PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

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 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
.1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
.1 ASHRAE STD 135-R2001, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).
.1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).
.1 CEA-709.1-B-2002, Control Network Protocol Specification.

.6 Electrical and Electronic Manufacturers Association (EEMAC).
.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.7 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.
.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 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.

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

1.5 SYSTEM DESCRIPTION

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

.2 Design Requirements:
.1 Design and 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 emergency power to any systems serving the data centre chillers. Otherwise utility power shall be used.
.5 Metric references: in accordance with CAN/CSA Z234.1.

.3 Language Operating Requirements:
.1 Use non-linguistic symbols for displays on graphic terminals wherever possible.
.2 System manager software: include 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.
.3 Include:
.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 and 25 05 02 EMCS: Shop Drawings, Product Data and Review Process.

.2 Submit for review:
.1 List existing field control devices to be re-used included in tender, along with unit price.

.3 Quality Control:
.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
.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. Label or listing of specified organization is acceptable evidence.
.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.
.8 Existing devices intended for re-use: submit test report.

1.7 QUALITY ASSURANCE

.1 Have local office within 50 km of project staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,

.2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.

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

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

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

1.8 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2weeks after award of Contract.

.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling.
.4 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste.
.5 Place materials defined as hazardous or toxic in designated containers.

1.9 EXISTING-CONTROL COMPONENTS

.1 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications. Only reuse field devices as indicated on drawings.
.1 Provide for new, properly designed device where re-usability of components is uncertain.

.2 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
.1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Departmental Representative.

.2 Failure to produce test report will constitute acceptance of existing devices by contractor, and subsequent failure within warranty period of contract will require replacement by Contractor at no extra charge to Owner.

.3 Non-functioning items:
.1 Provide with report specification sheets or written functional requirements to support findings.
.2 Departmental Representative will repair or replace existing items judged defective yet deemed necessary for EMCS.

.4 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.5 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Departmental Representative.
.1 Be responsible for items repaired or replaced by Departmental Representative.
.2 Be responsible for repair costs due to negligence or abuse of equipment.
.3 Responsibility for existing devices terminates upon final acceptance of EMCS.

.6 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: to match existing system.

2.2 ADAPTORS

.1 Provide adaptors between metric and imperial components.

PART 3 - EXECUTION

3.1 MANUFACTURER'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 PAINTING

.1 Painting:

.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.

.2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.

.3 Clean and prime exposed hangers, racks, fastenings, and other support components.

.4 Paint unfinished equipment installed indoors.

END OF SECTION

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, dampers, damper operators, valves, valve actuators, and low voltage current transformers.
.2 Related Sections:
.1 Section 25 05 01 - EMCS: General Requirements.
.2 Section 26 05 00 - Common Work Results for Electrical.

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 B 148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).
.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Air Movement and Control Association, Inc. (AMCA).
.1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.

.5 Canadian Standards Association (CSA International).
.1 CSA-C22.1-02, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions.

.2 Pre-Installation Tests.
.1 Submit samples at random from equipment shipped, as requested by Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.3 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.5 EXISTING CONDITIONS

.1 Repair surfaces damaged during execution of Work.

.2 Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

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, shockproof, vibration-proof, heat resistant, assembly.

.3 Operating conditions for interior parts: 0 - 32 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Operating conditions for exterior parts: -50 to 50 degrees C with 10-90% RH.

.5 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.6 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.7 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.8 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.9 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.

2.2 TEMPERATURE SENSORS

.1 General: except for room sensors to be resistance or thermocouple type to following requirements:
.1 Thermocouples: limit to temperature range of 200 degrees C and over.
.2 RTD's: 100 or 1000 ohm at 0 degrees C

(plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees 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 degrees C.
.6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 150 mm as indicated.

.2 Duct temperature sensors:
.1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length 460 mm or as indicated .
.2 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 6000 mm. Bend probe at field installation time to 100 mm radius at point along probe without degradation of performance.

.3 Outdoor air temperature sensors:

.1 Outside 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 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.

.2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 degrees C per volt change.

.3 Output signal: 4 - 20 mA into500 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 or 1000 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 degrees 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 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.

.2 0 to 100 degrees C, plus or minus 0.5 degrees C.

.3 0 to 50 degrees C, plus or minus 0.25 degrees C.

.4 0 to 25 degrees C, plus or minus 0.1 degrees C.

.5 10 to 35 degrees C, plus or minus 0.25 degrees C.

2.4 PRESSURE TRANSDUCERS

.1 Requirements:

.1 Combined sensor and transmitter measuring pressure.

.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 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 Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 degrees C.
.6 Over-pressure input protection to at least twice rated input pressure.
.7 Output short circuit and open circuit protection.
.8 Accuracy: plus or minus 1% of Full Scale.

2.5 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:
.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 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 1.5 % full scale/ 50 degrees 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 N.P.T. conduit connection. Enclosure to be integral part of unit.

2.6 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Requirements:

.1 Internal materials: suitable for continuous contact with compressed air, water, steam, etc., as applicable.

.2 Adjustable setpoint and differential.

.3 Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.

.4 Switch 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 switches with isolation valve and snubber, where code allows, between sensor and pressure source.

.7 Switches on steam and high temperature hot water service: provide pigtail syphon.

2.7 TEMPERATURE SWITCHES

.1 Requirements:

.1 Operate automatically. Reset automatically, except as follows:

.1 Low temperature detection: manual reset.

.2 High temperature detection: manual reset.

.2 Adjustable setpoint and differential.

.3 Accuracy: plus or minus 1 degree C.

.4 Snap action rating: 120V, 15 amps or 24V DC as required. Switch to be DPST for hardwire and EMCS connections.

.5 Type as follows:

.1 Room: for wall mounting on standard electrical box with without protective guard as indicated.

.2 Duct, general purpose: insertion length = 460 mm.

.3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.

.4 Low temperature detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 30 mm length.

.5 Strap-on: with helical screw stainless steel clamp.

2.8 SUMP LEVEL SWITCHES

.1 Requirements:
.1 Liquid level activated switch sealed in waterproof and shockproof enclosure.
.2 Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.
.3 N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

2.9 CURRENT / PNEUMATIC (I/P) TRANSDUCERS

.1 Requirements:
.1 Input range: 4 to 20 mA.
.2 Output range: proportional 20-104 kPa or 20-186 kPa as applicable.
.3 Housing: dustproof or panel mounted.
.4 Internal materials: suitable for continuous contact with industrial standard instrument air.
.5 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 2 % of full scale over entire range.
.6 Integral zero and span adjustment.
.7 Temperature effect: plus or minus 2.0 % of full scale/ 50 degrees C or less.
.8 Regulated supply pressure: 206 kPa maximum.
.9 Air consumption: 16.5 ml/s maximum.
.10 Integral gauge manifold c/w gauge (0-206 kPa).

2.10 AIR PRESSURE GAUGES

.1 Diameter: 38 mm minimum.

.2 Range: zero to two times operating pressure of measured pressure media or nearest standard range.

2.11 ELECTROMECHANICAL 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

2.12 SOLID STATE RELAYS

.1 General:
.1 Relays to be socket or rail mounted.

.2 Relays to have LED Indicator
.3 Input and output Barrier Strips to accept 14 to 28 AWG wire.
.4 Operating temperature range to be -20 degrees C to 70 degrees C.
.5 Relays to be CSA Certified.
.6 Input/output Isolation Voltage to be 4000 VAC at 25 degrees C for 1 second maximum duration.
.7 Operational frequency range, 45 to 65 HZ.

.2 Input:
.1 Control voltage, 3 to 32 VDC.
.2 Drop out voltage, 1.2 VDC.
.3 Maximum input current to match AO (Analog Output) board.

.3 Output.
.1 AC or DC Output Model to suit application.

2.13 CURRENT TRANSDUCERS

.1 Requirements:

.2 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 volt DC.
.3 0-10 volts DC.
.4 0-20 volts DC.

.3 Frequency insensitive from 10 - 80 hz.

.4 Accuracy to 0.5% full scale.

.5 Zero and span adjustments. Field adjustable range to suit motor applications.

.6 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

2.14 CURRENT SENSING RELAYS

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

.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.

2.15 VANE FLOW SWITCH

.1 Flow proving switch suitable for proving flow or no flow.

.2 Aluminum housing, S.S. Vanes, brass body.

.3 Maximum temperature: 110 degrees C, maximum pressure: 100 kPa.

.4 Electrical rating: 10A Res, 3A IND @ 250 VAC.

2.16 CONTROL VALVES

.1 Butterfly Valves NPS 2 and larger:
.1 Body: for chilled water ANSI Class 150 cast iron lugged body and wafer body installed in locations as indicated.
.2 End connections to suit flanges that are ANSI Class 150.
.3 Extended stem neck to provide adequate clearance for flanges and insulation.
.4 Pressure limit: bubble tight sealing to 170 kilopascals.
.5 Disc/vane: 316 stainless steel, aluminum bronze to ASTM B 148.
.6 Seat: for service on chilled water PTFE (polytetrafluoroethylene), EPDM (ethylene propylene diene monomer).
.7 Stem: 316 stainless steel.
.8 Flow factor (KV) as indicated on control valve schedule on drawing: CV in imperial units.
.9 Flow characteristic linear.
.10 Maximum flow requirement as indicated on control valve schedule on drawing.
.11 Maximum pressure drop as indicated on control valve schedule: pressure drop not to exceed one half of inlet pressure on drawing.
.12 Normally open Normally closed, as indicated.
.13 Valves are to be provided complete with mounting plate for installation of actuators.

2.17 IN DUCT REFRIGERANT SENSOR

.1 Stand alone, probe type, micro processor based system. Suitable for detection of R-134A Refrigerant.

.2 4-20 MA output signal @ 1000 OHMS.

.3 24 VAC or 24 VDC supply voltage.

.4 Detect 0-1000 ppm R134a.

.5 24 VAC/VDC alarm output relay.

.6 On board 85 dBA alarm buzzer.

.7 Operating temp: -20 degrees C to 50 degrees C, operating humidity: 0-95%.

.8 6 month calibration interval.

.9 5-8 year life expectancy.

.10 Standard of acceptance: Bacharach 6300 Duct.

2.18 ROOM REFRIGERANT SENSOR

.1 Wall mounted, detect R-134a, and compatible with existing Genesis Sherlock monitor.

.2 NEMA 3R enclosure.

.3 1ppm sensitivity at 25 degrees C and 45% r.h.

.4 5 ppm plus 2% accuracy.

.5 6 month calibration interval.

.6 Operating temperature: Zero degrees C to 43 degrees C.

.7 5 to 7 year life expectancy.

.8 Standard of acceptance: Genesis Sherlock, Infrared Refrigerant, Gas Sensor.

2.19 ELECTRONIC / ELECTRIC VALVE ACTUATORS

.1 Requirements:
.1 Construction: steel, cast iron, aluminum.
.2 Control signal: 0-10V DC or 4-20 mA DC.
.3 Positioning time: to suit application. 90 sec maximum.

.4 Scale or dial indication of actual control valve position.
.5 Size actuator to meet requirements and performance of control valve specifications.
.6 Minimum shut-off pressure: refer to control valve schedule.

2.20 PANELS

.1 Free-standing or wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Departmental Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.21 WIRING

.1 In accordance with Division 26 - Electrical.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

.4 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.

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:

.1 Complete installation in accordance with Section 26 05 00 - Common Work Results for 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. 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).

.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.

.6 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.

3.2 TEMPERATURE AND HUMIDITY 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.

.4 Thermowells: install for piping installations.
.1 Locate well in elbow 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.

3.3 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.

3.4 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS

.1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.
.1 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

3.5 I/P TRANSDUCERS

.1 Install air pressure gauge on outlet.

3.6 AIR PRESSURE GAUGES

.1 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.

.2 Install pressure gauge on output of auxiliary cabinet pneumatic devices.

3.7 REFRIGERANT MONITOR

.1 Re-commission existing room monitor to ensure it is functioning as per manufacturers design.

.2 Existing monitor is Genesis Sherlock 202.

3.8 ROOM REFRIGERANT SENSOR

.1 Install as per manufacturer's instructions and as per indicated on drawings.

.2 Provide calibration services for one year upon substantial completion.

3.9 IN DUCT REFRIGERANT SENSOR

.1 Install in existing duct where indicated on drawings.

.2 Provide inspection door in duct for maintenance and calibration of sensor.

.3 Provide calibration services for one year upon substantial completion.

3.10 IDENTIFICATION

.1 Identify field devices and wiring as indicated on drawing.

3.11 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance.

END OF SECTION