

INSTRUMENTATION AND CONTROL FOR HVAC

1. GENERAL

1.1 Scope

- .1 Complete and fully operational system of automatic controls, including all materials and labour.
- .2 Submissions of technical system data.
- .3 Demonstration of proposed installed controls system.

1.2 Work by Other Trades

- .1 Division 26 shall provide 120 V power for Controls Panels, SCU's and Central Computer Equipment.
- .2 Division 23 shall install thermal wells, control valves and devices on piping, furnished by the HVAC controls contractor.

1.3 Renovation or Addition Projects

- .1 Control Work involves renovations to an existing control system. The Contractor shall inspect the systems prior to Bid Opportunity close and include in the submission all interlocks and relays required to provide a fully operational controls system.
- .2 The Contractor shall ensure that the installation and commissioning of the automation system shall not disrupt the use of the facilities.
- .3 Prior to close of Bid Opportunity the Contractor shall inspect the system and include for replacement of defective control equipment and components.

1.4 Quality Assurance

- .1 Install all components in accordance with the latest regulations of the Canadian Electrical Code, applicable Municipal and Provincial Codes and Regulations, and latest CSA Electrical Bulletins.
- .2 The equipment manufacturer shall have trained service representatives resident in the Province where project is located.
- .3 The following components shall be stocked locally:
 - .1 *Replacement SCU and internal components
 - .2 *Replacement IP's
 - .3 *Replacement Sensors and Actuators

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1.5 Submittals

- .1 Provide Shop Drawings including complete operating data, system drawings, wiring diagrams and written detailed operational description of sequences and engineering data on each control system component. Include sizing and arrangements as requested.
- .2 Submit approved Shop Drawings for inclusion in operating and maintenance manuals.

1.6 City Orientation

- .1 Contractor to provide three (3) weeks written notice to the Contract Administrator and the City prior to commencing formal training sessions.
- .2 Formal training sessions shall commence only after "As-Built" Drawings have been completed, reviewed and approved by the Contract Administrator and shall be in addition to 15010 requirements.
- .3 Provide for operator training according to the following schedule.
 - .1 A seminar/workshop covering all aspects of system use as follows:
 - .1 operation of hardware components
 - .2 system software configuration
 - .3 user/system interaction
 - .4 calibration of sensors and system
 - .5 trouble shooting of system and components
 - .6 preventative maintenance
 - .2 A review workshop at one (1) month after system acceptance.
 - .3 A seminar after six (6) months of operation for clarification of system operating techniques for building operators.
 - .4 Allow for additional one day training seminars in addition to the above seminars, within the first year of operation. These seminars are to be scheduled at City selected dates and times.
 - .5 Coordinate above seminars/workshops to occur during peak cooling and heating season as well as during one shoulder season.
 - .6 Provide three (3) complete sets of training manuals to the City prior to commencing of the training session, plus one manual to the Contract Administrator.

1.7 Warranty

- .1 The Contractor shall supply and install at no cost all system software and hardware updates and upgrades occurring prior to the expiration of the warranty period.

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1.8 System Activation

- .1 Submit control calibration check sheet prior to system acceptance. Check sheets to include unit identification, controller/transmitter tag numbers, device controlled, controller PID settings, interlock devices and wire tag numbers.
- .2 Set damper linkages, static pressure/volume controls as required by the Balancing Trade.
- .3 Adjust and calibrate all room thermostats thirty (30) days prior to system acceptance.

1.9 Acceptance Testing

- .1 A final operational acceptance test of seven (7) consecutive days shall be conducted on the complete and total installed and operational control system to demonstrate that it is functioning properly in accordance with the specifications.
- .2 The correct operation of all monitored and controlled points shall be demonstrated as well as the operation and capabilities of all sequences, reports, specialised control programs and algorithms, diagnostics and all other software.
- .3 In the event of the failure of function, during the test, of any of the hardware components or software application or routines, the test will recommence and run until seven failure-free test days have occurred.
- .4 After successful completion of the acceptance test, the Contract Administrator will issue written acceptance of the control system.
- .5 Prior to acceptance of the Work, submit hard copy and electronic copy on diskette of final data base listings.

1.10 Costs

- .1 All costs incurred in testing the controls system, including City and Contract Administrator demonstration cost shall be included for under this Contract. No additional charges will be entertained by the City.
- .2 All equipment, software, consumable items, personnel and facilities as required to reasonably execute the factory or Site acceptance tests, including any signal simulation equipment shall be made available under the terms of this contract at no further cost to the City.

2. PRODUCTS

2.1 Electric and Electronic Control Systems for HVAC

- .1 Refer to Section 23 09 33 - Electric and Electronic Control Systems for HVAC.

2.2 Control Panels

- .1 Provide control panel of unitised cabinet type construction. Mount relays, switches and control point adjustment in cabinet and pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face

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- .2 Fabricate panels from 2.5 mm (12 ga) rolled sheet metal sheet with baked enamel finish, flush fitting, gasketed doors hung on piano type hinges and three point latches and locking handles. CSA approved for line voltage applications.
- .3 Mount panels on vibration free wall or free standing angle iron supports. Provide engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face.
- .4 Provide pans and rails for mounting terminal blocks, relays, wiring and other necessary devices.
- .5 Provide an individual switch for disconnection and a fuse for isolation of all panel mounted instruments requiring a 120 VAC supply.
- .6 Make all wiring connections in the shop from the equipment mounted on the panel to numbered terminal blocks conveniently located in the panel, including the power supply for all instruments.
- .7 Identify all wiring by means of stamped markings on heat shrinkable tubing. Install all wiring neatly and laced or bunched into cable form using plastic wire clips, where practical, contained in plastic wiring channels with covers. Maximum twenty five (25) conductors to each wire bundle.
- .8 Provide terminal blocks, tabular clamp, 300 V, complete with track. Each terminal shall be clearly indelibly marked with the wire number connection to it. Each field connecting conductor shall be served by one terminal. Provide 20% spare unit terminals, with a minimum of two spare terminals. Provide all necessary terminal block accessories such as manufacturer jumpers and marking tape.
- .9 Install "Hand-Off-Auto" selector switches such that safety controls and electrical over current protection are not overridden when selector switch is in the "Hand" position.

2.3 Wire

- .1 Control wiring for digital functions shall be 18 AWG minimum with 300 Volt insulation.
- .2 Control wiring for analog functions shall be 18 AWG minimum with 300 Volts insulation, twisted and shielded, 2 or 3 wire to match analog function hardware.
- .3 Sensor wiring shall be 18 AWG minimum twisted and shielded, 2 or 3 wire to match analog function hardware or 16 AWG as required by code.
- .4 Transformer current wiring shall be 16 AWG minimum.

2.4 Conduits and Cables

- .1 All wiring shall be in conduit or trays. Conform to Division 26 requirements for conduit and tray specifications.
- .2 Seal conduit where such conduit leaves heated areas and enters unheated area.
- .3 Run low level signal lines in separate conduit from high level signal and power transmission lines.

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- .4 Identify each cable and wire at every termination point.
- .5 Where applicable, mount field interface equipment (i.e. relays, transducers, etc.) in local device cabinets adjacent to field interface panels.
- .6 Separate conduits shall be provided for pneumatic tubing and electrical wiring runs.
- .7 Colour code all conductors and conduits by permanently applied colour bands on maximum 10 m intervals. Colour code shall follow base building schedule.

2.5 Related Accessories

- .1 Provide and install all necessary transformers, transducers, interposing relays, interface devices, contactors, starters and EP's to perform control functions required.

3. EXECUTION

3.1 Installation

- .1 Verify location of thermostats and other exposed control sensors with drawings before installation. Locate thermostats 1500 mm above floor.
- .2 Install damper motors on outside of ducts. Do not locate in air stream, except for roof mounted equipment.
- .3 Wire "hand/off/auto" selector switches such that automatic operating controls and not safety controls and electrical over current protection shall be overridden when switch is in the "hand" position.
- .4 Unless specified otherwise, install all outdoor air sensors on the north exposure of the building.
- .5 Install all safety limits at the operator's level.
- .6 Install pressure gauges on branch lines, at each controller, transmitter, and actuator excepting individual room thermostats.

END OF SECTION