ADDENDUM #4

RFP#: VT-208-18268-000
Construct Chiller Plant Phase II

Date: February 14, 2019

Issued By: Bob Blackwell, Contracts Officer
Virginia Polytechnic Institute and State University
University Design and Construction (0129)
90 Sterrett Facilities Complex
230 Sterrett Drive
Blacksburg, Virginia 24061
(540) 231-4775
(540) 231-9345
rcb05@vt.edu

All documents associated with Addendum #4 can be accessed at:
• https://drive.google.com/open?id=1IKtNMTbUjqlQbktFt0iDHAMy2ieCQHZ0l

A summary of all changes is provided below:

1) SPECIFICATIONS
   Section 230000
   Replace this section with the attached revised section.
   Section 230529
   Replace this section with the attached revised section.
   Section 260000
   Replace this section with the attached revised section

2) DRAWINGS
   Sheet M.1.402
   Replace this sheet with the attached revised sheet.
   Sheet M.2.204
   Replace this sheet with the attached revised sheet.
   Sheet M.4.204
   Replace this sheet with the attached revised sheet.
   Sheet MU.4.117
   Replace this sheet with the attached revised sheet.
   Sheet E.4.209
   Replace this sheet with the attached revised sheet.

3) RESPONSES TO CONTRACTOR REQUESTS FOR INFORMATION
   Responses to twenty (20) RFIs are included.

END OF ADDENDUM #4
**Addendum**

**VT Chiller Plant Phase II**

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**To**

2:00 PM, Thursday, February 28, 2019

**Bid Due Date**

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This addendum is issued to modify or interpret previously issued documents by additions, deletions, clarifications, or corrections. It forms a part of the previously issued documents.

This addendum may include revised pages and drawings, which shall be inserted before the corresponding page or drawings in the previously issued documents. Revised pages and drawings are identified by the corresponding addendum number and date.

**PROJECT MANUAL**

**Section 230000**
Replace this section with the attached revised section.

**Section 230529**
Replace this section with the attached revised section.

**Section 260000**
Replace this section with the attached revised section

**DRAWINGS**

**Sheet M.1.402**
Replace this sheet with the attached revised sheet.

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Replace this sheet with the attached revised sheet.
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Attachments:

Specifications: 230000, 230529, and 260000


Other: Contractor Questions and Responses (Total of 20)

END OF ADDENDUM NO. 4
SECTION 23 0000
GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Work under this section is subject to requirements of the Contract Documents including the GENERAL CONDITIONS, SUPPLEMENTAL GENERAL CONDITIONS, and sections under Division 01 - GENERAL REQUIREMENTS.

1.2 SUMMARY

A. Intent of drawings and specifications is to obtain complete systems, tested, adjusted, and ready for operation.

B. Include incidental details not usually shown or specified, but necessary for proper installation and operation.

C. Check, verify and coordinate work with drawings and specifications prepared for other trades. Include modifications, relocations or adjustments necessary to complete work or to avoid interference with other trades.

D. Information given herein and on drawings is as exact as could be secured but is not guaranteed. Do not scale drawings for exact dimensions.

E. Where architectural features govern location of work, refer to architectural drawings.

F. Contractor may install additional piping, fittings and valves, not shown on drawings, for testing purposes or for convenience of installation. Where such materials are installed, they shall comply with specifications and shall be sized to be compatible with system design. Remove such installed materials when they interfere with design conditions or as directed by Engineer.

G. Related Sections include the following:
   1. Division 01 Temporary Facilities for temporary services.
   2. Division 03 Cast-in-Place Concrete for general building applications of concrete.
   3. Division 09 Painting for painting of mechanical ductwork/piping.

1.3 CONTRACTOR QUALIFICATIONS

A. Contractor and/or their subcontractors providing the work included in Division 23 shall submit credentials related to meeting the following qualifications and experience requirements at the time of the first shop drawing submittals or at the Owners request, whichever occurs first, with their bid documents.

1. Evidence of being a Mechanical Contractor licensed to perform work in the Commonwealth of Virginia.

2. Qualifications and references for at least three (3) similar chiller plant and related chilled water distribution projects successfully completed in the last 10 years on a University campus. This should include work involving installation of the following:
   a. Electrical centrifugal chillers 1,000 tons in capacity and larger.
b. Field erected cooling towers 1,000 tons in capacity and larger.
c. Horizontal split case and vertical turbine pumps over 100 HP.
d. Large bore welded mechanical piping over 24” in diameter.
e. Large bore underground restrained joint PVC piping over 24” in diameter.

1.4 RELATED WORK

A. Utility Services:
   1. Include costs for temporary service, temporary routing of piping or any other requirements of a temporary nature associated with utility service.

B. Continuity of Service:
   1. No service shall be interrupted or changed without permission from Engineer and Owner. Obtain written permission before any work is started.
   2. When interruption of services is required, Contractor shall contact Owner and Engineer in writing at least 10 working days prior to requested shutdown date. Request for utility interruption shall include proposed date(s) of shutdown, duration of shutdown, utility to be disrupted, and description of work. The utility Owner shall perform disruption of utility service. Coordinate with the utility Owner for proper lockout/tagout procedures and notification to proceed with work.
   3. In the event that the Contractor damages a utility line, the responsible Contractor shall immediately contact the Owner and Engineer, and the Owner of the utility to report the incident. The responsible Contractor shall immediately repair the damaged utility to the satisfaction of the Owner of the utility.

C. Demolition:
   1. Perform demolition to accomplish new work.
   2. Accomplish work in neat workmanlike manner to minimize interference, annoyance or inconvenience such work might impose on Owner or other contractors.
   3. Except as noted otherwise, remove from the premises, all materials and equipment removed in demolition work.
   4. Equipment noted to be removed and turned over to Owner shall be delivered to Owner at place and time Owner designates.
   5. Where materials are to be turned over to Owner or reused and installed by Contractor, maintain condition of materials and equipment equal to that existing before work began. Repair or replace damaged materials or equipment at no additional cost to Owner.
   6. Where demolition work interferes with Owner’s use of premises, schedule work through Engineer, Owner and with other contractors to minimize inconvenience to Owner. Engineer must approve schedule before Contractor begins such work.
   7. All demolition work must be preceded by proper coordination for shut-off of utility services and for control of dust and noise. Consideration shall be given to ongoing University activities in adjacent areas. In confined areas of selective demolition, install and maintain dust and noise control barriers to keep dirt, dust and noise from being transmitted to adjacent areas. These protection measures must be removed after demolition operations are completed.
   8. Maintain and protect existing building services which cross through areas affected by selective demolition.
9. Unless otherwise noted, no wiring devices, fixtures, controls, circuitry (conduit and wiring), etc., made obsolete by the demolition shall be abandoned within or around the building.

10. Relocate all existing piping, circuitry (conduit and wiring), ductwork, etc., which impedes the installation of new materials and equipment, unless otherwise noted.

D. Concrete Work:
1. Provide anchor bolts, metal shapes and templates required to be cast in concrete or used to form concrete for support of mechanical equipment.
2. This work shall also include providing all housekeeping pads as shown on the plans and specified.

E. Painting:
1. Furnish equipment with factory applied prime finish unless otherwise specified.
2. If factory finish on equipment furnished by Contractor is damaged in shipment or during construction, refinish equipment to satisfaction of Engineer.
3. Furnish one gallon can of touch up paint for each factory finish which will be the final finished surface of product.
4. Exposed mechanical ductwork/piping and equipment will be painted by others as specified in Division 09. This contractor shall coordinate completion of painting.

1.5 REQUIREMENTS OF REGULATORY AGENCIES
A. Rules and regulations of Federal, State, and local authorities and utility companies, in force at time of execution of contract shall become part of this specification including the VUSBC and IMC.

1.6 REFERENCE STANDARDS
A. Agencies or publications referenced herein refer to the following:
1. AABC Associated Air Balance Council
2. ACCA Air Conditioning Contractors of America
3. ADC Air Diffusion Council
4. AMCA Air Movement and Control Association
5. ANSI American National Standards Institute
6. ARI Air-Conditioning and Refrigeration Institute
7. ASHRAE American Society of Heating Refrigerating and Air Conditioning Engineers
8. ASME American Society of Mechanical Engineers
9. ASTM American Society for Testing and Materials
10. AWS American Welding Society
11. AWWA American Water Works Association
12. FM Factory Mutual Engineering
13. FS Federal Specifications
14. IEEE Institute of Electrical and Electronics Engineers
15. IRI Industrial Risk Insurers
16. MCA Mechanical Contractors Association
17. MSS Manufacturers Standardization Society
18. NEBB National Environmental Balancing Bureau
19. NEC National Electrical Code
20. NEMA National Electrical Manufacturers Association
21. NFPA National Fire Protection Association
22. NIST National Institute of Standards & Technology
23. NSF National Sanitation Foundation
24. OSHA Occupational Safety and Health Administration
25. PDI Plumbing and Drainage Institute
26. SMACNA Sheet Metal and Air Conditioning Contractors National Association
27. UL Underwriters Laboratories, Inc.
28. All work shall also comply with the Virginia Uniform Statewide Building Code (VUSBC), the International Mechanical Code (IMC) and the International Energy Conservation Code (IECC).

1.7 SHOP DRAWINGS
A. Division 01 Submittal Procedures for administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples and other miscellaneous submittals.

B. Submit shop drawings for equipment and systems as requested in the respective specification sections. Submittals which are not requested may not be reviewed.

C. Mark general catalog sheets and drawings to indicate specific items submitted.

D. Include proper identification of equipment by name and/or number, as indicated in specification and shown on drawings.

E. When manufacturer's reference numbers are different from those specified, provide correct cross reference numbers for each item. Submittals shall be clearly marked and noted accordingly.

F. When equipment and items specified include accessories, parts and additional items under one designation, submittals shall be complete and include all required components.

G. Submittals of electrically powered equipment and devices shall include composite wiring diagrams, motor efficiency and power factor data.

H. Submit equipment room layouts drawn to scale, including equipment, piping, accessories and clearance for maintenance.

I. Where submittals cover products containing non-metallic materials, include "Material Safety Data Sheet" (MSDS) from manufacturer stating physical and chemical properties of components and precautionary considerations required.

J. Submittals which are not complete, not permanent or not properly checked by Contractor will be returned without review.

1.8 CERTIFICATES AND INSPECTIONS
A. Obtain and pay for inspections required by authorities having jurisdiction and deliver certificates approving installations to Owner unless otherwise directed.
1.9 OPERATION AND MAINTENANCE MANUALS

A. Division 01 Section Operation and Maintenance Data for administrative and procedural requirements.

B. Manuals shall be organized in 3 ring binders and shall include the following:
   1. Copies of all approved shop drawings. Shop drawings shall include record of Engineer’s review.
   2. Manufacturer’s operating, and maintenance instructions. Include parts lists of all items or equipment with component exploded views with part numbers. Where manufacturer’s data includes several types or models, applicable type or model shall be designated.
   3. CD ROM’s of O&M data with exploded parts lists where available.
   4. Phone numbers and addresses of local parts suppliers and service companies.
   5. Internet/WEB page addresses where applicable.
   6. Wiring diagrams.
   7. Startup and shutdown procedures.
  10. Lubrication instructions.
  11. Factory and field test records. (Refer to Test and Balancing in Part 3 of this Section).
  12. Air and water balance reports.
  13. Piping pressure test reports. Test reports shall include record of Engineer’s review.

1.10 INSTRUCTION

A. Instruct Owner’s representative in operation and maintenance of equipment. Instruction shall include complete operating cycle on all apparatus.

1.11 JOB CONDITIONS

A. Building Access:
   1. Arrange for necessary openings in building to allow for admittance of all apparatus.

B. Electrical Coordination:
   1. Division 23 - Motors.
   2. Provide all motors and all electrically powered or electrically controlled equipment.
   3. All relays, actuators, timers, alternators, pressure, vacuum, float, flow, pneumatic-electric, and electric-pneumatic switches, aquastats, freezestats, line and low voltage thermostats, remote selector switches, remote push-button stations, emergency break glass stations, interlocking, disconnect switches beyond termination point, and other appurtenances associated with equipment under Division 23 shall be furnished, installed, and wired under Division 23. Disconnects, wire, and conduit serving motors or electrical equipment shall be provided under Division 26, except as specifically noted elsewhere in these specifications. Where starters or other devices are furnished by this Contractor, they shall be installed by this Contractor, coordinated with Electrical Contractor, and shall be furnished in accordance with Division 26.
4. Motor starters or VFD’s for mechanical equipment shall be furnished and installed under Division 23. All power wiring shall be provided under Division 26. Power wiring to the mechanical equipment, including final connections, shall be provided under Division 26.

5. All wiring required for controls and instrumentation not indicated on the drawings shall be furnished and installed under Division 23.

6. Electrical drawings and/or specification show number and horsepower rating of motors furnished under this Division, together with their actuating devices. Immediately notify of any change in size, HP rating or means of control made to any motor or other electrical equipment. Additional costs due to these changes shall be under this Division at no cost to the Owner.

7. Power wiring and motor control wiring are indicated on electrical contract documents. Connect all equipment so that it is complete and ready to operate.

8. Wiring done by this contractor shall be in accordance with Division 26 requirements and applicable electrical codes.

9. Furnish wiring diagrams to Electrical Contractor for apparatus indicating external connection and internal controls.

10. All standard manufactured items or custom fabricated assemblies of electrically operated equipment shall be listed and labeled by a nationally recognized testing laboratory, such as Underwriter's Laboratory, Inc. (UL).

C. Cutting and Patching:

1. Refer to Division 01 Cutting and Patching for procedural requirements for cutting and patching.

2. Perform cutting and patching required for complete installation of systems, unless otherwise noted. Patch and restore all work cut or damaged to original condition. This includes openings remaining from removal or relocation of existing system components.

3. Provide all materials required for patching unless otherwise noted.

4. Do not pierce beams or columns without permission of Engineer and then only as directed. If openings are required through walls or floors where no sleeve has been provided, hole shall be core drilled to avoid unnecessary damage and structural weakening. Coordinate with Engineer for approval of all core drilled openings prior to commencing with work.

5. Where alterations disturb lawns, paving, walks, etc., replace, repair or refinish surfaces to condition existing prior to commencement of work. This may include areas beyond construction limits.

PART 2 - PRODUCTS

A. 2.1 ESCUTCHEONS

B. A. Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify elevations and measurements prior to installation of materials.
B. Store and handle all material in compliance with the manufacturer’s recommendations to prevent their deterioration and damage. Store all materials in the original containers or bundles with labels informing about manufacturer, product name, and any potential damages.

3.2 FLOOR, WALL, ROOF AND CEILING OPENINGS

A. Coordinate location of openings, chases, and furred spaces with appropriate contractors. Provide during progress of construction all sleeves and inserts that are to be built into structure.

B. Submit product data and installation details for all penetrations of building structure. Submittal shall include schedule indicating penetrating materials, (metal pipe, plastic pipe, conduit, etc.), sizes of each, opening sizes and sealant products intended for use.

C. Where penetrations of fire-rated assemblies are involved, seal penetrations with appropriate firestopping systems as specified under this Division and as detailed on drawings. 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.

D. Openings for pipe shall be minimum 1" larger in diameter than pipe, or where fire resistant penetrations are required, sized in accordance with recommendations of firestopping systems manufacturer.

E. Openings for insulated piping shall be sized based on outside diameter of insulation when it is specified or detailed to be continuous through opening.

F. Openings for duct penetrations shall be no more than ¼" larger on all sides than size of openings for duct or duct including insulation, if applicable. Openings for ducts with fire dampers shall be in accordance with fire damper installation requirements.

G. Seal non fire-rated floor penetrations with non-shrink grout or urethane caulk, as appropriate.

H. Seal non-rated wall openings with urethane caulk.

I. Where penetrations occur through exterior walls or floors into building spaces or into structures requiring a water tight seal, use steel pipe sleeves with integral water stop plate continuously welded on both sides. Sleeves shall have hot dip galvanized finish. Seal annular space between sleeves and pipe with modular wall and casing seals. Seal shall be modular, mechanical type consisting of inter-locking rubber links shaped to continuously fill the annular space between pipe and pipe sleeve. Provide two seals (one on the inside of the penetration and one on the outside of the penetration) for piping 18" and larger. Links shall be sized and selected per manufacturer’s recommendations and shall be rated for -40°F to 250°F service for all systems with operating temperatures below 150°F and -67°F to 400°F for all systems with operating temperatures above 150°F. Where casing seals are used with insulated pipe, insulation shall be butted against seals on both sides. Sealing system shall utilize Type 316 stainless steel bolts, washers and nuts.

J. Finish and trim penetrations as shown on details and as specified hereinafter.

K. Provide escutcheons where piping passes through walls, floors or ceilings and is exposed in finished areas. Size escutcheons to fit pipe and pipe covering for finished appearance.
Finished areas shall not include mechanical/electrical rooms, janitors closets, storage rooms, etc., unless suspended ceilings are specified.

3.3 EQUIPMENT ACCESS

A. Install piping, conduit and accessories to permit access to equipment for maintenance. Relocation of piping, equipment or accessories as required to provide access shall be provided at no additional cost to Owner.

B. Install equipment with ample space allowed for removal, repair or changes to equipment. Provide ready accessibility to equipment without moving other equipment being installed or already in place.

C. Access doors in walls, chases, or above inaccessible ceilings will be provided under Division 08, unless otherwise indicated. Access doors for valves, shock stops, unions or equipment/devices requiring access for servicing, repairs or maintenance located in walls, chases or above inaccessible ceilings, unless otherwise noted or other equipment shall provide access for service, repairs, and/or maintenance. Provide necessary coordination information to include required locations, sizes, and rough-in dimensions.

3.4 EQUIPMENT SUPPORTS

A. Provide supporting steel not indicated on drawings as required for installation of equipment and materials including angles, channels, beams, hangers, and supports.

B. Concrete anchors, used for attachment to concrete, shall be steel shell with plug type. Plastic, rawhide or anchors utilizing lead are not allowed.

C. Do not support equipment or piping from metal roof decking.

3.5 EQUIPMENT GUARDS

A. Provide equipment guards over belt driven assemblies, pump shafts, exposed fans and elsewhere as indicated in this specification or required by code.

B. Paint all equipment guards bright yellow.

C. All belt guards, including those factory made, shall be ventilated.

3.6 SUPPORT PROTECTION

A. Guard equipment in occupied areas, mechanical rooms and any areas requiring normal maintenance access to protect personnel from injury.

B. Provide minimum 1/2" thick closed cell elastomeric thermal insulation (as specified under this Division) applied with adhesive on lower edges of equipment and mechanical supporting devices suspended less than 7 ft above floors, platforms or catwalks in these areas.

C. Threaded rod or bolts shall not extend beyond supporting element and shall be protected as described above.

3.7 TEST AND BALANCING

A. Tests for equipment, ductwork, and piping systems shall be performed under this Division in accordance with technical requirements noted.
B. Provide equipment required for testing, including fittings for additional openings required for test apparatus.

C. All ductwork and piping inspections and testing shall be successfully completed and approved before application of covering materials.

D. Notify Engineer and Owner at least 10 calendar days prior to testing date when testing is specified to be witnessed by the Engineer or Owner.

E. When equipment or systems fail to meet minimum test requirements, replace or repair defective work or material as necessary and repeat inspection and test. Make repairs with new materials. Caulking of holes or threaded joints is not allowed.

F. Certify in writing equipment and system test results. Certification shall include identification of portion of system tested, date, time, test criteria, test medium and pressure used, duration of test and name and title of person signing test certification document. Results shall be submitted to Engineer and Owner within 3 days of test occurrence for review.

G. Maintain copies of certified test results, including record of Engineer’s review and those for any failed tests, at project site. At completion of project, include copies of test records and certifications in O&M manuals. Where specified systems require additional test and balance include requirements as specified in respective sections.

H. Where specified systems require additional test and balance, include requirements as specified in respective sections.

I. Should the Engineer or Owner have any reasonable doubt as to the proper functioning of any equipment installed under this Contract at any time during the guarantee period, the Owner and/or Engineer has the right to perform any test deemed practical to determine whether such equipment is functioning properly and performing at required capacity. If such tests show proper functioning, the cost of the test will be paid by the Owner. If the test indicates a deficiency in equipment capacity or performance, the Contractor shall pay the cost of the test and also remedy deficiencies shown by the test to the full satisfaction of the Engineer and Owner.

3.8 START-UP

A. All systems and equipment shall be started, tested, adjusted and turned over to Owner ready for operation. This shall include "Owner-furnished, Contractor-installed" (OFCI) as well as "Contractor-furnished, Contractor-installed" (CFCI) systems and equipment. Follow manufacturers pre-start-up check-out, start-up, trouble shooting and adjustment procedures. Contractor shall provide services of technician/mechanic knowledgeable in start-up and check-out of types of systems and equipment on project. Provide start-up services by manufacturer’s representative where specified or where Contractor does not have qualified personnel. Coordinate start-up with Engineer, Owner and all trades.

B. Refer to specification sections 019100 and 230800.

3.9 LUBRICATION

A. Upon completion of work and before turning over to Owner, clean and lubricate bearings except sealed and permanently lubricated bearings. Use only lubricant recommended by manufacturer.
B. Maintain lubrication of all mechanical equipment under his contract until Owner accepts work.

3.10 CLEANING

A. After installation is complete, clean all systems to as new condition (inside and outside).

B. Clean equipment and surfaces of work installed by others when soiled to as-new condition.

C. Repair or replace any equipment or surfaces of work which is damaged.

D. Clean piping and ductwork both internally and externally to remove dirt, plaster dust or other foreign materials. When external surfaces of piping or ductwork are rusted, clean and restore surface to original condition.

E. Clean pipeline strainers to restore them to original condition or replace with new strainer elements.

F. Clean all equipment as recommended by manufacturer.

G. Thoroughly clean equipment of stains, paint spots and overspray, dirt and dust. Remove temporary labels not used for instruction or operation.

H. Provide additional cleaning of individual piping systems and apparatus as hereinafter specified

I. Dirt, plaster dust and other foreign matter shall be blown and/or cleaned from coils, terminal devices, diffusers, register, and grilles.

J. Repair or replace any equipment or surfaces of work which is damaged to the full satisfaction of the Owner and the Engineer.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Work under this section is subject to requirements of the Contract Documents including the GENERAL CONDITIONS, SUPPLEMENTAL GENERAL CONDITIONS, and sections under Division 01 - GENERAL REQUIREMENTS.

1.2 SUMMARY

A. Provide all supporting devices as specified and as required for proper support of piping, equipment, materials and systems.

B. Support for all conditions of operation, including variations in installed and operating weight of equipment and piping, to prevent excess stress and allow for proper expansion and contraction.

C. Related Sections include the following:
   1. 21 1314 – Automatic Fire Sprinkler System
   2. 23 0550 - Vibration Isolation.
   3. 23 0700 - Mechanical Systems Insulation.
   4. 23 5223 – Mechanical Site Utility Pipe and Pipe Fittings

1.3 SUBMITTALS

A. Submit in accordance with Division 01 - Submittals

B. Shop drawings for each piping system for all pipe sizes and all applicable equipment including, but not limited to, the following:
   1. Manufacturer's name.
   2. Model numbers.
   4. Schedule of hangers and support devices with pipe support spacing.
   5. Insulated pipe supports along with application chart or table.
   6. Insulation protection saddles and weight bearing insulation table.
   7. Details and calculations for sizing all supplementary steel utilized for trapeze or specially designed supports.
   8. Structural attachments, inserts and concrete anchors.
   9. Drawings showing specific locations of any weld attachments to structure, including weight supported by such attachments.
   10. Equipment mounting devices.
   11. Pipe guides and anchors.
   12. All other appropriate data.
1.4 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall conform to latest requirements of ANSI/ASME Code for Pressure Piping B31.1 and MSS Standard Practice SP-58 (Materials, design and Manufacture), SP-69 (Selection and Application), and SP-89 (Fabrication and Installation Practices), except as supplemented or modified herein.

B. Unless otherwise indicated, design structural support members and support devices including couplings, rods, trapeze supports and strut systems with safety factor in accordance with AISC Manual of Steel Construction, but not less than 2.0.

C. Maximum deflection determined by the following equation shall be used.

\[ D = \frac{H}{250} \]

Where
- \( D \) = Maximum deflection in Inches
- \( H \) = Member height in Inches
- \( L \) = Member length in Inches

D. Unless otherwise indicated, hangers, support devices and hardware shall be steel with hot-dipped galvanized finish for outdoor application, and either factory standard paint, hot-dipped or electro-plated finish for indoor application. Coat cut edges, welds or any finish damaged with galvanized paint.

E. Material in contact with pipe shall be compatible with piping material so that neither shall have deteriorating action on the other. If materials are not compatible, provide nonmetallic separation between uninsulated copper or stainless steel piping and metal supports. Plastic coated steel supports are acceptable.

F. Unless otherwise indicated, steel support devices exposed to ventilation air stream shall be stainless steel, or steel with either galvanized finish or paint finish. Paint type shall be approved by Architect/Engineer.

G. This Contractor is responsible for proper placement and sizing of supporting devices to accommodate insulation thickness and pitching of pipe. Coordinate with work specified in Section 23 0700 - Mechanical System Insulation.

H. In addition to hangers specified in this section, piping connected to pumps, compressors, chillers. Cooling towers and similar rotating or reciprocating equipment shall have vibration isolation hangers or supports for all piping 4” and larger.

I. Piping connected to coils which are in assembly mounted on vibration isolators shall have flexible piping connections and vibration supports as indicated above. Piping connected to coils which are in equipment where fan assembly is separately isolated by means of vibration isolators and duct flexible connections does not require additional spring vibration supports. Flexible connections and vibration isolators are specified in Section 23 0550 - Vibration Isolation.

J. Where piping can be conveniently grouped to allow trapeze type supports, supporting steel shall be by means of standard structural shapes.

K. Hangers and rods shall be plumb when pipelines are at their normal operating temperatures.

L. Design of structural steel supports shall be reviewed and approved by Engineer.
M. Unless otherwise indicated, continuous insert channels are not allowed.

N. Punching, drilling, or welding of building structural steel is not allowed unless approved by Architect/Engineer.

O. Any proposed weld attachments to building structure shall be reviewed by Structural Engineer prior to execution of work. This review may result in use of other welding codes or standards which may apply to "structural work". Execution of this work may be assigned to General Trades responsible for building structural steel. Cost for this work, however, will remain the responsibility of this Contractor.

**PART 2 - PRODUCTS**

2.1 STRUCTURAL SUPPORTS

A. Provide all supporting steel, not indicated on structural drawings, that is required for installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspend or floor support equipment.

2.2 PIPE HANGERS AND SUPPORTS (METALLIC)

A. Manufacturers: Anvil (formerly Grinnell), Erico (formerly Michigan Hanger), Tolco, or B-Line, equal to Anvil figures listed.

B. Unless otherwise indicated, finish of devices indicated by Anvil figures shall be black steel for interior use and hot dipped galvanized steel for exterior use.

C. Hangers/supports for copper pipe without insulation shall be either copper plated or PVC coated.

D. For insulated pipe supports, refer to insulated Pipe Supports in Part 2 and Part 3 of this section.

E. Clevis and Roller Type Hangers:

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<th>Pipe Size</th>
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</tbody>
</table>
F. Flat Surfaces (Trapeze, Rack Type):
   1. Use structural steel members such as struts, angles, channels, beams to support pipes as required. Select members properly for pipe support types and loading conditions. Refer to Part 1 for design criteria. Submit support detail(s) with type of members selected and load calculations. Provide straps, clamps, rollers or slides indicated below at each support point.

<table>
<thead>
<tr>
<th>System</th>
<th>Pipe Size</th>
<th>Straps or Clamps</th>
<th>Rollers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Bare Pipes (60°F to 119°F)</td>
<td>all sizes</td>
<td>137</td>
<td>271, 274</td>
</tr>
<tr>
<td>Cold Pipes with Insulation (33°F to 59°F)</td>
<td>10&quot; and smaller</td>
<td>137</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>12&quot; and over</td>
<td>137</td>
<td>271, 274</td>
</tr>
</tbody>
</table>

2.3 INSULATION PROTECTION SHIELDS

A. Anvil Fig. 167, constructed of galvanized carbon steel. Select shield to accommodate outer diameter of insulation. Shield length and gauge shall be as follows.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Length</th>
<th>Gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot; thru 1-1/2&quot;</td>
<td>12&quot;</td>
<td>18</td>
</tr>
</tbody>
</table>

2.4 WEIGHT BEARING INSULATION INSERTS (1/4" THROUGH 1-1/2")

A. Insert thickness shall match pipe insulation thickness. Pipe insulation jackets shall be continuous through sections containing inserts.

B. Minimum length of inserts shall be 12" or 2" longer than insulation protection shields whichever is longer. Quantity and placement of inserts shall be based on weight of pipe and fluid plus 1.5 safety factor.

C. Cold Pipes (59°F and below):
   1. Cellular glass insulation (Type G), maximum compression strength 100 psi, Koolphen K insulation by Kooltherm Insulation, 5 lb/cu ft, maximum compression strength 50 psi, or HAMFAB H-Block by ICA Inc., maximum compression strength 30 psi. H-Block inserts shall be coated with vapor barrier coating.

2.5 PRE-INSULATED PIPE SUPPORTS (2" AND LARGER)

A. Manufacturers: Shaw Pipe Shields, B-Line, Bergen-Power, or Rilco equal to Shaw Pipe Shields models listed for 2" piping and larger.

B. Insulation shall consist of water-resistant calcium silicate of same thickness as adjoining pipe insulation, thermal conductivity not more than 0.38 at 75°F mean temperature, minimum density of 13 pcf, and compressive strength not less than 100 psi.

C. Structural inserts shall be water-resistant, high-density calcium silicate with minimum density of 32 pcf and minimum compressive strength of 600 psi. Structural inserts shall be used as recommended by manufacturer to meet load ratings.
D. Use vapor barrier steel jacket around insulation. Insulation jackets shall be galvanized steel conforming to ASTM A-527. Hanger bearing surface shall consist of galvanized sheet metal insulation protection shield or casing.

E. When recommended by manufacturer, use double layer insulation protection shield at support bearing surface. Insulation shall extend one inch beyond insulation protection shield to maintain vapor barrier integrity.

F. Pre-insulated pipe supports shall be load rated. Load ratings shall be established by pipe support manufacturer based upon testing and analysis in conformance with the latest edition of the following codes and standards: ASME B31.1, MSS SP-58, MSS SP-69, and MSS SP-89.

G. Unless otherwise indicated, used insulated pipe supports as indicated in the following schedule: Model numbers are based on Shaw Pipe Shields Inc.
   3. Pipe supported on pipe rollers: Models A4000, A6000, A8000, 8200, and A8400.

H. Load tests shall be made on both supporting materials and configurations. All tests shall be performed by independent testing laboratory. Results of pertinent tests shall be available on request.

I. Select proper model to conform with pipe service, support style, and support spacing.

J. Submit chart or table indicating selected model along with pipe sizes, rated loads, support device types and support spacing for each piping system.

K. Pipe support spacing shall be in accordance with manufacturer's recommendations, but in no case shall exceed maximum spacing indicated under Hanger and Support Spacing in Part 3 of this Section.

2.6 HANGER RODS (METALLIC)

A. Rods shall conform to the latest MSS Standards except as modified herein. Furnish rods complete with adjusting and lock nuts.

B. Rods shall have electro-plated zinc or hot dip galvanized finish.

C. Unless otherwise indicated, size rods for individual hangers and trapeze support as indicated in the following schedule.
D. Total weight of equipment, including valves, fittings, pipe, pipe content and insulation, shall not exceed limits indicated.

<table>
<thead>
<tr>
<th>Maximum Load (Lbs.)</th>
<th>Rod Diameter (in.)</th>
<th>Max. Pipe Size With Single Rod</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Not exceeding 650°F Service Temp.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>610</td>
<td>3/8&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>1130</td>
<td>1/2&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>1810</td>
<td>5/8&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>2710</td>
<td>3/4&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>3770</td>
<td>7/8&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>4960</td>
<td>1&quot;</td>
<td>16&quot;</td>
</tr>
<tr>
<td>8000</td>
<td>1-1/4&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>11630</td>
<td>1-1/2&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>15690</td>
<td>1-3/4&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>20700</td>
<td>2&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>

2.7 BOLTS, NUTS, STUDS AND WASHERS

2.8 ROD ATTACHMENTS
   A. Anvil Figure 290 galvanized finish.

2.9 U-BOLTS
   A. Anvil Figure 137, galvanized finish.

2.10 BEAM CLAMPS
   A. Beam Clamps: Anvil Figure 218, 228 and 292.
   B. Side Beam or Channel Clamps: Anvil Fig. 225 or 226. Use for sizes 4" and smaller only.
   C. Top Beam Clamps: Anvil Fig. 227. Use for sizes 4" and smaller only.
   D. C-Clamps: Anvil Fig. 87, 92, or 94. Provide clamps with retaining clips. Use for sizes 4" and smaller only.

2.11 ADJUSTABLE PIPE SADDLE SUPPORTS
   A. Anvil Figure 264.

2.12 RISER CLAMPS
   A. Anvil Figure 261.
   B. Proset system, proseal plug and fire-fill for sleeved and cored holes.

2.13 CONCRETE ANCHORS
   A. Manufacturers: Hilti, Rawl or Red Head.
B. Flush or shell type which meet description in Federal Specification FF-S-325, Group VIII, Type 1 for expansion shield anchors similar to Hilti-HDI/HDI-L.

C. Anchors shall be zinc plated in accordance with ASTM B633, SC1, Type III.

D. Select anchors with minimum safety factor of 8.0.

2.14 METAL FRAMING SUPPORT SYSTEM (STRUT SYSTEM)


B. Channels to have epoxy paint or electro-galvanized finish.

C. Channels shall not be lighter than 12 gauge.

2.15 EQUIPMENT RAILS

A. Manufacturers: Roof Products & Systems, ThyCurb, Custom Curb, Inc. or Vent Products equal to Roof Products & Systems Model ER-4 with raised cant style. Mounting rails shall be galvanized steel with integral base plate, continuous welded corner seams, factory installed 2x4 wood nailer and 18 ga galvanized steel counter flashing.

B. Mounting rail gauge shall be selected to support equipment adequately but shall be not less than 18 ga.

C. Height shall be not less than 18” above finished roof.

D. Equipment rails shall span minimum of 2 joists and not cantilever more than 6” where joists are used. Rails shall be level at top with pitch built in when deck slopes 1/4” per foot or greater.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supports to allow for free expansion of piping. Support all piping from building structural members using beam clamps, ceiling plates, wall brackets, or floor stands. At no time shall hangers and supports overload building structural members. Fasten ceiling plates and wall brackets securely to structure and test to demonstrate adequacy of fastening.

B. Select and size building attachments properly in accordance with MSS Standards and manufacturer’s published load rating information.

C. Coordinate hanger and support installation to properly group piping of all trades.

D. Suspend hangers by means of hanger rods. Perforated band iron or flat wire (strap iron) are not allowed.

E. Piping shall not be supported by other piping, ductwork, or conduit.

F. Pipe hangers or supports are not allowed to penetrate vapor barrier of pipe insulation.

G. Install adequate supports during erection of piping so as not to over stress either piping or equipment to which piping is connected.
H. Refer to Section 23 0000 - General Mechanical Requirements for requirements of personnel injury protection guards for supporting devices.

3.2 HANGER AND SUPPORT SPACING

A. Space pipe hangers and supports in accordance with the following schedule, with exceptions as indicated herein:

1. Steel Pipe (Standard Weight and Extra Strong):

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Max Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/4&quot; and smaller</td>
<td>7'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>9'-0&quot;</td>
</tr>
<tr>
<td>2&quot;</td>
<td>10'-0&quot;</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>11'-0&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>12'-0&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>14'-0&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>17'-0&quot;</td>
</tr>
<tr>
<td>8&quot;</td>
<td>19'-0&quot;</td>
</tr>
<tr>
<td>10&quot; and larger</td>
<td>20'-0&quot;</td>
</tr>
</tbody>
</table>

2. Copper Tube (Unless Otherwise Noted):

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Max Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot; and smaller</td>
<td>5'-0&quot;</td>
</tr>
<tr>
<td>1&quot; to 1-1/4&quot;</td>
<td>6'-0&quot;</td>
</tr>
<tr>
<td>1-1/2&quot; to 2-1/2&quot;</td>
<td>8'-0&quot;</td>
</tr>
<tr>
<td>3&quot; and larger</td>
<td>10'-0&quot;</td>
</tr>
</tbody>
</table>

B. Space pipe hangers and supports for PVC piping no less than 4'-0" for all pipe sizes.

C. Maximum spacing shown above, may be restricted by strength of attachment to building structure. Submit data with calculations with published load ratings showing attachment to be utilized and maximum spacing allowable for that type of attachment utilized and pipe size.

D. Refer to the contract documents for supports in the North Chiller Plant and Southwest Chiller Plant which show specific hanger locations for certain pipe sizes.

E. If pipe size changes between support points, maximum spacing shall be based on the smaller pipe size.

F. Maximum hanger and support spacing for copper tubing shall be 5 ft for tubing 1-1/4" and under, 8 ft for 1-1/2" through 2-1/2", and 10 ft for 3" and over.

G. Install supports for vertical piping and anchors as recommended by pipe manufacturer.

H. Spacing less than indicated above may be required to conform with building structure design and/or loading limitations.
I. Place hangers and supports to meet requirements of piping section of this specification, with regard to pitch for drainage and venting, and clearance between services.

J. Install hangers and supports to bear on outside of insulation when pipes are to be insulated.

K. Place hangers and supports within one foot of either side of each fitting such as elbow and tee and at each valve, strainer, and other piping specialty for piping 4” and above.

3.3 RISER SUPPORTS

A. Insulated Piping:
   1. Unless otherwise indicated, support vertical piping as indicated below.
   2. Support vertical piping at bottom of riser secured and anchored to building structure and provide guides on vertical piping. Use spring hangers at top of riser and at takeoffs from riser at each floor. Use spring hangers for minimum 3 hangers away from top elbow and from each take off at riser.
   3. Guide vertical piping 2” and smaller at every floor. Guide 2-1/2” and larger at every other floor. Spring hangers (Type 7) and guides (Type VSG) are specified in Section 23 0550 - Vibration Isolation.

B. Non-Insulated Piping:
   1. Unless otherwise indicated, maximum vertical support spacing for ambient bare pipes shall be 15 ft.
   2. Maximum vertical support spacing for copper tubing and plastic piping shall be 10 ft.
   3. Use riser clamps and intermediate supports as required.
   4. Rest riser clamps on floor or on pipe sleeve.

3.4 INSULATION PROTECTION SHIELDS (SIZES 1-1/2” AND BELOW)

A. Install insulation protection shields at support points as specified under insulated pipe supports.

B. Use one shield (bottom) for clevis hanger and 2 shields (top and bottom) for roller hanger/support or strap/clamp support. Apply 2 metal straps to hold shield(s) onto insulation jacket.

3.5 INSULATED PIPE SUPPORTS

A. Install insulated pipe supports at support points of all insulated pipe.

B. Pipe Size 1-1/2” and Smaller:
   1. Use insulation protection shields. Pipe insulation specified in Section 23 0700 - Mechanical Systems Insulation shall be continuous through support points.

C. Pipe Size 2” and Over:
   1. Use pre-insulated pipe supports.
   2. In lieu of pre-insulated pipe supports, field-assembled insulated pipe supports may be used. If used, submit application details including materials, thickness, compression strength, load bearing surfaces, load calculations of support assembly and total pipe weight based on support spacing.
   3. Field-assembled insulated pipe supports shall consist of weight bearing insulation inserts and insulation protection shields.
3.6 TRAPEZE SUPPORTS

A. Construct trapeze supports with struts, angles, or channels and hang them by inserts or welded beam attachments and rods.

B. Determine trapeze supports spacing by the smallest pipe on trapeze.

3.7 CONCRETE ANCHORS

A. Anchor application, size, and placement shall be reviewed and approved by Structural Engineer prior to installation.

3.8 EQUIPMENT RAILS

A. Use for all roof-mounted equipment, which is not curb mounted. Install bottom of equipment rail flat on roof deck. Insulate exterior of equipment rail.

B. Flashing will be by General Contractor. Provide counter flashing as specified and secure to wood nailer with stainless steel truss head screws.

END OF SECTION
SECTION 26 0000
GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 REFERENCE

A. Work under this Section is subject to requirements of Contract Documents including General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

1.2 DESCRIPTION

A. Intent of drawings and Specifications is to obtain complete systems tested, adjusted, and ready for operation.

B. Except as otherwise defined in greater detail, the terms "provide", "furnish" and "install" as used in Division 26 Contract Documents shall have the following meanings:
   1. "Provide" or "provided" shall mean "furnish and install".
   2. "Furnish" or "furnished" does not include installation.
   3. "Install" or "installed" does not include furnishing.

C. Include incidental details not usually shown or specified, but necessary for proper installation and operation.

D. Check, verify and coordinate work with drawings and specifications prepared for other trades. Include modifications, relocations or adjustments necessary to complete work or to avoid interference with other trades.

E. Included in this Contract are electrical connections to equipment provided by others. Refer to Designerural, Mechanical, Plumbing, and final shop drawings for equipment being furnished under other sections for exact locations of electrical outlets and various connections required.

F. Information given herein and on drawings is as exact as could be secured but is not guaranteed. Do not scale drawings for dimensions.

G. Perform work in "neat and workmanlike" manner as defined in ANSI/NECA 1, Standard Practices for Good Workmanship in Electrical Contracting.

1.3 CONTRACTOR QUALIFICATIONS

A. Contractor and/or their subcontractors providing the work included in Division 26 shall submit credentials related to meeting the following qualifications and experience requirements at the time of the first shop drawing submittals or at the Owners request, whichever occurs first, with their bid documents.
   1. Evidence of being an Electrical Contractor licensed to perform work in the Commonwealth of Virginia.
2. Qualifications and references for at least three (3) similar chiller plant projects successfully completed in the last 10 years on a University campus. This should include work involving installation of the following:
   a. Electric centrifugal chillers 1,000 tons and larger.
   b. 5kV chillers and associated controllers.
   c. 5KV switchgear.
   d. Variable frequency drives over 100 HP.
   e. Premanufactured electrical equipment enclosures.

1.4 RELATED WORK

A. Utility Services:
   1. Include costs for temporary service, temporary routing of service or other requirements of a temporary nature associated with utility service.

B. Continuity of Service:
   1. No service shall be interrupted or changed without permission from Designer and Owner. Obtain written permission before work is started.
   2. When interruption of services is required, Designer, Owner and other concerned parties shall be notified and shall determine a time.

C. Demolition:
   1. Division 010732 - Selective Demolition.
   2. Completely remove all equipment noted on the drawings for removal including all associated devices, controls, conduit, wiring, etc. Remove all exposed conduit and wiring back to the panel from which it is served. Mark all disassociated breakers "spare". Unless otherwise noted, the Contractor shall fill and patch all wall, floor, and ceiling openings resulting from this demolition work with materials and finishes identical to adjacent materials and finished
   3. Perform required demolition to accomplish new work.
      a. Remove abandoned wiring to source of supply.
      b. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
      c. Disconnect abandoned outlets and remove devices.
      d. Remove abandoned outlets if conduit servicing them is abandoned and removed.
      e. Provide blank cover for abandoned outlets that are not removed.
      f. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
      g. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.
      h. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
      i. Remove equipment pads and patch, smooth floor to match surrounding conditions.
j. Cut underground conduit sub-up down to the floor, seal, patch over, smooth floor to match surrounding conditions.

k. Patch all holes in walls or ceilings from removed raceways to match surrounding conditions.

4. Accomplish work in neat workmanlike manner to minimize interference; annoyance or inconvenience such work might impose on Owner or other Contractors.

5. Unless otherwise noted, remove from premises materials and equipment removed in demolition work.

6. Equipment noted to be removed and turned over to Owner, shall be delivered to Owner at place and time Owner designates.

7. Where materials are to be turned over to Owner or reused and installed by Contractor, it shall be Contractor's responsibility to maintain condition of materials and equipment equal to that existing before work began. Repair or replace damaged materials or equipment at no additional cost to Owner.

8. Where demolition work interferes with Owner's use of premises, schedule work through Designer, Owner and with other Contractors to minimize inconvenience to Owner. Designer must approve schedule before Contractor begins such work.

D. Cleaning and Repair

1. Clean and repair existing materials and equipment that remain or are to be reused.

2. Panelboards.
   a. Clean exposed surfaces and check tightness of electrical connections.
   b. Replace damaged circuit breakers and provide closure plates for vacant positions.
   c. Provide typed circuit directory showing revised circuiting arrangement.

3. Luminaires:
   a. Remove existing luminaries for cleaning.
   b. Use mild detergent to clean exterior and interior surfaces; rinse with clean water and wipe dry.
   c. Replace lamps and broken electrical parts.

E. Concrete Work:

1. Provide cast-in-place concrete as required by Contract Documents unless otherwise noted.

2. Concrete shall comply with Division 03 - Concrete.

3. Provide anchor bolts, metal shapes and templates to be cast in concrete or used to form concrete as required for anchoring and supporting electrical equipment.

F. Painting:

1. Furnish equipment with factory-applied finish coats or paint equipment per Division 09 – Finishes unless specified otherwise.

2. Furnish equipment with factory applied prime finish unless otherwise specified.

3. If factory finish on equipment furnished by Contractor is damaged in shipment or during construction, refinish equipment to satisfaction of Designer.

4. Furnish one can of touch up paint for each final factory-applied finish coat of product.
1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. Rules and regulations of Federal, State and local authorities and utility companies, in force at time of execution of Contract shall become part of this specification.

1.6 REFERENCE STANDARDS

A. Agencies or publications referenced herein refer to the following:
   1. AEIC  Association of Edison Illuminating Companies
   2. ANSI  American National Standards Institute
   3. ASME  American Society of Mechanical Engineers
   4. ASTM  American Society for Testing and Materials
   5. BICSI  Building Industry Consulting Services International
   6. EIA   Electronic Industries Association
   7. FIPS  Federal Information Processing Standards
   8. FCC   Federal Communications Commission
   9. ICEA  Insulated Cable Engineers Association
  10. IEEE  Institute of Electrical & Electronics Engineers
  11. IESNA Illuminating Engineering Society of North America
  12. NEC   National Electrical Code
  13. NECA  National Electrical Contractors Association
  14. NEMA  National Electrical Manufacturers Association
  15. NESC  National Electrical Safety Code
  16. NETA  National Electrical Testing Association
  17. NFPA  National Fire Protection Association
  18. NIST  National Institute of Standards & Technology
  19. OSHA  Occupational Safety and Health Administration
  20. TIA   Telecommunications Industries Association
  21. UL   Underwriters Laboratories, Inc.

B. Work shall be in accordance with latest edition of codes, standards or specifications unless noted otherwise.

1.7 LISTING

A. Install materials bearing UL label or UL listing, unless UL label or listing is not available for that type of material.

B. Other nationally recognized testing agencies, acceptable to AHJ, are approved.

1.8 ENCLOSURES

A. Typical NEMA Enclosures and Usage
   1. NEMA 1 - Indoors. Falling dirt.
   2. NEMA 2 - Indoors. Falling dirt. Falling liquids. Light splashing.
   3. NEMA 3 - Outdoors. Sleet, snow, rain. Windblown dust.
   4. NEMA 3X - Same as NEMA 3 plus corrosion resistant.
5. NEMA 3S - Same as NEMA 3 plus mechanism operable when ice covered.
6. NEMA 3SX - Same as NEMA 3S plus corrosion resistant.
7. NEMA 3R - Outdoors. Rain, snow, sleet.
8. NEMA 3RX - Same as NEMA 3R plus corrosion resistant.
10. NEMA 4X - Same as NEMA 4 - Indoors plus corrosion resistant.
11. NEMA 4 - Outdoors. Rain, sleet, snow. Wind blown dust. Hose down.
12. NEMA 4X - Same as NEMA 4 - Outdoors plus corrosion resistant.
15. NEMA 6P - Same as NEMA 6 - Indoors plus corrosion resistant. Prolonged submersion.
17. NEMA 6P - Same as NEMA 6 - Outdoors plus corrosion resistant. Prolonged Submersion.
18. NEMA 7 - Indoors. Class I, Division 1 or 2, Groups A, B, C or D. (Flammable gas).
19. NEMA 9 - Indoors. Class II, Division 1 or 2. Groups E, R, or G. (Combustible dust).
20. NEMA 12 - Indoors. Falling Dirt. Falling liquids. Flying dust, lint and fibers. Oil or coolant seepage.
21. NEMA 13 - Same as NEMA 12 plus oil or coolant spraying or splashing.

1.9 SUBMITTALS

A. Shop Drawings (Product Data):
   1. Refer to Division 01 - Submittal Procedures.
   2. Note that for satisfying submittal requirements for Division 26, "Product Data" is usually more appropriate than true "Shop Drawings" as defined in Division 01. However, the expression "Shop Drawings" is generally used throughout Specification.
   3. Submit shop drawings for equipment and systems as requested in respective specification sections. Submittals which are not requested may not be reviewed.
   4. Specifically mark general catalog sheets and drawings to indicate specific items submitted and its correlation to specific designation for product in drawings.
   5. Specifically indicate proper identification of equipment by name and/or number, as indicated in specification and shown on drawings.
   6. When manufacturer's reference numbers are different from those specified, provide correct cross-reference number for each item. Clearly mark and note submittal accordingly.
   7. Submit complete record of required components when luminaires, equipment and items specified include accessories, parts and additional items under one designation.
   8. Include wiring diagrams for electrically powered or controlled equipment.
9. Submit prefabricated electrical enclosure layouts drawn to scale, including equipment, raceways, accessories and required working clearances. Submit electrical equipment room layouts concurrently with electrical distribution equipment submittals.

10. Where submittals cover products containing non-metallic materials, include "Material Safety Data Sheet" (MSDS) from manufacturer stating physical and chemical properties of components and precautionary considerations required.

11. Submit shop drawings or product data as soon as practicable after signing contracts. Submittals must be approved before installation of materials and equipment.

12. Submittals that are not complete, not permanent, or not properly checked by Contractor, will be returned without review.

B. Certificates and Inspections:
   1. Obtain and pay for inspections required by authorities having jurisdiction and deliver certificates approving installations to Owner unless otherwise directed.

C. Operation and Maintenance Manuals:
   1. Refer to Division 01 - Operation and Maintenance Data.
   2. Upon completion of work but before final acceptance of system, submit to Designer for approval, electronic copy of operation and maintenance manuals. After securing approval, submit to Owner per Div 01 - Operation and Maintenance Data.
   3. Organize manuals by specification section number and furnish table of contents and bookmarks or tabs for each piece of equipment or system.
   4. Manuals shall include the following:
      a. Copies of shop drawings
      b. Manufacturer's operating and maintenance instructions. Include parts lists of items or equipment, with component exploded views and part numbers. Where manufacturer's data includes several types or models, designate applicable type or model.
      c. Phone numbers and addresses of local parts suppliers and service companies
      d. Internet/WEB page addresses where applicable
      e. Wiring diagrams
      f. Start up and shut down procedure
      g. Factory and field test records
      h. Additional information, diagrams or explanations as designated under respective equipment or systems specification section
   5. Instruct Owner's representative in operation and maintenance of equipment. Instruction shall include complete operating cycle on all apparatus.
   6. Furnish O&M manuals and instructions to Owner prior to request for final payment.

D. Record Documents:
   1. Refer to General Conditions of Contract and Division 01 - Project Record Documents. Prepare complete set of record drawings in accordance with Division 01.

1.10 JOB CONDITIONS

A. Building Access:
   1. Arrange for necessary openings in building to allow for admittance of all apparatus.
B. Coordination:
   1. Equipment provided under other Divisions of these specifications.
      a. Motors
      b. Electrically powered equipment
      c. Electrically controlled equipment
      d. Starters, where specified
      e. Variable frequency drives, where specified
      f. Control devices, where specified
      g. Temperature Control wiring
   2. Provide the following devices required for control of motors or electrical equipment, unless noted otherwise:
      a. Starters
      b. Disconnect devices
      c. Control devices:
         1). Pushbuttons
         2). Pilot lights
         3). Contacts
      d. Conduit, boxes and wiring for Power wiring
      e. Conduit, boxes and wiring for Control wiring, except for control wiring systems as defined in Section 23 0901.
   3. Connect and wire equipment complete and ready to operate according to wiring diagrams furnished by various trades.
   4. Wire starters or other similar control devices furnished by others.
   5. Equipment and wiring shall be selected and installed for conditions in which it will be required to perform. (i.e., general purpose, weatherproof, rain tight, explosion proof, dust tight, or any other special type as required.)
C. Cutting and Patching:
   1. Refer to General Conditions of the Contract and Division 01 - Cutting and Patching.
   2. Perform cutting and patching required for complete installation of systems, unless otherwise noted. Patch and restore work cut or damaged to original condition. This includes openings remaining from removal or relocation of existing system components.
   3. Provide materials required for patching unless otherwise noted.
   4. Do not pierce beams or columns without permission of Designer and then only as directed. If openings are required through walls or floors where no sleeve has been provided, hole shall be core drilled to avoid unnecessary damage and structural weakening.
   5. Where alterations disturb lawns, paving, walks, etc., replace, repair or refinish surfaces to condition existing prior to commencement of work. This may include areas beyond construction limits.
D. Housekeeping and Cleanup:
   1. Refer to Division 01 - Closeout Procedures.
2. As work progresses or as directed by Designer, periodically remove waste materials from building and leave area of work broom clean. Upon completion of work, remove tools, scaffolding, broken and waste materials, etc. from site.

1.11 WARRANTY

A. Refer to Division 01 for general warranty requirements.

B. Refer to technical sections for warranty requirement for each system.
   1. Where no warranty requirements are called out, warrant as called out in Division 01 or for 1 year after acceptance by Owner (whichever is longer) equipment, materials, and workmanship to be free from defect.

C. Repair, replace, or alter systems or parts of systems found defective at no extra cost to Owner.

D. In any case, wherein fulfilling requirements of any guarantee, if this contractor disturbs any work guaranteed under another contract, this contractor shall restore such disturbed work to condition satisfactory to Designer and guarantee such restored work to same extent as it was guaranteed under such other contract.

E. Warranty shall include labor, material, and travel time.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

A. Refer to Division 01 - Product Requirements.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify elevations and dimensions prior to installation of materials.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under provisions of Division 01.

B. Store and protect products under provisions of Division 01.

C. Store in clean, dry space.

D. Maintain factory wrapping or provide cover to protect units from dirt, water, construction debris, and traffic.

E. Handle in accordance with manufacturer’s written instructions.

F. Handle carefully to avoid damage to components, enclosure, and finish. Lift only with lugs provided for the purpose.

G. Provide supplemental heat if required to prevent moisture contamination.
3.3 HOUSEKEEPING PADS

a. Provide concrete housekeeping pads for all floor-mounted equipment, outdoor equipment, and as shown on the drawings.

b. Pads shall be 4” high (above grade or finished floor) and be 3” wider and longer than equipment it supports with beveled edges.

c. Minimum 3000 PSI.

3.4 FLOOR, WALL, ROOF AND CEILING OPENINGS

A. Coordinate location of openings, chases, furred spaces, etc. with appropriate Contractors. Provide sleeves and inserts that are to be built into structure during progress of construction.

B. Remove temporary sleeves, if used to form openings, prior to installation of permanent materials. Utilize minimum 0.71 mm (24 ga) galvanized sheet metal for permanent sleeves unless otherwise noted.

C. Provide Schedule 40 carbon steel pipe with integral water stop for steel sleeves required below grade or to exterior.

D. Submit to Structural Engineer for review and approval size and location of core-drilled holes prior to execution.

E. Submit product data and installation details for penetrations of building structure. Include schedule indicating penetrating materials, (steel conduit, PVC conduit, cables, cable tray, etc.), sizes of each, opening sizes and sealant products intended for use.

F. Where penetrations of fire-rated assemblies are involved, seal penetrations with appropriate firestopping systems as specified in Section 26 0593 - Electrical Systems Firestopping.

G. Provide 50 mm (2”) clearance around penetration openings intended for raceways and cables. Where fire resistant penetrations are required, size openings in accordance with written recommendations of firestopping systems manufacturer.

H. Seal non fire-rated floor penetrations with non-shrink grout equal to Embeco by Master Builders, or urethane caulk, as appropriate.

I. Seal non-rated wall openings with urethane caulk.

J. Where penetrations occur through exterior walls into building spaces, use steel sleeves with integral water stop, similar to type "WS" wall sleeves by Thunderline Corporation. Seal annular space between sleeves and pipe with "Link-Seal" modular wall and casing seals by Thunderline Corporation, or sealing system by another manufacturer approved as equal by Engineer. Sealing system shall utilize Type 316 stainless steel bolts, washers and nuts.
3.5 EQUIPMENT ACCESS

A. Install raceways, junction and pull boxes, and accessories to permit access to equipment for maintenance. Relocate raceways or accessories to provide maintenance access at no additional cost to Owner.

B. Install equipment with sufficient maintenance space for removal, repair or changes to equipment. Provide ready accessibility to equipment and wiring without moving other future or installed equipment.

C. Locate electrical outlets and equipment to fit details, panels, decorating or finish at space. Designer reserves right to make minor position changes of outlet locations before work has been installed.

D. Verify door swings before installing room light switch boxes. Install boxes on latch side of door unless otherwise noted

3.6 EQUIPMENT SUPPORTS

A. Provide supporting steel not indicated on drawings as required for installation of equipment and materials including angles, channels, beams, hangers, etc.

B. Provide steel shell with plug type concrete anchors for attaching equipment to concrete. Plastic, rawhide or anchors using lead are not allowed.

C. Do not support equipment or luminaires from metal roof decking.

3.7 SUPPORT PROTECTION

A. In occupied areas, mechanical and electrical rooms and areas requiring normal maintenance access, guard certain equipment to protect personnel from injury.

B. Provide minimum 13 mm (1/2") thick Armstrong Armaflex insulation or similar product applied with Armstrong 520 adhesive on lower edges of equipment, including bus duct, cable tray, pull boxes and electrical supporting devices suspended less than 2.13 m (7 ft) above floors, platforms or catwalks in these areas.

C. Protect threaded rods or bolts at supporting elements as described above. Trim threaded rods or bolts such that they do not extend beyond supporting element.

3.8 ELECTRICAL SYSTEMS IDENTIFICATION

A. Refer to Section 26 0553 – Electrical Systems Identification.

3.9 ACCEPTANCE TESTING

A. Contractor shall engage testing and inspection agency to perform acceptance tests. Equipment to be tested is noted as "Testing by Testing Agency" in technical specification sections. Perform in accordance with Section 26 0812 – Power Distribution Acceptance Tests and Section 26 0813 – Power Distribution Acceptance Test Tables.

B. When testing is to be witnessed by Designer, Owner, or Inspector, notify them at least 10 days prior to testing date.
C. When equipment or systems fail to meet minimum test requirements, replace or repair defective work or materials as necessary and repeat inspection and test until equipment or systems meet test requirements. Make repairs with new materials.

D. Contractor is responsible for certifying in writing equipment and system test results. Certification shall include identification of portion of system tested, date, time, test criteria and name and title of person signing test certification documents.

E. Maintain copies of certified test results, including those for any failed tests, at project site. At completion of project, include copies of test records and certifications in O&M Manuals.

3.10 START-UP

A. Systems and equipment shall be started, tested, adjusted, and turned over to Owner ready for operation. This includes "Owner-Furnished, Contractor-Installed" (OFCI) and "Contractor-Furnished, Contractor-Installed" (CFCI) systems and equipment.

B. Follow manufacturer's pre-start-up checkout, start-up, trouble shooting and adjustment procedures.

C. Contractor shall provide services of technician/mechanic knowledgeable in start-up and checkout of types of systems and equipment on project.

D. Provide start-up services by manufacturer's representative where specified or where Contractor does not have qualified personnel.

E. Coordinate start-up with all trades.

3.11 CLEANING

A. Clean systems after installation is complete.

B. Vacuum debris from panelboards, switchboards, motor starter and disconnect switch enclosures, junction boxes and pull boxes two weeks before energization and again prior to completion.

C. Where louvers are provided in switchgear or transformer enclosures, vacuum louvers free of dust and dirt.

D. Clean luminaire lenses and lamps at time of installation and clean lens exteriors just prior to final inspection.

E. Thoroughly clean equipment of stains, paint spots, dirt and dust. Remove temporary labels not used for instruction or operation.

END OF SECTION
GENERAL NOTES:

1. THIS DRAWING SHOWS SOME OF THE MAJOR VALVES, SPECIALTIES AND CONTROLS BUT NOT ALL FOR CLARITY REASONS. REFER TO THE FLOW DIAGRAMS AND DETAILS FOR ALL VALVES, SPECIALTIES AND CONTROL REQUIREMENTS.

2. CONNECT TO EXISTING DUCTWORK IN VERTICAL.

3. NEW LOCATION OF TOWER BLOWDOWN ASSEMBLY.

4. ROUTE TOWER BLOWDOWN PIPING TO EXISTING FLOOR DRAIN.

5. PROVIDE REFRIGERANT DETECTOR.

6. CONNECT NEW DETECTOR TO EXISTING REFRIGERANT DETECTION SYSTEM.

7. RELOCATE 4"F TO ALLOW FOR INSTALLATION OF CHW AND CDW HEADERS. NEW 4"F SHALL MATCH X-4"F MATERIAL AND CONNECTIONS TYPE.

8. X-4"F IS GALVANIZED STEEL PIPE WITH GROOVED ENDS.
INSTALL 24" STEEL CASINGS FOR CHILLED WATER SUPPLY AND RETURN UNDER EXISTING STEAM TUNNEL. NO PIPE JOINTS ARE ALLOWED INSIDE CASING. PROVIDE SUPPORT SPACERS FOR PVC PIPING AS REQUIRED. CASING SHALL EXTEND MINIMUM OF 3 FEET PAST TUNNEL WALL.

CONNECT TO EXISTING 16" CHILLED WATER RETURN WITH NEW DUCTILE IRON TEE AND RESTRAINTS. EXISTING PIPING IS PVC. NEW PIPING MUST EXTEND FROM CONNECTION TO EXISTING WEST TO NEW VALVE DURING SHUTDOWN.

ALTERNATIVELY, THE CONTRACTOR MAY ELECT TO INSTALL AN ADDITIONAL NEW 16" VALVE AT THE CONNECTION TO EXISTING SUCH THAT THE PIPING EXTENDING WEST CAN BE INSTALLED OUTSIDE OF A SHUTDOWN.

EXTEND NEW PVC CHILLED WATER SUPPLY PIPING INTO THE EXISTING AREAWAY. TRANSITION TO STEEL PIPING INSIDE THE AREAWAY.

AS-BUILTS FROM 1997 SHOW THE EXISTING PIPING AS 24". IN BIDDING THE CONTRACTOR SHALL ASSUME THE CONNECTION WILL BE MADE WITH A 24X16 TEE. CONFIRM SIZE IN THE FIELD PRIOR TO ORDERING FITTINGS AND PROVIDE EITHER A 24X16 TEE OR 16X16 TEE TO MATCH FIELD CONDITIONS.
AN INSPECTION TO IDENTIFY LEAD CONTAINING OR COATED BUILDING COMPONENTS HAS BEEN CONDUCTED AND CAN BE FOUND IN THE PROJECT SPECIFICATIONS. THIS REPORT IS PROVIDED FOR THE ASSOCIATED ELECTRICAL PANELS, CONTRACTOR'S USE AND MAY NOT BE ALL INCLUSIVE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COMPLY WITH ALL VIRGINIA CONDUIT, CABLING, AND STRUCTURAL PERTAIN TO EMPLOYEE EXPOSURES TO LEAD. ALL LEAD AND LEAD-COATED BUILDING COMPONENTS SHALL BE RECYCLED TO THE EXTENT POSSIBLE.

AN ASBESTOS INSPECTION WAS PERFORMED AND NO ACM WAS FOUND. THE ASBESTOS INSPECTION REPORT IS INCLUDED AS AN APPENDIX TO THE PROJECT SPECIFICATIONS.

CU FEEDER SCHEDULE - 3 WIRE AND GROUND

<table>
<thead>
<tr>
<th>FEEDER</th>
<th>NO. CURRENT CARRYING GROUND</th>
<th>FEEDER</th>
<th>GEC</th>
<th>COMMENTS</th>
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<tr>
<td>125 - T</td>
<td>1 4 # 1 1 # 6 1-1/2&quot;</td>
<td>130</td>
<td>1 # 6</td>
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B RANCH CIRCUIT SCHEDULE

<table>
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<tr>
<th>PHASE</th>
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<td>1 3 # 1</td>
<td>1 # 6</td>
<td>1-1/2&quot;</td>
<td>130</td>
</tr>
</tbody>
</table>

H VFD CHWP-4A

Bus Rating 100A Volts 480 kAIC Rating: 25 Location: Litton Reaves Chiller Plant

Main Circuit Breaker 100A Phase 3 Wire 3 Nema Rating: 1 Mounting: Surface

Remarks - Main Breaker shall have LI trip unit

Load Type Legend

G = General EG = Equipment Ground (30mA)

100/3 1 5.50 8.50 3.00 2 100/3 M X-CHWP-4B - M 3 5.50 8.50 3.00 4 - M -- M -- 5 5.50 8.50 3.00 6 - M - M - 6

JP = Junction Panel

8 R = Receptacle ST = Shunt Trip FR = 100% Rated

Total Load - This Panel, KVA 30.7 26.9

ELECTRICAL EQUIPMENT SOURCE FOR PUMPS. FOR THE SOURCE OF EACH CIRCUIT TO BE DEMO.

3 ROOF BACK TO THE SOURCE. THAT INCLUDES AUXILIARY COMPONENTS SUCH AS HEAT CONTROLS.

5 CHILLERS BACK TO SOURCE. DEMO CONDUIT BACK TO WALL OF ROOM INTO PULLBOX LABELED, BACK TO THE WORK.

6 DEMO OF CONDENSER WATER PUMPS BACK TO THE SOURCE. PROVIDE ALL WORK TO CONNECT TO MOTOR AND BACK TO NEW PANELBOARD AND MAKE OPERATIONAL.

3 NEW VFD FOR EXISTING MOTOR. PROVIDE ALL WORK TO MAINTAIN COVERED DEADFRONT SECTION.

9 PROVIDE A 20A/1P CIRCUIT BREAKER IN "RP1" WITH 2-#12 + 1-#12G IN 3/4" EMT CONDUIT.

10 PROVIDE A 20A/2P (30mA EG) CIRCUIT BREAKER TO MATCH EXISTING MCC FOR SQD MODEL 5. PROVIDE FILLER PLATES AND ALL WORK TO MAINTAINED COVERED DEADFRONT SECTION.

23 PROVIDE A 20A/1P CIRCUIT BREAKER IN "RP1" WITH 2-#12 + 1-#12G IN 3/4" EMT CONDUIT.

14 PROVIDE A 20A/2P (30mA EG) CIRCUIT BREAKER TO MATCH EXISTING MCC FOR SQD MODEL 5. PROVIDE FILLER PLATES AND ALL WORK TO MAINTAINED COVERED DEADFRONT SECTION.

17 PROVIDE A 20A/1P CIRCUIT BREAKER IN "RP1" WITH 2-#12 + 1-#12G IN 3/4" EMT CONDUIT.

26 PROVIDE A 20A/2P (30mA EG) CIRCUIT BREAKER TO MATCH EXISTING MCC FOR SQD MODEL 5. PROVIDE FILLER PLATES AND ALL WORK TO MAINTAINED COVERED DEADFRONT SECTION.
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2/7/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) ____________________________:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

The following question concerns Specifications Section (number) _________, page __________, paragraph_______:

Section 010010 Paragraph 1.1E.2.a.1) states that all work in SWCP shall be completed and the plant fully operational by February 21, 2020 and the bid form (page 5 of 8) states that NTP shall be issued on or before May 31, 2019 and the Owner furnished chiller will be delivered in the month of November 2019. In order to install, pipe, wire, startup, commission the chiller and associated equipment, we feel that the date in Section 010010 Paragraph 1.1E.2.a.1) should be changed from February 21, 2020 to April 15, 2020 (typical start of cooling season).

RESPONSE: Repeat from Addendum 3 Questions - Due to the year-round cooling loads that are served by the SWCP, the specified dates are required to be met.

All responses to questions will be made by Addendum.

Question submitted by: Candice Geter W.M. Schlosser Company, Inc.
Name Organization

Bidders shall submit form to: Brad Petterson AEI
Name Organization

Gerard Folio Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
Date: 2/7/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) ________________________________:

__________________________________________________________________________

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The following question concerns Specifications Section (number) ________, page __________, paragraph______:

Section 010010 Paragraph 1.1E.2.a.2) states that all work in NCP shall be completed and the plant fully operational by April 3, 2020 and the bid form (page 5 of 8) states that NTP shall be issued on or before May 31, 2019 and the Owner furnished chiller will be delivered in the month of December 2019. In order to install, pipe, wire, startup, commission the chiller and associated equipment and systems, we feel that the date in Section 010010 Paragraph 1.1E.2.a.2) should be changed from April 3, 3010 to May 15, 2020

RESPONSE: Repeat from Addendum 3 Questions - Due to the year-round cooling loads that are served by the NCP, the specified dates are required to be met.

All responses to questions will be made by Addendum.

Question submitted by: Candice Geter W.M. Schlosser Company, Inc.
Name Organization

Bidders shall submit form to: Brad Petterson AEI
Name Organization

Gerard Folio Virginia Tech
Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
DGS-30-272
(Rev. 04/15)

PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2/7/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number)
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The following question concerns Specifications Section (number) _______, page ________, paragraph______:

Please provide weights for each of the chillers (as shipped to the project).

RESPONSE: Refer to the chiller dimensional and weight data sheets provided in Addendum 3.

All responses to questions will be made by Addendum.

Question submitted by: Candice Geter W.M. Schlosser Company, Inc.
Name Organization

Bidders shall submit form to: Brad Petterson A.E.I
Name Organization

Gerard Folio Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2/7/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) ________________________________:

________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

The following question concerns Specifications Section (number) ________, page __________, paragraph______:

Please provide copies of the pre-priced quotations from Trane and Siemens for the Division 25 work.

RESPONSE: Refer to the proposals provided in Addendum 3.

All responses to questions will be made by Addendum.

Question submitted by: Candice Geter W.M. Schlosser Company, Inc.
Name Organization

Bidders shall submit form to: Brad Petterson AEI
Name Organization
Gerard Folio Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
DGS-30-272
(Rev. 04/15)

PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2/7/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number):

The following question concerns Specifications Section (number) 260553, page 2.2.6.2, paragraph 3.1.6.3 & 4 3.1.7.

Electrical System Identification specification requires installation of Arc Flash Hazard Labels and Maximum Fault current labels. Is a Power System Study including short circuit study and arc flash hazard analysis required. If so, please provide specification for study and define the scope of new and existing equipment that will be included at the NCP, the SWCP and each building included in the Additive Bid Item #3 package.

RESPONSE: Power systems study to include arc flash analysis shall be provided by the A/E. Contractor shall print and apply the stickers.

All responses to questions will be made by Addendum.

Question submitted by: Candice Geter W.M. Scholsser Company, Inc.

Name Organization

Bidders shall submit form to: Brad Petterson AEI

Name Organization

Gerard Folio Virginia Tech

Email addresses: bpetterson@acieng.com; gfolio@vt.edu
Date: 2/7/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) E.2.203 & E.2.601:

E2.203 Note 9 and E.2.601 Panel Schedule PP1 - please provide circuit numbers for the 6 roof level control valves.

RESPONSE: Use spare circuit breakers in Pnl PP1.

The following question concerns Specifications Section (number)_______, page_______, paragraph_______:

All responses to questions will be made by Addendum.

Question submitted by:____ Candice Geter ______________________________ W.M. Scholsser Company, Inc.
Name ____________________________________________________________ Organization

Bidders shall submit form to: Brad Petterson _________________________ AFI
Name ___________________________ Organization

Gerard Folio ___________________________ Virginia Tech
Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2/7/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) E.1.402 & E.1.602:

Main Breakers for MDF3 & 4 - please clarify if these main breakers are fixed mounted or drawout type. E.1.402 and specification section 262414.2.5.A.1 indicated fixed mounted. E.1.602 indicates drawout type.

RESPONSE: The intent is for the main breakers to be electrically operated, fixed mounted type.

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

All responses to questions will be made by Addendum.

Question submitted by: Candice Geter
Name

W.M. Scholsser Company, Inc.
Organization

Bidders shall submit form to: Brad Petterson
Name

AEI
Organization

Gerard Folio

Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
PREBID QUESTION FORM  
(Use separate Form for each question submitted.)

Date: 2/7/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) E.4.209:

Clarify the size of the breaker to be installed in Existing MCC and the size of the feeder from MCC to Panel HV1. Panel HV1 is rated at 100A and the one line indicates installing a 600A breaker in the existing MCC and 600A feeder to HV1.

RESPONSE: Provide 100A breaker in existing MCC and size (125-3) feeder circuit to new HV-1 panelboard. This drawing shall be revised by Addendum 4.

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

All responses to questions will be made by Addendum.

Question submitted by: Candice Geter W.M. Scholsser Company, Inc. Name Organization

Bidders shall submit form to: Brad Petterson A/EI Name Organization
Gerard Folio Virginia Tech Email addresses: bpetterson@acieng.com; gfolio@vt.edu
An extensive engineered sheeting and shoring system will required for demolition and installation of the new chiller building. Please provide us a specification for supportive excavation.

RESPONSE: Refer to the performance based specification requirements in Section 230502.

All responses to questions will be made by Addendum.

Question submitted by:  Candice Geter                    W.M. Schlosser Company, Inc.
Name                                      Organization

Bidders shall submit form to:  Brad Petterson               AEI
Name                                      Organization

                                      Gerard Folio                Virginia Tech
                                      Name                                      Organization

Email addresses:  bpetterson@aeieng.com; gfolio@vt.edu
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2-1-19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) M.4.204, Note #1 VS. MU.4.117, Note #3:

Please clarify under slab pipe material, PVC or Pre-insulated steel w/ HDPE jacket.

The following question concerns Specifications Section (number)_________, page _______, paragraph ______:

RESPONSE: Piping underslab at Dietrick shall be insulated steel with HDPE jacket per M.4.204, Note 1. More specifically this shall be schedule 40 steel piping with polyurethane insulation and HDPE jacket equal to Thermacor Ferro-therm, Perma-Pipe Xtru-Therm or Ravanco. Both of these sheets will be revised and reissued by Addendum 4 to clarify.

All responses to questions will be made by Addendum.

Question submitted by: Mike Kelley Waco Inc.
Name Organization

Bidders shall submit form to: Brad Petterson AEI
Name Organization

Gerard Folio Virginia Tech
Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
Date: 2-7-19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) ____________________________:

Neither the plans nor the P&ID's show any flexible pipe connections at the pumps or chillers. Is that the intent, not required?
If not please provide schedule and specifications for flex connectors.

The following question concerns Specifications Section (number)_______, page ________, paragraph ____:

RESPONSE: Flexible connections are not required as these pieces of equipment are dynamically balanced, minimal vibration is expected and even if minimal vibration is transmitted to the building structure, the structure is independent of other buildings/structures and will not cause vibration or noise nuisance to students/staff outside of the NCP and SWCP.
Related, note the requirements for piping connection strain free verification testing at the pumps and chillers in Section 230504, 3.2.C. and Section 232123, 3.1.G.

All responses to questions will be made by Addendum.

Question submitted by: Mike Kelley  Waco, Inc.
Name  Organization

Bidders shall submit form to: Brad Petterson  AEI
Name  Organization

Gerard Folio  Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
Date: 2-7-19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) ________________________________:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

The following question concerns Specifications Section (number) 233400, page _________, paragraph ______:

Specification 23 3400 Fans.

We have found no fans on the plans or equipment schedule, please advise.

RESPONSE: No new fans are required for the project. This Section can be omitted/ignored.

All responses to questions will be made by Addendum.

Question submitted by: Mike Kelley Waco, Inc.
Name Organization

Bidders shall submit form to: Brad Petterson AEI
Name Organization

Gerard Folio Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2-7-19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) M.1.201 & 202:
For rigging and equipment handling purposes, could you please provide some information regarding the NCP chiller room floor slab. Specifically in the area/pathway that will be used to remove and replace the chillers. We need to know if the existing conditions will support the chillers and rigging equipment. Please advise.

The following question concerns Specifications Section (number) 233400, page _______, paragraph ____:

RESPONSE: Refer to the attached record drawing for the ground floor of the NCP. Note that as part of this project, the existing slab, pads, and trenches are being modified to accommodate the new equipment.

All responses to questions will be made by Addendum.

Question submitted by: Mike Kelley Waco, Inc.
Name Organization

Bidders shall submit form to: Brad Petterson AEI
Name Organization
Gerard Folio Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2-7-19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) M.4.208:

Can the pipe rack that is supporting the existing 18" pipe be re-used for the new 12"? This rack runs from the walk in freezer to the mechanical room.

The following question concerns Specifications Section (number)233400, page _______, paragraph _____:

RESPONSE: The existing pipe rack is used on uninsulated piping. Provided new pre-insulated pipe supports are used for thermal break, yes the existing structural support components could be reused.

All responses to questions will be made by Addendum.

Question submitted by: Mike Kelley Waco, Inc. Name Organization

Bidders shall submit form to: Brad Petterson AEI Name Organization

Gerard Folio Virginia Tech Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
Date: 2-7-19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) M.2.204: The re-routed 4"F pipe shown running along col. line 4.6, between columns "C" & "D", what is the material for this line?

The following question concerns Specifications Section (number) 233400, page _______, paragraph _____:

RESPONSE: New 4"F (Fire) pipe shall match existing material and type. The material is galvanized pipe with grooved couplings. Drawing will be updated to reflect this information and reissued by Addendum 4.

All responses to questions will be made by Addendum.

Question submitted by: Mike Kelley Waco, Inc.
Name Organization

Bidders shall submit form to: Brad Petterson AEI
Name Organization
Gerard Folio Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: Feb. 5, 2019

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number):

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

23 0511 Variable Frequency Drive Systems

Please see the attached list of questions.

RESPONSE: Refer to individual responses on the attached list of questions.

All responses to questions will be made by Addendum.

Question submitted by: Don Benton 336-312-1403 dbenton@esscoinc.com

Name Organization

Bidders shall submit form to: Brad Petterson AFI

Name Organization

Gerard Folio Virginia Tech

Email addresses: bpetterson@aeieng.com, gfolio@vt.edu
February 5, 2019
Virginia Tech. Chiller Plant Phase II

Questions for specification Section 23 0511

1.4.D Calculations indicating conformance with electrical noise per this section is to be based on the whole building. Since we are just quoting the pump VFDs there are other drives that would have to be included. Who is to be responsible for this calculation?

Response: Provide calculations assuming the cooling tower VFDs have a 5% Z line reactor and no additional harmonic mitigation per M.1.601. Provide calculations for the elec service(s) that connect to the new VFDs. A calculation for the existing building electrical system that is untouched is not required.

1.5.A As with 1.4.D above harmonic levels to meet IEEE 519 at the point of common coupling indicated would be with the whole building load. Who is responsible for determining this and the mitigating harmonic devices needed?

Response: Consider the PCC on the line side of the service transformer for just the services connected to the new VFDs. A calculation for the existing building electrical system that is untouched is not required.

1.5.B States the VFD manufacturer shall perform harmonic analysis at the output of the distribution transformer to determine IEEE 519 compliance. Again there are other VFDs being supplied by others that impact this determination. Who is responsible?

Response: Refer to the response above.

1.5 A and B conflict between the point of common coupling for harmonic measurement. Primary or secondary side of the transformer?

Response: Consider the PCC on the line side of the service transformer.

1.7.D What is meant by “training for each VFD different system”?

Response: Provide training for each different VFD vendor (if applicable). If the cooling tower VFDs are inherently different regarding mnfr/model than the pump VFDs then two separate training sessions are required.

2.3.I This specification would require the VFD to utilize dynamic braking or line regeneration to prevent the VFD from “shutdown” or tripping on an overvoltage trip if it experienced motor regeneration. I would not think this is needed on a pump drive. This would be at additional cost to the drive.

Response: Bid per the specification. It is acceptable to include a voluntary alternate deduct for consideration.

2.3.M Request of power loss ride through of 3 cycles. Is allowing the drive to slow down acceptable during this event if needed to keep the drive from tripping? Is power loss defined as 100% loss of line power?

Response: Meet the spirit of the specification which is for the VFD to ride-thru momentary power flicker and anomalies without shutting down requiring a restart.
2.4.1 What is PCV stand for?
Response: This is a typo and should be "PCB" as described in several sections just above.

2.8 A & B This is very specific testing requirements that most likely will not be met by the drive manufacturer. Will the VFD manufacturer’s standard testing be acceptable?
Response: Assume that is acceptable for the Bid.

3.3 A requirement for a 3rd part to perform start up and training. Will ESSCO’s staff be acceptable? We are the authorized service center for the ABB drives that we will be offering.
Response: Yes, this is acceptable.

General Question:

Would we be allowed to offer ABB’s Ultra Low Harmonic drive in lieu of a fixed harmonic trap filter? This provides the benefit of a smaller foot print and a superior harmonic mitigation performance.

Response: Yes, as long and the performance meets or exceeds the specifications. This includes physical dimensions and heat dissipation.

Mark IDs for the VFDs differ from the mark IDs for the pumps. We have crossed reference them the best we can but updated drawings with accurate mark IDs are needed.

Response: Acknowledged. State your assumption for size of VFD for each name cross referenced to ensure bid is accurate.
DGS-30-272
(Rev. 04/15)

PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: 2/8/19

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number):

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RESPONSE: The elevation of the top of the slab/pad that the vertical turbine pumps will be mounted on is 2076.80 (see Detail 9/S.1.301) and the elevation of the sump bottom is 2066.47 (see Section 1/S.1.201).

The following question concerns Specifications Section (number) 23, page 2123-6, paragraph 2.46. Spec refers to "total sump depth (on structural drawings)."

I cannot find this information in structural or mechanical drawings.

Need to know sump depth in order to quote the vertical turbine pumps.

All responses to questions will be made by Addendum.

Question submitted by: Ralph Ownby

Carotek, Inc.

Name

Organization

Bidders shall submit form to: Brad Petterson

Name

AEI

Gerard Folio

Name

Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
Date: 2-5-2019

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) C.0.007 & C.1.401:

The pavement repair detail on Sheet C.0.007 calls for milling of travel ways adjacent to open cut trenches. Sheet C.1.401 shows the area to be milled. The trenches in Scope of Work 3 & 4 do not show milling in the roadway. Are we to assume these trenches require the same milling detail per Sheet C.0.007?

RESPONSE: Milling of existing paved surfaces adjacent to the new utility trenches shall be provided for all scopes of work per "Pavement Repair Detail AP-1" on Sheet C.0.007. Additional milling is required beyond the detailed areas for the sections of Stanger Street (curb face to curb face) and Barger Street (resurface existing concrete from previous project with asphalt) as shown on Sheet C.1.401 and C.1.402.

All responses to questions will be made by Addendum.

Question submitted by: Brian Wolsey

Name: Faulkner Construction

Bidders shall submit form to: Brad Petterson

Name: AEI

Gerard Folio

Name: Virginia Tech

Email addresses: bpeterson@aeieng.com; gfolio@vt.edu
Date: 2-5-2019

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) C.0.007:

Sheet C.0.007 shows a typical Concrete Sidewalk Section. Is there another detail for "Heavy Duty Concrete Repair" or is this section to be used for all concrete replacement on this project?

RESPONSE: The "Site Concrete Cross Sections (CP-1)" details shall be used for sidewalks only. The "Pavement Repair Detail (AP-1)" shall be used for all other roads, drives and other "heavy duty" locations.

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

All responses to questions will be made by Addendum.

Question submitted by: Brian Wolfe
Name
Organization: Faulconer Construction

Bidders shall submit form to: Brad Petterson
Name
AEI
Organization

Gerard Folio
Name
Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu
Date: 2/1/2019

Project Title: Construct Chiller Plant Phase II

Project Code No.: 208-18268-000

The following question concerns Drawing Sheet (number) E.2.201:

Note 9 references relocating existing control valve and to refer to mechanical dwgs for exact location. I looked at the dwgs and spoke with my mechanical estimators and we cannot find a valve in that area. Please advise

RESPONSE: This note refers to the relocation of the existing blowdown drain valve. Refer to Sheet Keynote 2 on M.2.202, Sheet Keynote 3 on M.2.204, Sheet Keynote 1 on M.2.403, and Sheet Keynote 1 on M.2.404.

The following question concerns Specifications Section (number)_______, page ________, paragraph ________:

All responses to questions will be made by Addendum.

Question submitted by: Chris Harrison G.J. Hopkins Inc.
Name Organization

Bidders shall submit form to: Brad Petterson AEI
Name Organization
Gerard Folio Virginia Tech

Email addresses: bpetterson@aeieng.com; gfolio@vt.edu