

SECTION 23 0913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Control panels.
- B. Control valves.
- C. Input/Output Sensors.
- D. Miscellaneous accessories.

1.02 REFERENCE STANDARDS

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

1.03 SUBMITTALS

- A. Refer to Section 23 0510- General HVAC Requirements for submittal procedures.
- B. 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.
- C. 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 drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience employed directly by the digital equipment manufacturer.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

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

2.02 CONTROL PANELS

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- B. NEMA 250, general purpose utility enclosures with hinged, lockable face panel.
- C. Finish: Baked enamel factory finish.
- D. Provide common keying for all panels with two keys per control panel.
- E. Nameplates:
 - 1. Use device identification and number from control drawings.
 - 2. Identify panel with permanent label mounted on panel face. Nameplate shall be bakelite with white letters, 3/8 inch minimum height.
 - 3. Identify all panel mounted devices with permanent label mounted adjacent to device. Nameplates shall be bakelite with white letters, 1/8 inch minimum height.
- F. Door mounted devices: Refer to the Sequence of Operation for devices specified to be door mounted.
- G. Wiring:

1. Power supply of capacity required with disconnect switch, surge protection, fuse holder with fuses or circuit breaker, 120 VAC service receptacle.
 2. Conductors color coded with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.
 3. Connections and junctions to terminal strips and devices only.
 4. Route wiring parallel to cabinet side in wiring troughs or laced with nylon ties.
 5. Wiring and devices that derive power from other sources shall be located in a separate compartment and be provide with separate terminal strips.
 6. Cover all line voltage terminations in panel.
- H. Indicator lights: 24 VAC light emitting diode. 100,000 hour lamp life. Provide single "Press-To-Test" button for all lights in panel.

2.03 CONTROL VALVES

- A. Terminal Unit Control Valves:
1. Bronze body, bronze trim, 2 or 3 port as indicated, replaceable plugs and seats, union and threaded ends.
 2. Rate for service pressure of 125 psig at 250 degrees F.
 3. Size for 3 psig maximum pressure drop at design flow rate.
 4. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.
 5. Operators (Modulating): Self-contained, linear motorized operator with approximately 3/4 inch stroke, 60 second full travel with transformer and SPDT contacts: 24 v DC, 6 watt maximum input.

2.04 INPUT/OUTPUT SENSORS

- A. Temperature Sensors:
1. Platinum resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 70 degrees F, interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
 2. Measuring current maximum 5 mA with maximum self-heat of 0.031 degrees F/mW in fluids and 0.014 degrees F/mW in air.
 3. Provide 3 lead wires and shield for input bridge circuit.
 4. Use insertion elements in ducts not affected by temperature stratification and smaller than 9 square feet. Use averaging elements where larger or prone to stratification. Sensor length 8 feet or 16 feet as required.
 5. Use sensor holder with mounting plate and conduit enclosure with cover plate for elements mounted on ducts. Provide extension between plate and enclosure on insulated ducts.
 6. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2 inches. Provide lagging extensions on insulated pipes.
 7. Room digital thermostats: Sensor with setpoint adjustment marked warmer/cooler, built-in override button, terminal block wiring connection and I/O communication port for portable monitoring device. Locking cover. blank cover in all public spaces
 8. Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.
- B. Static and Differential Pressure Sensors:
1. Manufacturer: JCI, Setra, Veris
 2. Designed for media sensed and for static or differential pressure measurement, as appropriate. The sensor should be capable of withstanding an over range pressure limit of 300% of the normal expected value. Sensor should incorporate a transducer with non-interacting zero and span adjustments. The zero shall be continuously adjustable on outputs.
 3. Unidirectional with ranges adjustable from 0-125 percent of maximum expected input.
 4. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
 5. Accuracy: One percent of full scale with repeatability 0.3 percent.

6. Output: 0 - 5 vdc with power at 12 to 28 vdc.
 7. Hydronic Systems - Provide high and low line isolation valves, and parallel pressure gage to pipe to read high/low pressures independently.
 8. Low and High Static Pressure Limit - provide hard wired safety function interlock to equipment starter. Provide additional dry contact for monitoring by the DDC System.
- C. Equipment Operation Sensors:
1. Status Inputs for Electric Motors:
 - a. U.L. Listed current sensing relay with split core current transformer, 1 amp @ 30 VAC adjustable setpoint output switch, adjustable mounting bracket, power and trip LED indication.
 - b. Constant speed fans and pumps: Output switch trip setpoint at 10% below the normal motor operating speed and current draw.
 - c. Variable speed fans and pumps: Output switch trip setpoint at 5% below the lowest motor operating speed and current draw as determined in the commissioning process, typically 20%.
 - d. Product: Veris Industries Hawkeye H-900, Kele D-150, Veris Industries.

2.05 SWITCHING DEVICES

- A. Duct Mounted Smoke Detector: NFPA 72, photoelectric type with auxiliary SPDT relay contact, key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Provide two-wire detector with common power supply and signal circuits.
- B. Electric Relays:
 1. Heavy duty, isolated, cabinet mounted, blade plug-in type with base.
 2. Rating: 10 amps, minimum at 125 VAC:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing 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 and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Locate all control devices except for sensors and devices integral to equipment within control panels, unless otherwise noted.
- C. Install control devices in a readily accessible location. Refer to definitions in Section 23 0510.
- D. Coordinate with Contractor and monitor the work so that other trades do not obstruct control devices or other items requiring access for service.
- E. Device mounting:
 1. All devices shall be permanently mounted and secured in place.
 2. Mount control panels on backboards adjacent to associated equipment on vibration free walls or free standing angle iron supports. Refer to Section 23 0510 for backboards.
 3. Panel mounted controls: Secure to panel backs with non-ferrous sheet metal screws.
 4. Gypsum Board and Plaster walls: Moly-bolt type anchor. No adhesive or plastic insert anchors.
 5. Concrete Walls: Non-ferrous screws and expansion shields.

6. Concrete masonry units: Mount to recessed box or secure with moly-bolt type anchor.
 7. Provide accessory wall adapter plates where required to cover block or wall opening edges.
 8. Pipe and duct mounted devices: Secure to well or mounting flange. Provide well and flange extensions on insulated duct and pipe to clear insulation thickness.
 9. Mount control valves with stem at or above the horizontal.
- F. Identification:
1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device. Nameplates shall be engraved plastic laminate with uppercase black letters on a white field, 1/4 inch minimum height.
 - a. Include sensor type, normal setpoints information on nameplate.
 - b. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.
 2. Color code conductors with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.
- G. Electrical wiring:
1. All control and interlock wiring shall be provided under this section.
 2. No splices between field devices and control panels are permitted.
 3. All Wiring materials and methods shall comply with Division 26 except:
 - a. Minimum wire size shall be 14 AWG(copper) for line voltages.
 - b. Minimum wire size shall be 18 AWG(copper) for signal.
 4. Fire Alarm System Interface: Signal for fan shutdown shall be obtained from fire alarm output relay located in mechanical room adjacent to the starter/motor control center, unless otherwise noted.
- H. Check and verify location of thermostats and exposed control sensors with plans and room details before construction of wall assemblies. Locate between 42 to 48 inches above finished floor. Mount at common elevation within same space. Align with lighting switches. Refer to Section 26 0537.
- I. Mount in center of 8x8 inch block face with recessed mounting box and accessory wall adapter plate covering block opening where mounted in concrete masonry units.
- J. Use a single sensor for outside air temperature.
- K. Mount outdoor thermostats and outdoor sensors indoors, with sensing elements outdoors on north side of building or in shaded location. Mount with sun shield.
- L. Mount outdoor thermostats and outdoor sensors away from building discharge openings or doors where conditioned air from building will effect signal. Do not mount on positive pressurized HVAC devices where conditioned air can leak thru opening effecting signal.
- M. Provide separable sockets for liquid elements. Mount sockets as specified in Section 23 2113. Cut element to length for full insertion into well and provide conducting compound.
- N. Provide mounting flanges for air bulb elements with extensions as required on insulated ducts to clear insulation.
- O. Install current sensing relays in starter enclosure for equipment served.
- P. Install control valves in a readily accessible location.
- Q. Install control valves with stems upright or horizontal, not inverted.
- R. Install damper operators in accessible locations.
- S. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 SCHEDULES

- A. Refer to Sequence of Operation for valve normal position and to Drawings for valve coefficients.

END OF SECTION