

Part 1 General

1.1 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit commissioning plans and procedures, in writing, at least 20 Working days prior to commissioning.

1.2 CLOSEOUT SUBMITTALS

- .1 Final Report:
 - .1 Include measurements, final settings and certified test results.
 - .2 Include completed commissioning forms
 - .3 Bear signature of commissioning technician and supervisor
 - .4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications as set during commissioning and submit to the Contract Administrator in accordance with Section 01 78 00 - Closeout Submittals.
 - .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.3 COMMISSIONING FORMS

- .1 The Contract Administrator will provide a base set of standard commissioning forms. Additional forms will be required, and must be prepared by the Contractor.
- .2 Supplement the provided forms as required to make a complete commissioning report package. Utilize the specifications, drawings, and Functional Requirements Specification as the basis for preparation of the additional commissioning forms.

1.4 COMMISSIONING

- .1 Carry out commissioning under direction of the Contract Administrator and in the presence of representatives of the Contract Administrator and the City.
- .2 Inform, and obtain approval from the Contract Administrator in writing at least 14 days prior to commissioning or each test. Indicate:
 - .1 Location and part of system to be tested or commissioned.
 - .2 Testing/commissioning procedures, anticipated results.
 - .3 Names of testing/commissioning personnel.
- .3 Correct deficiencies and re-test until satisfactory performance is obtained.
- .4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .5 Perform tests as required.

1.5 COMPLETION OF COMMISSIONING

- .1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Contract Administrator.

Part 2 Products

2.1 EQUIPMENT

- .1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.
- .2 Test instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.
- .3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 6 months prior to tests.

Part 3 Execution

3.1 STATUS PRIOR TO COMMISSIONING

- .1 Prior to commissioning, ensure that the following is completed:
 - .1 Installation of all panels and completion of all wiring connections.
 - .2 Testing wiring for continuity from the field device to the control panel.

3.2 PROCEDURES

- .1 Provide a minimum of one qualified technician to test and commission automation components.
- .2 Instrument I/O testing:
 - .1 Test both states of discrete points.
 - .2 Test, at minimum, two values for analog points.
- .3 Test each piece of equipment individually for complete functionality.
- .4 Completely test the E-Stop functionality of each piece of equipment, as provided.
- .5 All deficiencies must be corrected by the Contractor.
- .6 Commission each system using procedures prescribed by the Contract Administrator.
- .7 Optimize operation and performance of systems by fine-tuning control loops and PID values.

3.3 CALIBRATION

- .1 Where adjustability is provided on instruments with analog outputs, calibrate the analog output utilizing industry standard practices. Document and provided completed calibration forms.

3.4 CHECKLISTS, FORMS, AND REPORTS

- .1 Complete checklists, forms, and reports for each instrument, loop, and control device.
 - .1 Instrument Loop Checklist.
 - .2 Discrete Device Checklist

3.5 DEMONSTRATION

- .1 Demonstrate to the Contract Administrator operation of systems including sequence of operations under all potential conditions, start-up, shut-down interlocks and lock-outs.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .2 Canadian Standards Association (CSA International).
 - .1 CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.2 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

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.
- .3 Operating conditions: -40 – 55 degrees C with 5 - 95% RH (non-condensing) unless otherwise specified.

2.2 PUSHBUTTONS – PUSH-PULL/TWIST TO RELEASE

- .1 Supply and install a two-position maintained emergency stop operator station for Air Compressor AC-M903.
- .2 Requirements:
 - .1 Ingress Protection: NEMA 4
 - .2 Contact Life: 1,000,000 cycles
 - .3 Mechanical Life: 250,000 cycles
 - .4 Contact Rating: 10 A
 - .5 Contact Configuration: As shown on the drawings
 - .6 Illumination: Not required unless otherwise indicated.
- .3 Acceptable Products:
 - .1 Allen-Bradley 800T series as shown on the drawings or approved equal in accordance with B6.

Part 3 Execution

3.1 INSTALLATION

- .1 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .2 Readily accessible to allow for unhindered operation and servicing.
- .3 Wall installation:
 - .1 Located as shown on the drawings.
 - .2 Securely mounted.

3.2 IDENTIFICATION

- .1 Identify field devices with lamacoids. Install in a conspicuous location.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Process and HVAC instrumentation.

1.2 REFERENCES

- .1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .2 Canadian Standards Association (CSA International).
 - .1 CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 SUBMITTALS

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Manufacturer's Instructions:
 - .1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

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.
- .3 Operating conditions: 0 – 35 degrees C with 5 - 95% RH (non-condensing) unless otherwise specified.
- .4 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 DUCT TEMPERATURE SENSORS WITH INTEGRAL TRANSMITTERS

- .1 Requirements:
 - .1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.
 - .2 Sensing element: hermetically sealed.
 - .3 Stem and tip construction: copper or type 304 stainless steel.
 - .4 Time constant response: less than 3 seconds to temperature change of 10 degrees C.

- .5 Suitable for insertion into ducts at various orientations, insertion length 150 mm or as indicated
- .6 Transmitter:
 - .1 Power Supply: loop powered
 - .2 Output Signal: 4-20 mA, 2-wire
 - .3 Accuracy: 0.2 degrees C over range of 0 to 70 degrees C.
 - .4 Stability: 0.02 degrees C drift per year.
 - .5 Transmitter range: -40 °C to 60 °C
- .7 Acceptable Products:
 - .1 Rosemount
 - .2 Endress & Hauser

2.3 ROOM TEMPERATURE SENSOR WITH INTEGRAL TRANSMITTER

- .1 Requirements:
 - .1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.
 - .2 Mounting: Wall
 - .3 Protection: NEMA 4 or IP67
 - .4 Power Supply: loop powered
 - .5 Output Signal: 4-20 mA, 2-wire
 - .6 Accuracy: 0.2 degrees C over range of 0 to 70 degrees C.
 - .7 Stability: 0.02 degrees C drift per year.
 - .8 Acceptable Products:
 - .1 Rosemount
 - .2 Endress & Hauser TST434

2.4 FLOW SWITCH (DIFFERENTIAL PRESSURE SWITCH)

- .1 Service:
 - .1 Ventilation airflow, fan failure sensing.
- .2 Requirements:
 - .1 Industrial - grade
 - .2 Adjustment for setpoint pressure
 - .3 Temperature range:
 - .1 -20°C to 60°C
 - .4 Pressure limits:
 - .1 68.95 kPa (10 psig) continuous
 - .2 172.4 kPa (25 psig) surge
 - .5 Repeatability: +/- 2%
 - .6 Form C (SPDT) switch, rated 5A at 120 VAC
 - .7 Electrical connections: Inside enclosure

- .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.
- .9 CSA approved.
- .3 Sizing:
 - .1 Size as required to provide clear indication of air-flow failure.

2.5 ULTRASONIC LEVEL MEASUREMENT SYSTEM

- .1 Service:
 - .1 Fluid: Water
 - .2 Sensing range: 0 – 10m H₂O
- .2 Transmitter Requirements:
 - .1 Ambient Temperature: -20 to 50°C
 - .2 Power Supply: 120 VAC
 - .3 Enclosure: Wall mount, NEMA 4X
 - .4 Relay Outputs: Qty three (3) dry-contacts (2 SPST for Control, 1 SPDT for Alarm)
 - .5 Analog Output: Qty one (1) 4-20 mA
 - .6 Range: 0.3 to 15 m
 - .7 Accuracy: 0.25% of maximum range or 6 mm, whichever is greater.
 - .8 Resolution: 0.1% of program range or 2 mm, whichever is greater.
- .3 Transducer Requirements:
 - .1 Ambient Temperature: -20 to 65°C
 - .2 Degree of Protection: IP65/IP68
 - .3 Range: 0.3 to 8 m
 - .4 Beam Angle: 10°
 - .5 Frequency: 44 kHz
- .4 Cable Requirements:
 - .1 Type: 1 PR, 18 AWG, Shielded Twisted Pair
 - .2 Electrical Characteristics: 62.3 pF/m @ 1 kHz between conductors, 108.3 pF/m @ 1 kHz between conductor and shield
 - .3 Length: 10 meter
- .5 Acceptable Products:
 - .1 Siemens MultiRanger 200 Transmitter, Siemens Echomax XRS-5 transducer
 - .2 or approved equal in accordance with B6

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 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.
- .4 Electrical:
 - .1 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.
 - .2 Install communication wiring in conduit or utilizing ACIC cabling if shown on the drawings.
 - .1 Provide complete conduit /cable system to link instrumentation and the control panel(s).
 - .2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
 - .3 Maximum conduit fill not to exceed 40%.
 - .4 Design drawings do not show conduit layout.

3.2 TEMPERATURE SENSORS

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.
- .3 Duct installations:
 - .1 Do not mount in dead air space.
 - .2 Locate within sensor vibration and velocity limits.
 - .3 Securely mount extended surface sensor used to sense average temperature.
 - .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
 - .5 Support sensor element separately from coils, filter racks.
- .4 Averaging duct type temperature sensors.
 - .1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

3.3 FLOW SWITCH (DIFFERENTIAL PRESSURE SWITCH)

- .1 Impulse lines:

- .1 Route and install in a neat manner, parallel to building and equipment lines.
 - .2 Slope lines upward from pressure tapings to the instrument.
 - .3 Avoid abrupt changes in diameter.
 - .4 Minimize differences in length.
- .2 Install in a manner to allow easy removal of the pressure switch for maintenance purposes.

3.4 ULTRASONIC LEVEL MEASUREMENT SYSTEM

- .1 Install in a manner to allow easy removal of the transducer and cable assembly for maintenance purposes.
- .2 Install transducer cable in conduit.

3.5 IDENTIFICATION

- .1 Identify field devices with lamacoids. Install in a conspicuous location.

3.6 TESTING AND COMMISSIONING

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 40 80 11 – Automation Commissioning.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Provide training for the automation and control systems installed.

1.2 SUBMITTALS

- .1 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to the Contract Administrator, 30 working days prior to anticipated date of beginning of training.
 - .1 List name of trainers, and type of visual and audio aids to be used.

1.3 QUALITY ASSURANCE

- .1 Provide competent instructors thoroughly familiar with all aspects of the instrumentation system installed in the facility.
- .2 Contract Administrator reserves right to approve instructors.

1.4 INSTRUCTION

- .1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of the system installed.

1.5 TRAINING MATERIALS

- .1 Provide equipment, visual and audio aids, and materials for classroom training at City's site.
- .2 Supply manual for each trainee, describing in detail data included in each training program.
 - .1 While utilization of manufacturer information and manuals for reference material is acceptable, custom a custom manual describing the operation of this specific installation is required.
 - .2 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.6 TRAINING PROGRAM

- .1 Operations Training
 - .1 Location: Site
 - .2 Number of sessions: Two (2)
 - .3 Duration of each session: One hour.
 - .4 Number of trainees: Coordinate with Contract Administrator prior to training.
 - .5 Audience: Operations and maintenance personnel.
 - .6 Content:
 - .1 General system overview.

- .2 Description of system components.
- .3 Presentation of the HVAC heating control system operation.
- .4 Presentation of the sump pump control system.
- .5 Presentation of the air compressor control system.
- .6 Description of operation, including adjustment of set-points and other common operations.

1.7 MONITORING OF TRAINING

- .1 Contract Administrator to monitor training program and may modify schedule and content.

Part 2 Products

2.1 GENERAL

- .1 Not Applicable.

Part 3 Execution

3.1 TRAINING

- .1 Provide on-site training to City personnel, as indicated above.

END OF SECTION