

PART 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/Air Conditioning and Refrigeration Institute (ARI)
 - .1 ANSI/ARI 210/240-03, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - .2 ARI 270-95, Sound Rating of Outdoor Unitary Equipment.
- .2 ANSI/UL 1995 B-1998, Standard for Heating and Cooling Equipment.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B52-99, Mechanical Refrigeration Code.
 - .2 CSA C22.1 HB-02, Canadian Electrical Code Handbook.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association
 - .1 NFPA 90A-02, Standard for the Installation of Air Conditioning and Ventilating Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for packaged rooftop HVAC units.
- .2 Shop Drawings:
 - .1 Submit shop drawings to indicate project layout and dimensions; indicate:
 - .1 Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.
 - .2 Piping, valves, fitting shipped loose showing final location in assembly.
 - .3 Control equipment shipped loose, showing final location in assembly.
 - .4 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.
 - .5 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.
 - .6 Pump and fan performance curves.

- .7 Details of vibration isolation.
- .8 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's Field Reports: manufacturer's field reports specified.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual:
 - .1 Indicate: brief description of units, indexed, with details of function, operation, control, and service for components.
 - .2 Provide for units, manufacturer's name, type, year, number of units, and capacity.

PART 2 PRODUCTS

2.1 VENTILATION

- .1 Ventilation units
 - .1 Generalities
 - .1 The apparels must be built as described hereafter. The fan and the coil must be replaced without having to dismantle the apparel structure. The equipment must be approved for outdoors installation.
 - .2 The manufacturer must provide the control components needed by a stand-alone operation.
 - .3 The Contractor must coordinate the general Contractor the delivery and the installation method on the roof. The unit must be delivered in one piece, with simple point connection 575/3/60V, prefilled with refrigerant and factory tested to insure a minimal installation time on site.
 - .4 The units must have equivalent quality than the Innovent units (distributed by EnviroAir Industries).
 - .2 Base
 - .1 The base will be built with welded structural steel including lifting eyes. The bolted bases are not acceptable. Steel must be covered with 2 layers of epoxy and urethane. A roof base on 460mm must be provided with the unit.
 - .3 Frame
 - .1 The frame must be made of steel walls 50 mm thick, double wall, and insulation with polyurethane of thermal value R-6.5 per inch (total r_13).

- .2 The external wall must be in galvanised steel, 22 Gauge, painted in gray color. The walls and the inner floor must be in galvanised steel.
- .4 Noise level
- .1 Sound level of the fans must not be higher than the following values: the values are, per octave band:

UC-O1 & UC-2 fans								
Frequency	63	125	250	500	1000	2000	4000	8000
Supply	77	71	82	78	80	77	76	67
Return	67	80	69	73	66	66	64	56

- .5 Access door
- .1 The access doors must be all on the same side, as shown on the plans.
- .2 The access doors must be double walled with urethane insulation. The doors must have piano type hinges in stainless steel.
- .3 The apparel must have a door at each location requiring maintenance (fans, controls, filters, coil, compressor section, controls etc.)
- .4 Access panel instead of doors are not acceptable.
- .5 Fans access doors must be lockable.
- .6 Motors and fans
- .1 All fans to be with type SWSI plenum with direct drive.
- .2 Provide the fans as indicated in characteristics.
- .3 Minimum service factor of the motors must be 1.15. They must run with high efficiency with a bhp not exceeding 85% of the motor nominal hp.
- .4 All drives must have a minimum of 2 straps with service factor of 1.2.
- .5 All the motor-fan sets must be built on an anti-seismic base with springs with minimum deflection of 25%.
- .6 Motors to be with premium efficiency, TEFC, 575/3/60V. A frequency variator must be provide per fan.
- .7 All the metallic parts must be covered with type Hi-pro polyester coating paint.
- .7 Aluminium Airfoil type dampeners
- .1 The blades and the frame of airfoil type must be built of extruded aluminium, 12 Gauge minimum (2.057 mm). The blades must be mono-bloc with 152 mm large.
- .2 The frame in extruded aluminium must be filled with grooving for vinyl joints. The standards frames measure 50 mm x 100 mm x 15.9mm.
- .3 The hexagon shaped aluminium swivel bars must measure 22 mm and clip with the blade group.

- .4 The bearings must be with double seal on an inner Celcon rod inside another external polycarbonate bearing mounted in the frame, to prevent the bearing to swivel.
- .5 Bearings must be designed to avoid all metal-on-metal or metal-on-bearing friction. The interconnections must have their own separate bearing, Celcon type to eliminate all friction at the joints level.
- .6 Hardware parts used to join the blades must be installed on the frame, out of the air flow. All the parts must be in anticorrosive cadmium plated steel.
- .7 To avoid air leaks, the dampener seals must overlap each other.
- .8 Little dampener installation needs an intermediary shaft. Those assembly parts must be included.
- .9 Make-up and exhaust frames and blades to be insulated.
- .10 Provide factory installed actuators, connected to the DDC Controller.
- .11 Acceptable product: T.A. MORRISON 9000 serie, or approved equivalent.
- .8 Economizer
 - .1 Each unit must be provided with an economizer, making the make-up air quantity vary according to the external temperature and then allow a free cooling. Probes must be factory mounted and the DDC Control must include the operation sequence.
 - .2 Hood on the make-up and on the exhausted air and birds grids must be provided. The dampeners must be provided and respect the dampener section.
- .9 Filters
 - .1 1st stage filter must have 50 mm thick, with disposable MERV 8 filters, like FARR 30/3.
- .10 Heating Coil
 - .1 An heating coil of 60 kw capacity opened homologated UL must be provided with SCR control. The fuses and the high temperature cut-off must be included and the coil electrical power supply must be connected on site.
- .11 DDC System
 - .1 The manufacturer must provide a programmable stand-alone digital control system to control the make-up air temperature. The manufacturer must provide an operation standard sequence for this unit type. The control will be programmed to control the return temperature, the make-up temperature and the exhaust temperature.
- .12 Electricity
 - .1 The apparel must be completely NEC, CSA and ETL built and certified.
 - .2 All the major components must have the UL seal. All the wiring to be in type liquid tight ducts.
 - .3 The apparels must be totally factory tested to verify the controls and the circuits.
 - .4 The unit must be provided with 120 V inner light.
 - .5 Each electrical equipment will be connected separately. Supply fan, return fan, coil and lights.

- .13 Characteristics
 - .1 Model: OAH008GVAM
 - .2 Mark: DAIKIN
 - .3 Return pressure loss: 1.0" SO ext,
 - .4 Return flow: 5000 cfm/ 1.5 hp
 - .5 Supply flow : 5000 cfm / 3 hp
 - .6 Supply pressure loss: 1.6 SP ext.
 - .7 Filters : MERV8
 - .8 Electrical connection: 575/3/60
- .14 Motorized dampeners
 - .1 Provide motorized dampeners with high sealing. They must be of mark "Tamco", 1000 Serie (recirculation) or 9000 Serie (intake and exhaust). Dimensions on the plan are the free dimensions of the dampener (montage: flanges). When the ducts are in steel, the dampeners must be from the same material.
- .15 Fan
 - .1 See plan for description
- .16 Operation sequence
 - .1 Stationary
 - .1 The fans do not operate.
 - .2 The dampeners are in normal position.
 - .3 The electrical coil does not operate.
 - .2 Normal operation
 - .1 Under normal operation the supply fan drive is positioned at 30% (1500 cfms). The exhaust fan drive is positioned at 36% (1800 cfms). The exhaust will always be 300 cfms more than the supply, under each cycle, this in order, if possible, to avoid air contamination in the users room.
 - .3 In operation
 - .1 The system starts according to occupancy hour programmed in the central control system. When starting, the return fan starts and the 60 seconds later, the supply fan starts. The mixing dampeners are set to the minimum, 25% (1250 cfms).
 - .4 Summer mode
 - .1 Operation in summer mode is determined when external temperature is higher than 15°C. The temperature probe of the sheath (TTA) modulates the mixing dampeners in order to maintain the set point (22°C, adjustable).
 - .5 Winter mode
 - .1 Operation in winter mode is determined when external temperature is equal or under to 14°C. The sheath probe (TTA) modulates the mixing

dampeners in sequence and the electrical coil SCR in order to maintain the set point (17°C, adjustable).

.6 Emergency mode

- .1 Upon entrance garage door opening signal (LS), the mixing dampers are closed. The systems operates with 100% exhaust and make-up with flows of 1550 cfms make-up and 1800 cfms exhaust.
- .2 Upon gas detection (NO₂ or CO), flows are gradually increased up to 5000 cfms.
- .3 The temperature adjustments to summer mode are maintained.
- .4 The winter settings modulates the coil to maintain 17°C. The steam heaters are in addition with the coil. Should the coil be at 100% and not be able to maintain the set point, the temperature sinks down to 7°C. At this temperature, the drives are slowed down to keep 7°C. Always insure 300 cfm more in exhaust.
- .5 The emergency mode is maintained 5 minutes (adjustable) after the return to normal detectors condition.
- .6 Gas detectors have two set points; the first one activates the ventilation in emergency mode and an audible alarm. The second level activates a red alarm signal on the face of the control panel.
- .7 Upon an exit garage door opening and closing signal (LS), the drives are set back to normal operation mode flows.

.7 Safety

- .1 A low limit (bl) sets the system in stationary mode upon detection of 4°C.

.8 Alarms

- .1 The following alarm will be programmed in the central control system:
 - .1 Low supply temperature
 - .2 Supply and return fan false start
 - .3 Low freezing limit
 - .4 Gas detection

.17 CABINET

- .1 Cabinets: weatherproofing tested and certified to AGA rain test standards and soundproofing tested to ARI 270, dBA at 20 m free field.
- .2 Framing and supports: 2 mm thick welded steel, galvanized after manufacture, with lifting lugs at bottom of unit.
- .3 Outer casing: weathertight 1.0 mm thick galvanized steel with baked enamel finish, complete with flashing.
- .4 Access: gasketed hinged doors with quick locking door handle type fasteners.

.2 CONTROL

- .1 Work description

- .1 Provide, install, connect, adjust, caliber and start a complete automatic numeric control system as specified hereafter or on the plans including all controls described in the sequences. All must be connected to the existing DDC of Danone Johnson Control de Servisys.
- .2 Provide the shop drawings including a scheme of the existing and proposed network architecture, systems schemes, material list, operation sequence, technical data and a graphic scheme list for approval.
- .3 Draw graphs and required sequences in the existing control system.
- .4 Do a probe test for all the control apparels for an operation to the owner's satisfaction.
- .5 Provide a technical support of 2 years required for a good operation during the warranty period (2 years).
- .6 Coordinate the equipment start up with the equipment manufacturer and the sub-contractor in system balancing.
- .7 Para-seismic protection: see the general clauses
- .2 General
 - .1 The numerical controls must come from one unique manufacturer: Johnson Control (Servisys)
 - .2 All controls must be connected in Bacnet network and communicate equals. The general application controllers must communicate with Ethernet link and specific application or terminal application controls must communicate pe link MS/TP.
- .3 Equipment description
 - .1 Manufacturer
 - .1 The only manufacturer accepted for this project is Johnson Control de Servisys in order to insure compatibility with the existing system.
 - .2 BL: Electrical bulb thermostat -30 to 30°C with automatic reset.
 - .3 TTA, TTR: Sheath temperature Probe -50 to 150°C
 - .4 TTM: Average temperature probe 24 ft. -50 to 150°C
 - .5 THR, THA: Sheath humidity transmitter 0-100% H, +/- 2% H, 4-20 MA.
 - .6 HP : Room Humidity transmitter 0-100% H, +/- 2% H, 4-20 MA
 - .7 LC : Current transmitter 0-60A, 0-5V C.C., n°H722; 0-200A, contact N.O. de 1A à 30 V C.A/V C.C.
 - .8 M-X Bélimo Electrical servo-motor, See the table of the servo motors
 - .9 VD : Complete variable frequency variator with by-pass, fuses, breaker , factory build in a same NEMA 1 box, like ABB.
- .3 EXECUTION
 - .1 Installation
 - .1 All the installations described on the plans and on this quotation, temporary or permanent, must be conform to Canadian Electricity Code, the Electrician Examinations Bureau and to the section 16 of the quotation. On the field work, the CCQ norms must be respected.

- .2 The work will be executed by electricians having a permit issued by the province of Quebec, adequately trained and experienced for this type of work and regularly employed by the control Entrepreneur.
- .3 The present sub-contractor will be responsible for complete installation of all systems component provided by him and necessary to the good system operation.
- .4 Cables must follow building lines.
- .5 All components to be CSA approved and UL listed when applicable.
- .6 All control equipment pieces must be identified by identification plate of lamicoid type wearing the identification that appears on the control diagram.
- .2 Cables and electrical ducts
 - .1 The sub-contractor will be responsible for electrical connection starting from electrical distribution panels including ducts, breaker boxes and controls or control panels 120V primary supply wiring .
 - .2 All conductors must be continuous form the source to the connected point.
 - .3 All conductors must be clearly identified with the same code on both extremities.
 - .4 The conductors exposed must be protected by metallic ducts with thin wall "EMT" and the hidden and accessible conductors will be in cable FT4.
- .3 Probe and start-up
 - .1 Provide a probe test and start-up report to be given with the "As built" report indicating the freezing conditions, the fire condition or other protections, all the alarms, all the interlocking are conform and indicate a good function of the operations sequences.
- .4 Formation
 - .1 Provide the services of an instructor qualified to form the owner representative on the operation, the maintenance and the calibration of the control equipment.
 - .2 Minimal duration of the formation will be 2 hours per system.
 - .3 Formation register must be signed by the Owner and transmitted to the general Entrepreneur.
- .5 Control sequence
 - .1 Systems UC-1 (H Type)
 - .1 Stationary
 - .1 The fans do not operate.
 - .2 The dampeners are in normal position.
 - .3 The electrical coil does not operate.
 - .2 In operation
 - .1 The system starts according to the occupancy hour programmed in the central control system. At system start, the return fan stats and 60 seconds later, the supply fan starts. The mixing dampeners open to the minimum (minimum fresh air).
 - .3 Summer mode

- .1 The operation in summer mode is determined when the external temperature is higher than 15°C. The TTA sheath probe modulates in sequence the mixing dampeners, the expansion valves and the internal controls of the condenser in order to maintain the set point (22°C), when the room probe is in request for cooling.
- .4 Winter mode
 - .1 The operation in winter mode is determined when the external temperature is lower than 9°C. The sheath probe TTA modulates the mixing dampeners in order to maintain the temperature above the set point (17°C) when the room probe is in request for cooling (see summer mode).
- .5 Safety
 - .1 The lower limit (BL) stops the system on detection of 4°C.
- .6 Alarms
 - .1 The following alarms must be programmed to the central control system :
 - .1 Low supply temperature
 - .2 Supply and return fan false start
 - .3 Low freezing limit
 - .4 Gas detection
- .7 Compressor ventilation system
 - .1 Existing controls are conserved except the 2 intake dampeners. Controls will be replaced by the motorized opening and closing of the motorised dampeners and the start and stop of the supply fan (VA-1 and VA-2) the signal must be transmitted to the speed variator to allow proper compressors ventilation. The control sequence start signal is the same than on the existing dampeners. A temporised delay must be incorporated to the fan start-up versus the opening of the dampener.

2.2 REMOTE PANEL

- .1 Provide remote readout panel for each unit containing:
 - .1 Signal lights indicating system status, heating system failure, cooling system failure, and dirty filters.
 - .2 Check switches proving signal light operation.
 - .3 System on-off switch and cooling system on-off switch.
 - .4 Fan on-off switch.
- .2 Provide gauges in remote panel indicating outside air, mixed air, return air and discharge air temperatures for each deck before heat exchangers.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install as per manufacturers' instructions on roof curbs provided by manufacturer, as indicated.
- .2 Manufacturer to certify installation, supervise start-up and commission units.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.
 - .2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
 - .3 Schedule site visits to review work at stages listed:
 - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
 - .2 Once the products are delivered and stored on site and preparatory work is completed, but before the beginning of installation work covered by this section;
 - .3 Upon completion of work, after cleaning is carried out.
- .2 Obtain reports within three (3) days of review and submit immediately to Departmental Representative.
- .3 Performance Verification:
- .4 General:
 - .1 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, actuators, humidifiers, sensors, electrical disconnects.
- .5 Performance Verification:
 - .1 Rooftop Air Handling Units:
 - .1 Set zone mixing dampers for full cooling, except that where diversity factor forms part of design set that % of zone dampers to full heating.
 - .2 Set outside air and return air dampers for minimum outside air.
 - .3 Set face and bypass dampers so face dampers are fully open and bypass dampers are fully closed.

- .4 Check for smooth, vibration less correct rotation of supply fan impeller.
- .5 Measure supply fan capacity.
- .6 Adjust impeller speed as necessary and repeat measurement of fan capacity.
- .7 Measure pressure drop of each component of air handling unit.
- .8 Set outside air and return air dampers for the % of outside air required by design and repeat measurements of fan capacity.
- .9 Reduce differences between fan capacity at minimum and maximum outside air less than 5%.
- .10 Set face and bypass dampers to full bypass and repeat measurement of fan capacity.
- .11 Reduce difference between fan capacity with F BPD fully closed to bypass and fully open to bypass to less than 5%.
- .12 Reduce difference between fan capacity at full cooling and fan capacity at full heating to less than 5%.
- .13 OAD: verify for proper stroking, interlock with RAD.
- .14 Measure DBT, WBT of SA, RA, EA.
- .15 Measure air cooled condenser discharge DBT.
- .16 Measure flow rates (minimum and maximum) of SA, RA, EA, relief air.
- .17 Simulate maximum cooling load and measure refrigerant hot gas and suction temperatures and pressures.
- .18 Use smoke test to verify no short-circuiting of EA, relief air to outside air intake or to condenser intake.
- .19 Simulate maximum heating load and:
 - .1 Verify temperature rise across heat exchanger.
 - .2 Perform flue gas analysis. Adjust for peak efficiency.
 - .3 Verify combustion air flow to heat exchanger.
 - .4 Simulate minimum heating load and repeat measurements.
- .20 Measure radiated and discharge sound power levels under maximum heating demand and under maximum cooling demand with compressors running.
- .21 Verify operating control strategies, including:
 - .1 Heat exchanger operating and high limit.
 - .2 Early morning warm-up cycle.
 - .3 Alarms.
 - .4 Voltage drop across thermostat wiring.
 - .5 Operation of remote panel including pilot lights, failure modes.
- .22 Set zone mixing dampers for full heating and repeat measurements.
- .23 Measure leakage past zone mixing dampers by taking temperature measurements. Reduce leakage to less than 5%.
- .24 Measure return fan capacity.

- .25 Adjust impeller speed as necessary and repeat measurement of return fan capacity.
- .26 Check capacity of heating unit.
- .27 Refer to other sections of these specifications for PV procedures for other components.
- .2 Start-Up:
- .3 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, operators, humidifiers, sensors, electrical disconnects.
- .4 Verify accessibility, clean ability, drainage of drain pans for coils, humidifiers.

.6 Commissioning Reports:

.1 In accordance with Section 01 91 31 - General Commissioning (Cx) Requirements: reports.

.1 Report forms as specified Section 01 91 31 - General Commissioning (Cx) Requirements: Report Forms and Schematics.

3.4 DEMONSTRATION

.1 Training: in accordance with Section 01 91 31 - Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

END OF SECTION