

SECTION 230900
INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete and fully functional VAV HVAC as shown and as specified.
- B. All systems provided shall comply with applicable codes and standards. The installation shall be complete and operational. Refer to complete specifications and drawings for additional detailed requirements. Manufacturers recommended installation guidelines shall be used if no other specific direction is given. Bidder shall be responsible to coordinate and include in his bid all necessary appurtenances and additional material as required to ensure proper installation and function. All bidders shall be responsible to review the complete set of specifications, drawings and addendums.

1.2 DESCRIPTION

The VAV system shall be a complete single duct, stand-alone, pressure independent system with heat-cool switchover. Provide all control components as required to control the system as specified.

1.3 SUBMITTALS

Product Data: For each product specified include data sheets indicating function, calibration, engineering data sheets and manufacturer make/model.

PART 1 - PRODUCTS

2.1 CONTROL DEVICES

- A. Variable Frequency Drives (VFDs) –Furnished by the AHU manufacturer.
- B. Control Valves:
 - General: Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service.
 - Water Valves: Electrically controlled hot water and chilled water three way diverting control valves shall be of bronze rotating ball design with NPT stainless steel trim for linear modulating service. Valves shall be equivalent to Honeywell series VBN3 with MN6105 actuators.
 - Sizing: Reference drawings

C. Temperature Sensors.

Duct Temperature Sensors. Duct sensors shall be modulating stand-alone equivalent to Honeywell T775 series 2000 with integral scheduler, graphical interface and sensor calibration. Furnish with matching temperature sensor.

Space Sensors. Space sensors shall be equivalent to KMC STE-8001 with operator interface and LCD display.

Differential Sensors. Duct static pressure controllers shall be equivalent to Neptonic Series SPC with LCD display. Provide sensors compatible with for the VFD controller.

2.2 WIRING

- A. General. All wiring shall be copper in accordance with NEC and applicable codes and standards.
- B. Insulated wire shall use copper conductors and shall be UL listed for 90°C (200°F) minimum service.
- C. Control Contractor shall be responsible for providing interlock/power wiring for VAV terminals and AHU accessories. The Fire Alarm Contractor shall be responsible for shutdown relays at the AHU panel and the installation of smoke detectors.

PART 3: EXECUTION

3.1 Protection

- A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.
- B. Controls Contractor shall be responsible for all work and equipment either stored on-site or installed on-site. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.
- C. Controls Contractor shall install and configure devices specified in this section and devices furnished by others as required for a complete and functional system.

3.2 Coordination

- A. Site.
 - 1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
 - 2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.
- B. Test and Balance
 - 1. Provide a certified technician to assist with preliminary testing and balancing the AHU and VAV terminal units.

3.3 General Workmanship

- A. Install equipment, piping, and wiring or raceways horizontally, vertically, and parallel to walls wherever possible.
- B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
- C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.
- D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.
- E. Equipment, installation, and wiring shall comply with industry specifications, standards, and local codes for performance, reliability, and compatibility.

3.4 Wiring

- A. Control and interlock wiring and installation shall comply with national and local electrical codes, and manufacturer's recommendations.
- B. Install wiring in raceway where subject to mechanical damage and in mechanical, electrical, or service rooms.
- C. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.
- D. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.
- E. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3 feet in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size.
- F. Label communication wiring to indicate origination and function.

3.5 Installation of Sensors

- A. Install sensors according to manufacturer's recommendations as required for proper system operation.
- B. Mount sensors rigidly and adequately for the operating environment.
- C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.
- D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.
- E. Install pipe-mounted temperature sensors in thermos-wells. Install temperature sensors with heat-conducting fluid in thermal wells.
- F. Differential Air Static Pressure.
 - 1. Supply Duct Static Pressure. Make pressure tap connections according to manufacturer's recommendations.
 - 2. Piping to pressure transducer pressure ports shall contain a capped test port adjacent to transducer.
 - 3. Pressure transducers, except those controlling VAV boxes, shall be located in control panels, not on monitored equipment or on ductwork. Mount transducers in a vibration-free location accessible for service without use of ladders or special equipment.
- G. Freeze-stats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment per code or as described in the sequence of operation. Switches shall require manual reset.

3.6 Actuators

- A. General. Mount actuators and adapters according to manufacturer's recommendations.
- B. Valve Actuators. Connect actuators to valves with linkage approved by actuator manufacturer.

3.8 Control System Checkout and Testing

- A. Startup Testing. Complete startup testing to verify operational control of the system before notifying Owner of system demonstration. Provide Owner with schedule for startup testing. Owner may have a representative present during any or all startup testing.
 - 1. Calibrate and prepare for service each instrument, control, and accessory furnished.
 - 2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that all terminations are tight.
 - 3. Calibrate each device according to manufacturer's recommendations.
 - 4. Verify that relays, solenoid valves, actuators, control valves, and magnetic starters, operate properly and that normal positions are correct.
 - 5. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
 - 6. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules.
 - 7. Verify operation of smoke detectors and static pressure controllers for VFD control.

3.9 Sequence of Operation

A. AHU

Run Conditions: The unit shall run whenever manually energized by the building occupants: Interlock from the fire alarm relays to the AHU starter shall be by the Fire Alarm Contractor.

Smoke Detection: The unit shall shut down and generate an alarm upon receiving a smoke detector alarm from the smoke detectors. Smoke detectors shall be interfaced with the existing fire alarm panel by the fire alarm contractor..

Supply Fan: The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

Supply Air Duct Static Pressure Control:
The controller (SP-1) shall measure duct static pressure and shall modulate the supply fan VFD speed to maintain a duct static pressure set point as noted on the drawings. The set point shall be field adjustable. The supply fan VFD speed shall not drop below 20% (adj.) of scheduled performance.

Supply Air Temperature Set Points:
The adjustable temperature controller shall monitor the return air temperature and shall maintain a air temperature setpoint based on zone cooling and heating requirements and manual setting of the controller.

Duct mounted heat-cool switchover sensors shall provide automatic switchover based on the supply air temperature.

The supply air-cooling temperature set point shall be resettable and based on 68°F (adj.).

The supply air heating temperature set point shall be resettable and based on 77°F (adj.).

Cooling and Heating Coil Valves:

The temperature controller shall measure the supply air temperature and modulate the coil valves to maintain specified set points as required.

The cooling coil valve shall open to 30% (adj.) whenever the freeze-stat is energized.

B. VAV Terminals

Zone Set Point Adjust:

Occupants shall be able to adjust the zone temperature heating and cooling set points at the zone / space sensor by an amount set by the system operator (adj.).

Variable Volume Terminal Unit - Flow Control:

The unit shall maintain zone setpoints by controlling the airflow through one of the following:

- When zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
- When the zone temperature is between the cooling setpoint and the heating setpoint, the zone damper shall maintain the minimum required airflow for zone ventilation (adj.).
- When zone temperature is less than its heating set point, the control action shall reverse to maintain the zone temperature at its heating setpoint. Occupants will manually energize or de-energize the boiler and chiller.

Zone Set Point Adjust:

Occupants shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

Outside Air Damper:

Damper shall stroke open to the pre-set value open when the air handling unit is energized.

END OF SECTION 230900