

- a. Floor Plans with panel and controller locations and control wiring routing.
- b. Shop drawings.
- c. Control Narratives.

10.0 Equipment Status

- .1 Where the status of electrical devices such as motors or heaters must be monitored, the preferred interface with the control panel is via a current donut.

11.0 Freezes stats

- .1 freeze stats shall be manual reset for all systems and shall be capillary type sensitive to the nearest 0.3 ft. The element shall be of sufficient length to traverse ducts, coils or plenums three times (see 17.517). Replace existing 1 pole freeze stats with suitable 2 pole freeze stats to provide alarm connection.
- .2 Freeze stats shall be dual pole, one of the relay contacts to be wired to the fan starter and the other contact to be wired to the BAS controller for indication, alarming and proper equipment shutdown sequence.
- .3 Low condensate temperature freeze stats shall not be installed or connected.

12.0 Pressure Sensors

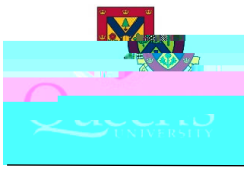
- .1 Pressure sensors shall be differential pressure type with range and output to suit application.
- .2 Acceptable sensor types are: Enercorp Model LPTB

13.0 Current Operated Switches

- .1 Acceptable current operated switches are Greystone CS-100, Enercorp Model D150-

14.0 Solid State Relays

- .1 Interface to motor controllers or other electrical loads shall be through a high "coil" impedance solid state relay. Where the controlled load exceeds two (2) amperes, provide



Johnson A-4000-137
Barber Colman AL-431
Balston 9900-05DX

- .2 Air pressure gauges installed with EPTs shall be 1-1/2" in diameter and have a range of 0-30 psig. Gauges shall be firmly supported by mounting in brass gauge blocks which are to be securely attached to enclosures with mechanical fasteners.

16.0 Cabling

.1 Cabling to Field Interface Box (FIB)

Cabling to the field interface box shall be accomplished using copper multi-pair cable with uniquely colour-coded pairs. AWG 24 wiring shall be used for runs of 300 feet or less. AWG 22 shall be used for runs of 300 feet or more. Aluminum conductor cable shall not be used for signal transmission purposes. Size cables for 25% spare conductors. CAT6 cable shall be used for Ethernet-enabled devices.

.2 Floor Distribution

Cabling from the floor distribution box to sensor/actuator location shall be accomplished with 24 AWG stranded cable Beldon 9501 or equivalent.

.3 Room Temperature Sensor Cable

Cable between room temperature sensors and remote I/O units shall be Belden 9501 single pair cable or approved equivalent.

.4 Remote I/O Unit Network Cable

Cabling between the main control panel and remote I/O units shall be FT6 CAT6 data cable containing 2 pairs of conductors minimum.

.5 Installation Practices

All installations shall be performed in a neat and professional manner throughout and shall comply with applicable codes and legislation.

17.0 Conduits

- .1 Unless explicitly specified by Facilities, all wiring outside electrical enclosures shall be installed in EMT. Conduits shall not be filled past 75% of capacity. A pull rope shall be left in each conduit when the installation is complete. Bend radius shall be greater than 3 times the conduit diameter. A maximum of three 90 degree bends is permitted between pull boxes. The installation shall follow horizontal and vertical lines to fit the layout of the area and shall be properly installed
- .2 Conceal conduits except in mechanical and electrical service rooms and other unfinished areas.
- .3 Where it is not practical to conceal conduits in finished areas, obtain written authorization from Facilities to use surface mounted raceway (SMR). Use a commercially available SMR acceptable to Facilities with compatible components.
- .4 All surface mounted boxes shall have covers designed to fit the box without exposed sharp corners.

18.0 Cable Labelling



- .1 Each multi-conductor cable shall be indelibly labelled at both ends with its cable number. A list identifying the signal carried by each pair in the cable and the cable colour code shall be provided as part of the documentation package.
- .2 Single pair cable, such as is used in floor distribution (17.402), shall be indelibly labelled at both ends with the name of the signal conveyed.

19.0 Pneumatic Installation

- .1 An air pressure gauge shall be installed on the control side of each electric to pneumatic transducer and on the supply to each transducer enclosure. An inline air filter shall be installed on the supply side of each electric to pneumatic transducer. Control air piping shall be type "M" copper. The installation shall follow horizontal and vertical lines to fit the layout of the area and shall be properly installed. Copper tubing joints shall be solder fittings except at the instruments where compression fittings may be used. Nonmetallic tubing is permitted at device connections only with a maximum length of 1 m. Nonmetallic tubing joints shall use barbed connectors. The use of tubing as connectors is not acceptable. Pneumatic tubing shall be tagged at both ends with the name of the signal conveyed. All pneumatic components removed shall be turned over to the owner.

20.0 Component Labelling

- .1 Engraved lamacoid plastic name plates with white lettering and a black background shall be installed at all sensors, control panels, field interface boxes and all other instruments to clearly indicate the service of a particular device.
- .2 On all sensor nameplates provide the point descriptor name (e.g. DUN_A01_MAT). Point descriptor names shall follow the Descriptor Naming Guideline presented in Section 25.601.
- .3 Provide a nameplate at each computer connection labelled "COMPUTER CONNECTION".
- .4 Attach a nameplate to the outside of each FIB and control panel. Nameplate shall indicate panel type and panel number (e.g. FIB-2A).
- .5 Each FIB nameplate shall also indicate associated control panel and control panel location.
- .6 Beside each relay, EPT etc. attach a permanent nameplate indicating the point descriptor associated with the relay.
- .7 Mechanically fasten nameplates.
- .8 On each motor starter attach a nameplate indicating point descriptor of the starter.

21.0 Component Attachment

- .1 Components, as well as cable, conduit and tubing, shall be attached to a means of support using suitable hardware. Adhesive mounting devices are not acceptable.

22.0 CO2 Sensors

- .1 Duct mounted CO2 sensors to be Vaisala Model GMD20D.

23.0 Outdoor Air Temperature Sensors



- .1 Outdoor Air Temperature Sensors (OAT) shall be installed on the north side of the building, well away from sources of heat such as lamps or exhaust vents. OAT sensors shall not be mounted in locations where there is a horizontal surface less than five feet below the sensor.
- .2 All acceptable OAT sensors have a solar shield. The sensor shall be oriented so that the shield opens downward. The conduit running to the sensor box from the building interior shall be sealed to prevent ingress of warm building air. Sensor shall be mounted to an FS type box. An FS cover and gasket shall be installed.
- .3 OAT sensors shall not be mounted in fan intakes.

24.0 Control Panel Installation

- .1 The control panel shall be installed in a non-locking electrical enclosure with hinged cover and with minimum dimensions of 30" in height, 20" in width and 6" in depth. The panel shall be mounted in such a way as to allow the installation and access to expander modules.
- .2 Control panel cabinets shall have a removable inner mounting plate.
- .3 Field interface devices such as relays and pneumatic transducers shall not be mounted in the same enclosure as the control panel.
- .4 The control panel 24Vac supply transformer shall be mounted in a 12"x12"x6" electrical enclosure with hinged cover. A dedicated 120Vac circuit shall be wired to the transformer



- .1 The contractor shall do all cutting and breaking works, removal of rubbish, etc. required in the building for the installation of the work. The contractor shall be responsible for patching and painting to match existing finishes damaged during construction.

29.0 Cleaning

- .1 Leave area clean at the end of the day. Remove waste materials and rubbish from the site.

30.0 Fire Prevention

- .1 All necessary precautions must be taken to eliminate any possible fire hazard. Provide sufficient and adequate firefighting equipment in first class order, to protect against any fire emergency in the area of the work. Provide firestop caulking when a penetration has been made through a fire separation.

31.0 Existing Enclosures

- .1 Where approved by Facilities, existing enclosures containing equipment made redundant by this installation may be reused provided they are of sufficient size and are undamaged. Remove redundant equipment. When reusing enclosures ensure any reference to cable numbers in or on the enclosure are corrected to indicate the current cable number.

32.0 Sensor Installation

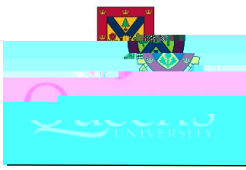
- .1 Mount sensors to manufacturers' instructions. Duct temperature averaging sensors shall have capillaries of sufficient length to traverse the duct three times. Averaging type duct temperature sensors shall be used for measuring:
 - .2 mixed air temperatures;
 - supply air temperatures when the sensors cannot be placed downstream of both coils and fans;
 - hot deck temperatures;
 - cold deck temperatures;
 - temperatures that are to be sensed immediately downstream of coils.
 - .3 Return air temperature sensors shall be installed upstream of return fans.
 - .4 Supply air temperature sensors shall be installed downstream of supply fans.

33.0 Dampers and Valves

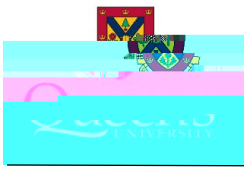
- .1 It is the responsibility of both the controls contractor and equipment suppliers to insure the proper operation of valves, dampers, and linkages.
- .2 Damper operators shall not be mounted in the air stream. Damper operators shall be easily accessible for adjustment, maintenance and replacement.

34.0 Naming Convention

- .1 Names shall be reviewed with Facilities before implementation.
- .2 QUEMS II computer names are composed of 8 to 16 characters, including two



.4 The next two or three characters (###_



- .4 During commissioning the contractor shall record on a form acceptable to Facilities the status of each point when commissioning. Any deficiencies shall be noted. When deficiencies are corrected the point shall be rechecked for proper operation and recorded.

37.2 Documentation

- .1 The following documentation shall be provided:
 - Schematic of each system showing component names
 - Floor plan showing areas served and location of equipment
 - Cross referenced point names to be provided on paper and in Excel or compatible format on USB drive.
 - Description of dampers and valves including whether normally open or normally closed
 - Commissioning signed verification report
 - Sensor calibration data
 - Catalogue cuts for parts supplied
 - Diagram of each FIB showing location of components, control circuit wiring, point descriptor and name of equipment controlled or monitored. Indicate relay type.
 - Control narrative, describing in detail the sequence of operation.

37.3 Standards and each sysl2i()Ji g261. 5