

1. DESIGN STANDARD:

- 1.1 Rice University maintains an extensive Facility Control and Management System (FCMS). New and renovated systems must meet the following criteria:
 - 1.1.1 Each system controller must be stand-alone with processing capacity for all assigned control functions including time of day schedules.
 - 1.1.2 The individual controllers must communicate on the Ethernet LAN to the Central Site Operator interface located in the Central Plant Building. Provide all data points as required for the project. Subject to review by Rice University's Project Manager.
 - 1.1.3 All new and existing replacement systems must be Direct Digital Control. All open systems must use Lon Mark open protocol devices.
 - 1.1.4 All systems must communicate to and be configurable from one of the software systems maintained by Rice.
 - 1.1.4.1 Tridium
 - 1.1.4.2 Siemens System 600.
 - 1.1.5 All control points must be trendable, resettable (either operator initiated or event initiated), configurable and scalable.
 - 1.1.6 All software must be developed using dynamic graphics. Mapping and configuration of new points into the Human Machine Interface. (HMI) must be a requirement of each construction project.
- 1.2 A specification which defines the fundamental requirements of the FMCS will be supplied by the Rice University's Project Manager. The design professional must customize the specification for the project.
 - 1.2.1 Provide for an acceptance procedure for competitive products.
 - 1.2.2 Define sequences of operation for each piece of equipment.
 - 1.2.3 Complete a Point Input/Output Summary. The Summary must be reviewed by the Rice University's Project Manager at the Schematic Design, Design Development and Construction Document Phase of design process.

2. PRODUCT STANDARD:

- 2.1 The specification provided by the Rice University's Project Manager will give the design

professional performance standards for most of the devices that are to be specified.

- 2.1.1 Field communication should be convenient for operating personnel. All temperature sensor and field controllers must have ports for interrogation of system performance.
 - 2.1.2 Field devices including controllers should be housed in sturdy metal enclosures. Housing of sensors should be removable with tools provided by the manufacturer (tamper proof). Field cabinets should have hinged access and be lockable.
 - 2.1.3 Location of devices should be consistent with the criteria outlined for service of equipment (Ref 15050).
- 2.2 Actuators should be suitable for the controlled devices. Except as otherwise approved by the Rice University's Project Manager, actuators must be electric motor driven.
- 2.2.1 Steam valves must have normally closed, spring return actuators.
 - 2.2.2 Chilled and heating water valves should fail in the last commanded position. (If spring return is desirable for isolation of systems to preserve and direct emergency system capacity, the design profession should make that recommendation.)
 - 2.2.3 Outside air dampers must have normally closed, spring return actuators. Outside air dampers must have positive feed back on closure.
 - 2.2.4 Automatic volume control dampers may fail in the last commanded position. Dampers must be commanded closed when the air system is shut-down by the fire alarm system.
 - 2.2.5 Modulating control valves must be designed such that actuator travel is proportional to the change in flow. Globe, plug and characterized (ball) valves are acceptable. All control valves will have unions at the inlet and outlet sides of the valve.
 - 2.2.5.1 Steam coil, heat exchangers, re-boilers and coil slabs in excess of 200 gallons per minute should utilize two control valves (1/3-2/3 capacity control criteria). High turn-down valves with similar result may be considered.
 - 2.2.5.2 Two position valves must close-off against the shut-of head of the system pump.
 - 2.2.5.3 Chilled and heating water valves/actuators should be designed for modulating control at 35 psig differential pressure without noise or damage to valve.

- 2.2.5.4 System bypass valves (where used) should modulate against the design head of the system without noise or valve seat damage.
 - 2.2.5.5 Three-way mixing valves used for heating water temperature reset, should open to the heating device when the pumping system is shut-down to prevent overheating at the heating equipment.
 - 2.2.5.6 All control valves must be rebuildable in the field. "Throw-away" valves are not acceptable.
- 2.3 Energy flow measurement at each building should include:
- 2.3.1 Chilled water flow(gpm), supply and return temperature and calculated BTUH.
 - 2.3.2 Steam mass flow and calculated BTUH.
 - 2.3.3 Electrical building use reported in KW and KWH.
 - 2.3.4 Instruments specified will be approved by Rice University's Project Manager.
3. PERFORMANCE STANDARD:
- 3.1 Flow control of chilled water systems must be maintained by straight through valves at coils and variable frequency drives on building pumps. VFD control should be based on system differential pressure. Reset of pressure control based on maximum commanded valve position of cooling coils should be employed.
 - 3.2 A proof of flow device in each heating water system must be "hard wire" interlocked to prevent flow of steam when proof of flow is not established.
 - 3.3 The following data must be transmitted to the FCMS:
 - 3.3.1 Chilled water supply and return temperature, flow pressure. Calculated use (tons).
 - 3.3.2 Steam mass flow rate (1 lbs/hr) Steam pressure.
 - 3.3.3 Alarms for high chilled water temperature, no flow for heating water, steam high pressure, status failure for chilled and heating pumps, high level (failure) of condensate receivers.
 - 3.4 Freeze protection of outside air unit preheat coils must be applied. Acceptable methods are pumped hot water coils or steam coils. Size of preheat coil should be minimized

(40°F maximum LAT). Apply separate heating coil if necessary to deliver higher LAT for heating service.

- 3.4.1 Freeze stat must be serpentine to cover face of coils. Stat must be manual reset type and must shut down unit, close damper and maintain LAT at coil face when any 1'-0" section of continuous element senses temperature below the low limit (35°F adjustable).
- 3.4.2 Minimum required access for continuous or averaging elements is 36" between coils.
- 3.5 Outside air temperature reset must be employed. Each "new" building or significant "addition" should include an outside air sensor for this purpose. Reliance on global OA sensors is not advised. Outside air reset schedule must be adjustable. Automatic reset of set point based on building demand should be considered.
- 3.6 Single zone units must employ adjustable dead bands to avoid simultaneous heating and cooling.
- 3.7 VAV systems must reduce flow to minimum before heating is applied.
- 3.8 Double duct systems must be VAV whenever possible. Logic for volume control must be carefully applied.
- 3.9 Air system should be schedulable by individual thermostatic zone. Normal over-ride is from the FCMS by the operator.
 - 3.9.1 In some cases, the space user may require direct interface with the FCMS for system over-ride. Method of interface must be approved by the Rice University's Project Manager.
 - 3.9.2 Morning warm-up/cool-down without outside air should be employed.
 - 3.9.3 Unoccupied set-up and set-back should be employed on most air systems.