1. PART 1 – GENERAL

1.1 Terms

.1 All terms and conditions of the mechanical specifications section 230500E are an integral part of this section.
.2 The work of this section are subject to a separate portion under the responsibility of the general contractor.
.3 Only digital control products that meet the standards ASHRAE 135-95 (native - BACnet) will be accepted. Programming control sequences is performed with type BACnet points. When submitting as-built drawings, the Contractor shall submit the check list detailed points of inputs and outputs for each of the equipment and / or for each of the control modules indicating their instance number BACnet. All identifying names BACnet modules and points will be awarded with as-built drawings.
.4 Only are allowed to bid contractors with the following qualifications:
  .1 Manufacturers or distributors recognized of original equipment offering the complete range of equipment required for the work.
  .2 Companies whose main activity is the supply, installation and commissioning of digital control system and accredited by a recognized manufacturer.
  .3 Companies with qualified service personnel to respond to a service call 24 hours a day, 365 days a year.
  .4 Companies with a minimum experience of 10 years in automatic control and relevant experience in installing digital controls.

1.2 Datasheets

.1 Submit product data and shop drawings in accordance with the requirements of section 230500E.
.2 Design in detail the control systems to meet specific operations. Refer to the operating sequences described in the plans and in this section.
.3 Shop drawings, data sheets of all control units as well as complete controls diagrams should indicate the following: rest position equipment, model numbers, connection lines, sequences of operation and setpoints and ranges of adjustment.

1.3 Scope of Work

.1 The work of this section include, but are not limited to, the provision of equipment and labor necessary for the proper operation of systems and accessories described below and / or plans, everything must be operational.
  .1 Such work includes installation, electrical connections and low voltage and 120V, adjustments, calibrations and putting into operation of all systems supplied.
  .2 Include the integration of existing systems to new systems unmodified.
.2 The Contractor shall provide all control devices necessary for the transfer and integration of the sequences described in specifications and plans, including software, programming, graphics, updated at the server screen.
.3 Connect the 120V power required for the controls from existing electrical panels or junction boxes to replace existing controls.
.4 Perform testing and calibration of all test equipment for an operation to the satisfaction of Departmental Representative.

.5 Documents:
  .1 Shop Drawings complete with detailed network architecture, identifying components, their models and the links between them;
  .2 Guarantees and Certificates in accordance with Section 230500E;
  .3 Instruction Manuals in accordance with Section 230500E;
  .4 As built drawings in accordance with Section 230500E and article 1.1 above.
.6 Train technical personnel.
.7 Provide two sets of key boards, key guards, key calibration thermostats or other equipments tools necessary for the operation and maintenance of monitoring equipment provided by this section.
.8 All opening and cutting required by this section are part of contractor's scope of work.

1.4 Training of technical staff

.1 Provide services of qualified instructors to train the Departmental Representative on the operation, maintenance and calibration of monitoring equipment.
.2 The training courses will be given during the normal working hours. Documents such as manuals, as-built drawings, manuals and other relevant documents should be submitted at the beginning of the course. The allocated training period will comply with the article 1.33 – Training operation and maintenance staff, at section 250500E of this specifications document.

1.5 Testing and commissioning

.1 Simulate all local alarm panel and remote panels in the presence of the Departmental Representative.
.2 Test each sequence of operation so that the systems operate to the satisfaction of Departmental Representative.
.3 Once the installation is complete, check, adjust and adjust all control devices and control or security supplied and installed under this section.
.4 Make adjustments and put the facility in good working condition.

1.6 Identification

.1 All equipment, including but not necessarily limited to, probes, current relays, electrical relays and terminal blocks of programmable controllers and subpanels shall be identified (name of the point, relay number, number sign) with nameplates.
.2 IDs used are the same as those shown in the diagrams and existing control and such.

1.7 Regulations

.1 All wiring must comply with the requirement of manufacturer and Board of Examiners of electricians of the province of Quebec for all electrical work.
.2 The system shall include all devices control and monitoring, equipment as well as all devices, and equipment installed remotely, software, and wiring interconnect lines necessary to obtain a complete system, as described in this section. The system must comply with local codes and national regulations.

2. PART 2 - PRODUCTS AND INSTRUMENTATION

2.1 General

.1 The control and regulation must conform to the specifications and conditions below. Unless otherwise indicated, the devices of the same type must come from a single manufacturer. Once installed, the control equipment and control must be switched off in order to be safe in the event of a failure or defect.

.2 All wiring indicated or required for the automatic control system covered by this section, unless otherwise specified in the plans or specifications. Wired devices or piping included as part of the piece, not within this section.

2.2 Transmission type

.1 The transmission of control signals of the main elements of existing HVAC systems will be electronic, but some local elements remain pneumatic systems and the Contractor shall provide new PE or EP relays to control the following elements:

.1 The control valves actuators on hot water coils heating, chilled water, and of steam distributors of humidifiers;

.2 Actuators for return, exhaust and fresh air dampers;

.3 Filters differential pressure indicators / transmitters;

.4 Fans variable speed device at 60 lb / in ² (414 kPa) on variable volume systems and their duct pressure sensors

.5 Night temperature set back between 15 and 21 lb / in ² (104 to 145 kPa) for systems serving perimeter zones

.2 Refer to detail of modification of a typical panel shown on plan H-01.

2.3 Sensors and transmitters

.1 Existing humidity and temperature sensors and pressure transmitters are of analog type 3000 ohms, or 24vac, or 24 VDC, or 4 @ 20mA with Modbus communication. For details see the diagrams of typical controls systems attached.

.1 Provide controllers for specific applications and communication interfaces required in order to modify the setpoints remotely from the central server or a control communication Ethernet / Internet proprietary networks.

2.4 Low temperature protection

.1 The systems low temperature detectors are of electrical dry contact type for protection against freezing, and existing to be maintained.

2.5 Current transmitter / detector

.1 The electronic current transmitter giving a reading of the analog current flowing through an electrical conductor are existing and of Veris trade mark, to be maintained.

2.6 Local cabinets

.1 The controllers will be installed in the existing lockable metal cabinets after removing the existing controllers Custodian or Walker.
.2 Panels mounted as shown on the plan, on a wall or on legs.

2.7 Bacnet main processors

.1 Compliance BACNET
.2 The operator interfaces and controllers of general application must be connected through an internetwork communication BACNET. All communications taking place on this inter-network must comply with the protocol BACNET, ASHRAE Standard 135-1995. The product should be "Native BACNET."
.3 The inter-network communication BACNET must meet ISO 8802-3 (Ethernet) for operator interfaces and controllers of general application.
.4 Communication mechanism
  .1 Communication services taking place in the communication network BACNET will ensure a transfer of value and operator interface that is open protocol.
    .1 Connecting an operator interface to any controller communication network BACNET will allow the operator to interface with all other controllers as if that interface was directly connected to other controllers. Operators will be able to view and edit data, status information, reports, operating software, custom programs, etc.., all controllers from any controller communication network BACNET.
    .2 All values in the database (objects, variables, software, custom program variables) of any controller will be read from any other controller on the communication network for the transfer of the value of inter-network should not have to be performed by an operator / installer.
    .3 All objects and all the characteristics of objects will be easily viewed and shared, and that, at the whole system.
.5 Only one graphic interface level will be installed on this project. This level should be available to all workstations present or future including laptops.
.6 The graphic software should include a client-server DDE NET (NETWORK DIRECT DATA EXCHANGE), as well as client-server OPC (OLE FOR PROCESS CONTROL). It must meet the technological requirements mentioned in section 2.12 below.
.7 Operating Environment
  .1 The computerized control system of the building consist of one or more panels centralized management (s) independent (s) first level (PGC) operating without the services of an operator. Units are programmed from an operator station central or portable. The portable as central can be connected and disconnected without affecting the operation of the controllers and complete system.
  .2 The operating system of the computer control system will be available in French.
.8 System capabilities
  .1 The central allow the system operator many interventions without having to move. It will produce analysis reports, charts, alarms, trend logs, load control, lowering and other energy saving functions or control. The PGC will be able to replace the conventional controls for HVAC systems such as analog controllers, relays, sequencers, specific programs and strategies for energy saving.

.9 Man / machine interface
.1 The central control station or laptop can be connected to any PGC and have access to all the programming it and all network data in a transparent manner. Control stations can be connected to the communication network of high-speed controllers PGC.

2.8 Structure of digital controllers

.1 General Application Controller (CAG)
.1 Compliance BACNET
.1 Each controller must be of general application and BACNET connected network will take advantage of the protocol data link / physical layer ISO 8802-3 (Ethernet). Each building controller shall communicate directly with equal equipment BACNET the Ethernet network operator services Read (establish) and Write (run) as defined in clauses 15.5 and 15.8 of ASHRAE Standard 135-95. PICS of this product are required.
.2 The building controller must at least meet the requirements of a Class 3 device BACNET.
.2 BACNET standard object types that should be supported in read and write mode: analog input, analog output, analog value, binary input, binary output, binary, calendar, schedule, loop PID controller, history log and alarms.
.2 Self-governing operation
.1 Each CAG will have a 32-bit processor Intel 386. Each CAG will be equipped with an integrated battery with a capacity of 72 hours in order to maintain the real-time clock running. The life of the battery shall be 10 years minimum.
.3 Each CAG will own 32 megs of RAM, expandable using conventional memory modules.
.4 Each CAG will use 1 meg of flash memory to support its operating system. The version of the operating system can be changed without having to change any EPROM or EEPROM.
.5 Communication Ports:
.1 RS232: The CAG will support at least two RS232 communication ports can operate at 19200 baud simultaneously "multi-user". Each port can support the composition and the automatic reply BACNET protocol.
.2 RS485: The CAG will support an RS485 BACnet MSTP to communicate with application specific controllers subnet speed 39200 baud.
.3 Echelon Lon Works: The CAG will support standard Echelon FTT port to communicate with Echelon controllers from different manufacturers.
.4 Intelli-Net: The CAG will support a communication port 1 mega baud to communicate with other AGC any previous generation.
.5 Ethernet: The CAG will support a communication port Ethernet standard ISO 8802.3 to 10 mega baud. Connections may be of the coax, thin or thick net income. This network will communicate with other AGC or with PCs, BACNET protocol.
.6 Communication Network
.1 Each CAG will be addressable by DIP SWITCH. The network can be of LAN (Local Area Network) or type WAN (Wide Area Network). The amount of AGC connected to the network may be 1024. The network will be Ethernet.
.7 Each CAG will be equipped with LED to indicate the status of the communication.
.8 If the AGC does not meet the minimum requirements in terms of speed data link / physical layer, a router network independent BACNET meets these requirements may be provided. In this alternative there must be a router CAG.

.9 Inputs and Outputs
.1 The CAG should be compatible with standard peripherals. The analog should have a minimum resolution of 12 bits for the inputs and outputs for 10 bit. All connections of input and output of controller general application must be made using screw terminals plug that can be défichés to allow quick and easy maintenance.

2.9 Communication between panels

.1 The total system may include up to 1024 controllers of general application (CAG). Controllers are interconnected by Ethernet-type network with a communication speed between them 10 million baud. All PGC can interact via the communications network, without the intervention of another computer or a central station. The network will have a total length of 3500 meters.

2.10 Operator terminal

.1 The operator station will save the program, database and reports trends and historical diskettes, and for each of the controllers seamlessly. There will be at least the following characteristics:
.1 Computer table;
.2 Intel Core i3 2120 processor (3.3GHz, 3M)
.3 4 GB DDR3 Non-ECC SDRAM, 1333MHz, (1 DIMM) of RAM;
.4 A 320 GIG hard drive;
.5 Compatible mouse with two buttons.
.2 Graphic color display:
.1 Communication is HDMI type;
.2 Screen type LED;
.3 Size 22";
.4 Color diagrams or graphs, and the dynamic data, that can be displayed simultaneously;
.5 Graphics static or dynamic can be generated on the screen via one or more programs of events;
.6 Screen and keyboard, which can be used to enter and receive data simultaneously, to generate graphs and controls;
.7 Supply 120V, 60Hz
.3 Communication Ports
.1 Provide all serial ports, parallel and network communication and all required cables to get a good operating system with Ethernet communications up to 10 Mbps.

2.11 Wiring and electrical conduits

.1 The electrical installation must be performed in accordance with the rules of art. The electrical and exposed in the engine room passes in parallel or at right angles to the building structure. The electrical installation through ducts must be properly consolidated and secured to prevent any obstruction with devices and terminals.
.2 The Contractor building operations and control performs the necessary electrical installation to full operation of the control system and automation.
.3 Unless otherwise indicated in the plans, the work of electrical connections from the control panel including existing and conduits, boxes, circuit breakers and wiring for 120-volt primary power controls or control panels are part of the this section.
.1 Conduits and wire trays:
.1 All exposed conductors shall be installed in metal conduit (EMT), but in cable trays in false ceiling.
.2 Conduits have a minimum of 20 mm in diameter.

.3 Conduits shall be concealed wherever possible and shall be installed parallel to the lines of the building.
.4 Flexible conduits not exceeding 2 m will be used to compensate for vibrations at expansion joints.
.5 The conduits shall be hanged to 2 m with supports near joints. Refer to section 12 of the Canadian Electrical Code for details.
.6 Flexible conduits are used to transition between control elements and ducts EMT. Flexible ducts shall not exceed 500 mm.
.7 In humid places, conduits and associated hardware that will conform to the application.
.8 Each conduits shall be clearly identified by means of a strip of paint or a red sticker every three (3) meters (10 ') and on each side of a wall, floor or a junction box and drawing.

.2 Wire pulling and outlet boxes:
.1 All boxes shall conform to the dimensions required by the Canadian Electrical Code.
.2 Made of galvanized metal, unless otherwise indicated.
.3 In suspended ceilings, the boxes will be attached directly to the frame.
.4 A pull box will be installed every 30 m.

.3 Wiring and identification:
.1 All wires are full length from their source to the point of connection.
.2 They will be clearly identified by the same code on both ends. A letter may be accepted as a prefix for end discrimination with existing wiring.
.3 Terminals will also have the same identification.
.4 The markers used to identify conductors 18 AWG or less will be of "Thomas & Betts" model WC, mini style or equivalent.

.4 Selection of conductors:
.1 The conductors used for power control panels (mains voltage only) will be type RW-90 copper stranded with a caliber respecting standards of the Canadian Electrical Code and black and / or white. Drivers grounding will be green.
.2 Drivers for signals from the local processing units are type 2 or 3 conductor No. 18 AWG aluminum shielding and drain wire. If multipair cables are used, each pair must be shielded as the model of Belden 8760 or approved equivalent.
.3 The drivers for the communication network will UTPCat 5, multimode 50 micron fiber with LC connector.
.4 Shielded conductors are grouped in separate conduits son of control (more than 24 V).
.5 The control, CPUs and local processing units are fed from a circuit powered by 24 VAC.

2.12 Specific CSA technology requirements

.1 Objective
.1 The objectives of this article is to defined the technology requirement for the application that will be implanted for the future Mechanical System Control at CSA

.2 Context
.1 In respect with the CSA's Mechanical System Control Modernization project, an application will be proposed by the contractor to manage the Mechanical System control but this application will be required to comply with various technology requirements to be accepted by CSA.

.2 Considerations for the Contrarctor
.1 The proposed system will include a typical production implementation diagram. Those diagrams will supply the technical requirement, the software, the installation document required for the proposed system. An evaluation of the proposed system will be done to validate CSA has the necessary capacity in its technologic environment to implement the product (Ex: CPU, memory, hard disk space, licenses, number of servers, etc.)

.3 Technology requirements
.1 Authentication
.1 Two type of authentication will be considered:
.1 Application authentication: Meaning an application account and a password used to access the application and managed by the application. All passwords will have to be stored encrypted and also the transport of the password needs to be encrypted.
.2 Windows authentication: The proposed solution will allow CSA employees to authenticate using Microsoft Active Directory. Web form authentication synchronizes with Active directory or windows authentication will be the preferred. The Microsoft authentication will need to support Kerberos, NTLMv2 or above otherwise the proposed solution will be rejected.

.2 Operating System
.1 The proposed system will be required to be installed on Microsoft Windows Server 2008 (32 bits) or 2008 R2 (64 bits) operating system. The Standard and Enterprise edition of that operating system are available. A native 64 bits solution on a Microsoft Server 2008 R2 64bits, will be preferred. Please take note that CSA's servers environment is virtualize and using VMware as virtual technology.

.3 Telecommunication
.1 The proposed system will need to be compatible with TCP IP version 4 and version 6.
.2 CSA have deployed the 802.1x technology, supporting this technology would be preferable.

.4 Monitoring and event journaling
.1 The proposed system is required to have audit logs for user's access and usage of the system and the applications. Key element for health monitoring of the application will be supply to the system administrators.
.2 CSA has an infrastructure supervision systems that validates the good operation of its systems and applications. The key elements required for the proper operation of the proposed system shall be given to the system administrators in order to assure an adequate supervision.

.5 Backup and restore
.1 The proposed system will supply a method for backing up the system for restore purpose in case of disaster or data loss and will be documented. CSA already have backup systems for servers and database, the proposed system will need to integrate with those.

.6 Web Server
.1 The proposed system is required to function with Microsoft IIS services 7 or above. All other solution will need to be analyse before being considered as acceptable.

.7 Database server
.1 The proposed system will be required to support Oracle 11g as a technology for database if required. A system proposing Microsoft SQL server 2008 will also be considered but will required to be analyse internally by CSA before accepting the system as Microsoft SQL is not our preferred Database system. Any other type of database will only be accepted after being analyse.
.2 Depending on the technology proposed, if a username and password is required to be save in a file, registry or else, the information will need to be encrypted.

.8 E-mail server
  .1 If the proposed system requires sending e-mail, it will have to be able to use a SMTP relay. CSA should be able to modify the "From" address for messages send from the application and also the content for these message need to be in the two officials languages.
  .2 In addition, it would be preferable to be able to use SMTP with TLS 1.1 authentication.
.9 Name resolution (DNS)
  .1 The proposed system must be able to operate with standard DNS queries for its various communications with our environment. No communication "Netbios" type will be permitted.
.10 Antivirus
  .1 CSA servers are all equipped with an antivirus solution for which specific exclusions in the proposed solution should be provided, if necessary, to IT administrators.

.4 Desktop Client requirements
  .1 Operating system
    .1 The proposed system must allow access to the client interface via CSA workstation whose operating system is Microsoft Vista or windows 7 32bits and 64bits.
  .2 Internet Browser
    .1 The proposed system must run with the browser Microsoft Internet Explorer 9 or above, 32bits or 64bits.
  .3 Client solution
    .1 A web client solution is sought to minimize the complexity of using the client side and the administration side maintenance. A solution without the need to install software or ActiveX is preferred. If a client or ActiveX software solution is required, no administrative rights should be necessary to make use. The web interface, if applicable must be able to deploy the client software or the prerequisite during an attempt for a user to access the system. CSA's users are not administrator on their computer.
    .2 If the proposed client solution is not « web », then it will be required to work in a Citrix XenApps 5 environment and the use of enterprise or floating licenses will be preferred.
.5 Mobil Technology
  .1 The system sought should also support mobile technologies preferably technology using HTML 5. CSA currently is using BlackBerry technology but Canadian government is evaluating an enterprise solution for tablets technology and therefore BlackBerry may not be the only one considered.

3. PART 3 – INSTALLATION

3.1 General

.1 Install BacNet / IP controllers to control the (27) twenty-seven HVAC systems type A and type B shown in the plans and listed in plan H-01 HVAC system schedule, being 9 of type A and 18 of type B as well as two independent units 8-URC-002 and 8-URC-003.
.2 Install BacNet / MSTP controllers to control (42) forty-two HVAC type C1, C2, C3, C4, D, E1, E2, E3, and E4 specified on drawings and listed in table of HVAC system in plan H-01. The total capacity shall be capable of managing (64) systems, including (22) systems out of scope of work.
.3 Install at least one controller type BacNet / IP in each mechanical room or pavilion which include the following signals of MSTP local controllers:
  .1 Mechanical room at P1N4
  .2 Mechanical room at P3N4
  .3 Mechanical room at P4N4

.4 Mechanical room at 6B-100, for the pavilion # 6
.5 Pavilion # 8

.4 In pavilion # 2, for the management of system controllers located P2N3 use the existing controller BacNet / IP network in the mechanical room P2N3 that manages six (6) existing systems 2S-065 to 2S-070 of computer rooms. This processor is a UNC model 500/510 of Ivensys / Schneider with expansion capability of 125 controllers. All accessories and added programming language must be compatible or equivalent.
.5 Program systems in accordance with the control drawings and real sequences of operation of existing HVAC systems listed and included in the project.
.6 Get operation schedules, real updated sequences, alarms and other specific data from the Departmental Representative before starting the work.
.7 Program graphics in accordance with the control drawings and sequences of operation.
.8 Get legend symbols and colors from Departmental Representative.
.9 Establish a architecture diagrams and graphics to be approved by the Departmental Representative
.10 Copy in the software all diagrams of Departmental Representative.
.11 Provide a CD copy of software programmed into each panel.
.12 Provide a CD copy of libraries containing programmed graphical diagrams.
.13 Provide all documentation necessary for reintegration of programs in the system by the Departmental Representative.
.14 Provide computer files of library of all equipment provided for the project (technical data catalogs, repair, spare parts, etc.).

4. PART 4 - SEQUENCES OF OPERATION

4.1 See Appendices #1, a, B, C1, C2, C3, C4, D, E1, E2, E3 and E4 attached to this section, for the original diagrams and sequences.
4.2 Note that many of these original sequences have been revised since 1993 and that those appendices are to permit the contractor to know the amount of control devices he has to modernize and the amount of points to manage and to monitor.
4.3 The correspondence between the actual and old pavilion numbers is described at appendix 2.