PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 25 05 01 - EMCS: General Requirements.

1.2 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

.2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:

- .1 Outage of main power supply in excess of back-up power sources, provided that:
  - .1 Automatic initiation of back-up was accomplished.
  - .2 Automatic shut-down and re-start of components was as specified.
- .2 Failure of communications link, provided that:
  - .1 Controller automatically and correctly operated in stand-alone mode.
  - .2 Failure was not due to failure of any specified EMCS equipment.
- .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
  - .1 System recorded said fault.
  - .2 Equipment defaulted to fail-safe mode.
  - .3 AEL of total of all input sensors and output devices is at least 99% during test period.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Final Report: submit report to Departmental Representative.

- .1 Include measurements, final settings and certified test results.
- .2 Bear signature of commissioning technician and supervisor
- .3 Report format to be approved by Departmental Representative before commissioning is started.
- .4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 01 00 10 - General Instructions.
- .5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.4 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Departmental Representative before interim acceptance in accordance with Section 01 00 10 - General Instructions.

1.5 COMMISSIONING

.1 Do commissioning of all control valves, cooling tower and chilled water system sequences.

.2 Carry out commissioning under direction of Departmental Representative and in presence of Departmental Representative.

.3 Inform, and obtain approval from, Departmental Representative 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.

.4 Correct deficiencies, re-test in presence of Departmental Representative until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Load system with project software.

.7 Perform tests as required.

1.6 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative.

1.7 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 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 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

PART 3 - EXECUTION

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by a qualified commissioning professional and approved by Departmental Representative.

.3 Commission integrated systems using procedures prescribed by by a qualified commissioning professional and approved by Departmental Representative.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.6 Test full scale emergency evacuation and life safety procedures under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

.1 Completion Testing.
- .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
- .2 Include following activities:
  - .1 Test and calibrate field hardware including stand-alone capability of each controller.
  - .2 Verify each A-to-D convertor.
  - .3 Test and calibrate each AI using calibrated digital instruments.
  - .4 Test each DI to ensure proper settings and switching contacts.
  - .5 Test each DO to ensure proper operation and lag time.
  - .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
  - .7 Test operating software.
  - .8 Test application software and provide samples of logs and commands.
  - .9 Verify each CDL including energy optimization programs.
  - .10 Debug software.
  - .11 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Departmental Representative. This document will be used in final startup testing.
- .3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Departmental Representative and provide:
  - .1 2 technical personnel capable of re-calibrating field hardware and modifying software.
  - .2 Detailed daily schedule showing items to be tested and personnel available.
  - .3 Commissioning to commence during final startup testing.
  - .4 O&M personnel to assist in commissioning procedures as part of training.
  - .5 Commissioning to be supervised by qualified supervisory personnel and Departmental Representative.
  - .6 Commission systems considered as life safety systems before affected parts of the facility are occupied.
  - .7 Operate systems as long as necessary to commission entire project.
  - .8 Monitor progress and keep detailed records of activities and results.
- .4 Departmental Representative to verify reported results.

3.3 ADJUSTING .1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION .1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
- .1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 Institute of Electrical and Electronics Engineers (IEEE).
- .1 IEEE 260.1-2004, IEEE Standard Letter Symbols for Units of Measurement (SI Customary Inch-Pound Units, and Certain Other Units).

.3 Canadian Standards Association (CSA International).
- .1 CAN/CSA-Z234.1-00-(R2006), Canadian Metric Practice Guide.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

1.3 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS:
- .1 AEL - Average Effectiveness Level.
- .2 AI - Analog Input.
- .3 AIT - Agreement on International Trade.
- .4 AO - Analog Output.
- .5 BACnet - Building Automation and Control Network.
- .6 BC(s) - Building Controller(s).
- .7 BECC - Building Environmental Control Center.
- .8 CAD - Computer Aided Design.
- .9 CDL - Control Description Logic.
- .10 CDS - Control Design Schematic.
- .11 COSV - Change of State or Value.
- .12 CPU - Central Processing Unit.
- .13 DI - Digital Input.
- .14 DO - Digital Output.
- .15 DP - Differential Pressure.
- .16 ECU - Equipment Control Unit.
- .17 EMCS - Energy Monitoring and Control System.
- .18 HVAC - Heating, Ventilation, Air Conditioning.
- .19 IDE - Interface Device Equipment.
- .20 I/O - Input/Output.
- .21 ISA - Industry Standard Architecture.
- .22 LAN - Local Area Network.
- .23 LCU - Local Control Unit.
- .24 MCU - Master Control Unit.
- .25 NAFTA - North American Free Trade Agreement.
- .26 NC - Normally Closed.
- .27 NO - Normally Open.
- .28 OS - Operating System.
- .29 O&M - Operation and Maintenance.
- .30 OWS - Operator Work Station.
- .31 PC - Personal Computer.
- .32 PCI - Peripheral Control Interface.

1.3 ACRONYMS AND ABBREVIATIONS (Cont'd)

.1 (Cont'd)
- .33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
- .34 PID - Proportional, Integral and Derivative.
- .35 RAM - Random Access Memory.
- .36 SP - Static Pressure.
- .37 ROM - Read Only Memory.
- .38 TCU - Terminal Control Unit.
- .39 USB - Universal Serial Bus.
- .40 UPS - Uninterruptible Power Supply.
- .41 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.
- .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
- .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.
- .1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.
  - .1 Area descriptor: building or part of building where point is located.
  - .2 System descriptor: system that point is located on.
  - .3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25character field for each point identifier.
- .2 Point expansion : comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
- .3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
  - .1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

.3 Point Object Type: points fall into following object types:
- .1 AI (analog input).
- .2 AO (analog output).
- .3 DI (digital input).
- .4 DO (digital output).
- .5 Pulse inputs.

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
- .1 Printouts: to IEEE 260.1.

1.5 SYSTEM DESCRIPTION

.1 Refer to Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

1.5 SYSTEM DESCRIPTION (Cont'd)

.2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
- .1 Building Controllers.
- .2 Control devices as listed in I/O point summary tables.
- .3 OWS(s).
- .4 Data communications equipment necessary to effect EMCS data transmission system.
- .5 Field control devices.
- .6 Software/Hardware complete with full documentation.
- .7 Complete operating and maintenance manuals.
- .8 Training of personnel.
- .9 Acceptance tests, technical support during commissioning, full documentation.
- .10 Wiring interface co-ordination of equipment supplied by others.
- .11 Miscellaneous work as specified in these sections and as indicated.

.3 General Requirements:
- .1 Provide conduit and wiring linking elements of system.
- .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.
- .3 Location of controllers as reviewed by Departmental Representative prior to installation.
- .4 Provide utility power to EMCS as indicated.
- .5 Metric references: in accordance with CAN/CSA Z234.1.

.4 Language Operating Requirements:
- .1 Provide English operator selectable access codes.
- .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
- .3 Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.
- .4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
- .5 Include, in English:
  - .1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definements).
  - .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points.
  - .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit for review:
- .1 Equipment list and systems manufacturers at time of tender within 48 h after award of contract.

.3 Quality Control:
- .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

1.6 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.3 Quality Control:(Cont'd)
- .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
- .3 Submit proof of compliance to specified standards with shop drawings and product data.
- .4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
- .5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
- .6 Permits and fees: in accordance with general conditions of contract.
- .7 Submit certificate of acceptance from authority having jurisdiction to Departmental Representative.

1.7 QUALITY ASSURANCE

.1 Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.

.2 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

.3 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.8 DESIGNATED CONTRACTOR

.1 For 555 Booth: Hire the services of VCI Controls to complete the work of all EMCS sections.

.2 For 601/615 Booth: Hire the services of Johnson Controls to complete the work of all EMCS sections.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 There is an existing VCI control system presently installed at 555 Booth and a Johnson Controls based control system presently installed at 601/615 Booth. All materials must be selected to ensure full compatability with existing automation control system.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS .1 Installation: to manufacturer's recommendations.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): transmitters, sensors,controls, meters, switches, transducers, valves, valve actuators, and low voltage current transformers.
- .2 Related Sections:
  - .1 Section 23 05 19 - Meters and Gauges for HVAC Piping.
  - .2 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning.
  - .3 Section 25 05 01 - EMCS: General Requirements.
  - .4 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.
  - .5 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.4 EXISTING CONDITIONS

.1 Cutting and Patching: in accordance with Section 01 73 00 - Execution Requirements supplemented as specified herein.

.2 Repair surfaces damaged during execution of Work.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 Internal parts to be assembled in watertight, heat resistant, assembly.

.3 Operating conditions: 0 - 40 degrees C with 10 - 90% RH (non-condensing) for equipment installed indoors, -45 to 50 degrees C weatherproof for equipment installed outdoors, 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 Range: including temperature, humidity, pressure, as indicated in I/O summary in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation.

2.2 TEMPERATURE SENSORS

.1 General: to be resistance or thermocouple type to following requirements:
- .1 Thermocouples: to be limited to temperature range of 200°C and over.
- .2 RTD's: 100/1000 ohm at 0°C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm°C.
- .3 Sensing element: hermetically sealed.
- .4 Stem and tip construction: copper or type 304 stainless steel.
- .5 Time constant response: less than 3 seconds to temperature change of 10°C.
- .6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 or 150 mm as indicated. Strap-on pipe temperature sensors are acceptable only where system shut-down & drainage is not possible.

.2 Sensors:
- .1 Outside water and air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in NEMA 4 enclosure.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:
- .1 Input circuit: to accept 3-lead, 100 ohm at 0°C, platinum resistance detectors type sensors.
- .2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01°C per volt change.
- .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .4 Input and output short circuit and open circuit protection.
- .5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.
- .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.
- .7 Maximum current to 100 ohm RTD sensor: not to exceed 25 mA.
- .8 Integral zero and span adjustments.
- .9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50°C.
- .10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.
- .11 Transmitter ranges: Select narrowest range to suit application from following:
  - .1 Minus 50°C to plus 50°C, plus or minus 0.5°C.
  - .2 0 to 100°C, plus or minus 0.5°C.
  - .3 0 to 50°C, plus or minus 0.25°C.
  - .4 0 to 25°C, plus or minus 0.1°C.
  - .5 10 to 35°C, plus or minus 0.25°C.

2.4 PRESSURE AND DIFFERENTIAL PRESSURE SENSORS AND SWITCHES

.1 Requirements:
- .1 Range: as indicated in I/O summaries.
  - .1 Pressure sensing elements: bourdon tube, bellows or diaphragm type.
- .2 Adjustable setpoint and differential.
- .3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.
- .4 Sensor assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.
- .5 Accuracy: within 2% repetitive switching.
- .6 Provide sensor pressure and accuracy ratings:
  - .1 Chilled water range: 0 to 2068 kPa.
- .7 Provide sensors with isolation valve and snubber between sensor and pressure source.

2.5 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:
- .1 Internal materials: suitable for continuous contact with process material measured including water, as applicable.
- .2 Output signal: 4 - 20 mA into 500 ohm maximum load.
- .3 Output variations: less than 0.2% full scale for supply voltage variations of plus or minus 10%.
- .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full scale output over entire range.
- .5 Integral zero and span adjustment.
- .6 Temperature effects: not to exceed plus or minus 0.5% full scale output over entire range.
- .7 Output short circuit and open circuit protection.
- .8 Differential pressure ranges to suit application.

2.6 ELECTRICAL RELAYS

.1 Requirements:
- .1 Double voltage, DPDT, plug-in type with termination base.
- .2 Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.
- .3 Contacts: rated at 5 amps at 120 V AC.
- .4 Relay to have visual status indication.

2.7 VORTEX FLOW METER

.1 As indicated in Section 23 05 19 - Meters and Gauges for HVAC Piping.

2.8 ULTRASONIC LEVEL DETECTOR

.1 Continuous, non contact level measurements using ultrasonic pulse or guided microwave.

.2 Connection suitable to tank in application.

.3 Linearization function for up to 32 points.

.4 4-20 mA output signal.

.5 Local display.

2.9 WIRING

.1 Wiring must be continuous without joints.

.2 All wiring to be in EMT conduits.

.3 Sizes:
- .1 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.
- .2 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair.

2.10 CURRENT SENSING RELAYS

.1 Requirements:
- .1 Suitable to detect belt loss, motor failure/motor status.
- .2 Trip point adjustment, output status LED.
- .3 Split core for easy mounting.
- .4 Induced sensor power.

2.10 CURRENT SENSING RELAYS (Cont'd)

.1 Requirements:(Cont'd)
- .5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.
- .6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.
- .7 Adjustable latch level.

2.11 CONTROL DAMPERS

.1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 1219 mm high. Three or more sections to be operated by jack shafts.

.2 Materials:
- .1 Frame: 2.03 mm minimum thickness extruded aluminum. For outdoor air and exhaust air applications, frames to be insulated.
- .2 Blades: extruded aluminum. For outdoor air/exhaust air applications, blades to be internally insulated.
- .3 Bearings: maintenance free, synthetic type of material.
- .4 Linkage and shafts: aluminum, zinc and nickel plated steel.
- .5 Seals: synthetic type, mechanically locked into blade edges.
  - .1 Frame seals: synthetic type, mechanically locked into frame sides.

.3 Performance: minimum damper leakage meet or exceed AMCA Standard 500-D ratings.
- .1 Size/Capacity: refer to damper schedule
- .2 25 L/s/m^2 maximum allowable leakage against 1000 Pa static pressure for outdoor air and exhaust air applications.
- .3 Temperature range: minus 40degrees C to plus 100 degrees C.

.4 Jack shafts:
- .1 25 mm diameter solid shaft, constructed of corrosion resistant metal complete with required number of pillow block bearings to support jack shaft and operate dampers throughout their range.
- .2 Include corrosion resistant connecting hardware to accommodate connection to damper actuating device.
- .3 Install using manufacturers installation guidelines.
- .4 Use same manufacturer as damper sections.

2.12 ELECTRONIC CONTROL DAMPER ACTUATORS

.1 Requirements:
- .1 Direct mount proportional type as indicated.
- .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
- .3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.
- .4 Power requirements: 5 VA maximum at 24 V AC.
- .5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
- .6 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

2.13 TANK LEVEL SWITCHES

.1 Requirements:
- .1 Indicate high/low water level and to alarm.
- .2 For mounting on top of tank.
- .3 Maximum operating temperature: 120 degrees C.
- .4 Snap action contacts rated 15 amp at 120 V.
- .5 Adjustable setpoint and differential.

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. Install and wire chiller remote control devices and panel controls as per manufacturer's instructions.

.3 Temperature transmitters, controllers and relays: install in NEMA 1 enclosure for indoors, NEMA 4 for outdoors 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 Fire stopping: provide space for fire stopping. Maintain fire rating integrity.

.6 Electrical:
- .1 Complete installation in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
- .3 Install all communication wiring in conduit.
  - .1 Provide complete conduit system to link Building Controllers, field panels and OWS(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 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.3 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS

.1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.

3.4 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 Outdoor installation:
- .1 Protect from solar radiation and wind effects by non-corroding shields.
- .2 Install in NEMA 4 enclosures.

3.4 TEMPERATURE SENSORS (Cont'd)

.4 Thermowells: turnover wells to piping contractor for installation.
- .1 Where pipe diameter is less than well insertion length.
- .2 Thermowell to restrict flow by less than 30%.
- .3 Use thermal conducting paste inside wells.

3.5 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. Provide commissioning service by the manufacturer's authorized representative.

.2 Identify wiring and conduit clearly.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 23 22 23 - Steam Condensate Pumps

.2 Section 23 25 00 - HVAC Water Treatment Systems.

.3 Section 23 52 00 - Packaged Boiler Plant.

1.2 SEQUENCING

.1 Packaged Boiler Plant:

- .1 Boiler and associated ancillaries operate standalone with fully automated control system to initiate safe reliable and efficient operation.
- .2 EMCS to monitor via direct connection through terminal strips within packaged boiler plant.
  - .1 Winter boiler status/firing rate.
  - .2 Summer boiler status/firing rate.
  - .3 General alarm.
  - .4 Critical alarm (this alarm indicates a failure to heat condition and shall also send a distinct signal to security desk).
  - .5 Condensate return.
  - .6 Steam header pressure.
- .3 EMCS to provide control points via direct connect through terminal strips within packaged boiler plant..
  - .1 Lead/Lag boiler switch.
  - .2 Steam pressure setpoint reset.
  - .3 Emergency Boiler #4 disable.
  - .4 Emergency Boiler #2 disable.
  - .5 Condensate tank level control valve.
- .4 EMCS to accept all available control inputs/outputs of the boiler controller's and sequencing controller through MSTP network connection using Modbus communication protocol.

.2 Water Treatment:

- .1 Water treatment to operate standalone through conductivity controller located within packaged boiler plant.
- .2 EMCS to monitor the following points via direct connection through terminal strips within packaged boiler plant.
  - .1 General alarm (conductivity out of range, component failure, etc.)
  - .2 Low chemical treatment level alarm
- .3 EMCS to monitor and log for minimum 2 year period, make-up water via pulse input from a signal pulse input from a signal splitter installed at water meter within boiler plant.

.3 Existing Condensate Tanks:

- .1 Existing condensate pumps are being replace with new. Existing low water cut-off switch to be rewired to new starter. EMCS to control pump enable/disable to achieve duty standby operation. Enable pump to switch every 200 hours of operation. Only disable lead pump when lag pump is confirmed enabled through status signal. Pumps to run continuously unless low-cut or off. EMCS to provide pressure regulating by pass valve to regulate flow going to packaged boiler plant pressure setpoint to be determined on site during commissioning. EMCS to provide 0-10V signal to packaged boiler plant based on tank level as determined by new level sensor on existing tank which controls flow control valve to feedwater tank. Co-ordinate with boiler plant supplier.

1.2 SEQUENCING (Cont'd)

.3 Existing Condensate Tanks:(Cont'd)

.2 615 Booth only:

.1 Condensate pumps to operate continuously with low water pump cut-off controls rewired to new starter and lead/lag operation as described above. Tank level rending to be compared against 601 Booth tank level reading to establish 0-10V signal to be sent to flow control valve based on average.

.3 If condensate return valve status from boiler plant indicates closed position disable pump.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END