

SECTION 15000
BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General Conditions, General Requirements, and Division 1 of the Specifications, apply to all Sections of Division 15.
- B. Other Contract Documents complement the requirements and apply to the work of Division 15.
- C. Section 02310 – Earthwork.
- D. Section 09900 – Painting.

1.2 SCOPE OF WORK

- A. The work of this Section shall include the furnishing of systems, equipment and materials specified in this Division, and as called for in the Mechanical Drawings. All facilities, supervision, coordination, transportation, handling, labor and methods for the fabrication, installation, interconnections, painting and other finishes, start-up, tests, adjustments, clean-up and other necessary work for the complete and satisfactory systems and equipment, ready for operation and use, shall be included. Whenever the words "Contractor" appear in this Division, they refer to the Contractor responsible for work specified in Section 15000. The Contractor shall be responsible for the design, procurement, installation, and maintenance of the fire protection system, including but not limited to fire alarm, fire detection, fire extinguishing, fire suppression, fire protection system design details, and shall be responsible for all those documents, drawings, sections of specifications, design requirements, and details affect work herein specified. All errors, omissions, conflicts, and omissions reported to Architect and Owner prior to commencement of work shall be corrected at the Contractor's expense.
 - B. Drawings for the work are diagrammatic, intended to convey the general arrangement and locations of the work and not to indicate the actual construction and as other work will permit. Because of the nature of the work, basic items such as necessary duct and pipe offsets, pipefittings, and equipment shall not be shown. Contract documents show design basis equipment and materials. The Contractor shall be responsible for selecting the District approved equipment of the design basis performance, efficiency, weight, physical size and configuration. The Contractor shall be responsible for the necessary design modifications and for coordinating the work to meet all intended requirements of the original design documents. The Contractor shall provide all equipment, duct and pipefittings, access panels, sleeves, inserts, and accessories, by code or other Sections shall be coordinated and included for the work.
 - C. Changes from the Contract Documents required to make this work conform to the actual construction or other work of other trades shall be made by the Contractor at the cost to the Owner and shall not impact on the time schedule of the work. All changes to the Contract Documents shall be shown on shop drawings and shall require the Contractor's approval before commencing the work. Failure to follow the approved shop drawings shall result in the forced removal of all work, performed prior to approval. The Contractor shall include all changes.
 - D. Equipment specification may not deal individually with the minimum requirements for components, parts, controls and devices which may be required to meet the performance specified or as required to meet the equipment design.

Where such items are required, they shall be included by the supplier of the equipment,

15682	Air Cooled Water Chillers
15684	Centrifugal Water Chillers
15686	Water Cooled Rotary Water Chillers
15712	Cooling Towers
15765	Variable Frequency Drive Units
15781	Packaged Roof Top Air Conditioning Units
15801	Water Treatment
15817	Electric Resistance Duct Heaters
15855	Air Handling Units
15870	Power Ventilators
15885	Air Filters
15890	Ductwork
15895	Ductwork Accessories
15900	Energy Management and Control System (Automated Logic)
15930	Variable Air Volume Terminal Units
15936	Grilles Registers, Diffusers
15990	Start-up Requirements for HVAC Systems
15991	Testing, Adjusting and Balancing of HVAC Systems
15992	Tests - Piping

B. Additional Associated Sections from Division 16

16650	Energy Management and Control System (Automated Logic)
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C. DEFINITIONS

PIPING: As used herein, is defined as pipe, fittings, valves, flanges, unions, specialties and accessories and appurtenances necessary for, or incidental to, a complete system.

DUCTWORK: As used herein, is defined as all air delivery and recirculation and exhaust ducts whether of sheet metal or other mate

PART 2 MATERIALS

2.1 GENERAL

- A. Each system component installed by Contractor shall meet or exceed performance specification requirements listed in the Contract Documents including all drawings, all sections of the Specifications, HVAC, Plumbing and Fire Protection Design Requirements, HVAC, Plumbing and Fire Protection System Design Details. Components with a lesser degree of performance or quality as determined by Owner Representatives, Plan Reviewing Architects and Engineers, design Architects and Engineers or identified by Building Inspectors, or documented as inferior in the final Test and Balance Report will not be accepted and shall be replaced with no additional charge to Owner.
- B. Materials and equipment shall be new, unused, standard current products from manufacturers regularly engaged in the production of such equipment and shall bear label of the Underwriters' Laboratory for the intent use or shall be materials approved by the code enforcing agency.
- C. Where two or more units of the same class of equipment or material are required, these shall be the product of a single manufacturer throughout entire project and shall fit in the allocated spaces provided, complying with all clearances and codes.
- D. All hardware and accessory fittings shall be a type designed, intended or appropriate for use, be compatible and compliment the item with which they are used. They shall have corrosion protection suitable for atmosphere in which they are installed. Florida Tech is located in a Coastal Environment, all exterior materials shall be Stainless Steel, Hot-Dipped Galvanized, or painted in accordance with Section 09900 – Painting, unless otherwise approved. All such hardware shall be U.S. standard size.
- E. All materials including insulation, jackets, and adhesives shall have a Flame Spread Rating not exceeding 25, and Smoke Developed Rating not exceeding 50, when tested in accordance with NFPA 255, "Methods of Test of Surface Burning Characteristics of Building Materials". Submittal data shall specifically indicate those ratings.
- F. All materials and equipment shall be fabricated in the United States of America and shall be labeled accordingly. Foreign made materials and equipment are not acceptable unless specified in Contract Documents.
- G. All equipment and piping supports shall be hot dipped galvanized except as otherwise noted in Contract Documents. Hangers for copper pipe shall be vinyl coated. Do not use copper clad hangers.
- H. Air conditioning system components shall conform to federal, state and local sound emission and vibration isolation guidelines. Objectionable noise or excessive vibration created in any part of the building by operation of any equipment under this contract will not be permitted. Contractor shall attenuate noise and isolate various items of equipment from the building structure and take all steps that may be necessary to eliminate objectionable noise or excessive vibration produced by Division 15 equipment. If noise attenuation or vibration isolation measures do not produce satisfactory results all components which prove to be in violation shall be replaced at no additional cost to the Owner, to comply with codes and ordinances having jurisdiction at the job site.
- I. Follow installations directions and recommendations of material and equipment manufacturers.

PART 3 EXECUTION

3.1 GENERAL

- A. The Mechanical Contractor must be in good standing with the Florida Institute of Technology. Florida Statutes, Chapter 489 requires all construction work to be done by licensed Contractors.

The work being performed shall be within the scope of Contractor's license. Any person who is not licensed must work under direct supervision of a person who has licenses required by the state law and by the county or municipal licensing ordinances. The job foreman must speak English and must have ten-years experience of installing the tonnage of mechanical equipment specified in the contract documents. Florida Tech may request the change of the job foreman. Workers skilled and competent in the type of work involved shall accomplish the installation. Workmanship throughout shall correspond to the standards of the best trade practices.

- B. Work other than interior work shall commence as soon as the building has sufficiently advanced in construction layout. No interior work shall be installed until the building roof is in place and watertight and the building is completed to a stage, that in opinion of the A/E, is acceptable and not detrimental to work to be installed.
- C. Contractor shall install all systems and equipment in accordance with the Contract Documents, and equipment or material manufacturer recommendations and instructions. Contractor shall commission, prepare and adjust HVAC and other mechanical systems prior to Owner's independent test & balancing work.
- D. Work lines and established grades shall be in strict accordance with the Contract Documents. The Contractor shall be responsible for furnishing to all trades, in ample time, any information they may require to construct all equipment bases, trenches, pits, chases, and openings in floors, walls and finishes, and to provide clearances to accommodate the work. The contractor shall set all sleeves, anchor bolts or inserts to fasten equipment before adjacent concrete work is poured.
- E. Coordinate location of all Division 15 work with Division 16. Do not run piping, ductwork and similar Division 15 work in National Electric Code (NEC) dedicated service areas for electrical equipment, including above panel boards, starters, communication panels, control panels, telephone backboards, data panels and similar electrical elements. Water piping shall not be installed directly above electrical equipment. When piping is required to be installed in electrical rooms a drain pan shall be provided to protect the electrical equipment. Refer questionable locations to the A/E for resolution prior to installation and correct non-conforming installed work at no additional cost to the Owner.
- F. All piping systems (chilled water, hot water, potable water, refrigerant piping, pneumatic piping,) shall be capped or plugged at the end of each workday until system is complete to prevent contamination.
- G. Provide a schematic wiring diagram for each component of HVAC system including controls. Diagrams shall be located in mechanical rooms and mounted on wall at eye level.
- H. Provide a schematic duct diagram indicating room numbers and component locations. Diagram for each air handler shall be located in mechanical room and mounted on wall at eye level.

3.2 COORDINATION OF WORK AND DRAWINGS

- A. Each contractor and subcontractor shall be responsible for coordinating the installation of his equipment/labor with the General Contractor and work of other Contractors and trades. The contractor shall harmonize the work of different trades so that interference between piping, ductwork, equipment and structural work will be avoided.
- B. It is recommended that each contractor prepare shop drawings at 1/4" to 1'-0" scale clearly indicating all applicable components and coordinate the same with all trades. It is recommended that coordination shop drawings show in detail the space conditions of all concerned trades, and be reviewed and accepted by the A/E. Contractor's failure to coordinate work between trades using coordination shop drawings or other means will not cause for any additional cost changes to the Owner, and/or changes to the project schedule. If the contractor installs his work before coordinating with other trades or causes interference with work of other trades, the contractor shall make necessary changes in the work to correct the condition, at no additional cost changes to the Owner, and/or changes to the project schedule.

- D. Provide cutting and patching, surface finishing and painting in the existing structure, as required for the installation of work, and furnish lintels and supports as required for openings. Cutting of structural members will not be permitted without prior approval of the A/E. Extent of cutting shall be minimized; use core drills, power saws or other machines that will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.8 SLEEVES

- A.

3.10 PROTECTION

- A. Special care shall be taken for the protection of equipment and materials furnished. Store and completely protect all materials from damage. Materials and equipment shall be kept clean and dry, free from deterioration by weather elements, painting, plaster, etc., until the project is completed. Damaged or defective materials shall not be installed. Damage from rust, paint, etc., and finishes on equipment which have been scratched or marred shall be touched-up to match original finish or shall be completely refinished to restore equipment to original condition.
- B. Where the installation or connection of equipment requires work in areas previously finished by other Contractors, the area shall be protected and not marred, soiled or otherwise damaged during the course of such work. The Contractor shall provide drop cloths, or any other materials necessary to protect floors, walls, furniture, equipment, etc. from soil or damage.
- C. Contractor shall arrange with other Contractors for promptly repairing and refinishing any damage to the building or its contents incurred by the installation or testing of the systems installed at no charge to the Owner.
- D. Where insulated piping extends to exposed areas, or to weather exposed areas, provide finish or jacket as specified in section 15260.
- E. Welding will be permitted in the existing buildings as long as the contractor provides for an approved fire watch and other required safety measures. Contractor's work, and construction means, methods, materials and equipment used shall not compromise the building fire safety, as well as safety and welfare of coworkers and building occupants.

3.11 MECHANICAL IDENTIFICATION

- A. Identification of mechanical systems shall be as specified in Section 15190; MECHANICAL IDENTIFICATION.

3.12 WIRING AND ELECTRICAL WORK FOR MECHANICAL EQUIPMENT

- A. All electrical work, equipment and wiring shall comply with National Electric Code.
- B. A standard wiring color code shall be established for each electrical and control component of the system and all similar devices shall be wired alike, maintaining the established color code throughout the entire project.
- C. The Mechanical Contractor, unless specified otherwise, shall furnish all Division 15 equipment, complete with motors and controls. The Mechanical Contractor shall set the motors in place. Some low power single-phase equipment may be furnished with unit mounted disconnects.
- D. Division 16 shall provide power services for motors and equipment furnished by Mechanical Contractor to include safety disconnect switches, (except unit mounted disconnects), motor starters, wiring and final connections. For special requirements for starters and disconnects in kitchen and exterior locations refer to Division 16. The entire fire alarm system including interlock wiring required for air handling unit shutdown shall be provided under Division 16.
- E. The Mechanical Contractor shall provide internal wiring, equipment control wiring, interlock wiring (except fire alarm system) for equipment furnished and temperature control wiring.
- F. The Mechanical Contractor shall check all electrical service and control connections to ensure proper operation of equipment and systems installed under work in Division 15.
- G. Division 16 shall furnish motor starters for motors furnished by Mechanical Contractor, except where other sections call for starters to be furnished by the equipment supplier (e.g. chillers).
- H. Mechanical Contractor shall furnish variable frequency drives (VFD) and set the same in place, ready to be wired by Division 16.

3.13 EXCAVATING TRENCHING AND BACKFILLING

- A. Provide excavation necessary for water supply piping, underground chilled water piping, etc., and backfill such trenches and excavations after work has been installed and tested. Care shall be taken in excavating, that walls and footings and adjacent load bearing soils are not disturbed, except where lines must cross under a wall footing. Where a line must pass under footing, the crossing shall be made by the smallest possible trench to accommodate the pipe. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of pipe or utility installation, than that which is authorized.
- B. Trenches for piping and utilities located inside foundation walls and to a point five-feet outside of the wall shall not be less than 16" nor more than 24" wider than the outside diameter of the pipe to be laid. The widths of trenches for piping and utilities located more than five-feet outside of building foundation walls, other than for sewers, shall be governed by conditions found at the site.
- C. Trenches for sewers shall be excavated so that the pipe may be laid to the alignment and depth required and the maximum trench widths up to the level of the outside top of the pipe shall be no more than 24". Other trench widths shall be governed by the conditions found at the site.
- D. Bottoms of trenches shall be so shaped that when pipe is in place the lower fourth of the circumference for the full length of the barrel will be supported on compacted fill. Bell holes shall be dug so that no part of the weight of the pipe is supported by the bell, but shall be no larger than necessary for proper jointing. All piping requiring excavation below the compacted fill required for the structure shall be excavated to at least 6" below pipe invert.
- E.

piece of equipment constructed of dissimilar metal an insulated joint shall be installed to prevent formation of galvanic couple. Pipe hangers and supports of dissimilar metal shall be isolated from contact with pipe. Metal pipe and equipment shall be isolated from direct contact with concrete or other corrosive materials and soils.

3.17 PAINTING AND FINISHING

- A. All exposed metal surfaces shall be painted, unless specified otherwise. Mechanical equipment shall have factory finish as specified; any damage to that finish shall be field primed and painted to match existing. All ferrous metal equipment and supports, not factory finished, shall be cleaned, primed with a suitable primer and given two finish coats of exterior enamel.
- B. Exposed galvanized metal, including ducts, shall be primed with galvanized metal primer and painted with enamel paint to match surrounding area.
- C. Other unpainted ferrous metal including all pipe sleeves or equipment supports shall be cleaned and primed with metal primer suitable to the metal, and shall be finished with two coats, one flat and one enamel as selected.
- D. All equipment and piping, after insulation has been installed, shall be primed and painted with one color semi-gloss coat and with one-color enamel paint. Color to be selected by the Owner.
- E. Refer to Section 09900 for paint schedule and preparation.

3.18 TESTS

- A. All materials, equipment and systems that are required to be tested by these specifications or by any applicable regulation or code, shall be tested in the presence of owner's representative or authority having jurisdiction. All items requiring pressure or leakage tests shall be tested before being concealed from view. All defects disclosed by tests shall be rectified and the tests repeated. The Contractor shall provide all labor, materials and equipment used in tests.

3.19 COMPLETION OF WORK

- A. Prior to acceptance of the installation and final payment of the Contract, the Contractor shall provide and complete the following:
- B. **CLEANING:** as required by Special Conditions applicable to this Division of the work.
 - 1. At the conclusion of the construction, the site and structure shall be cleaned thoroughly of all debris and unused materials remaining from the mechanical construction. All areas and temporary storage spaces shall be cleaned of all packing boxes, wood frame members and other waste materials used in the mechanical construction.
 - 2. The entire system of piping and equipment shall be cleaned internally. The Contractor shall open all dirt pockets and strainers, completely blowing down as required and clean strainer screens of all accumulated debris. Strainers shall be cleaned in the presence of the Test and Balance firm.
 - 3. All tanks fixtures and pumps shall be drained and proven free of sludge and accumulated matter.
 - 4. All temporary labels, stickers, etc. shall be removed from all fixtures and equipment. (Do not remove permanent nameplates, equipment model numbers, ratings, etc.).
 - 5. Heating and air conditioning equipment, tanks, pumps, traps, etc., shall be thoroughly cleaned and new filters or filter media installed.
- C. **OPERATION AND MAINTENANCE MANUALS**
 - 1. At substantial completion the Contractor shall provide the Owner with five copies of a hardbound Operating & Maintenance manual (O & M) for all equipment furnished and

installed under his work, otherwise systems involved will not be acknowledged as complete and therefore not accepted.

2. Requirements and methods of preparing and procedures for submitting Operating and Maintenance Manuals shall be in accordance with Division One.
 3. The O & M manuals shall contain notarized cover sheet outlining the warranty commencement dates and the obligations of installing contractor responding to equipment related deficiencies, i.e. Warranty Calls.
 4. The O & M manuals shall include factory installation, maintenance and operating instructions, and repair manuals for each and every component within each system, such as but not limited to: chillers, pumps, cooling towers, air handlers, fans, controls, etc. Submittal or cut sheets shall not be acceptable as primary information on any component. The manufacturer parts list and serial numbers for all operating equipment shall also be included.
 5. The O & M manuals shall include all information on component and equipment modifications, such as required options, impeller sizes, and performance curves.
 6. The O & M manuals shall provide detailed sequence of operation for each system stating how and when each component is activated and controlled to achieve designed operation and performance.
 7. The O & M manuals shall include detailed control drawings for each system indicating components used and their respective locations within the buildings being served. Drawings shall list building and room numbers.
 8. All controls and safety devices shall be clearly and permanently embossed or have printed plates indicating their purpose or operation. Plates shall be laminated plastic (color selected by A/E) with white or black letters, attached to the equipment or device with screws, rivets or non-soluble cement (glue).
 9. Provide name, address, and phone numbers of equipment suppliers used for all system components.
 10. Upon completion of the work, the Contractor shall put the system into service. The Contractor shall be entirely responsible for the equipment during all testing operations.
 11. The Contractor shall assist the owner's Test and Balance firm in operation of equipment and providing access (in the form of ladders and scaffolding where required) to devices which require measurement and/or adjustment. The Contractor shall aid in the identification and location of equipment. The Contractor shall correct all field conditions found to be unsatisfactory by the Test and Balance firm to include, but not be limited to: reconfiguration of pipe fittings, replacement of belts and pulleys and similar tasks as may be necessary but not otherwise required under applicable specification sections or other portions of the contract documents.
- D. AS-BUILT PRINTS:
1. Requirements and methods of preparing and procedure for submitting project record as-built prints shall be in accordance with Division 1.
 2. Contractor shall keep day-to-day records of all changes, and upon completion of the work, incorporate these changes on the clean copies of the original ACAD drawings. Five-copies of as-built ACAD prints shall be provided to the Owner at the date of substantial completion. One of the five-sets shall be on 11" x 17" paper.
 3. The drawings shall show all equipment, piping (including underground) and ductwork with dimensions and reference points, other concealed non-accessible work, branching arrangement and valve location for piping systems, locations of damper and heaters in duct systems, locations of control system sensors and other control devices, and work of change orders not shown on contract documents.
- E. INSTRUCTIONS AND DEMONSTRATIONS

1. Systems shall be tested and placed in proper working order prior to demonstrating systems to the Owner.
2. Prior to acceptance of the mechanical installation, schedule and conduct a walk-thru instruction seminar to demonstrate to the Owner or his designated representatives all essential features and functions of all systems installed, and instruct to the Owner the proper operation and maintenance of such systems. The contract shall allow for three working days to perform the demonstrations.
3. Provide trained personnel who are fully knowledgeable and capable of answering any question raised pertaining to the mechanical systems installed to perform the demonstrations and instructions. Provide manufacturer's representatives for systems as required, to assist with the demonstrations.
4. Dates and times for performing the demonstrations shall be coordinated with owner's representative and the Architect.
5. System demonstrations shall be in accordance with operating and maintenance data. All