

25 00 00 Integrated Automation

Revision 01/04/2019

Purpose:

The Architect and/or Engineer shall incorporate the Rice specific requirements indicated in this standard's section into their design. The Architect and/or Engineer shall further produce project specifications in line with industry standards that are updated to reflect these Rice specific requirements.

1. General Requirements.

- a. All buildings and major remodels shall be engineered and connected to one of the two existing BMS systems using this section unless direct instructions from FE&P, AVP is received to the contrary

2. Systems.

- a. Approved system manufacturers
 - i. Siemens Building Technology, Inc.
 1. Siemens PXC Compact Series with BACnet Controllers with Web page display options utilizing BACnet MSTP Unitary Controllers.
 - ii. Tridium Vykon N4 – Distech branded BACnet Controllers or other pre-approved equals.
- b. Only Tridium or Siemens systems using BACnet Protocol (ASHRAE 135 Standard) are permitted. All systems and devices shall have the ability to be integrated into the Siemens Desigo or Tridium Web Supervisor front-end platform.
- c. Each panel shall be fully licensed using non "proprietary" license files, listing Rice University as the owner and shall include BACnet Client/Server options. Any panel that communicates with MODBUS equipment shall include a MODBUS license. NO "sharing" of license files or protocol across the network shall be permitted.
- d. All I/P networking shall be on Rice University IT network. No ethernet driven sub-networks, only building level BACnet MSTP local networks are approved. Coordinate I/P requirements with Rice Project Manager prior to start of Construction Documents. No I/P hardware shall be used or installed without specific approval from the Rice University IT department.
- e. I/P Addresses will be assigned by Rice University. To gain assignment, MAC address(s) shall be provided for each device to be connected, included with device name, function and physical location.
- f. The contractor/vendor shall be fully trained, certified and authorized by the manufacturer as a local dealer or branch office. The successful contractor/vendor must maintain an office within a forty (40) mile radius of Rice University. Rice will expect the successful contractor/vendor to maintain an ample parts inventory to supply Rice

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- University with parts on an as needed basis. All “regularly used” components (i.e. temperature sensors, valve parts, DDC components) shall be available within 24 hours of ordering at no additional expense to Rice University.
- g. All panels shall have a 120 VAC convenience outlet located within the panel.
 - h. Individual power supplies to panel devices shall be provided through a “switched” circuit to allow easy de-energization during service. Preferably in the unit casing.
 - i. All panels shall have a light fixture located inside the panel.
 - j. BMS system shall be fully integrated with other systems using BACnet protocols (Air Handler Unit controllers, Variable Speed Drives, Occupancy Sensing, Lighting Controls, Chillers, boilers, water pumping packages, etc.) The points to be integrated shall include all points offered by the system manufacturer and will be subject to review by Rice University. At the University’s discretion, points may be omitted if deemed not needed.
 - k. Graphics shall be simulated and submitted for approval prior to creation. All graphics shall allow for full operator interaction including PID loop tuning, schedule changes, zone temperature or other process variable current values and temporary over riding ability. Provide backgrounds showing walls, room numbers and such as provided by the project ACAD drawing layers. Graphics shall include setpoint vs. actual values for all analog points. Highly integrated sub systems may use textual pages to display large amounts of integrated data if that makes sense.
 - l. System HVAC zones not controlled by occupancy sensing shall each be configured with a local seven (7) day time of day (with holidays) schedule (separate schedule per zone) which can be easily managed via the front end graphics. Each zone shall provide four temperature set points, each separately adjustable depending on occupancy status.
 - i. Un-occupied Cooling
 - ii. Occupied Cooling
 - iii. Occupied Heating
 - iv. Un-Occupied Heating
 - m. The system architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.
 - n. The system, upon completion of the installation and prior to acceptance of the project or inspection by the commissioning agent, shall perform all operating functions, display all integrated points (including sub systems) and accept all operator commands via the front-end graphical system as detailed in this specification.
 - o. The system will, using the Rice University Ethernet, be capable of alarming a critical alarm condition within ten (10) seconds of field occurrence for all vendor-supplied points. Non-critical alarms, alert conditions, and return-to-normal transitions will be logged and displayed at any operator workstation within twenty (20) seconds of their occurrence in the field. All graphic displays must display the graphic and display all values within ten (10) seconds of initiation, and data can be no older than twenty (20) seconds from a true field value. This is an inviolable performance requirement.
 - p. The system shall be designed so all individual alarm points for each piece of equipment triggers one “General Alarm” per equipment is visible on the front end graphics. This

alarm will be selectable and generate a pop-up menu providing more detailed information on the exact alarm(s).

- q. All controllable points (i.e.: Valve positions, start/stops and set points shall be provided with a “Timed Override” feature so that commanded points shall return to Automatic Control upon the expiration of the override timer. This “Timed Override” feature shall be a form of a pop-up menu that is operator selectable from the graphic which the equipment is located.
- r. Building Systems Integration
 - i. All indicated equipment shall be required to have the ability to interface with other automation systems on equipment located throughout the Rice University community, Siemens Desigo and/or Tridium Web Supervisor are the two approved HMI’s. This section establishes seamless interconnection with third party electrical and mechanical building systems. These subsystems shall be controlled and monitored through the same front end system as located at the Central Plant, and are graphically programmed with the same user consoles as provided to each and every operator station.
 - ii. All desired system information to or from the indicated equipment shall be available to the system. No limits shall be placed by the equipment manufacturer on the owner with regard to the access of or the transmission of or what may be done with the data provided from the equipment control system.
 - iii. Full cooperation by the equipment manufacturer in this open protocol effort shall be a requirement for bidding. No exceptions shall be allowed to this requirement, and no bid shall be accepted which does not define clearly and exactly how the proposed equipment will comply with this section. This includes but is not limited to all Variable Frequency Drives (VFD), electric power equipment, emergency generators, lighting systems, and the Air Quality Monitoring System.
- s. Field Devices
 - i. Temperature Sensors
 - 1. Provide temperature sensors for duct, immersion, remote probe, and outside air applications.
 - 2. DDC temperature sensors shall be of the 100 ohm, 500 ohm, or 1000 ohm nickel or platinum RTD, or 10,000 ohm thermistor type.
 - 3. All sensors of a particular category shall be of the same type manufacturer and shall have an interchangeability of +/- 0.1% at three reference temperature.
 - 4. Sensor time constant response to temperature change time shall be less than three (3) seconds per degree change.
 - 5. Sensors requiring field-calibration shall not be acceptable.
 - 6. All sensors shall be precise and accurate so that they do not require adjustments or calibrations.

7. Minimum sensor operating ranges shall be as follows:
 - a. Chilled Water – 30°F to 100°F
 - b. Condenser water – 30°F to 150°F
 - c. Air Systems – 0°F to 150°F
 - d. Outside Air – 0°F to 120°F
 - e. Hot Water – 40°F to 240°F
- ii. Duct Sensors
 1. Provide flanged or threaded or threaded probe type sensors designed for duct type mounting.
 2. Sensor shall be encapsulated in an aluminum probe 4" in length.
 3. Sensors shall include a suitable junction box for terminating sensor wiring and shall include a lagging protrusion where installed in externally insulated ducts.
 4. Adjacent to each sensor provide a test hole plugged with a removable cap or plug to be used for test and calibration purposes.
 5. All sensors shall be located in the most easily accessible location while providing accurate sampling.
- iii. Immersion Sensors
 1. Provide Immersion type sensors with a ½" OD threaded fitting for direct installation in a thermo-well.
 2. The probe shall be encapsulated in an aluminum, brass, or stainless steel jacket and shall be installed in a stainless steel thermo-well (provided by Div. 17 contractor) suitable for installation in a ¾" NPT threaded fitting.
 3. Sensors shall include a suitable junction box for terminating sensor wiring.
 4. Thermo-wells shall have pressure and temperature ratings suitable for their application.
 5. Thermo-wells for insulated piping shall have a 2-1/2" lagging protrusion.
 6. Locate thermo-wells so the sensing probe will give a true and correct reading.
 7. Install thermo-wells on the side of pipes and so as to not cause undue restriction in small piping.
 8. Where thermo-wells are located in pipe lines 1-1/2" and smaller, provide a section of pipe of such diameter that the net area of the pipe line will not be reduced by the thermometer well.
 9. All thermo-wells shall be filled with silicon and complete with caps and chains.
 10. Thermo-wells shall be installed on a 45-degree angle into the direction of water flow in the monitored piping.
- iv. Remote Probe Sensors

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1. Provide remote probe sensors with sensing elements encapsulated in a nominal 2" stainless steel sheath suitable for return air, or strap-on mounting.
 2. Sensors shall include a nominal 3' lead section and a suitable junction box for terminating sensor wiring.
- v. Outside Air Sensors
1. Provide shielded weatherproof outside air sensors with sensing elements encapsulated in a nominal 2" stainless steel sheath suitable for outdoor applications.
 2. Sensors shall include a waterproof junction box, or conduit body for terminating sensor wiring and a removable sun shield.
 3. Location shall be on exterior NORTH sidewall at a level requiring a six (6) foot stepladder for servicing. Do not install at ground accessible level.
- vi. Electronic Analog Sensors
1. Range: Sensors shall operate within the range indicated above for Heating, Ventilating, and Air Conditioning (HVAC) systems.
 2. Accuracy: Provide electronic analog sensors with an accuracy of +/- 0.5°F.
 3. Provide sensors with a time constant response to achieve 60% of a step temperature change in six (6) seconds in air or water flowing at three (3) feet per second.
 4. Sensors of the same type shall be interchangeable without calibration.
- vii. Humidity Sensors
1. Duct Sensor with accuracy of +3% RH @ 77.0°F, range of 10% RH to 90% RH, including hysteresis, linearity, and repeatability.
 2. Room Sensors with accuracy of 5% RH @ 77.0°F, range of 0% RH to 100% RH.
 3. Pressure Sensors
 - a. Sized, as needed, for best accuracy.
 - b. Provide pressure sensors impervious to instantaneous pressure changes of 150% of working pressure.
 - c. Provide sensors with external adjustable span and adjustable zero (Averaging type).
 - d. Provide pressure sensors with the following characteristics:
 - i. Ambient temperature: 40°F to 140°F
 - ii. Provide pressure sensors with stainless steel needle isolation valves between each sensor and sensor pressure source.
 - iii. Provide differential pressure sensors with three (3) valve manifold for isolation and nulling.

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- iv. On steam systems provide pressure sensors with a pigtail siphon between the sensor isolation valve and sensor.
 - v. Provide condensate wells and blowdown valves for differential pressure sensors.
 - vi. Provide switching type sensors with platinum alloy, silver alloy, or gold plated wiping contacts rated for the application, voltage and power levels.
 - vii. Provide valved-calibration taps adjacent to each pressure sensor for calibration.
 - 4. Differential Pressure Analog Sensors
 - a. Provide differential pressure analog sensors of the solid state pre-amplifier types for electronic systems.
 - viii. Flow Sensors
 - 1. Provide sensors for measuring flow in piping and ductwork that are compatible with static pressure and differential pressure analog of the pneumatic and electronic controllers served.
 - 2. Provide sensors with an output characteristic which gives a continuous mathematical function over the full range of flow from maximum to minimum required.
 - 3. Mount flow sensor concealed in public spaces or exposed in mechanical equipment room.
 - ix. Temperature Indicators
 - 1. Provide a temperature indicator for each sensor, thermostat, and thermostatic switch except room thermostat.
 - 2. Sensing elements shall be compatible to, and similar to, those of sensors, thermostats, and thermostatic switches.
 - 3. Sensing elements for pipes and taps shall have separable stainless steel or bronze screw wells with heat sensitive liquid in the well.
 - 4. Select indicators with the midpoint range readings approximately equal to the normally expected temperature of the measure medium.
 - 5. For local indication provide liquid-in-glass or remote bulb dial type indicators. For remote indication provide sensor-transmitter with remote indicator.
 - a. Liquid-in-glass indicators shall be remote reading, seven (7) inches long, bronze or stainless steel casings, rigid stem, adjustable, with stainless steel or bronze screw insertion wells for piping or bolted insertion for air.
 - x. Damper Operators
 - 1. Sized for specific application.
 - xi. Automatic Control Valves
 - 1. Sized for specific application. (Provide separate Valve Schedule)

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2. All valves shall be installed with plastic engraved name tags to match Valve Schedule. Attach with stainless steel chain.
 3. Sequence staging shall be provided via the DDC system.
 4. Control valves over ½", shall be provided with a means to manually position the valve.
- xii. Air Quality Monitoring System Sensors (CO₂)
1. Provide indoor air quality sensors to monitor Carbon Dioxide (CO₂). Sensors shall be wall mounted and in the Sequence of Operation.
 - a. Wall mounted sensors shall be provided with paintable plastic cover to match interior finish (No LED indicators)
 2. Sensor Voltage shall be 24 VAC
 3. Sensing Range:
 - a. CO₂: 0-2000 ppm +/- 100 ppm
 - b. High level setpoint to be determined by Rice.
 4. CO₂ sensor shall have no more than 1% drift during the first year and minimal drift thereafter so no calibration will be required.
- xiii. Miscellaneous Field Devices
1. All field mounted valves, damper actuators, and sensors shall have engraved type nameplates attached by stainless steel chain. ID tag shall identify the device as shown on submittal drawings. "Dymo" type labels shall not be acceptable, except for room sensors.
 2. Field devices such as E/P's, P/E's, I/P's and relays shall be located in their equipment's respective control panel.
 3. Wall mounted devices are not acceptable.
 4. All field installed control devices, such as lab control modules, shall be installed inside a rated enclosure with wiring protected from external hazards.
 5. All field control panels containing devices shall be equipped with a hinged lockable door.
 6. Each panel and all devices inside each panel shall bear engraved nameplates which correspond to the ID as shown on submittal drawings.
 7. Do not attach nameplates to devices, rather attach to mounting back plane.
 8. All devices shall be wired through a wiring terminal strip located within the panel.
 9. Each terminal shall be identified to match submittal drawings.
 10. Provide each panel each panel with a 120 VAC switch, breaker and receptacle to accommodate test equipment.