PART 1 – GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): Sensors, controls, dampers, damper operators, valves, and valve actuators.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
.1 CSA-C22.1-15, Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

1.4 EXISTING CONDITIONS

.1 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 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight assembly.

.3 Operating conditions: 0 - 32 degrees C with 10 - 90% 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 30. 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 lead wires. 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 100mm.

.2 Room temperature sensors.

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

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

2.3 HUMIDITY SENSORS

.1 Room and Duct Requirements:
.1 Range: 5 - 90 % RH minimum.
.2 Operating temperature range: 0 - 60 degrees C.
.3 Absolute accuracy:
.1 Duct sensors: plus or minus 3%.
.2 Room sensors: plus or minus 2%.

.4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.
.5 Maximum sensor non-linearity: plus or minus 2% RH with defined curves.
.6 Duct mounted sensors: locate so that sensing element is in air flow in duct.

2.4 STATIC PRESSURE SENSORS

.1 Requirements:
.1 Multipoint element with self-averaging manifold.
.1 Maximum pressure loss: 160 Pa at 10 m/s. (Air stream manifold).
.2 Accuracy: plus or minus 1% of actual duct static pressure.

2.5 VELOCITY PRESSURE SENSORS

.1 Requirements:
.1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.
.2 Maximum pressure loss: 37Pa at 1000 m/s.
.3 Accuracy: plus or minus 1% of actual duct velocity.

2.6 CONTROL DAMPERS

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

.2 Materials:
.1 Frame: 2.03mm 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/mý 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 Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

.5 Jack shafts:
.1 25mm 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.

2.7 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.

2.8 CONTROL VALVES

.1 Body: globe style.
.1 Flow characteristic as indicated on control valve schedule: equal percentage.
.2 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.
.3 Normally open.
.4 Two port, as indicated.
.5 Leakage rate ANSI class IV, 0.01% of full open valve capacity. With shut off capability of 551KPa.
.6 Packing easily replaceable.
.7 Stem, stainless steel.
.8 Plug and seat, stainless steel.
.9 Disc, replaceable, material to suit application.

.10 NPS 2 and under:
.1 Screwed National Pipe Thread (NPT) tapered female connections.
.2 Valves to ANSI Class 250, valves to bear ANSI mark.
.3 Rangeability 50:1 minimum.
.11 NPS 2½ and larger:
.1 Flanged connections.
.2 Valves to ANSI Class 250 as indicated, valves to bear ANSI mark.
.3 Rangeability 100:1 minimum.

2.9 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 Fail to normal position as indicated.
.5 Scale or dial indication of actual control valve position.
.6 Size actuator to meet requirements and performance of control valve specifications.
.7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.
.8 Minimum shut-off pressure to suit operating conditions.

2.10 WIRING

.1 In accordance with Section 26 27 26 - Wiring Devices.

.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 20AWG stranded twisted pair.
.2 Analog input and output: shielded #18 minimum solid copper #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 Fire stopping: provide space for fire stopping. Maintain fire rating integrity.

.4 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 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

.4 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.

.5 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.

.5 VAV Terminal Units: supply, install and adjust as required.

.1 Air probe, actuator and associated vav controls.

.2 Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators.

.3 Co-ordinate air flow adjustments with balancing trade.

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.

3.3 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 MAGNEHELIC PRESSURE INDICATORS

.1 Install adjacent to fan system static pressure sensor and duct system velocity pressure sensor.

3.5 IDENTIFICATION

.1 Identify field devices.

3.6 AIR FLOW MEASURING STATIONS

.1 Protect air flow measuring assembly until cleaning of ducts is completed.

3.7 TESTING AND COMMISSIONING

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

END OF SECTION

PART 1 - GENERAL

1.1 DESIGNATED CONTRACTOR

.1 Hire the services of Schneider Electric or its authorized representative to complete the work of all EMCS sections.

1.2 SEQUENCING

.1 Sequencing of operations for systems as follows:

.1 VAV Boxes

.1 Interior Zones: Room temperature sensors and controllers shall be provided for all VAV boxes. The controller shall modulate the VAV box damper to maintain space temperature at 24°C.

.2 Perimeter Zones:

.1 Upon start-up of the main air handling system, the terminal unit fan (Where it exists) shall be started by the BAS and run continuously until the main air handling system shuts down.

.2 Room temperature sensors shall be provided for all VAV boxes. Controllers shall be digital heat/cool dual setpoint with day/night settings.

.3 The temperature shall be maintained at 23°C cooling, 21°C heating, within 1°C by modulating the VAV box damper and modulating the control valve to the heater in sequence.

.4 On a call for heating when the main air handling system is off, the terminal unit fan (where applicable) shall start and the heating valve shall modulate open.

.5 Perimeter heating zones with recessed fan coils in the floor shall have fans operate continuous during occupied hours with the heating water enabled. The space temperature sensor for the VAV shall modulate the heating valve to maintain setpoint. In unoccupied mode the fan coils and heating valve shall cycle to maintain after hours setpoint.

.2 Air Handling Units

.1 General

.1 Start/Stop

The BAS shall start and stop the system based upon a time of day, day of week schedule.

Duct static pressure will be controlled from a new sensor in the ductwork 2/3 the distance to the furthest terminal unit on the lowest respective floor.

.2 Temperature Control

The BAS shall modulate the 2-way chilled water and Glycol Heating control valve open and closed to maintain supply air temperature. Supply air temperature shall be reset from outdoor air based on the following

Outdoor Air	Supply Air
10°C	13.0°C
-10°C	18.0°C

The outdoor, exhaust and return dampers for the air handling unit shall be controlled separately through independent signals from the BAS. The dampers shall modulate between maximum and minimum position to maintain a maximum of 800ppm on any CO2 sensors.

.3 Humidity Control

At outdoor air temperature below 41ºF(Adjustable) the BAS shall enable the humidifier with an on command.

A return air sensor in the return air plenum shall measure relative humidity, and the BAS shall send a modulating signal to the humidifier controller to maintain humidity setpoint in the return duct airstream.

The BAS shall reset return air relative humidity as follows:

Outdoor Temperature	Relative humidity
0	30%
-25°C	20%

A high limit controller in the discharge duct of each system shall prevent the supply air relative humidity from exceeding 80%.

The humidifier shall be interlocked with a hardwired air proving switch installed in the supply air ductwork.

.4 Safety Devices

A hard wired interlock with the low limit mixed air control shall shut down both the supply fan and return fan should the supply air temperature drop below 45°F.

This safety shall be upstream of the cooling coil.
In the event the supply fan discharge pressure exceeds 5.0" w.g. both the supply fan and return fan shall shut down.
In the event the discharge temperature exceeds 90°F, both supply fans and both return fans on that system shall shutdown by an electrical interlock.
A common alarm point shall be provided for the system to indicate shutdown as a result of:

.1 mixed air low temperature
.2 supply fan excess discharge pressure
.3 return fan excess discharge pressure
.4 high discharge air temperature

A smoke detector in the common supply and return ducts shall be supplied, and installed, by Division 26 to interface with the fire alarm system.
A pressure switch across each filter bank shall alarm at the BAS when pressure drop exceeds 1.5"(Adjustable) to indicate the need for cleaning.

.2 Flow Measuring System Control Sequence

.1 General. The system has one supply and one return fan. The system shall be started and stopped by the BAS.

.2 Fan and Control System Interlock and Start-Up

Upon a signal from the BAS indicating the energizing of the system fans, the control system shall go to a start-up mode by sending the normal operating system static setpoint signal to the system static pressure controller. Upon receipt of this setpoint signal and transmitter signal, the system static pressure controller sends a signal to the VSD to gradually increase the speed of the supply fan to maintain the supply system at a constant static.
As the supply air volume increases, the system sends a signal to the BAS to gradually increase the speed of the return fans as it maintains a constant airflow differential between the supply and return fan air volumes.
With the main air handling unit operating the BAS shall energize the Mezzanine transfer fan. BAS shall monitor the status of the fan.

.3 Volumetric Synchronization Control and Readout

Airflow measuring stations sense the airflow rate the supply air fan and return fan and send airflow signals

to the BAS.
Using the results from each airflow station the BAS adjusts the speed of the return fan to maintain the predetermined airflow offset between the supply and return fans.
The economy cycle shall upon activation, position the return and outside air dampers to vary the desired volume of outside air to the supply fan system.

.4 System Static Pressure Control and Readout

Static pressure shall be controlled from sensors located as described above. Setpoint shall be 250 Pa(Adjustable)
The static pressure sensor sends a static pressure signal to a differential pressure transmitter in the control centre and a transducer converts the static signal into a transmitter signal. The output of transmitter is sent to the BAS.

.5 Morning Warm-up Control

The control system shall go to a morning start-up (100% return air) mode. When the outdoor air temperature is below -10°C.
Since the return fan capacity is less than that of the supply fans, the supply air fans capacity shall be limited in this condition to 80% of their normal capacity.
During this mode, the VAV boxes shall be at maximum setting.

.6 High/Low Pressure System Alarm and Shutdown

Abnormal high supply static pressure at the output of supply fans or abnormal low return static pressure at the inlet of return fans is sensed by static pressure sensors. These static pressure signals are sent to the BAS. When the static pressure exceeds the trip point setting of a switch, it deactivates all fans and energizes an alarm indicator at the BAS. When the high/low pressure alarm is activated, the system will not restart until the motor protection time delay sequence has ended and the override reset switch has been operated.

.7 Night Cycle

It shall be possible to reset the setpoint of each VAV box independently, such that zones can run in the day or night mode.
In the event the occupied/unoccupied button on the temperature sensor is pushed, that zone shall reset to an occupied mode (if in unoccupied mode), and energize the respective fan systems. The operator shall be able to inhibit the fan operation after hours as required.

.8 Temperature Monitoring

The BAS shall monitor the space temperature at each zone in the building.

.9 Fire Alarm Shutdown and Smoke Venting

.1 On receiving an alarm from the fire alarm system, Division 26 shall shutdown all supply and return fans through the fan starter circuits, and provide a signal to the BAS to initiate an orderly shutdown of the system.

After the fire alarm panel has been reset, the fire alarm system shall provide a 'return to normal' signal to the BAS which shall permit the system to restart in an orderly manner.

.3 Water to Glycol Heat Exchanger

.1 On a call for heating from 1 or more Air Handling Units connected to the glycol loop the BAS start the lead glycol pump. Should the Lead Glycol pump fail to start the lag pump shall start and the BAS shall alarm. The Lead pump shall rotate on a weekly basis. The pump VFD shall modulate to maintain pressure setpoint at most remote point. The BAS shall modulate the 2-way heating water control valve to maintain glycol Temperature Setpoint.

.4 Lighting Zones

.1 The building is divided in zones as listed below. Locate the relay panels in the electrical rooms adjacent to the lighting panels. Provide the switches and wiring to the switches to provide lighting scheduling from the BAS. The BAS contractor shall allow for 14 lighting relays.

.2 The features include Day-Night scheduling, Night Override, and On-time monitoring of individual zones. The system provides for individual control of all lighting zones to allow for any tenant requirements.

.3 Each zone will have its lights operating on a time-of-day schedule basis set to time provided by each tenant (i.e., 7:00 a.m. to 21:00 p.m.). The system within five (5) minutes of returning to the unoccupied mode will signal the tenants by flashing the lights off for two (2) seconds. If the tenant requires additional lighting, he or she must go to the centre core and press the light switch corresponding to their area. In this case, the system will command the light on for another two (2) hours. Thereafter, the system will again flash the lights, if no override time is requested, the lights will turn off and remain off until the next override request or scheduled on time.

.4 During the night (unoccupied) mode only the night-lights will be operational until the tenant lights have been overridden.

.5 Centre Core (elevator lobby and washrooms). These zones will only operate on a time-of-day basis, the initial setting for the core areas will be On at

6:45 a.m. and OFF at 21:30 p.m. The operating time for the common lobby areas will vary starting ON at 6:20 a.m. and OFF at 10:30 p.m.

PART 2 - PRODUCTS

2.1 ACCEPTABLE EQUIPMENT

.1 There is an existing Schneider Electric system presently installed in the building. All materials must be selected to ensure full compatibility with the existing Schneider Electric System.

PART 3 - EXECUTION

3.1 ACCEPTABLE CONTRACTOR

.1 Hire the services of Schneider Electric to complete the work of all EMCS sections.

.2 This contractor shall provide all new terminal/Local controllers and master controllers to suit the existing control system.

.3 Update all graphics to suit the requirements of this project.

.4 Contractor shall provide a signed point to point verification report as part of their closeout documentation. Each point shall have an identifier number to suit BGIS CMMS operations.

.5 Controls Contractor shall include an additional 16hrs to demonstrate system per Section 23 05 00 – Common Work Results for HVAC to Departmental Representative that the system is fully operational prior to acceptance. Provide 16 hours of onsite training to BGIS CMMS Operation staff after completion of demonstration for new sequences of operation.

END OF SECTION