

SECTION 15950
CONTROLS
(Applicable to all campuses except IUPUI)

A. GENERAL

1. Manufacturers: Johnson Controls Inc. or Siemens Building Technologies.
2. Type: Distributed Direct Digital Control (DDC) with pneumatic actuation and actuator position feedback.
3. IU has pre-purchase agreement with Johnson Controls and Siemens. University will directly purchase all of the required parts. The installation of controls shall be specified as a part of project construction documents. Contact IU Engineering Services for further details.

B. PNEUMATIC CONTROLS

1. Air Piping

- | | |
|-------------------------------------|---|
| a. In exposed locations | Seamless copper tubing, Type L, solder joints. Polyethylene tubing in conduit (EMT) is acceptable unless ambient temperature exceeds 100 degrees F. |
| b. Concealed inaccessible locations | Seamless copper tubing, Type L, solder joints. Polyethylene tubing in conduit (EMT) is acceptable unless ambient temperature exceeds 100 degrees F. |
| c. Concealed accessible locations | Copper Type L solder joints or polyethylene with tubing with compression or push-on fittings |

C. CONTROL VALVES

1. Single seated, globe pattern, equal percentage flow (linear for connection to campus chilled water loop) with replaceable neoprene or silicone diaphragm type operators and adjustable spring range. All valves to return to "safe" position in the event of power or air failure.

D. DAMPERS

1. Modulating control: Opposed blade proportioning type.
2. Two position control: Parallel blade type.

3. Leakage: Outside air dampers - less than 6.5 cfm/sq.ft. at 4"wg. differential pressure.
4. Return, relief, mixed and supply air dampers - less than 10 cfm/sq.ft. at 4"wg. differential pressure.
5. Seals - Extruded vinyl blade edge seals and flexible metal compressible jamb seals.

E. FREEZE PROTECTION ON AIR HANDLER WATER COILS

1. Coil Circulating Pump: Install a circulating pump to circulate water through the first upstream coil. Size the circulating pump to ensure about 2 ft/sec. tube velocity.
2. Sensors: Install freezestats (low limit controllers) to detect freezing air conditions. Set freezestat alarm temperature at 35 degrees F. Provide sufficient freezestats so that each monitors no more than a 3 feet wide path of air. Install freezestat on upstream face of chilled water coils. Wire freezestats in series so that any can trip the safety circuit.
3. Provide an aquastat in chilled water coil return piping. Set alarm temperature at 40 degrees F.
4. Control Response: When outside air temperature drops below 35 degree F enable the coil circulating pump. Disable the coil circulating pump when outside air temperature rises above 38 degree F. Discuss pump on/off sequence with IU Engineering Services.
5. In the event of a freezestat or an aquastat alarm close outside air dampers and shut down supply fan. If there is a return air system shut down the return air fan, open return air dampers, and close relief dampers. Alarm campus control center of alarm conditions. Manual reset following alarm conditions is required.
6. Return/Outdoor Air Mixing: Ensure sufficient duct length or install air mixing devices to ensure air temperature uniformity within 10 degree F across a section of the duct immediately upstream of the chilled water coils.

F. PNEUMATIC ACTUATORS

1. Piston type, with pilot positioners if modulating control.
2. Do not locate actuators within contaminated/exhaust air streams. Mount external to duct.

G. ROOM THERMOSTATS

1. Two pipe, non-bleed or “relay” type design, fully proportional with adjustable throttling range and tamper proof locking settings.

H. TEMPERATURE SENSORS

1. Corrosion resistant, platinum or nickel alloy, tamper-proof suitable for mounting on vibrating surface.

I. HUMIDITY SENSORS

1. Span 15 to 75% relative humidity for 3 to 15 psig pressure change. Corrosion resistant, temperature compensated, factory calibrated.

J. PRESSURE SENSORS

1. Duct: linear output, range 0 to 6”wg, adjustable in 2” spans.

K. P/E (PRESSURE ELECTRIC) SWITCHES

1. Snap acting SPDT switch, UL listed, with calibrated indicator scale, set point adjustable from 3 to 20 psig, with mounting bracket, barbed fitting for air tubing, screw terminals for wire connection.

L. LOW LIMIT CONTROLLER

1. Air Stream - unit mounted, line voltage cutout thermostat, 4 wire, 2 circuit, manual reset, 20’ element, 15-55°F range.
2. Water Flow - unit mounted line voltage cutout thermostat, 4 wire, 2 circuit, manual reset, bulb element, 15-55°F range.

M. AIR COMPRESSOR AND REFRIGERATED AIR DRYER

1. Air compressor: Duplex type, each compressor sized to operate not more than 33% of time during any one hour period; mounted on high pressure (100 psig) ASME storage tank. Provide one electrical circuit sized for both compressors running simultaneously.
2. Refrigerated air dryer: Use R22 or other non CFC or non HFC refrigerant. The dryer shall be sized to reduce dew point of air to 28°F to provide required air flow at 80 psig inlet pressure and 100°F ambient temperature. Provide factory mounted bypass and air purification system to ensure clean, dry, oil free air supply.

3. Air compressor and dryer shall be furnished by owner and installed by contractor. Inertia base for the compressor shall be furnished and installed by mechanical contractor.

N. CONTROL PANELS

1. Wall mounted, provide for each control system, adjacent to systems served. UL listed for use with line voltage devices.

O. ELECTRONIC CONTROLS

1. Acceptable products
 - a. Johnson Controls, Inc. - Metasys.
 - b. Siemens Building Technologies - Apogee Modular Building Control.
2. Include front-end software and upgrades for all campuses except IU Bloomington.
3. Stand-Alone Direct Digital Control (DDC) Panels
 - a. Provide stand-alone DDC panels containing microprocessor based control processors, communication controllers, power supplies, input/output modules, and interface to the existing Metasys and Apogee Energy Management Systems (EMS) in the Physical Plant control center.
4. Memory
 - a. Supply each DDC panel with sufficient memory to support its own operating system and databases.
5. Point Types
 - a. Each DDC Panel shall support:
 - Binary inputs for status/alarm contacts
 - Binary outputs for on/off equipment control
 - Analog inputs for temperature, pressure, humidity, flow and position measurements.
 - Analog outputs for valve and damper position control, and capacity control of primary equipment.
 - Pulse inputs for pulsed contact monitoring.
6. Expandability
 - a. Provide a modular system which permits easy expansion. The system

architecture shall support 20% expansion capacity of all types of DDC panels, and all point types included in the initial installation.

7. Self Diagnostics

- a. DDC panels shall continuously perform self diagnosis, communication diagnosis and diagnosis of all subsidiary equipment. The DDC panel shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication.

8. Surge and Transient Protection

- a. Provide isolation at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980.

9. Power Failure and Restart

- a. In the event of the loss of normal power, DDC panels shutdown in an orderly manner to prevent the loss of database or operating system software. Use non-volatile memory for all controller configuration data and battery back-up to support the real-time clock and all volatile memory for a minimum of 72 hours.
- b. Upon restoration of normal power the DDC panel shall automatically resume full operation without manual intervention. Should DDC panel memory be lost the DDC panel shall request download from the front end and resume normal operations after completion of the download. The user shall have the capability of reloading the DDC panel via the local area network, or via telephone line dial-in.

10. Control Software

- a. As provided by Johnson Controls Inc. Metasys or Siemens Building Technologies Apogee MBC.

11. Operator Interface

- a. Use English language and industry standard software for command entry and menu selection. Provide display to enable operator to view all system point and application data.
- b. Provide the following operator commands:
 - Start-up/shut-down selected equipment
 - Adjust set points
 - Add/Modify/Delete time programming
 - Enable/Disable process execution

- Lock/Unlock alarm reporting for each point
- Enable /Disable totalling and trending for each point
- Override PID loop set points
- Enter temporary override schedules
- Define Holiday schedules
- Change time/date
- Enter/Modify analog alarm and warning limits
- View limits
- Enable/Disable demand limiting for each meter Duty Cycle for each load.
- Access levels to be determined by password code.

P. ELECTRONIC INSTRUMENTATION

1. RTD Temperature Sensors

- a. "Ultra Precision" type - 100 Ohm Platinum or 1000 Ohm Nickel - Accuracy \pm 0.1% resistance tolerance.
- b. Outside air - watertight unilet fitting, protect from solar radiation.
- c. Water - bulb type, mounted in brass or stainless steel wells filled with a heat conductive compound.
- d. Duct - flexible averaging bulb element.

2. Humidity Transmitters

- a. Solid state sensor, range 10% to 80% RH. - Accuracy \pm 5% RH.

3. Pressure Sensors

- a. Variable capacitance type, 4-20mA output, over pressure to 2000 psi, immune to humidity, accuracy \pm 0.25% of span.

4. Differential Pressure Sensors

- a. Variable capacitance type, 4-20mA output, over pressure to 2000 psi, immune to humidity, accuracy \pm 0.25% of span.

5. Flow Transducers

- a. Water circuits – external clamp on ultrasonic transducers, accuracy 0.5% of flow rate when flow velocities are 1feet per second or greater. Output 0/4-20 mA. Manufactured by "GE" model AT-868-1-1-1 with transducer kit ATXP-C0A-00-24.0IN.

- b. Ventilation air - Single or multiple sensors factory positioned and connected to produce an averaged velocity pressure, accuracy $\pm 3\%$ of full scale when flow velocities are 500 to 3000 fpm. Size the duct at the measurement point to give a velocity of 2000 fpm at design air flow rate. Provide required straight lengths of ductwork upstream and downstream of the sensors. Install access panels.

6. Current Sensing Relay Switch

- a. Add current sensing relay switch for variable speed status.

Q. OTHER INSTRUMENTATION

1. Thermometers

- a. Solar-powered digital thermometers similar to TREND. Range 30° F to 200° F. Install in brass thermometer well.

2. Pressure Gauges

- a. 4-1/2" dial, install with snubber to damp pulsations. Ranges as follows:
 - Water lines 0 to 150 psig
 - 150 psig steam lines 0 to 200 psig
 - 40 psig steam lines 0 to 100 psig
 - 15 psig steam lines 0 to 30 psig
 - Compressed air at compressor/receiver 0 to 200 psig

- b. Control Air: 1-1/2" dial. 0 to 30 psig

- c. Provide pressure gauges on all output transducers and field devices.

3. Differential Pressure Indicators

- a. Dwyer Magnehelic or equal. 0 to 2" w.g.