

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning.
- .2 Section 25 05 01 - EMCS: General Requirements.
- .3 Section 25 05 02 - EMCS: Submittals and Review Process.
- .4 Section 25 05 54 - EMCS: Identification.
- .5 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.
- .6 Section 26 05 00 - Common Work Results - Electrical.
- .7 Section 26 27 26 - Wiring Devices.

### **1.2 REFERENCES**

- .1 American National Standards Institute (ANSI).
  - .1 ANSI C12.7-1993 (R1999), Requirements for Watthour Meter Sockets.
  - .2 ANSI/IEEE C57.13-1993, Standard Requirements for Instrument Transformers.
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.
- .3 National Electrical Manufacturer's Association (NEMA).
  - .1 NEMA 250-03, Enclosures for Electrical Equipment (1,000 Volts Maximum).
- .4 Canadian Standards Association (CSA).
  - .1 CSA-C22.1SB-F02, Canadian Electrical Code, Part 1 (19<sup>th</sup> Edition) Safety Standard for Electrical Instalaltions.

### **1.3 DEFINITIONS**

- .1 Acronyms and Definitions: Refer to Section 25 05 01 - EMCS: General Requirements.
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## **1.4 SUBMITTALS**

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.
- .2 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions for specified equipment and devices.

## **1.5 EXISTING CONDITIONS**

- .1 Cutting and Adjusting: In accordance with the Architectural Section.
- .2 If needed, repair surfaces that were damaged during Work execution.
- .3 Hand over to the Departmental Representative all removed material that cannot be reused.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- .1 Control devices of each category to be of same type and manufacturer.
  - .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, vibration-proof assembly.
  - .3 Operating conditions: 0 - 32 °C with 10 - 90% relative humidity (RH) (non-condensing) unless otherwise specified.
  - .4 Terminations: Use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
  - .5 Transmitters and sensors to be unaffected by external transmitters including walkie-talkies.
  - .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
  - .7 Outdoor Installations: Use weatherproof construction in NEMA 4 enclosures.
  - .8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.
  - .9 Measure Range: As required by each system.
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## **2.2 TEMPERATURE SENSORS**

- .1 General - except in the case of ambient temperature sensors, the sensors type must be of the resistance or thermistance type and have the following characteristics.
    - .1 Thermistance: 10 kohms at 21 °C, NTC characteristic. Sensors must be linearized in the controllers.
    - .2 Sensing element: Fully sealed.
    - .3 Rod and tip: Copper or stainless steel grade 304.
    - .4 Response time: Less than 3 seconds for a temperature variation of 10 °C.
    - .5 Immersion wells: NPS ¾, stainless steel spring loaded construction, with heat transfer compound compatible with sensor.
  - .2 Room temperature sensors and display wall modules.
    - .1 Temperature sensing and display wall module.
      - .1 LCD display to show space temperature and temperature setpoint.
      - .2 Buttons for occupant selection of temperature setpoint and occupied/unoccupied mode.
      - .3 Jack connection for plugging in laptop personal computer, contractor supplied zone terminal unit and contractor supplied palm compatible handheld device for access to zone bus.
      - .4 Integral thermistor sensing element 10,000 ohm at 2 °C.
      - .5 Accuracy 0.2 °C over range of 0 to 70 °C.
      - .6 Stability 0.02 °C drift per year.
      - .7 Separate mounting base for ease of installation.
    - .2 Room temperature sensors.
      - .1 Wall mounting, in slotted type covers having finish as indicated.
      - .2 Element 10-50 mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of ±0.2 °C.
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.3 Air Duct Temperature Sensors:

- .1 General purpose air duct type: Suitable for insertion into air ducts at various orientations, insertion length 460 mm or as indicated.
- .2 Averaging air duct type: Incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 6,000 mm. Bend probe at field installation time to 100 mm radius at point along probe without degradation of performance.

## **2.3 HUMIDITY SENSORS**

.1 Characteristics:

- .1 Entry signal provided by relative humidity sensors with the previously detailed characteristics.
- .2 4-20mA output signal with a maximum resistance of 500 ohms.
- .3 Protections at the input and output against short circuits.
- .4 Output variation: Less than 0.2% of full scale for supply voltage variation of  $\pm 10\%$ .
- .5 Combined non-linearity, repeatability, hysteresis effects: not to exceed  $\pm 1\%$  of full scale output.
- .6 Integral zero and span adjustments.
- .7 Temperature effects: Not to exceed  $\pm 1.0\%$  of full scale/6 months.
- .8 Long term output drift: Not to exceed 0.25% of full scale/6 months.

## **2.4 PRESSURE TRANSMITTERS**

.1 Characteristics:

- .1 Combined pressure transmitters.
    - .1 Internal materials: Suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
  - .2 Output signal: 4 - 20 mA into 500 ohms maximum load.
  - .3 Output variations: Less than 0.2% full scale for supply voltage variations of  $\pm 10\%$ .
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- .4 Combined non-linearity, repeatability, and hysteresis effects: Not to exceed  $\pm 0.5\%$  of full scale output over entire range.
- .5 Temperature effects: Not to exceed  $\pm 1.5\%$  full scale/50 °C.
- .6 Over-pressure input protection to at least twice rated input pressure.
- .7 Output short circuit and open circuit protection.
- .8 Precision in the order of  $\pm 1\%$  on the full scale.

## **2.5 DIFFERENTIAL PRESSURE TRANSMITTERS**

- .1 Characteristics:
  - .1 Internal materials: Suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
  - .2 Output signal: 4 - 20 mA into 500 ohms maximum load.
  - .3 Output variations: Less than 0.2% full scale for supply voltage variations of  $\pm 10\%$ .
  - .4 Combined non-linearity, repeatability, and hysteresis effects: Not to exceed  $\pm 0.5\%$  of full scale output over entire range.
  - .5 Integral zero and span adjustment.
  - .6 Temperature effects: Not to exceed  $\pm 1.5\%$  full scale/50 °C.
  - .7 Over-pressure input protection to at least twice rated input pressure.
  - .8 Output short circuit and open circuit protection.
  - .9 Unit to have 12.5 mm NPT conduit connection. Enclosure to be integral part of unit.

## **2.6 DAMPER LIMIT SWITCH**

- .1 Limit Switch:
    - .1 Acceptable products: Telemecanique; LSA1A Honeywell.
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## **2.7 CURRENT TRANSDUCER**

- .1 Requirements:
  - .1 Purpose: Combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:
    - .1 4-20 mA DC.
    - .2 0-1 VDC.
    - .3 0-10 VDC.
    - .4 0-20 VDC.
  - .2 Frequency insensitive from 10 - 80 Hz.
  - .3 Accuracy to 0.5% full scale.
  - .4 Zero and span adjustments. Field adjustable range to suit motor applications.
  - .5 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

## **2.8 CONTROL PANELS**

- .1 Install new equipment in the existing panels. Provide new panels as required.
- .2 Wall mounted enamelled steel cabinets with hinged and key-locked front door.
- .3 Multiple panels as indicated to handle requirements with additional space to accommodate 25% additional capacity as required by Departmental Representative without adding additional cabinets.
- .4 Panels to be lockable with same key.

## **2.9 WIRING**

- .1 In accordance with Section 26 27 26 - Wiring Devices.
  - .2 For wiring under 70 V use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.
  - .3 Wiring must be continuous without joints.
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- .4 Sizes:
  - .1 Field wiring to digital device: #18 AWG twisted pairs.
  - .2 Analog input and output: Shielded #18 minimum solid copper twisted pair.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
  - .2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
  - .3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: Install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.
  - .4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.
  - .5 Electrical system:
    - .1 Complete installation in accordance with Section 26 05 00 - Common Work Results - Electrical.
    - .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.
    - .3 Refer to electrical control schematics included as part of control design schematics on drawings mentioned in section 25 90 01 EMCS: Site Requirements, Applications and Systems Sequences of Operation. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Departmental Representative before beginning Work.
    - .4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
    - .5 Install communication wiring in conduit.
      - .1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).
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- .2 Conduct sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
- .3 Conduct filling should not exceed 40% of their capacity.
- .4 Design drawings do not show conduit layout.
- .6 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative review before beginning Work. Wiring in mechanical rooms and in service rooms, and exposed wiring must be in conduit.
- .6 VAV Terminal Units:
  - .1 Co-ordinate air flow adjustments with balancing trade.

### **3.2 TEMPERATURE AND HUMIDITY SENSORS**

- .1 Install to ensure minimum field adjustments or calibrations.
- .2 Sensors must be readily accessible and adaptable to each type of application to allow quick and easy replacement and servicing without special tools or skills.
- .3 Outdoor Installation:
  - .1 Protect from solar radiation and wind effects by non-corroding shields.
  - .2 Install in NEMA 4 enclosures.
- .4 Duct Installations:
  - .1 Do not mount in dead air space.
  - .2 Locate within sensor vibration and velocity limits.
  - .3 Securely mount extended surface sensor.
  - .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
  - .5 Support sensor element separately from coils, filter racks.

### **3.3 CONTROL PANELS**

- .1 Arrange for conduit and tubing entry from top, bottom or either side.
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- .2 Wiring and tubing within panels: Locate in trays or individually clipped to back of panel.
- .3 Identify wiring and conduit clearly.

### **3.4 "MAGNEHELIC" MANOMETERS**

- .1 Install a "Magnehelic" manometer near each static pressure sensor associated to an air handling system and near each duct air flow measuring station, as instructed by the Departmental Representative.
- .2 Install "Magnehelic" manometer as indicated on the plans.

### **3.5 IDENTIFICATION**

- .1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

### **3.6 TESTING AND COMMISSIONING**

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

**END OF SECTION**

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