lighting. These systems will also include switches and automatic controls (occupancy sensors, automatic lighting shutoff systems, dimming systems, etc.) as necessary to provide the necessary lighting levels while complying with or exceeding the Energy Code requirements. Power for emergency egress lighting shall be provided by the emergency generator.
- B. LED luminaires shall comply with the latest guidelines for best practices in retrofit installations as described in the NC SCO document – Energy Efficient Lighting Guidance Document for New Construction and Retrofits: The State of North Carolina (Rev. March 2016).
- C. Catalog numbers are for general identification of luminaires only. All related parts, such as plaster rings, junction boxes, louvers, shields, mounting stems, canopies, connectors, straps, nipples, etc., to fit them properly to the construction, shall be furnished and installed.
- D. A lighting luminaire shall be provided for every lighting outlet indicated. Any omission shall be brought to the attention of the Engineer before submitting proposal; otherwise a unit selected by the Engineer shall be furnished and installed at no additional charge.
- E. All luminaires shall be grounded per NEC.
- F. Luminaires connected with flex to the rigid raceway portion of the wiring system shall carry a green bonding jumper within the flex. The jumper shall be fastened to both the luminaire and the raceway system with a Steel City "G" clip or approved equivalent. Phase and ground conductors run in a flex shall be #12 minimum.
- G. Surface-mounted luminaires being installed on combustible material shall be mounted at least 1-1/2" from the surface of the material; except units which are plainly marked on luminaires as U.L. approved for mounting directly to such surfaces.
- H. Mount all luminaires plumb and square. Keep rows in perfect line.

- I. Manufacturers shall be regularly engaged in the manufacture of lighting luminaires of types and ratings required, shall have a service organization in the continental US, and shall have products that have been satisfactorily used in similar service for not less than five (5) years. The manufacture of the luminaires shall comply with the provisions of all applicable Codes and Standards. All luminaires shall be tested prior to shipping.
- J. All LED luminaires shall meet the NEMA 410-2011 standard for inrush current and shall be less than 20% total harmonic distortion. Provide a minimum of 2.5-KV surge suppression integral with the driver. All luminaires shall be listed on the LED Lighting Facts website ([www.lightingfacts.com](http://www.lightingfacts.com)), Energy Star website ([www.energystar.gov](http://www.energystar.gov)), or the Design Light Consortium website ([www.designlights.org](http://www.designlights.org)). All integrally manufactured (not modular) products shall have a minimum 10-year warranty. For modular manufactured products (separate LED elements and drivers) shall have a 10-year warranty for LED elements and minimum 5-year warranty on drivers.
- K. Indoor LED Luminaires:
1. Construction/Finish: No visible welding, no plane-protruding screws, latches, springs, hooks, rivets or plastic supports viewed from the occupied (room) side are allowed.
  2. Maintenance: Power supplies, drivers, ballasts, LED arrays, boards and light engines shall be easily field replaceable using common hand tools (e.g. screw drivers, pliers, etc.) and without uninstalling the luminaire.
  3. Electrical and Photometric Requirements:
    - a) Operating Voltage: 24 VDC, 120 VAC at 60 Hz, 277 VAC at 60 Hz, or universal voltage (120, 220/240, 277 VAC at 50/60 Hz).
    - b) Power Factor:  $\geq 0.90$  (at full luminaire output and across specified voltage range).
    - c) Total Harmonic Distortion:  $\leq 20\%$  (at full luminaire output and across specified voltage range).
    - d) Transient and Surge Protection: ANSI C62.41-2002 Category A surge protection standards up to and including 2.5 kV.
    - e) Sound: Class A not to exceed a measured value of 24dBA.
    - f) Maximum Standby Power: 1W.
    - g) Warranty: Five (5) years, non-prorated on complete luminaire including driver.
    - h) LED arrays in product(s) shall be considered defective in material or workmanship if a total of 10% or more of the individual light-emitting diodes in the product(s) fail to illuminate during normal operation after installation.
    - i) LED Power Supply/Driver:
      - 1) Driver efficiency (at full load):  $\geq 85\%$  for drivers capable of  $\geq 50$  Watts, 80% for drivers capable of  $< 50$  Watts.
      - 2) Federal Communications Commission (FCC) compliance: FCC 47 Part 15 Non-Consumer limits for EMI/RFI emissions.
    - j) Temperature Rating: Each luminaire shall be designed to operate at an average operating temperature of 25°C. The operating temperature shall be 0°C to 25°C.
    - k) Thermal Management:
      - 1) 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.
      - 2) The LED manufacturer's maximum junction box temperature for the expected life shall not be exceeded at the average operating ambient temperature.
      - 3) The LED manufacturer's maximum junction temperature for the catastrophic failure shall not be exceeded at the maximum operating ambient temperature.

- 4) The driver manufacturer's maximum case temperature shall not be exceeded at the maximum operating temperature. Thermal management shall be passive by design. The use of fans or other mechanical cooling devices shall not be allowed.
- l) Flicker Criteria: IESNA, IEEE PAR1789.
- m) EMI/RFI: The luminaire and associated on-board circuitry shall meet Class A emission limits per FCC Title 47, Subpart B, Section 15 Non-Consumer Requirements for EMI/RFI Emissions.
- n) Inrush Current: NEMA 410.
- o) Colorimetric:
  - 1) Correlated Color Temperature (CCT): Only allowed CCTs are: 2700K, 3000K, 3500K, 4000/4100K, and 5000K unless specifically noted otherwise.
  - 2) Tolerances shall meet ANSI C78.377-2015 (LED).
  - 3) Color Rendering Index (CRI) [ $R_a$ ]  $\geq 80$  with a positive  $R_9$  value.
  - 4) Color shift shall be minimal.

## 2.2 EXIT SIGNS AND EMERGENCY LIGHTING

- A. Emergency lighting and exit signs are as specified and located on plans. All exit signs shall be LED type.
- B. the system shall be fed from the Emergency Power Distribution System which is supplied by utility under normal conditions and automatically transferred to the emergency generator system upon utility power failure.
- C. Failure of any one element, such as a lamp, shall not result in loss of illumination from any fixture used for emergency egress lighting.
- D. The emergency power wiring shall be a complete system in itself and shall be kept entirely separate from any other wiring in the project.

## PART 2 EXECUTION

### 2.1 INSTALLATION

- A. Installation shall meet the requirements of previous sections of these specifications.
- B. Installation shall meet manufactures installation instructions.
- C. Mount all luminaires plumb and square. Keep rows in a perfect line.
- D. Install lamps in each luminaire.
- E. Bond and ground luminaire metal accessories and metal poles in accordance with the NEC and per Section 260526. Install supplementary grounding electrode at each pole.

### 2.2 SUBMITTALS

- A. Lighting submittal shall include all proposed luminaires, controls, and accessories. Incomplete submittals will be rejected.

### 2.3 DELIVERY

- A. Equipment shall be delivered to the jobsite with protective wrappings and/or packing to protect factory applied final finishes.

#### 2.4 CLEANING

- A. Clean photometric control surfaces as recommended by manufacturer.
- B. Clean finishes and touch up damage with manufacturer's approved paint or coating materials.

#### 2.5 SPARE PARTS

- A. 1% of each type of LED driver (minimum of one (1) unless noted otherwise).
- B. Two (2) of each type of LED light engine.
- C. 10% of each type of occupancy sensor.
- D. 2% relays and one (1) extra circuit board for each type of lighting control panel.
- E. Parts list for all luminaires provided that includes LED light engines, LED drivers, etc. with part numbers shall be included in closeout documents.

END OF SECTION 265000

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27 05 26	GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS
27 05 36	RACEWAY FOR COMMUNICATION SYSTEMS
27 05 53	IDENTIFICATION FOR COMMUNICATION SYSTEMS



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SECTION 27 05 00 – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 GENERAL

1.1 REQUIREMENTS

- A. Division 27 Communications specifications are intended to include a complete telecommunications infrastructure for the facility. The scope for this project is for the Contractor to provide raceways and boxes as documented in the drawings and specifications. Cabling and associated equipment (including network electronics (switches, routers, wireless access points), telephones, VoIP instruments, and patch cables) will be provided by the Owner.
- B. Standards. All work shall be in accordance with the latest edition of all applicable campus, State, and Federal regulations and codes. Special considerations should be made to comply with NEC, NFPA, and North Carolina State Construction Office requirements. All work shall also be in accordance with the latest versions of the BICSI TDMM manual and TIA-569 standard.

PART 2 PRODUCTS

2.1 MATERIALS

- A. The materials used for this system are to be manufacturer and part number specific with no substitutions, unless specified as accepting “or equal.” See Design and Construction Guidelines – Division 27 - Communications for a list of materials acceptable for use in North Carolina State University projects.

- 1. [https://facilities.ofa.ncsu.edu/files/2015/02/division27\\_communications.pdf](https://facilities.ofa.ncsu.edu/files/2015/02/division27_communications.pdf)

END OF SECTION 27 05 00

## SECTION 27 05 26 – GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS

### PART 1 GENERAL

#### 1.1 REQUIREMENTS

- A. Grounding and bonding for communications systems are supplemental to the electrical power grounding system and devoted to the communications system infrastructure. Bonding and grounding of telecommunications systems is a requirement in each building on campus. Its purpose is to protect personnel and equipment from unwanted electrical currents associated with the communications infrastructure and equipment.
- B. Grounding and bonding responsibilities are divided and shared between the electrical contractor and the communications contractor.
- C. Grounding and Bonding applies to all communications systems elements, but especially to the following specifications:
  - 1. SECTION 27 05 36 RACEWAY FOR COMMUNICATION SYSTEMS
- D. Standards. All work shall be in accordance with the latest versions of the BICSI TDMM manual and TIA-607 standard, and with manufacturer's recommendations. All work shall comply with all applicable NFPA and NEC requirements.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. The materials used for this system are to be manufacturer and part number specific with no substitutions, unless specified as accepting "or equal." See Design and Construction Guidelines – Division 27 - Communications for a list of materials acceptable for use in North Carolina State University projects.
  - 1. [https://facilities.ofa.ncsu.edu/files/2015/02/division27\\_communications.pdf](https://facilities.ofa.ncsu.edu/files/2015/02/division27_communications.pdf)

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Bonding Conductor for Telecommunications (BCT): The bonding conductor for communications shall bond the TMGB to the main electrical service (power) grounding system. The BCT originates in the MDF and terminates at the electrical service ground for the building. The BCT shall be a continuous copper conductor sized according to length. This conductor shall be installed in EMT, bonded to the conduit at each end and be sized, as a minimum, the same size as the TBB.
- B. Telecommunications Bonding Backbone (TBB): This conductor interconnects the TGB with the TMGB. The TBB shall be routed in a separate conduit alongside the telecommunications riser



cables. The TBB shall be insulated and be a continuous conductor without splices. The TBB shall be a copper conductor with a minimum conductor size of 6 AWG.

- C. Installation Compliance: Provide grounding connections for cable systems as required by manufacturer's recommendations and in compliance with TIA-607-C and as required by the NEC.
- D. Telecommunications Infrastructure Bonding: Bond all installed equipment racks, cable tray, and other metallic components to grounding bus bar in telecom room with a minimum 6 AWG copper conductor with green colored insulation.
- E. TBB Sizing Requirements:
  1. The TBB should be sized per the table below with the TBB length calculated from the last TGB in the run to the TMGB.

TBB Length (LF)	TBB Size (AWG)
Less than 13	6
14-20	4
21-26	3
27-33	2
34-41	1
42-52	1/0
53-66	2/0
Greater than 66	3/0

- F. Telecommunications Grounding Busbar (TGB): The TGB is the interface to the building telecommunications grounding system located in each IDF and serves as the communications grounding system for that room. It shall be installed onto the wall-mounted plywood at 7' 6" AFF. The bar shall be electrically insulated from its mounting hardware. In addition to being bonded to the TMGB, the TGB shall be bonded to building steel if available. This does not apply to buildings constructed of reinforced concrete.
- G. Wireway: A #6 AWG TBB conductor shall be installed for the TGB to the wireway with each section bonded together per manufacturer and NEC requirements.
- H. Pathway Components: A #6 AWG TBB insulated grounding conductor shall be installed to each pathway component per manufacturer and NEC requirements.
- I. Equipment Cabinets and Racks: A #6 AWG TBB insulated grounding conductor shall be installed between the TMGB or TGB and all equipment racks.
- J. Interconnection with Building Ground: The grounding system for telecommunications is for telecommunications systems only. No other building or system grounds may be made to the TMGB, TGB, or communications systems components.

END OF SECTION 27 05 26

## SECTION 27 05 36 – RACEWAYS FOR COMMUNICATION SYSTEMS

### PART 1 GENERAL

#### 1.1 REQUIREMENTS

- A. Pathway systems. A horizontal pathway system shall be installed in campus buildings to route and protect all telecommunications cabling from the MDF/IDF to the outlets in all work space locations. Unless otherwise noted, all cabling for University properties shall be housed in conduit/backbox systems (as opposed to surface mounted or hung cabling). The scope of conduit/backbox use includes cabling for voice and data communications, CATV, elevator emergency phone, security cameras, fire alarm phone lines, automatic transfer switches, emergency generators, and miscellaneous building and freezer alarm lines.
- B. Standards. All work shall be in accordance with the latest edition of all applicable campus, State, and Federal regulations and codes. Special considerations should be made to comply with NEC, NFPA, and North Carolina State Construction Office requirements. All work shall also be in accordance with the latest versions of the BICSI TDMM manual and TIA-569 standard, and with manufacturer's recommendations.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. The materials used for this system are to be manufacturer and part number specific with no substitutions, unless specified as accepting "or equal." See Design and Construction Guidelines – Division 27 - Communications for a list of materials acceptable for use in North Carolina State University projects.
  - 1. [https://facilities.ofa.ncsu.edu/files/2015/02/division27\\_communications.pdf](https://facilities.ofa.ncsu.edu/files/2015/02/division27_communications.pdf)

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Fire safety considerations. The installation of raceways and conduits shall comply will all applicable fire safety and electrical codes. In general, the North Carolina State Construction Office determines the compliance of these systems with codes, and they reserve the right to inspect and approve/disapprove their installation. The horizontal pathway system shall be a combination of cable trays installed in the ceiling areas of the building from the BDF/IDF with 1" conduit run to each work space outlet. The riser pathway system shall be a completely enclosed metallic conduit system between the BDF and all IDFs. All conduit penetrations of rated walls and floors shall be fire-stopped per applicable UL assembly.
- B. Horizontal pathway sizes. Typically the horizontal pathway system will consist of a network of wireways installed in the ceiling areas of the building with 1" conduits run to each work space outlet. All horizontal cabling is run in a star topology (homerun) from each outlet back to the nearest IDF or BDF.

1. Each Telecommunications outlet will have a 1" minimum EMT conduit routed from the recessed outlet box that extends to the wireway.
  2. Conduit Bends: A maximum of 180 degrees will be allowed between pull points. Conduit runs exceeding 180 degrees of turns require the installation of a fully accessible pull box to facilitate cable installation. The use of LB-type or similar conduits is not permissible.
  3. Box Size: Telecommunications outlets shall be double gang 4" X 4" X 2-1/8" deep and shall be fitted with a double gang plaster ring to facilitate the installation of a double gang telecommunications faceplate. Outlets shall be installed at 18" AFF and/or shall be level with nearby electrical outlets. In cases where outlets are installed above countertops the outlet height shall be noted on the drawings.
- C. Maximum horizontal pathway length. The maximum length of the horizontal cable channel is limited to 295 ft. (90m). Since this channel includes patch cords at the outlet and in the IDF and also the cable slack loop installed in the IDF, the actual length of the horizontal pathway is somewhat shorter. A good rule of thumb to use in designing these pathways is the "250 ft. rule". The pathway run from the outlet box farthest from an IDF back to where the wireway penetrates the wall of that IDF shall not exceed 250 ft. It is imperative that this calculation includes allowances for the vertical conduit run from the wireway to the outlet box and for the vertical and horizontal deviations in the wireway routing.
- D. Routing. Typically, wireways are routed in corridors or other publicly accessible areas of the building. Normally, they are routed in the ceiling areas, above acoustic tile ceilings when possible. Routing of wireways through occupied spaces is discouraged, but may be required due to utility conflicts or hard ceilings.

Also, there are areas of buildings that shall typically not be used for wireways or routing. These include:

1. Stairwells.
  2. Elevator shafts and equipment rooms.
  3. Outdoor areas (including covered breezeways) where moisture may be present. The cabling to be installed has no water resistance characteristics.
  4. Wet areas inside buildings such as shower facilities, equipment wash down areas, steam rooms, etc.
  5. Hazardous locations. Since the wireways need to remain accessible for technicians to install cabling on an ongoing basis, routing through areas exposing personnel to dangerous heights, high voltage equipment, hazardous chemicals, etc. shall be avoided.
  6. Locations with excessive heat. The cabling to be installed in these pathway systems is not designed to withstand excessive heat. Wireways and conduits shall be routed to avoid heat sources hot enough to cause sheath deformation over time in the cables.
  7. Confined spaces. Wireways shall not be routed in spaces that are designated as confined spaces requiring special permitting or safety precautions for entry.
  8. EMI sources. Wireways and conduits shall be located away from extraordinary sources of electromagnetic interference (EMI).
- E. Access. In areas of buildings where acoustic tile ceilings are present, the wireway system is typically installed between the top of the grid and the deck above. In these applications, the bottom of the support structure (trapeze) shall be installed at least 3" above the grid. In areas without

acoustic tile ceilings, the wireway system shall be installed exposed with the bottom of the support structure at least 8'- 6" AFF. Wireways shall not be installed above inaccessible (hard) ceilings.

The wireways shall be installed to maximize accessibility for future cable and conduit installations. A minimum of 24" accessible workspace shall be maintained on one side of the wireway.

- F. Conduit requirements. A maximum of 180 degrees between pull points shall be maintained in all conduit runs. For 4" riser conduits, install 48" long sections of 6"x 6" wireway in straight sections of the conduit runs to create pull points. The 4" conduits shall be connected to the end cap of each end of the above wireway sections. Plastic bushings are required on all conduit ends. These pull points shall be located to provide the maximum possible access for cable installation by technicians. Junction boxes shall not be installed in lieu of conduit bends without the approval of NCSU Comtech.
- G. Cabinet connections. For cabinet type IDFs, all conduits shall be connected directly to the junction box (shared with horizontal cables) mounted above the cabinet.
- H. Aesthetics. All visible system elements shall be painted to match surrounding surfaces. Elements installed in locations not visible by building occupants do not require painting. Ideally, all elements of the horizontal and riser pathway systems will be completely hidden from view. However, if this is not possible, the designer shall carefully determine routing and components used to minimize negative aesthetics impacts. Historically, false columns, soffits, and archways have been constructed to conceal wireways and conduits in especially sensitive areas of buildings. These structures shall be installed in a manner consistent with the visual architecture of the building, while still allowing access for installation of cabling.

END OF SECTION 27 05 36

SECTION 27 05 53 – IDENTIFICATION FOR COMMUNICATION SYSTEMS

PART 1 GENERAL

1.1 REQUIREMENTS

- A. This section describes labeling requirements for communications systems. Labeling is a critical requirement and shall be attended to in detail.

PART 2 PRODUCTS

2.1 MATERIALS

- A. The materials used for this system are to be manufacturer and part number specific with no substitutions, unless specified as accepting “or equal.” See Design and Construction Guidelines – Division 27 - Communications for a list of materials acceptable for use in North Carolina State University projects.

1. [https://facilities.ofa.ncsu.edu/files/2015/02/division27\\_communications.pdf](https://facilities.ofa.ncsu.edu/files/2015/02/division27_communications.pdf)

END OF SECTION 27 05 53

DIVISION 28 – TABLE OF CONTENTS

<u>SECTION</u>	<u>TITLE</u>
28 31 00	FIRE DETECTION AND ALARM



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919-233-8091  
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## SECTION 28 31 00 - FIRE DETECTION AND ALARM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section.

#### 1.2 SCOPE

- A. This section of the specifications includes the furnishing of the microprocessor controlled fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, auxiliary control devices, notification devices, and accessories as shown on the drawings and specified herein.

There is an existing system to be modified on this project. All new devices shall be compatible and UL Listed for use with these systems. This specification applies in all parts that are applicable to the modification of the existing system – no exceptions.

- B. The University maintains and services all fire alarm equipment on campus.
- C. The fire alarm system shall comply with applicable provisions of the NC Building Code, NFPA 70 - National Electrical Code (NEC) and NFPA 72 -National Fire Alarm Code. The Contractor shall furnish all parts, materials, and labor customarily required or provided for a complete and operating system, in accordance with all requirements applicable, even if each needed item is not specifically shown or described in the project plans or specifications.

#### 1.3 QUALITY ASSURANCE

- A. 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 by UL, Inc. All products, including initiating devices, shall be as produced or supplied by the same manufacture as the main fire alarm control panel. Products of firms that do not maintain factory authorized service organization and spare parts stock are not acceptable for use on this project.

Manufacturer's shall agree to make factory training/certification, product programs and/or operating systems, and continued product updates and/or Tech notes available to the University. Any licensing and/or proprietary agreements between the manufacture/distributor and the University must be completed and in place prior to the manufacture and/or product being acceptable for installation.

- B. Installer's Qualifications: An experienced company who is an authorized representative of the FACP manufacturer for both installation and maintenance of all equipment is required for installation of the FACP and connection of all circuits for any project. The Installer shall have a minimum of five (5) years documented experience installing fire detection and alarm systems similar in size and scope to this project. The Installer technicians shall be individually certified

NICET Level 2 and by the manufacturer of the equipment and trained and certified on the specific model being installed. The Installer shall have at least one technician on staff certified NICET Level 3. Certifications shall be current to latest release and must have occurred in the most recent 24 months. All connections to the FACP, system programming, and/or programming changes shall be accomplished only by the Installer technicians compliant with qualifications, and must be present for the 100% test, Engineer's inspection, and Owner inspections.

- C. Codes and Standards: The codes and standards listed below are utilized as design criteria for "minimal" system coverage. The University may require additions to these codes and standards based on historical consensus criteria for design and installation of fire alarm systems specific to facility applications within University type settings.
1. NFPA Compliance: Comply with current applicable requirements of NFPA-72, National Fire Alarm Code.
  2. NEC Compliance: Comply with current applicable requirements of NFPA-70, National Electrical Code (NEC) standards pertaining to fire alarm systems.
  3. State Building Code Compliance: Comply with applicable requirements of the North Carolina State Building Code.
  4. Testing Laboratory Compliance: Comply with provisions of UL safety standards pertaining to fire alarm systems. Provide products and components, which are Listed and Labeled.
  5. FM Compliance: Provide fire alarm systems and accessories, which are FM approved.
  6. Comply with Authority(ies) Having Jurisdiction (AHJ):
    - a. NC State code requirement issues: NC Department of Insurance/North Carolina State Construction Office.
    - b. University code requirement issues: NCSU Fire Marshall
    - c. University policy and system application requirements: NC State Facilities Operations Electronic Systems –

[https://facilities.ofa.ncsu.edu/files/2015/02/division26\\_fire\\_alarm\\_systems.pdf](https://facilities.ofa.ncsu.edu/files/2015/02/division26_fire_alarm_systems.pdf)

#### 1.4 SUBMITTALS - GENERAL

- A. 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 and may be subject to rejection. Identification requirements for non-complying features of items are very specific.
1. Installer Certifications:
    - a. 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.

- b. Copies of manufacturer signed certifications and NICET certifications as required in section 1.3.B above.
2. Product Data: Submit Manufacturer's technical product data, including specifications and installation instructions, for all system components (i.e, boards, devices and/or modules, duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and/or other similar items which require mechanical installation.) that will support the entire fire alarm system. Submit technical product data on any required fire alarm system servicing and/or support equipment.
3. Maintenance Data: Submit maintenance data and parts lists for each type of fire alarm equipment being furnished, including furnished specialties and accessories. Include this data and product data in maintenance manual.
4. Shop Drawings: Submit (2) bound, full size sets of shop drawings showing all equipment, all device/module locations, and connecting wiring of entire fire alarm system depicted on scaled architectural floor plans with Installer's border sheet. Include wiring and riser diagrams and battery calculations. Shop drawings should also be submitted to NC State University for review. See (Attachment A) for typical wiring and riser diagrams. Provide distance and proposed route for each Notification Appliance Circuits (NAC's). Electronic copy of such plans shall also be provided by the Engineer in a format compatible with the most recent release of AutoCAD.

The fire alarm contractor shall submit complete Shop Drawings to the Engineer and Owner for review, prior to performing any work. These shall clearly demonstrate compliance with the Engineer's plans and specifications, which have a System Response Matrix showing the fire alarm system's actions (outputs) required for each type of alarm, supervisory, and trouble signal. Any non-compliant features must be fully described. Additionally, Contractor shall conduct a mandatory pre-construction meeting and pre-shop drawing submittal meeting with the electrical contractor, the fire alarm contractor, and NC State University.

Engineer's approval (with or without corrections) of contractor's Shop Drawings, samples, cut sheets, etc., is for general conformance with the contract documents and design concept. It shall not relieve the contractor of responsibility for full compliance with the project plans and specifications, except for any specific non-compliant features for which the engineer gives written authorization.

5. Wiring and Cabling: Submit wire and cable for signal circuits and notification circuits.
6. 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.
7. Standby Battery Sizing Calculations:
  - a. Provide battery calculations used to size secondary power source(s). Calculations must be submitted prior to installation of equipment. Identify NAC current draws and voltage drops for each circuit in the submittal package. In no

case shall the calculated voltage at any notification appliance fall below the minimum listed operating voltage for the devices used.

- b. Include a copy of system battery sizing calculations with the shop drawing submittal to the engineer. Use manufacturer's battery discharge curve to determine expected battery voltage after 24 hours of providing standby power. Then use calculated Notification Appliance Circuit current draw in the alarm mode to determine expected voltage drop at EOL, based on conductor resistance per manufacturer's data sheet or NEC
  - c. The voltage drop at EOL must not exceed 14% of the expected battery voltage, after the required standby time plus alarm time. (Typically, for a 24 volt system, this limits the voltage drop from the battery to the EOL to 3 volts). Determine "worst case" voltage at far end of each NAC, by subtracting its calculated V-drop from the expected battery voltage. The result must be no less than the minimum listed operating voltage for the alarm notification appliances used.
  - d. All of these calculations must be placed on a dedicated sheet of as-built drawings, for future reference by fire alarm service technicians. NAC voltage drop is to be verified during system tests.
  - e. Submittal shall list voltage drop allowed for main fire alarm panel and Notification Appliance Circuits panels (NAC's). Calculations must be submitted prior to installation of equipment. Battery calculation shall be based on "worst case" scenario of current draw, voltage available after 24-hours standby and 15 minutes of full alarm, shall be indicated on a battery chart. The UL minimum voltage allowed by panel shall be used to calculate NAC current draw and voltage drop. Submittals shall provide milliamp current draw data for each device submitted and UL Listed minimum voltage required to operate.
- B. Assumption of Existing System Responsibility/Liability: Any construction project additions and/or renovations that will require changing the current programming of an existing fire alarm system in any way shall require an official transfer of the entire FACP system responsibility to that contractor. This also includes significantly impairing any active system to accommodate phased construction projects where the FACP will either be: removed in its entirety at the completion of the project and/or significantly modified and/or totally replaced through a dual system coverage conversion type project. A signed letter transferring the responsibility of the system as well as an emergency contact list shall be provided to the owner prior to the start of any construction.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER'S/MODELS

- A. Manufacturer's/Models: Subject to compliance with requirements in section 1.3.A above, the current manufacturer's and corresponding panel models that are acceptable to be incorporated into the contract are limited to the following:
  - 1. Existing system is Notifier (Contractor shall verify in field). All components installed as part of this project shall be listed and compatible with existing system and devices.

### 2.2 AUXILIARY POWER SUPPLY PANELS (APS)

- A. APS - Minimum Requirements: Match existing.

## 2.3 ALARM NOTIFICATION APPLIANCES

- A. Audible/Visual Combination Devices: Match existing.

## 2.4 INITIATING DEVICES

- A. Addressable Type Devices – General: Match existing. All initiating devices shall be individually addressable. Addressable devices shall comply with the following requirements:
1. All addressable spot type and duct smoke detectors shall be the analog type and the alarm system shall automatically compensate for detector sensitivity changes due to ambient conditions and dust build-up within detectors. This feature must be armed and sensitivities set prior to acceptance of the system.
  2. Address Setting: Addressable devices shall provide an address-setting means.
  3. Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with two (2) wires.
  4. 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.
  5. 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.
  6. Spot-type detectors must be the plug-in type, with a separate base (not a mounting ring), to facilitate their 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.
  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.
  8. Sounder Base: 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 in the Matrix.
  9. 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.
  10. 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.
- B. Addressable Manual Stations (Pull Stations): Match existing. 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.

1. All pull stations shall be dual-action, have a positive, visual indication of operation and utilize a key type reset.
  2. 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 semi-flush mounting as shown on the plans. Unless otherwise indicated on the Drawings pull stations shall be mounted at 48" Above Finished Floor.
- C. Photoelectric Smoke Detectors: Match existing. 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.
- D. Addressable Thermal Detectors (Heat): Match existing. Thermal Detectors shall be intelligent addressable devices rated at 135°F. (58° C.) and 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.
1. Non-Rate of Rise Detectors: 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.
  2. Specialized Element Temperature Ratings: 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.
- E. Duct Smoke Detectors: Match existing. Probe length shall extend the full width of the duct. Those over 36 inches long must be provided with far-end support for stability. Lengths shall be determined by Mechanical Contractor in coordination with the University. Furnish each duct detector unit with a remote alarm indicator light (RAIL) and test station. Mount remote indicator light/test station on wall at 8'-0" AFF in the nearest corridor or public area. Detectors shall be turned over to HVAC Contractor for him to install in ducts. Fire alarm AHU and fire/smoke damper shutdown relay circuits shall be wired from the fire alarm control panel to a termination point, adjacent to the AHU and fire/smoke damper control. Mechanical Contractor shall make all control wiring connections for shutdown of respective AHU and fire/smoke damper via addressable control relay(s) at termination point activated by the fire alarm control panel. Addressable control relays shall be installed within three (3) feet of the controller for the equipment being controlled. All air handling systems and fire/smoke dampers shall be shutdown directly by the FACP during alarm shutdowns. Building automation systems shall not be used for alarm shutdowns of air handling systems.
- Each duct detector installation shall have a hinged or latched duct access panel, 12x12 inches minimum, for sampling tube inspection and cleaning. Indicate airflow direction on the duct, adjacent to the detector, using stencil or permanent decal.
- A supervised "AHU Shutdown Defeat" switch shall be provided in/adjacent to the FACP or as a key-operated function in the Remote Annunciator (where provided). If the RA option is utilized,

provide an informative engraved at the FACP about this function; otherwise provide an informative engraved label at the switch provided in/adjacent to the FACP. The switch shall cause a system "trouble" indication when the switch is placed in the off-normal ("Shutdown Defeated") position.

Unless the AHJ requires otherwise, all duct detectors shall be programmed for fire alarm (not supervisory annunciation).

## 2.5 MONITOR AND CONTROL DEVICES

- A. Addressable Dry Contact Monitor Modules: Match existing. 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.
1. Indication of Operation: An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
  2. Mounting Requirements: Monitor Modules shall mount in a standard 4-inch square, 2-1/8" deep electrical boxes. Modules must be located in conditioned spaces unless they are tested, listed and marked for continuous duty across the range of temperatures and humidities expected at their installed location.
  3. Supervision: Unless specifically noted otherwise on the drawings provide one monitor module for each sprinkler switch.
- B. Addressable Control Modules: Control Relay Device: Addressable relay module with contacts rated for 120vac, 20 amps (or add an auxiliary relay with contacts so rated). Addressable control relays shall be installed within three (3) feet of the controller for the equipment being controlled. Devices shall have visible LED(s) on cover.
- C. Isolator Modules: Match existing.

## 2.6 MISCELLANEOUS SYSTEM ITEMS

- A. Remote Display Annunciators: Not applicable.
- B. Battery Power Supply (BPS) &/or Supplementary Notification Appliance Circuit (SNAC): These types of panels shall be completely maintenance free, shall not require liquids, fluid level checks or refilling, and shall not be capable of producing spills and/or leaks. Batteries shall be sealed gel-cell type with expected life of 10 years. Battery voltage shall be as required by the FACP and related equipment. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 15 minutes of alarm upon a normal AC power failure. Battery cabinet shall be twice the size of the batteries it will contain. NAC circuits shall not exceed 75% of maximum current load allowed.
- C. Wire:
1. Non-Power-Limited Circuits: Copper conductors with 600V rated, THHN/THWN, color coded insulation.

- a) Low Voltage Circuits: STRANDED, #18 AWG, minimum.
  - b) Line Voltage Circuits: SOLID, #12 AWG, minimum.
2. Power Limited Circuits: NFPA70, Types FPL, FPLR, or FPLP, as recommended by the manufacturer. Data Loop wire shall be shielded pair #18 AWG, 30 pf/ft capacitance or less, unless specifically prohibited by the manufacturer and stated on the wiring submittal.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. 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.
- B. 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.
- C. All addressable loop controller circuits shall be "Class A" and shall have a minimum of 20% spare addresses for future use. Loops shall be confined to one floor of coverage and shall not include any devices/modules located or serving other floor areas of coverage. Loop 1 shall be assigned to the lowest elevation level of the building. Loop numbers shall increment with elevation levels of the building floors. Device numbering starts the loop with address 001 and increments sequentially accordingly as electrically connected in the circuit to the return of the loop.
- D. The system design includes AHU and fire/smoke damper shutdown; therefore, silencing the alarm (without resetting) must not reverse them. A supervised programmable "Hot Key" for all AHU Shutdown Defeat modules will be provided in the FACP. The switch will indicate "Normal" or "Off Normal" position. In addition, a supervised Hand-Off-Auto switch(es) will be provided at the FACP for any building smoke control equipment (pressurization, smoke purge or exhaust fans).
- E. The coverage of each fire alarm loop 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.
- F. 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:
  - 1. On AC Input(s): A feed-through (not a shunt-type) branch circuit transient arrestor such as: EFI HWM-120, Leviton OEM-120EFI, Northern Technologies TCS-HW, Transtector ACP100BWN3, or other equivalent Listed device shall be installed. Install at panelboard and trim excess lead lengths. Wind a small coil in branch circuit conductor, within panelboard,

downstream of the suppressor connection. Coil is to be about 1" diameter, 7 to 10 turns, and tie-wrapped.

G. Wiring:

1. Style 6 Circuits Required: Systems with one or more addressable sub-panels that (1) have an integral addressable loop controller, or (2) monitor multiple conventional initiation zones, shall comply with the NFPA 72 requirements for Style 6 circuits.
2. 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:

<u>Addressable Devices</u>	<u>Approved Manufacture Data</u>
Signal Line Circuit cable	Red jacket with Red(+)/Black(-)
Alarm Indicating Appliance Circuits	Blue (+)/Black (-)
<u>Conventional Type Devices or Circuits connected directly to the FACP or to Monitored or Controlled Addressable Devices</u>	
Initiating Circuits, General*	Red (+)/White (-)
Initiating Circuits, Smoke Detectors Only*	Violet (+)/Gray (-)
AHU Shutdown Circuits	Yellow (+)/Brown (-)

3. No T-taps are allowed in system wiring.
4. No splices are allowed in the system wiring. All wiring runs shall be continuous between devices. Use terminals on devices or terminal cabinets on each floor. "Wire nuts" and crimp splices shall not be permitted. Floating terminal strips shall not be permitted.
5. Permanent wire markers shall be used to identify all connections at the FACP and other control equipment, at power supplies, and in terminal cabinets. In addition, for wiring inside terminal cabinets, affix typed professional legend to inside of terminal cabinet doors indicating wiring diagrams, line/load direction, etc.
6. All wiring shall be in metal raceway. All wiring and cable must be in EMT, 3/4" minimum diameter, unless indicated otherwise on the Drawings or elsewhere in the Specifications. All fire alarm system raceway, couplings, and connectors must meet the performance and installation requirements of Section 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Couplings shall be steel compression type and connectors shall be steel compression type with insulated throats. All conduits that penetrate outside walls from air conditioned space must have internal sealing (duct-seal), to prevent condensation from infiltrating humid air.
7. 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.

8. 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.
  9. 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.
  10. Acceptable cables include Atlas 228-18-1-1STP, Belden YQ28541, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (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.
    - a) 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 of all systems, AWG #16 minimum.
    - b) EXCEPTION #2: In underground conduit, use Type TC or PLTC cable (PE insulated) to avoid problems from moisture.
  11. 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.
  12. 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, as verified with a megger. Provide advance notice to the University of these tests.
  13. 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.
- H. Any circuit breaker supplying 120 VAC to any fire alarm equipment shall have a locking tab installed at the breaker. Electrical contractor shall provide breaker locks for breakers serving fire/smoke dampers.
- I. All junction and pull boxes shall be painted red prior to pulling wire unless installed in finished areas.
- J. Addressable interface modules (used to monitor all contact type initiating devices) shall be located in a conditioned space, unless they are tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed location. With AHJ approval they may be permitted to serve as many as three (3) sprinkler system valve supervisory switches, or six (6) heat detectors, in a single space.



- K. No isolation modules, relay modules, interface modules, terminal cabinets, etc. shall be located above drop ceilings.
- L. Unless suitably protected against dust, paint, etc., spot type smoke detectors shall not be installed until the final construction clean-up has been completed. In the event of contamination during construction, the detectors shall be replaced at the contractor's expense. Covers supplied with smoke detector heads do not provide protection against heavy construction dust, spray painting, etc., and shall not be used for that purpose. These covers are suitable only during final, minor clean-up or touchup operations.
- M. Mechanical Contractors shall include two (2) relocations per duct detector specified on drawings to assure working placement in ducts. Coordinate with Mechanical Contractor and University.
- N. Spare Parts Requirements:

Provide the following spare parts with the system, each individually packaged and labeled:

Smoke Detectors	Minimum of one (1) or 6% of installed quantity
Smoke Detector bases	Minimum of one (1) or 2% of installed quantity
Duct Smoke Detectors	Minimum of one (1) or 4% of installed quantity
Monitor/Relay Modules	Minimum of one (1) or 4% of installed quantity
Audio-Visual Devices (Each Type)	Minimum of one (1) or 4% of installed quantity

Note: 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.

- O. All intelligent fire alarm systems shall be zoned. Systems shall be zoned first by floor, then by wing (N,S,E,W), if applicable. System shall also be zoned at any fire partitions or identifiable building features. System devices shall be zoned by type (i.e. smoke detectors, pull stations, heat detectors, duct detectors, sprinkler system monitoring components, etc. shall be on separate zones). Combining separate types of devices on the same zone is prohibited. Any LED type annunciators shall have separate zone lights for alarm (red) and trouble (amber). All supervisory LEDs shall be amber in color.

### 3.2 AUXILIARY POWER SUPPLY PANELS (APS)

- A. General Installation: In addition to the requirements covered previously, in this specification, auxiliary power supplies shall comply with the following requirements with regard to installation, configuration, application, and operation:
  - 1. Each APS utilized in the system shall be supervised individually by the FACP. This may be accomplished by:
    - a) On board means of setting the FACP assigned address.
    - b) Utilization of a system addressable monitor type module.
  - 2. Specific items of supervision include: AC power failure, battery fault, ground fault, and individual output circuit faults.

### 3.3 ALARM NOTIFICATION APPLIANCES

- A. New and Existing to Remain locations. 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.

- B. 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.
- C. Alarm notification appliance (NAC) circuits shall be NFPA 72 Style Y (Class B). The load connected to each circuit must not exceed 80% of rated module output and the coverage of each circuit shall not exceed 3 floors (to limit the effect of faults, and to facilitate trouble-shooting). The NAC voltage drop during alarm must not exceed 14% of the voltage measured across the batteries at that time. To achieve this, the design must consider wire size, length of circuit, device load, inherent voltage loss within the FACP's power supply, etc. The contractor shall use power outage testing to verify that the NAC circuit was designed and installed properly. (Incorrect Notification Appliance Circuit performance is a frequent cause of expensive, time-consuming rework being required on fire alarm systems to obtain AHJ acceptance.)
- D. End of Line (EOL) resistors: The end of line resistors shall be installed in accessible terminal cabinets or dedicated accessible boxes, to facilitate testing and maintenance. End of line resistors shall not be mounted more than 8 feet above finished floor.

#### 3.4 ADDRESSABLE INTERFACE MODULES (CONTROL AND MONITOR MODULES)

- A. Addressable interface modules (used to monitor all contact type initiating devices) must be located in conditioned space, unless they are tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed location.
- B. One module can serve as many as 3 sprinkler system valve supervisory switches in a single space; otherwise provide one module per switch.
- C. One module may serve as many as 6 heat detectors, in a single space.
- D. Sprinkler system supervisory circuits for monitoring valve position, air pressure, water temperature, pump status, etc., must cause distinct audible and visible indications at the FACP. The audible supervisory signal shall either be a 4" diameter bell or a pulsing piezo-electric alarm. Provide the following engraved label adjacent to the bell/alarm: "SPRINKLER STATUS ABNORMAL". If only valve position is supervised, provide an engraved label reading: "SPRINKLER VALVE CLOSED".

#### 3.5 DETECTORS

- A. Install smoke detectors in interior exit access corridors, M/E rooms, computer rooms, and other spaces as shown on the drawings.
- B. Detectors used for elevator: Primary and/or alternate recall points shall be indicated on the control Matrix. Elevator capture or control signals shall come from the FACP as relayed by control modules.
- C. The FACP and all other control equipment locations, including any transponders, sub-panels, and booster power supplies, must be protected by a spot type smoke detector located within 15 feet of the equipment (measured horizontally).
- D. 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.
- E. Spot-type smoke detectors shall have a built-in locking device to secure the head to the base, for tamper resistance. For detectors mounted within 12 feet of the floor, activate this lock after the system has been inspected and given final acceptance.

- F. Spot-type smoke detectors shall not be used where ceiling height exceeds 25 feet because it makes access for maintenance very difficult and could impede response.
- G. Unless suitably protected against dust, paint, etc., spot type smoke detectors shall not be installed until the final construction clean-up has been completed. In the event of contamination during construction, the detectors must be replaced.
  - 1. Covers supplied with smoke detector heads do not provide protection against heavy construction dust, spray painting, etc., and must not be used for that purpose. They are suitable only during final, minor cleanup or touchup operations.
- H. A detector installed where accidental damage or deliberate abuse is expected shall be provided with a guard that is listed for use with it and is acceptable to the AHJ.
- I. Identification of individual detectors is required. Assign each a unique number as follows, in sequence starting at the FACP: (Addressable Loop # -- Device #). Show on the as-built plans and also permanently mount on each detector's base so that it's readable standing on the floor below without having to remove the smoke detector. Exception: For detectors with housings (i.e., air duct, projected beam, air sampling, flame), apply the identification to a suitable location on exterior of their housing. 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.
- J. 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.
- K. Unless suitably protected against dust, paint, etc., detectors shall not be installed until the final construction clean up has been completed. Contaminated detectors must be REPLACED by the Contractor at no additional cost to the Owner.

### 3.6 DUCT MOUNTED SMOKE DETECTORS

- A. All air duct/plenum detectors must have a Remote Alarm Indicator Lamp (RAIL) installed in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling. Duct smoke detectors are permitted to be installed only inside an air duct. It is not appropriate to mount them in front of a return air opening. Duct detectors shall also be installed in a manner that provides suitable, convenient access for required periodic cleaning and calibration.
- B. Each duct detector installation shall have a hinged or latched duct access panel, 12x12 inches minimum, for sampling tube inspection and cleaning. Indicate airflow direction on the duct, adjacent to the detector, using stencil or permanent decal.
- C. Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long must be provided with far end support for stability.
  - 1. The preferred method for providing support is to extend the intake tube through the far side of the duct, seal around the tube where it penetrates the duct wall, and plug the end with a rubber stopper. This facilitates visual inspection, intake tube cleaning, and injection of smoke or equivalent aerosol for testing the detector

- D. Duct smoke detector mounting position and air sampling tube orientation, are critical for proper operation. The Manufacturer's detailed installation instructions must be followed. The contractor shall mark the direction of air flow on the duct at each duct detector location.
- E. Unless the AHJ requires otherwise, all duct smoke detectors shall be programmed for supervisory annunciation.

### 3.7 AIR HANDLER UNIT (AHU) SHUTDOWN

- A. A supervised "AHU Shutdown Defeat" switch shall be provided in/adjacent to the FACP. The switch must cause a system "trouble" indication when it's placed in the off-normal ("Shutdown Defeated") position.
  - 1. This is to provide the owner with a convenient means to temporarily resume HVAC operation in the event an unwanted alarm will not clear, prior to arrival of the fire alarm service technician.
- B. If the system includes AHU shutdown or smoke removal startup, silencing the alarm (without resetting) must not reverse the shutdown. A supervised "AHU Shutdown Defeat" switch must be provided in the FACP. The switch must be labeled and its "Normal" position indicated. Provide supervised Hand Off Auto switch(es) at the FACP for any building smoke control equipment (pressurization or exhaust fans).
- C. If the building has smoke control system fans (pressurization or exhaust), or smoke purge fans, provide Hand-Auto-Off switch(es) in or adjacent to FACP. They must be clearly labeled, and FACP-monitored or provided with status indicator lights.
  - 1. This shall be provided by the controls contractor, rather than the fire alarm contractor, and does not need to be part of the fire alarm system. For three-position toggle switches: 'HAND' (Manual Run) shall be "up" and have an amber LED; 'AUTO' shall be center position with a green LED; 'OFF' shall be down and have a red LED.

### 3.8 ALARM VERIFICATION FOR SMOKE DETECTORS

- A. The fire alarm system shall be equipped with Alarm Verification.
- B. System shall provide as a feature an alternate signal processing algorithm to verify the presence of smoke. The algorithm shall be selectable during system programming. The total effective delay created by the verification algorithm shall not exceed 60 seconds.

## PART 4 SYSTEM TESTING & CERTIFICATION

### 4.1 Contractor/Installer Testing and Certification

- A. Database and Drawing Inspection: The Contractor/Installer must 100% test all site-specific software functions for the system and provide a written test report or detailed check list. This documentation must include a system operation matrix showing the actual FACP response for each initiating device input. Drawings shall be verified for accurate device locations and system addresses.
  - 1. The complete final configuration database (site-specific programming) for the system must be permanently stored on a CD or thumb/jump drive and archived by the manufacturer or authorized

distributor. A disk or CD copy of that database must also be provided to the Owner when the system is commissioned.

2. 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.

B. Contractor/Installer Field Testing: Upon completion of the installation the Division 26 Contractor and the Manufacturer's authorized representative together shall 100% test each and every *new* alarm initiating device for proper response and annunciation, every *new* alarm signaling appliance for effectiveness, and all other *new* functions such as elevator capture, control of smoke doors/dampers, proper operation of HVAC systems, and pressurization fans. ALL *new* supervised circuits must also be tested to verify proper supervision. *In addition, the complete system shall be tested as required per NFPA 72 for "Reacceptance Testing"*. All site-specific software shall be tested and verified by contractor. (Control circuits and remote annunciation lines are among those required to be supervised.) The documentation shall be part of the programming reports. The contractor shall keep history of all deficiencies determined. All deficiencies shall be corrected and retested. Once this has been accomplished, the contractor shall submit to the Engineer all documentation of all problems and corrections and request the Engineer to inspect and test the system.

1. In occupied facilities all Audio Visual device tests shall be scheduled with the Owner.

C. Upon successful completion of the Pre-final Inspection and correction of all deficiencies, the manufacturer's authorized representative shall issue a test report to: the Engineer and NC State Facilities Operations Electronic Systems detailing and certifying the test, including those requirements as specified in this document.

#### 4.2 ENGINEER Testing and Certification

A. Engineer System Inspection: In an effort to expedite the inspection process for projects already seriously behind schedule, the Engineer can request NC State Construction Management to schedule the NC State Facilities Operations Electronic Systems acceptance commissioning field inspection and test to be performed in conjunction with the Engineer inspection. This is not recommended and has proven to produce lengthy punch-lists and numerous re-inspections by the Owner.

See Attachment B for Addressable System Checklist

B. Once the Engineer has inspected, tested and is satisfied the system is 100% operational, and has met all aspects of the Engineer design, the Engineer shall notify NC State Construction Management to schedule the NC State Facilities Operations Electronic Systems owner acceptance commissioning inspection and test. At that time the Contractor and Engineer shall also and submit the following:

- The latest copy of Detector Sensitivity Report.
- A printout of the current installed site-specific database.
- Signed NFPA "Record of Completion" form per NFPA 72.
- Current copy of as-built drawings with correct room numbers and device system addresses. Room numbers must be installed.
- Copy of battery calculations.

- Copy of record for the Signal Line Circuit voltage measurements taken at the EOL devices during the Engineer test. Take readings at the start of the test and every 15 minutes during NAC test. Test shall be 30 minutes minimum. Test shall be conducted with AC power off and under battery power only.

#### 4.3 Owner Testing and Inspection

- A. Database and Drawing Inspection: The NC State Facilities Operations Electronic Systems will require all the above and a minimum of five (5) days for review of the system database and drawing review, prior to scheduling any on-site test.
1. Upon completion of the system database and drawing review any discrepancies will be documented and forwarded to NC State Construction Management requiring action and corrections from the Contractor's system installer/programmer. When the required actions and corrections have been addressed and performed a corrected printout of the installed site-specific database and drawings shall be forwarded to the Life Safety Shop for re-review. After review and satisfaction that the corrections have been made, then and only then, will the NC State Facilities Operations Electronic Systems schedule their field inspection and test. The NC State Facilities Operations Electronic Systems will notify NC State Construction Management of the scheduled date and time.
- B. Owner acceptance commissioning field inspection: A 100% fully functional test of all aspects of the system will be conducted. Therefore, it is expected that the system shall be complete in all aspects. Each function and aspect of system will be tested along with each and every initiating device. Also, all other system functions shall be verified, including but not limited to (where applicable): elevator capture features, control of HVAC systems, door locks, pressurization fans, fire or smoke doors/dampers/shutters, sprinkler systems, etc. The trades' personnel representing the various aspects must be present. The Engineer representative does not have to attend but may attend if so desired. The fire alarm vendor's technician who programmed the system shall be present.
- NOTE: If at any time, during the owner's acceptance commissioning field inspection and test, it appears that the installation contractor has not performed a prior 100% performance test, the current test will be terminated and rescheduled.
1. Upon completion of the acceptance commissioning field inspection and test, the NC State Facilities Operations Electronic Systems will forward a list of discrepancies in the form of a formal "Punch List" to NC State Construction Management for comment and/or inclusion in the Engineer's punch-list of items requiring action and/or corrections from the effected systems contractors/installers. Once the contractors/installers have corrected these items, the Engineer shall notify NC State Construction Management and schedule a re-inspection by the NC State Facilities Operations Electronic Systems. When the systems are verified to be satisfactory by the NC State Facilities Operations Electronic Systems, the Engineer shall be notified by NC State Construction Management to schedule an inspection and test with the Office of State Construction. On or before the day of the Office of State Construction the following shall be completed and/or provided to the Owner:
    - Copy of current database installed in the system on digital thumb/jump drive.
    - All drawings shall be posted.
    - All spare parts and test equipment as described in the specification shall be turned over to the owner.
    - All training requirements shall be met or scheduled.
    - All required software on CD or digital thumb/jump shall be turned over to the owner.

- All certifications.
- A new signed and dated NFPA "Record of Completion" form per NFPA 72.

#### 4.4 System Acceptance

- A. Office of State Construction inspection: The above items shall be completed before the Office of State Construction inspection. Upon completion of Office of State Construction inspection any items or discrepancies must be corrected. When this obligation has been met the warranty shall begin on the day the Engineer notifies the Office of State Construction and the NC State Facilities Operations Electronic Systems to that effect.
1. Beneficial or partial occupancy acceptations shall require the system contractor/installer to remain responsible for the "live" system. A daytime and after hours contact list shall be provided to the NC State Facilities Operations Electronic Systems which will include the names and phone numbers for three (3) responsible individuals until Final acceptance has been granted.
- B. The contractor shall notify the supervisor of the NC State Facilities Operations Electronic Systems prior to performing any work on the system after the final acceptance by the Office of State Construction.

### PART 5 SYSTEM DOCUMENTATION, TRAINING, & MAINTENANCE

#### 5.1 System Documentation

- A. The Contractor/Installer shall provide the Engineer: with three (3) copies of the following:
1. As-Built Drawings: Submit bound full size sets of scaled architectural as-built floor plans depicting final device/module and equipment locations with corresponding system addresses, all circuiting, and pathways, and terminal cabinet locations, including wire color code and/or label numbers, and showing all interconnections in the system. Include wiring and riser diagrams with actual field measured battery calculations for the main fire alarm panel and all individual circuits of the Notification Appliance Circuit panels (NAC's). In addition provide an electronic copy on CD in format compatible with the most recent release of AutoCad.
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.
- B. The Contractor/Installer shall provide the Owner: with the following:
1. A current factory approved certification/ training schedule for the specific system installed.
2. As-Built Drawings: Submit (1) bound full size set, and (1) one 11"x17" set, and an electronic copy in format compatible with the most recent release of AutoCad, of scaled architectural floor plans depicting final device/module and equipment locations with corresponding system addresses, all circuiting, and pathways, and terminal cabinet

locations. Include wiring and riser diagrams with actual field measured battery calculations for the main fire alarm panel and all individual circuits of the Notification Appliance Circuit panels (NAC's).

- a) Electrical and Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, riser panels, etc.
  3. Three (3) copies of 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.
  4. Three (3) copies of the complete maintenance, installation, and programming manuals for the installed fire alarm system. If available an electronic version is desired and acceptable. Also provide all 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.
  5. Three (3) of each interconnection cables that are required to connect the fire alarm system to a PC.
- C. The Equipment Manufacturer's shall provide the Owner: with the following:
1. Agreement to License and/or factory certification system training for the NC State Facilities Operations Electronic Systems technicians to maintain and service the equipment installed under this contract.
  2. Direct access and support for the NC State Facilities Operations Electronic Systems Shop technicians from the Manufacturer's or Factory's Technical Services.

## 5.2 System Training and Maintenance

- A. During the design specification review process, the Design Manager and the NC State Facilities Operations Electronic Systems will jointly review the proposed specifications to determine if training is required for the proposed life safety system. Training requirements, scheduling, and purchasing of computers will be coordinated by the NC State Facilities Operations Electronic Systems directly with the installation equipment Contractor/Installer and the equipment Vendor/Factory. All cost involved with training travel (transportation, accommodations, meals, etc.) will not be assessed to the Contractor/Installer as part of the contract, but will be funded separately by NC State from allocated reserves.
- B. The Equipment Manufacturer's shall provide the Contractor/Installer and/or the Owner: with the following:
1. The schedule of available dates when classes are available to obtain License and/or factory certification system training for the NC State Facilities Operations Electronic Systems technicians to maintain and service the equipment installed under this contract.
  2. Training Content: Factory/Manufacture classes, training and testing shall provide what is necessary to certify and/or authorize attendees to program and service the fire alarm system installed for this project, including system hardware and software. Additionally, the training shall cover the following topics as a minimum:



- a) Preventative maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
- b) Overall system concepts, capabilities, and functions. Training shall be in depth, so that the owner shall be able to add or delete devices to the system and to take any device out of service and return any device to service without need for Manufacturers approval.
- c) Explanation of all control functions, including training to program and operate the system software.
- d) Manuals, drawings, and technical documentation.
- e) The actual system software used to support the fire alarm system installed for this project shall be provided on jump drive, and any required "software keys" to successfully operate the software on the technicians computers shall be provided to the Owner's technicians upon successful completion of the training.

C. The Contractor/Installer shall provide the Owner: with the following:

- 1. The contractor shall submit a complete site specific system orientation training schedule including dates, times and location for approval by the Owner and Engineer, which shall include:
  - a) Preventative maintenance and any special servicing and/or maintenance techniques, including methods and means of troubleshooting and replacement of all field wiring and devices and, methods and procedures used for troubleshooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry and interconnections.
  - b) Overall system concepts, capabilities, and functions.
  - c) Explanation of all control functions, input or output.
  - d) Any device and/or equipment locations that are not easily found.
  - e) Any programming peculiarities that is inherent in the system.
- 2. The Contractor/Installer is responsible for ensuring that the manufacturer's authorized representative shall provide a schedule of the available manufacture certification training for attendance by the Owner's designated employees. The training will include the proper programming procedures, operation of the system, troubleshooting and maintenance aspects, and all required periodic maintenance.
  - a) The authorized representative will coordinate training arrangements with the Owner's schedule.
  - b) Location: On-site certification training is preferred and NC State will make available classroom space as needed by the manufacturer. If travel is required, the NC State Facilities Operations Electronic Systems will determine the personnel required to be trained.

3. The Contractor/Installer is responsible for ensuring the manufacturer provides the Owner with the following:
  - a) Licenses and/or certifications to maintain and service the equipment installed under this contract.
  - b) Direct access and support for the University Technicians to the Manufacturers Technical Services.
4. Equipment: The Contractor/Installer is responsible for providing a list of all required support equipment necessary to support the fire alarm system installed for this project. This list shall include computers (laptop or desktop), software, connecting cables, accessories and auxiliary equipment necessary to effectively operate the life safety system.

### 3.7 WARRANTY

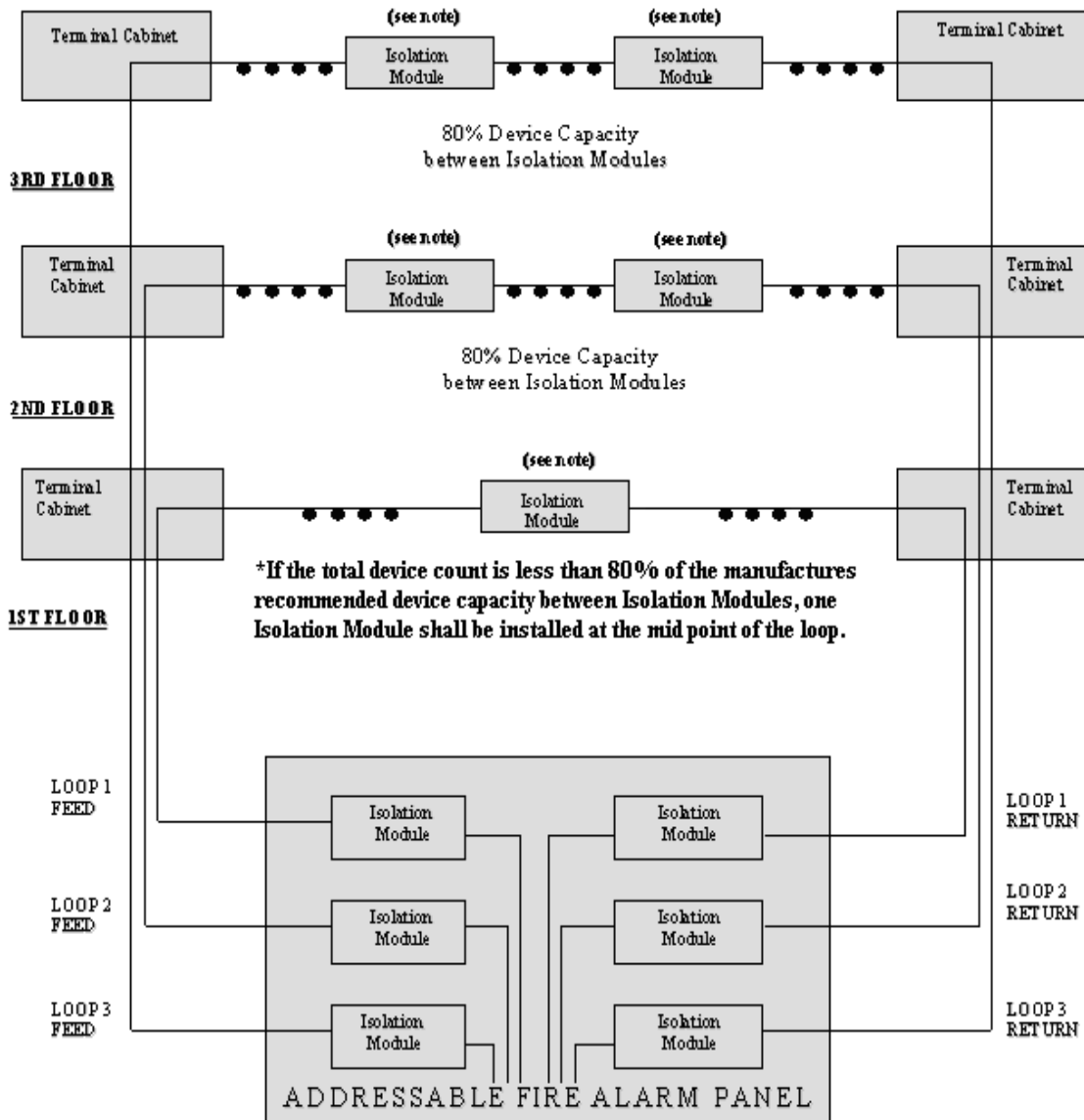
- A. This warranty coverage shall include parts for one (1) year.

**North Carolina State University**  
Partners III Renovation  
NC State Project ID No. 202435062  
SCO No. 24-28212-01A  
Hanbury Project No. 22057.03  
Issued for Construction Set - 12/20/2024

Attachment A:

**REQUIREMENTS FOR FIRE DETECTION AND ALARM SYSTEMS**

**Typical Addressable Fire Alarm System Riser in Large, Multi-story Buildings**



**\*NOTE:** Isolation modules mounted outside terminal cabinets shall be mounted per the same specifications and guidelines described by NCDOT for audio/visual devices.

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Attachment B:

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# FIRE ALARM SYSTEM CHECK LIST



BUILDING NAME: \_\_\_\_\_ LOCATION: \_\_\_\_\_

DESIGNER: \_\_\_\_\_ INSTALLER: \_\_\_\_\_

INSPECTION BY: \_\_\_\_\_ DATE: \_\_\_\_\_

## Preparation for Acceptance Test

- Fire authorities have been notified of the system test. Also notify any location where alarms are transmitted. **DO NOT ROLL FIRE TRUCKS BY ACCIDENT.** All building occupants have been clearly notified of the system test.

## All required documents are on site for the SCO inspection and review.

- A copy of the project plans and specification
- A copy of the contractor's approved shop drawings including:
  - cut sheets
  - battery size calcs
  - Matrix
  - plans
  - Voltage drop calcs
  - Training Certificates
- A copy of the Fire Alarm system "as built" drawings showing the routing of circuits installed
- Final NFPA 72 "Fire Alarm System Record of Completion" form
- A copy of the System Operation Matrix, giving the FACU response for each initiating device input, has been provided by the fire alarm installer to facilitate testing.
- A copy of the sensitivity report
- A copy of the printout generated by the 100% device testing

## NFPA 72 "Record of Completion"

- NFPA 72 "Record of Completion" Form, filled out, with all signatures and at FACU**
- Appropriate year of form is used per year of Building Code permit
- Appropriate chapters must be indicated (see chapter list in the reference section of document)
- The manufacturer's authorized distributor (by definition the "installer") who made final connections at the FACU and programmed the system gave the owner and AHJ advance notice of the required 100% operational tests, so they could elect to attend.  
NOTE: The required 100% testing cannot properly be done by a single technician without a helper, even if the FACU has Walk-Test or an equivalent feature. Query the tech on how testing was performed.
- Signatures on the form must match the typed/printed names and each section must be complete. Do not accept a company name in place of the responsible individual. The individual must have a certificate. NOTE: If part or all of the testing was witnessed by a representative of the AHJ, the final line of the form is signed to indicate that. (SCO design contracts give that responsibility to the electrical PE.)
- Verify the technician who programmed the alarm system was trained and certified by the manufacturer, for the specific FACU model being installed, within the past 2 years. (A copy of the cert. should have been submitted with the Shop Drawings.) NICET Level III certification will extend this to 36 months.

## REVIEW THE FOLLOWING ITEMS FROM THE SHOP DRAWING SUBMITTAL:

- Contractor has submitted battery calculations to the designer, verifying the system meets applicable capacity requirement of NFPA 72. The minimum endurance is 24 hours plus 5 minutes of alarm load. See the specification for additional requirements imposed by the AHJ.
- Battery sizing calculations verifying adequate Amp-Hour rating, indicating that the worst case NAC voltage on battery is within alarm notification appliance listing, and that NAC alarm load voltage drop at EOL does not exceed **14%** of battery voltage.
- Notification Appliance Circuit (NAC) calculated current draw, demonstrating that none exceed 80% of rated module output.
- If system is the Emergency Voice/Alarm type, amplifier load calculations.
- Copy of factory training certificates for technicians who programmed the system.

## REVIEW THE FOLLOWING ITEMS FROM 100% Test:

- System Status and Programming Report, which includes the following 3 elements:**
  - Program settings for each alarm initiating device
  - Current sensitivity reading of each smoke detector
  - System operational matrix, giving response for each alarm input



- If building has smoke purge system, an HVAC balance report in purge mode**
- Two bound copies of the following information on the system (may be combined):**
  - Manufacturer's technical literature (cut sheets) on system components
  - Required maintenance schedule on system, to comply with NFPA 72
  - As-built drawings with loop #'s, device addresses, equipment terminals

**COMPARE DOCUMENTS TO INSTALLATION**

Shop drawings calcs:	NFPA 72 says:	Installed size is:
FACU batteries ___Ahr___@___V each	___Ahr___@___V each	___Ahr___@___V each
NAC batteries ___Ahr___@___V each	___Ahr___@___V each	___Ahr___@___V each
DACT batteries ___Ahr___@___V each	___Ahr___@___V each	___Ahr___@___V each
SLC loops _____class_____	_____class_____	_____class_____
NAC Circuits _____class_____	_____class_____	_____class_____

**Check Fire Alarm Control Panel(s)**

- VERIFY SYSTEM IS IN TEST MODE AND THE FIRE TRUCKS WILL NOT ROLL.**
- Operating instruction summary is framed and mounted at (or inside) the FACU.
- Green grounding wire is bonded to FACU cabinet, and also connected to designated terminal on motherboard (if any).
- AC Power
  - o Branch circuit to FACU does not share conduit with 24vdc alarm initiating circuits or notification appliance circuits.
  - o Circuit breaker(s) serving FACU (and associated equipment) have lock on clips and red dot at breakers. (Some electricians will not paint the handle to avoid damage to the breaker)
  - o Placard inside FACU gives the following info on this circuit: **Panelboard location, panelboard identification, and branch circuit number** (The same applies to SNAC panels and any other system control equipment)
  - o Surge arrestor model listed in project spec (feed-through type with "pi" configuration) is installed at electrical panelboard, on the 120vac branch circuit to FACU. Arrestor leads are trimmed as short as practical. See attached wiring diagram for more info.
- Fire alarm control unit (FACU) is powered up and clear of alarms, supervisory signals, and trouble conditions.
- Have ground fault put on any alarm initiating or notification appliance (horn-strobe) circuit. FACU must indicate "ground" and general "trouble." Verify this ordinary "trouble" signal is not sent to any Remote Supervising Station.
- Record battery size and verify date of installation is marked on each battery (Marking of the date of manufacture of the battery is a code requirement – so you will find 2 dates)
- Have technician disconnect a battery lead and verify the FACU indicates a local trouble signal within one minute of that action.
- Reconnect battery, **then** turn off 120vac. Batteries should measure approx. 13 volts, and differ  $\leq 0.4$  volt. (Also check batteries in any booster power supplies.)
- If system is connected to Remote Supervising Station, verify the FACU did **not** transmit AC Power Failure "trouble" signal, as it was not maintained for 1-3 hours.
- Have technician confirm FACU is programmed to send an AC power failure trouble signal to Remote Supervising Station if power loss continues for 1 hour minimum to 3 hours maximum. Also, verify that no other types of "trouble" signals are reported.

- The FACU and any transponders, sub-panels, DACT and "ADA" booster power supplies must be protected by a smoke detector within 15 feet of their location, measured horizontally, as required by Code (NFPA 72).
- Addressable loop controller circuits are Class "A", with isolation modules at FACU on the outgoing and return loop, after each 25 addressable devices (max) on the loop, and (if  $\leq 25$  devices) at midpoint.
  - Have the technician apply a short circuit on the SLC loop. This will force two isolation modules to clamp. The test is to verify their operation and device count between the two that clamp.
  - With AC power off, there will be multiple troubles on the system. The total count will increase during this test. Exclude the count prior to the short.
  - On retrofit and repair work where the AHJ has approved the use of a class B SLC wiring design the isolation modules will not be installed.
  - Verify the number of devices between Isolation modules meets the specification requirement.
- While on battery power, initiate Alarm. Batteries should remain at 12+ volts each, but dropping slowly. Let alarm continue during next step.
- Verify the Notification Appliance Circuit (NAC) voltage drop at the EOL is  $\leq 3$  volts. Do this separately for each NAC. Look at the shop drawing to find the worst case scenarios when spot checking at a final.
- Silence the alarm and verify that any Remote Supervising Station has received a fire alarm signal. Reset the FACU and verify the Station receives a subsequent "restore" signal, indicating the alarm condition has been cleared.
- Verify requirements on wire type and gauge were followed and that the color code for circuits is proper throughout the system. (Review specifications and shop drawing requirements.)
- Have installing technician demonstrate that the system is programmed so all **spot-type** smoke detectors have automatic drift compensation and FACU will indicate when prescribed sensitivity limits are reached or exceeded.
- If system has provisions for "alarm verification" algorithm, arm it only if needed for the environment. Do **not** apply it to multi-sensor or multi-criteria smoke detectors.
- If any addressable control relays are installed, verify their contact ratings are suitable for connected load. (Some are rated for resistive loads only.) Also, if they require separate 24vdc power for operation, verify the circuit is electrically supervised. Compare their installed location to the design intent.
- All field wiring in the system has wire markers where landed at the FACU, and also in the terminal cabinet(s) on each floor of multistory buildings.
- If system uses an LED "zone" annunciator to provide a quick visual overview of the fire scenario for responding public safety personnel (general fire area and type of alarms), a framed directory or typed/engraved LED labels provide clear information on "zone" (area) boundaries and the type(s) of alarms (i.e., smoke, waterflow, etc.)
- During the walk through of the site verify that there are **no** splices in the system wiring other than at terminal blocks which are installed in identified terminal cabinets. "Wire nuts" and butt splices are not permitted on new work.
- All circuits are properly and securely terminated. Approved terminal fittings are used for any stranded wire terminations at screw posts that lack pressure connectors.

- Initiate alarm on a representative sample of devices by operating manual fire alarm box, blowing smoke into detector, flowing water from sprinkler system inspector's test station, etc., except do not test any non-restorable, fixed temperature heat detector. (get total counts from 72 form)
  - Photo smoke \_\_\_\_/\_\_\_\_
  - Ionization smoke \_\_\_\_/\_\_\_\_
  - Pull Station \_\_\_\_/\_\_\_\_
  - Duct smoke \_\_\_\_/\_\_\_\_
  - Other detector \_\_\_\_/\_\_\_\_
  - tamper switch \_\_\_\_/\_\_\_\_
  - Heat detector \_\_\_\_/\_\_\_\_
  - Flow switch \_\_\_\_/\_\_\_\_
  - \_\_\_\_\_/\_\_\_\_
- For each device tested have FACU operator read out the FACU display and the LED display. (Radios are very helpful at this point.) There should be a clear indication of device type, device number and location for each device tested.
  - Individual detectors of all types shall be identified on their bases (Loop # -- Device #), in sequence on the loop from the FACU
- While spot testing devices in the facility verify operation of audible-visible alarm notification appliances.
  - Audible alarm devices must be 15 dBA above normal ambient sound level in all occupiable areas of building. (Use meter if in doubt.)
  - Indoor strobes must flash 60-120 times/minute and those installed in a single space (room, corridor, etc.) must be synchronized and remain synchronized throughout the test.
- Also verify HVAC shutdown and closure of (any) smoke doors. These functions must be done by the FACU, rather than by integral smoke detector relay contacts.
  - Shutdown must occur within 20 seconds, except gas pack units can be arranged for up to 60 seconds delay before the fan stops, to prevent heat exchanger damage.
  - After verifying the HVAC shutdown is operational it is acceptable to activate the HVAC bypass to avoid excessive restarting of large air handler systems.

#### **ELEVATORS**

- Elevator control key and technician must be on site for the following tests to take place
- Elevator lobby detectors must be within 21 feet of each elevator door
- Test detector(s) located at elevator lobby that will initiate elevator recall
  - Verify recall to a primary floor
  - Verify recall to alternate floor
  - Verify illumination of "Fire Hat"
- Test detector(s) located in shaft & elevator machine room
  - Verify recall to designated floor
  - Verify flashing illumination of "Fire Hat"
- Heat Detectors installed in a shaft or machine room and used for shunt trip activation shall be located within 2 feet of each sprinkler head. (Verify heat setting is less than sprinkler setting per code req.)

#### **SPRINKLER SYSTEMS**

- If a sprinkler system is present, check the operation of the waterflow alarm switches by flowing water from Inspectors Test connection(s), unless dry pipe system. Alarm sounds in 20-45 seconds and any outside water motor gong rings properly in  $\leq 300$  seconds.
- Inspectors Test Connection flow is limited to 1/2" stream (or actual orifice size of the sprinklers in the system, if different) by a valve or sight glass marked accordingly, or by a sprinkler head (minus deflector) mounted at discharge. NOTE: If a pipe union with an internal restrictor plate is used for this purpose, have the sprinkler contractor take at least one apart for inspection, to verify the orifice size.
- Close any electrically supervised sprinkler control valves to verify supervisory alarm at FACU within 2 turns of control wheel or, for Post Indicator Valve (PIV), within 1/5 of valve control mechanism's travel distance. Then reopen to verify "restore" signal.
- If dry pipe or pre-action sprinkler system, have contractor demonstrate waterflow alarm functions, and that both high and low air pressure are supervised as required.
- Each fire extinguishing system, such as in a kitchen hood, is connected to give building fire alarm. Have contractor demonstrate that this functions properly, by manually operating the monitored switch, without releasing extinguishing agent.

NOTE: Kitchen hood fire extinguishing system activation must shut off the gas, if used, and, for wet chemical type, also operate a shunt trip breaker to shut off the electric power to all protected appliances under the hood. The exhaust fan(s) keep running but the make-up air must shut down. These functions are to be done directly by fire extinguishing system, rather than the FACU, since it is not appropriate to cut off the gas supply or to operate the shunt trip for other types of alarms not involving the kitchen hood extinguishing system (e.g., smoke detectors, fire alarm boxes, etc.).

- Verify that fire alarm system monitors power to any fire suppression system shunt trip breakers. (Look for kitchen hood systems and sprinklered elevator spaces.)
- If remote alarm annunciator in building, verify proper operation, including the audible "Trouble" signal. Check its "Lamp Test" and "Trouble Silence" features, if provided.
- If a Fire Pump is part of the sprinkler system – verify that NFPA 20 certification was provided and testing has been successfully completed

#### **OTHER SUPPRESSION SYSTEMS**

- Pre-action suppression system – If installed and if it has an independent control panel it will require a separate NFPA 72 certificate from the building Fire Alarm Panel
- Dry Chemical suppression system – If installed and if it has an independent control panel it will require a separate NFPA 72 certificate from the building Fire Alarm Panel

#### **PROPER INSTALLATION OF DEVICES**

- Verify all dust covers have been removed. If still installed how was the 100% test done?
- Spot type smoke detectors shall not be located within 3 feet of a supply or return air diffuser, nor in a strong air stream from a supply diffuser at any distance.
- Wall-mounted smoke detectors must be installed between 4 and 12 inches from the ceiling (measured to the nearest edge of the detector), as required by NFPA 72.
- Wall mounted detectors shall not have wall-mounted luminaires or other obstructions below.
- Ceiling mounted smoke detectors shall be at least 4 inches from a wall or ceiling obstruction.
- All smoke detectors are analog addressable model(s) having a separate plug-in head, concealed locking device, and terminal strips for circuit connections.  
NOTE: Snap-ring mounted models with removable terminal strip plug for connection to loop conductors do not comply with the intent of this requirement and typically do not have a locking device to deter tampering.
- Verify that the isolation modules and addressable initiating device interface modules are located in a conditioned space (not attics, boiler rooms, unheated warehouses, damp locations, outside corridors, parking decks, etc.). Exception: Any devices that are specifically listed for the ambient conditions expected (or likely) in the area where installed.
- Verify that all detectors, modules and pull stations installed outside or in non-conditioned spaces are listed for use at the both ends of the expected temperature. (eg Typically addressable pull stations are not listed for use in parking decks because the low end is 32 degrees.)
- Verify that any strobes in walk-in coolers or freezers are listed for that environment or provided with heated Lexan enclosures for which they are specifically listed.
- Check any outside alarm bells and strobes for operation. Verify outside strobe is the weatherproof type with at least 100cd output, double flash, with clear lens.

#### **DUCT SMOKE DETECTORS**

- Intake tube has its holes /slots facing into the air stream, and a stopper installed to seal its far end.
- If the tube is over 36 inches long, the far end must be supported for stability. If support is provided by extending the intake tube through the far side of HVAC duct (best for inspection, cleaning, testing), the duct penetration must be sealed.

- Each duct smoke detector has a Remote Alarm Indicator Light (RAIL) in nearest corridor or other public space. (Because addressable, test switch is **not** required.)
- At each duct detector a 12"x12" minimum access door, hinged or latched type, is provided to facilitate sampling tube inspection and cleaning.
- Air flow direction is permanently indicated on the duct by stencil or decal, to help assure the sampling tubes are installed and maintained in the correct orientation.

#### **DACT**

- Verification of the dial out ability** or other means of remote alarm signaling
- Verify that DACT it is connected and functioning properly, to transmit fire alarm, supervisory, and trouble signals as separate, distinct events.
- Verify two phone lines are present and labeled when sprinkler is installed.
- Verify that DACT is programmed for 24-hour silent test call to the supervising station.
- Verify each type of signal is properly received and coded at the receiving station. (Supervisory signals include sprinkler valve tamper, fire pump off-normal, hi-low air pressure, etc.)
- Inspector is to personally talk to someone at the receiving station to verify alarm receipt

#### **PRINTER**

- The specification should require that systems with more than 100 addressable points, or in a building that exceeds 3 occupied floors or 60,000SF, an event printer is to be provided which uses ordinary non-thermal paper. In a high rise building, the printer must be FACU-monitored and on a generator-supported circuit.
  - NOTE: Printer does not have to be adjacent to FACU and, except for high rise buildings, does not have to be electrically supervised.

#### **OTHER SYSTEMS**

- For dormitories there will be special testing required for the sounder bases and the handicapped notification which uses higher candela strobes. Even if system is dual event it must dial out on 1<sup>st</sup> alarm.
- For institutions check for keys to the lockable pull stations if they are installed.
- Where smoke "sniffer" systems are used - create a test procedure with the help of the designer.
- Where beam detectors are used verify they are not on walls subject to movement and are not subject to direct sunlight.
- Where smoke evacuation &/or AHU bypass is used verify that the panel can be locked and operation limited to qualified people.
- Mass Notification systems require special procedures and testing to verify proper operation.

#### **TRAINING ETC**

- Verify that the Owner's designated personnel have received training in system operation: How to interpret, silence, and reset FACU signals, how to obtain service, etc.
- Verify that when required by specification, owner's personnel have received more thorough, detailed training in system troubleshooting and repair, plus installation manuals and other documentation, as applicable. (This is standard for the UNC-Chapel Hill campus.)
- Contractor has provided electronic copy of system's site-specific programming. (CD, flash drive)
- Contractor has provided spare parts in accordance with the specification for the project.

## REFERENCE INFORMATION TO ASSIST SYSTEM INSPECTION

After the required 100% system operational test the contractor submits a "final" copy of NFPA 72\* "Fire Alarm System Record of Completion" form. This form is to verify the proper operation of all (restorable) alarm initiating devices, audible and visible notification appliances, and other system functions including HVAC control, closure of smoke doors and dampers, pressurization fans, remote signaling, etc.

\*Use only the NFPA form, or an identical reprint. The NFPA 72 form will vary with the year the project was permitted. The year required should be listed in the project specification.

### NC Building Code, Chapter 35 Referenced Standards set the NFPA 72 version requirements

Projects permitted under NC Building Code 2002 - NFPA72 1999

Projects permitted under NC Building Code 2006 - NFPA72 1999

Projects permitted under NC Building Code 2009 - NFPA72 2002

Projects permitted under NC Building Code 2012 - NFPA72 2007

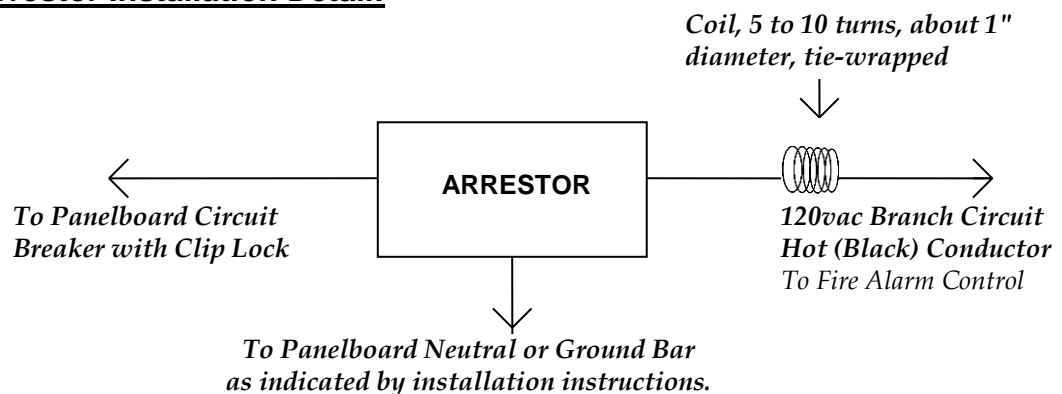
### NFPA 72 Chapters (note they vary by version year)

(1999) Chapters: 1-Fundamentals, 2-Initiating Devices, 3- Protected Premises, 4-Notification Appliances, 5- Supervising Station FA system, 6- Public FA reporting systems, 7-Inspection and Testing, 8-FA for Dwelling units, 9-Reference publications\_\_\_\_\_

(2002) Chapters: 1- Administration, 2-Referenced Publications, 3- Definitions, 4- Fundamentals, 5- Initiating Devices, 6- Protected Premises, 7- Notification Appliances, 8- Supervising Station FA system, 9- Public FA reporting systems, 10- Inspection and Testing, 11- Single and Multiple Station & Household\_\_\_\_\_

(2007) Chapters: 1- Administration, 2-Referenced Publications, 3- Definitions, 4- Fundamentals, 5- Initiating Devices, 6- Protected Premises, 7- Notification Appliances, 8- Supervising Station FA system, 9- Public FA reporting systems, 10- Inspection and Testing, 11- Single and Multiple Station & Household\_\_\_\_\_

### Transient Arrestor Installation Detail:



NOTE: Securely mount transient arrestor in accessible junction box or other proper metal enclosure adjacent to the panelboard, and provide engraved label indicating its location

## REFERENCE INFORMATION TO ASSIST SYSTEM INSPECTION

**Wiring:** All addressable system wiring shall be color coded in accordance with following scheme, which must be maintained throughout system, without color change in any run:

- Addressable Loop Controller Circuits: Cable per spec, with Red Jacket and Red(+) and Black(-) Conductors
- One-way Voice/Alarm and Two-way (Fireman's Telephone): Wire per specifications

**The following circuits use THHN / THWN conductors, of the size and color indicated:**

- Alarm Notification Appliance Circuits: AWG 14, Blue(+) and Black(-) conductors
- AHU Shutdown, Elevator Capture, other control functions: These are now done by addressable control relays on the loop. The relays may require separate power circuits, in which case use AWG 14 conductors, with Yellow (+) and Brown (-) color code. **NOTE: Check any power circuits to addressable relays for electrical supervision by disconnecting 1 lead.**
- Circuits that power door magnets from the FACU or SNAC panels: AWG 14, Orange
- Circuits from ZAM's to monitored initiating devices: AWG 16 or 14, Violet (+), Grey (-)
- NOTE: Most manufacturers either require or recommend low capacitance, twisted, shielded pair cable for Signaling Line Circuits (addressable loops). All shielded cable must have the grounded "drain" wire maintained continuously around the loop. If unshielded cable was used, verify that the manufacturer's installation instructions require or state a preference for use of unshielded cable. For addressable system retrofit when a non-addressable system had previously been in service, if existing single-conductor wiring from the old system was used (sometimes done if in fine condition, properly color coded, with terminal strips, etc.), verify that the manufacturer's installation instructions do not require the use of twisted pair conductors or low capacitance cable and the installer also agreed to replace the existing fire alarm system wiring if unsatisfactory performance is caused by its re-use (e.g., spurious signals, cross-talk, etc.).

**Spares:** Provide the following spare parts with the system, each individually packaged and labeled. For multi-building project calculate separately for each building with FACU:

- Fuses (If Used).....2 of each size in system
- Manual Fire Alarm Boxes.....2% of installed quantity
- Addressable Control Relays.....4% of installed quantity
- Indoor Horns/Speakers with Strobes Lights.....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, Electronic Heat Detectors.....4% of installed quantity
- Spot-Type Smoke Detectors / Sounder Bases.....6% of installed quantity

**NOTE: Increase decimal quantities of all spare parts to next higher whole number when calculating.**

**NOTE: No spares are required for projected beam, air sampling, or duct type smoke detectors.**