230900 HVAC INSTRUMENTATION AND CONTROLS

PART 1 – GENERAL - Andover Controls BAS system is the standard for the University, and must be specified as a proprietary item.

1.0 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.1 SECTION INCLUDES

A. Control Panels

B. Control Valves

C. Input/Output Sensors

D. Thermostats

E. Transmitters

F. Miscellaneous Accessories

1.2 REFERENCES

A. AMCA 500- Test Methods for Louvers, Dampers and Shutters.

B. ASTM D1693- Environmental Stress- Cracking of Ethylene Plastics.

C. NEMA DC 3- Low- Voltage Room Thermostats.

D. NEMA Standards Publication 250- “Enclosures for Electrical Equipment (1000 Volts Maximum)”

E. NFPA 70- National Electrical Code.

F. NFPA 90A- Installation of Air Conditioning and Ventilation Systems.

1.3 SUBMITTALS FOR REVIEW

A. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

B. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drops for each system.

1.4 SUBMITTALS AT PROJECT CLOSEOUT

A. Provide submittals as required for Contract Closeout.

B. Project Record Documents: Record actual locations of control components, including panels, and sensors.

C. Revise shop drawings to reflect actual installation and operating sequences.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommend cleaning materials and calibration tolerances.

E. Warranty: Submit manufacturer's warranty and ensure forms had been filled out in Owners name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. The BAS Contractor shall provide all electronic sensors, electric actuators, direct digital controllers, control panels, transformers, power and control wiring, software and programming required for a complete and operable installation as specified herein. Andover shall manufacture all devices utilizing a communication protocol to communicate with the existing campus Andover system. Sensors, actuators, transformers, input/output devices, ect. may be manufactured by someone other than Andover. All such devices shall be compatible with Andover Controls.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience approved by manufacturer.

C. Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State of Pennsylvania.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 WARRANTY

A. All work shall be guaranteed for a period of one year from date of acceptance. The guarantee shall include all parts and labor required to repair/replace defective materials and workmanship.

PART 2 – PRODUCTS

2.1 CONTROL PANELS

A. Provide all required cabinets for automatic controls for all systems. Panels shall house relays, power sources, controllers and associated control devices required for complete and operable systems. Mount temperature indicators, pressure gages, pilot lights, push buttons and switches flush on cabinet panel face.

B. The main control panel, located in the basement mechanical room, shall require a single point, 110V power supply. Panel shall interface with the existing campus Andover system and shall be capable of sending and receiving signals from all HVAC systems for monitoring and control purposes.

C. Cabinet shall be Type 1 per NEMA Standard 250, general purpose utility enclosures and shall have a factory applied enamel finish.

D. Provide common keying for all panels.

E. Provide panel identification with permanently attached engraved nameplate indicating, as a minimum, panel I.D. No., and description.

2.2 CONTROL VALVES

A. Provide automatic control valves for the specified controlled media, steam or water. Equip control valves with actuators of required input power type and control signal type to accurately position the flow control element and provide sufficient force to achieve required leakage specification.

B. Control valves shall meet the heating and cooling loads specified and shall close off against the differential pressure conditions within the application. Valves shall be sized to operate accurately and with from 10% to 100% of the maximum design flow.

C. Trim material shall be stainless steel for all applications.

D. Provide valves consistent with piping specification sections.

E. Heating system valves shall spring return to open position.

F. Control valves and actuators shall be manufactured by Belimo or Siemens.

2.3 INPUT/OUTPUT SENSORS

A. Temperature Sensors

1. All temperature devices shall use precision thermistors accurate to +/- degree F over a range of -30 to 230 degrees F. Space temperature sensors shall be accurate to +/- 0.5 degrees F over a range of 40 to 100 degrees F.

2. Standard space sensors shall be available in an off white enclosure for mounting on a standard electrical box.

3. Refer to Specification Section 15975, paragraph 3.1 for space temperature sensor configurations and required options.

4. Duct temperature sensors shall incorporate a thermistor bead embedded at the tip of a stainless steel tube. Probe style duct sensors shall useable in air handling unit applications where the air has been mixed and is a uniform temperature.

5. Averaging sensors shall be employed in ducts and air handling units where varying temperatures will be encountered. The averaging sensor tube must contain at least one thermistor for every 3 feet, with a minimum tube length of 12 feet. Freezestats shall have as a minimum, one linear foot of element for each square foot of coil face area.

6. Immersion sensors shall be employed for measurement of temperature in all chilled and hot water applications as well as refrigerant applications. Thermal wells shall be brass or stainless steel for non-corrosive fluids below 250 degrees F and 300 series stainless steel for all other applications.

B. Static Pressure Sensors:

1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.

2. Air pressure measurements in the range of 0 to 10" water column shall be accurate to +/- 1% using a solid state sensing element.

3. Differential pressure measurements of liquids or gases shall be accurate to +/- 0.5% of range.

4. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.

5. Static pressure sensors shall be manufactured by Modus Instruments, Ashcroft, Mamac or Veris.

C. Current Sensors:

1. Current status swtiches shall be used to monitor fans, pumps, motors, and electrical loads. Current switches shall be available in solid and split core models, and offer

either a digital or an analog to BAS. Acceptable manufacturer is Veris or approved equal.

2. Current switches shall be manufactured by Veris or Weidmuller.

D. Carbon Dioxide Sensors:

1. The carbon dioxide sensor shall be accurate to ± 40 ppm or ± 3% of reading, whichever is higher. In addition, the sensor shall be designed to monitor carbon dioxide levels for use in demand controlled ventilation according to ASHRAE Standard 62. It shall be factory configured for a linear analog output over a range of 0-2000 ppm of carbon dioxide.

2. Additional features shall include analog output, programmable control relay, automatic calibration to compensate for sensor drift and nondispersive infrared technology.

3. Carbon dioxide sensors shall be manufactured by Veris or Telaire.

E. Humidity Sensors:

1. Humidity sensors shall be accurate to +/- 5% at full scale for space applications.

2. Humidity sensors shall be manufactured by Vaisala, inc. or Kele Inc.

2.4 THERMOSTATS

A. Provide low voltage or line voltage thermostat control of single zone heating or air conditioning equipment as required by the sequences of operation. Unless indicated otherwise, thermostats shall not include a display of the current space temperature and shall use slider adjustment provide a mechanism for local setpoint adjustment.

2.5 TRANSMITTERS

A. Pressure Transmitters:

1. Direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

B. Temperature Transmitters:

1. Directly proportional electronic output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degrees F span and plus or minus 1 percent for 50 degrees F span, with 100 degrees F temperature range, compensated bulb, averaging capillary.

C. Steam Multivariable Transmitter:

1. Provide fully compensating multivariable mass flow transmitter, with LCD meter for measuring flow, differential pressure, gage pressure and temperature.

2. Include 3-valve integral manifold, consisting of two blocking valves, one equalizing valve and two drain/vent valves at the test ports.

3. Provide 2" pipe mounting bracket.

4. Inputs:
    a. Differential pressure
    b. Gage pressure
    c. Steam pressure

5. Output: 4-20 maDC

6. Power: 24 VDC

7. Range: 0-150" w.g. for 4-20 maDC output

8. Accuracy: 1% rate accuracy over 8:1 flow range

9. Service: Steam at 50 psig normal working pressure, 100 psig maximum.

10. Installation shall be in accordance with the piping specification sections.

2.6 DAMPERS

A. Automatic dampers furnished by the BAS Contractor shall be single blade or multiple blades as required. Dampers shall be installed by the HVAC Contractor where directed by and under the supervision of the BAS Contractor. The HVAC Contractor shall provide all blank-off plates and transitions necessary to install smaller than duct size dampers.

B. Damper frames shall be constructed of 13 guage galvanized sheet steel mechanically joined with linkage concealed in the side channel to eliminate noise and friction. Compressible spring stainless steel seals and acetyl or bronze bearings shall be provided.

C. Damper blades width shall not exceed eight inches. Seals and 3/8 inch square steel zinc plated pins are required. Provide opposed blade dampers for modulating applications and parallel blade dampers for two position control.

D. For high performance applications, control dampers shall meet or exceed the UL Class I leakage rating.

E. Damper actuators shall be electronic, and shall be direct coupled over the shaft, without the need for connecting linkage. The actuator shall have electronic overload circuitry to prevent damage. For power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing. Non-spring return actuators shall have an external manual gear release to allow positioning of the damper when the actuator is not powered or equivalent.

F. Control and smoke dampers shall be manufactured by Ruskin, Johnson Controls or Arrow. Damper actuators shall be manufactured by Belimo or Siemens.

2.7 METERS

A. All new buildings and major renovations to existing buildings must include all equipment ,programming, and graphics to allow the metering of utilities including electricity, water, steam, natural gas via the campus BAS system (Andover Controls).

B. Acceptable meter manufacturers:

a. Electicity
   i. Square D
   ii. Kele
   iii. GE/Andover

b. Water
   i. Badger
   ii. Neptune
   iii. Sensus

c. Steam
   i. Rosemount orifice meter
   ii. Micrometer V cone
   iii. Spirax Sarco condensate pump and cycle counter

d. Natural Gas
   i. Sensus ii.
   ii. Roots

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment, such as, air handling units.

F. Ensure installation components are complementary to installation of similar components.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install instrumentation where shown on the drawings, indicated in the specifications and as required for a complete and operable system.

C. Check and verify location of thermostats and other exposed control sensors with plans and room details before installation.

D. Provide separable sockets for liquids and flanges for air bulb elements.

E. Provide static pressure tips at all static pressure sensors.

F. Mount control panels where indicated on vibration free walls or free standing supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

G. Provide conduit and electrical wiring in accordance with Division 16. Electrical material and installation shall be in accordance with appropriate requirements of Division 16.