Division 15 Mechanical

Section 15970 - Control Systems

Introduction

Equipment associated with:

THE MANAGEMENT OF HEATING, VENTILATION, AND AIR CONDITIONING RELATED UTILITIES.

Part 1 - General

- The Energy Management Control System (EMCS) shall be Direct Digital Control, fully automatic, with electric and electronic components as required. All actuation within mechanical rooms and major air handling units shall be electric/electronic. Discuss with the University if pneumatic controls are being proposed.

- All terminal boxes, sensors and actuators shall be electronic/electric.

- System design shall be capable of Stand-Alone operation, defined as operating the equipment in a safe manner even when completely disconnected from the rest of the network. This mode of operation may not be able to achieve all aspects of the sequence of operation (SOO), but it shall still operate the equipment under a basic control scheme achievable with the local inputs and outputs available to the controller while operating under stand-alone circumstances. An alarm shall always be generated and sent to the EMCS monitoring system operator(s) when a controller is not connected to the network.

- System design shall be modular to ensure future expansion capabilities, whether it be additional control/monitoring points or supervisory functions.

- System shall have a minimum of 10% capacity expansion within the current equipment.

- Monitor all central utilities and emergency systems from a local and remote location.

- Metering devices to be installed per design guidelines Section 15980.

- Provide electronic speed control for variable volume systems.

- All controllers on new building projects must be native BACnet: BACnet compliant and BTL-certified (ASHRAE Standard 135-2012). Exceptions only with University approval. If the project is within an existing building, the communication protocol may match existing, pending University approval.

Part 2 - Products

- The EMCS shall consist of high-speed, peer-to-peer network of native BACnet DDC controllers and Niagara^{AX} Network manager(s) (Niagara^{AX} JACE). Discuss JACE size with the University.

- The building controls interface shall be web-based. Access to the building network manager (Niagara^{AX} JACE) shall be accommodated via an embedded web server. Control system access shall not require special operator software for web browser access.

- The direct digital control system shall be directly connected to the Owner's campus-wide EMCS via an IP network connection to campus control network. Coordination with University of Arizona Facilities IT is required to obtain network connectivity and configuration information.

- BACnet communications protocol will be utilized on the dedicated building communication network between EMCS controllers and other BACnet devices to assure interoperability between all devices within the building network. BACnet/IP shall be used for major equipment controllers, while BACnet MS/TP will be acceptable for minor equipment (such as terminal units, individual zone controls, etc.). BACnet/Ethernet shall be disabled on

any device capable of supporting this protocol. Coordination with University of Arizona Facilities IT is required to obtain BACnet network connectivity and configuration information.

- The EMCS shall provide the direct integration of standard BACnet/IP and Modbus TCP protocols. LonWorks/LonTalk protocol shall be supported where applicable.

- The EMCS shall provide BACnet/IP communication in compliance with the ASHRAE Standard 135 Annex J. All B-BC and B-AAC controllers, as well as any BACnet gateways used (by specific University of Arizona permission only), must be BACnet/IP. B-ASC, B-SA, and B-SS controllers may be BACnet MS/TP.

- All software shall be latest version available at the date of substantial completion.

- Noise, surge and spike protection: Kele model # HSP-121-B

- Shall be capable of withstanding power outages and surges for extended periods of time.

- Memories shall be non-volatile, or unit shall hold memory up to 30 days minimum on backup batteries.

- All CV and VAV terminal unit controls shall be DDC application specific type for new building construction (B-ASC).

- Use Fisher 92B steam pressure reducing valve with the appropriate pilot.

- Use manual reset freeze stats.

- Humidity sensors: OMEGA-HX-93C.

- Siemens, Alerton, Automated Logic, Delta Controls, Trane, Distech, Honeywell, and Schneider Electric all offer BACnet-compliant, BTL-certified controls products. Other manufacturers may also offer suitable products for use at University of Arizona. All Building Automation, Controls, or Energy Monitoring System products are subject to University of Arizona approval.

Part 3 - Execution

- Supply the following monitoring and control features where applicable:

  - Building Systems- Complete utility usage (water, Heating water, chilled water, electric) see section 15980 for additional requirements.

  - Utility Usage

    Chilled water flow in GPM, totalized energy in BTU's.
    Chilled water header differential pressure (psig).
    Heating Hot water flow in GPM, totalized energy in BTU's.
    Domestic Hot water flow in GPM totalized in Btu's.
    Domestic water totalized in gallons.
    Electric use totalized in kW hrs., real time demand in kW.
    Individual equipment power and energy use where required by University of Arizona.
    Chilled water supply and return pressure and temperatures.
    Steam pressures.
    Domestic water pressures.
    Hot water supply and return pressure and temperatures.
    Status of equipment pumps and drives.
    Change of set point capability for all variable frequency drives.
    Provide HVAC equipment greater than 1 HP with time scheduling capability, i.e., time clocks.
    Reset of hot water supply temperatures.
    Chiller operational status, run times, pressures and temperatures.

Cooling tower operational status and temperatures.
Report of any EMCS component failures on critical equipment as required by University of Arizona.
Emergency generator-run time, load, kW, kVA.
Alarms as specified in other sections.

- Individual Unit Characteristics

  Air Handler status, start/stop.
  Supply, Return and Mixed air temperatures.
  Return Air humidity (expressed as dew point temperature).
  Demand reset of hot and cold decks (based on zone terminal unit demand).
  Economizer control (enthalpy).
  Chilled water return temperature control.
  Lighting controls where specified.
  Occupancy reset of temperature and system shutdown (scheduled and/or via sensors).
  Filter differential pressure indication.
  Space humidity status and reset when specified,
  High limit humidity control.(Dehumidification mode).
  Status of Hot and Cold duct static pressure.
  Demand reset of duct static pressure.
  Active control strategy for maintaining outdoor air requirements, (e.g.: CO_2 sensing, flow measurement).

- Terminal Unit characteristics

  Adjustment of flow set points (min and max).
  Override of temperature setpoint.
  Occupied and Unoccupied set points for flow and temperature.
  Adjustable dead-band.
  Discharge air temperature.
  Valve position.
  % cooling load.
  %heating load.
  Current flow setpoint.
  Current airflow.

- Provide a single building outdoor air station that measures Temperature and Humidity. (This station will be used for all building reset and AHU mode decisions, i.e.: economizer, dehumidification.) This station must be installed on the North side of the facility out of direct sunlight in a location that will not be affected by influences other than actual ambient air conditions, such as exhaust air, radiant heat from nearby objects, reflected radiant heat, evaporation, vandalism, or other confounding factors.

- Dew point temperature is to be used for humidity control actions not relative humidity.

- Provide airflow measuring stations as required.

- All control valves and isolation valves are to be located outside the Air Handler enclosure (not in the airstream).

- Chilled water control valves to fail to “open” position. Hot water control valves to fail to “closed” position.

- Provide adequate space to install all control valves with stems in the vertical position without exception.

- Provide adjustable static pressure safety switch to shut down VFD controlled fans.

- Identify all controls and wiring within pertinent control panel and provide control system drawing framed under Plexiglass on inside of panel door.

- All Graphic screens to be submitted for review and approval by the University prior to installation.

- Contractor shall provide all software (including any licensing required), hardware (special cables, operator terminals, etc.), and administrator access privileges to allow full configuration, programming, and administration of all system components and devices provided.

- Contractor to provide one (1) week (forty hours) of factory-approved classroom training for a University Technician as part of their project scope. This training shall cover basic system operator topics, and shall include study materials suitable for use in cross-training other University Technicians. Submission of training materials is required in the submittal phase. Training is to be scheduled at the University's convenience.

End of Section 15970