PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)
.1 ANSI/ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size.

.2 American Society for Testing and Materials (ASTM International)
.1 ASTM C547-11e1, Standard Specification for Mineral Fiber Pipe Insulation.

.3 ASTM International
.1 ASTM C 547-11, Specification for Mineral Fiber Pipe Insulation.

.4 Canada Green Building Council (CaGBC)
.1 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating Systemfor New Construction and Major Renovations 2009.

.5 CSA International
.1 CSA B52-05(R2009), Mechanical Refrigeration Code.
.2 CAN/CSA-C656-05(R2010), Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for air conditioning components and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.3 Shop Drawings: (Cont'd)
.1 (Cont'd)
in Province of Newfoundland and Labrador, Canada.
.2 Indicate on drawings:
.1 Major components and accessories including sound power levels of units.
.2 Type of refrigerant used.

.4 Sustainable Design Submittals:
.1 LEED Canada submittals: in accordance with Section 01 35 21 - LEED Requirements.
.2 Construction Waste Management:
.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect equipment from nicks, scratches, and blemishes.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 Storage and Handling Requirements: (Cont'd)
.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.

.5 Packaging Waste Management: remove for reuse or return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.

1.5 WARRANTY

.1 For refrigeration compressors, 12 months warranty period is extended to 60 months.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Integrated package: to CAN/CSA-C656.

.2 Installed system shall be a VRF (variable refrigerant flow) multi split air conditioning system. The system shall utilize a single air cooled condensing unit serving the indoor fan coil units.

.3 Refrigerant: R-410A or non ozone depleting refrigerant.

.4 Unit capacity: as indicated on drawing.

.5 Acceptable manufacturers: Daikin, Mitsubishi City Multi, Toshiba and Samsung.

.6 Note: System depicted on drawings is representative of the Daikin System. Other manufacturers listed above may have different components, piping, electrical and control requirements. Any alterations shall be responsibility of the contractor to implement.

2.2 OUTDOOR UNIT

.1 The outdoor unit shall be completely weather proof and corrosion resistant. The unit shall be constructed from rust-proofed steel panels and coated with a baked enamel finish.

.2 The outdoor unit shall consist of: two inverter scroll compressors, motors, fans, condenser coils, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil seperators, servce ports, liquid receiver and suction accumulator. Liquid and suction lines must be individually insulated between the condensing and indoor units. The coils shall draw air in through two sides of the unit and discharge out of the top of the unit. The system shall have two fan mounted on top of the two coils.

.3 The outdoor unit shall have two inverter controlled hermetic scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow variations in total cooling and heating loads as determined by the suction gas pressure as measured in the condensing unit.

.4 The refrigeration process of the outdoor unit shall be maintained by pressure and temperature sensors controlling solenoid valves, check valves and bypass valves. The cooling mode of the outdoor unit shall be controlled by a 4-way valve. Condensate shall be removed from the unit by means of a drain pipe connector located on the bottom of unit.

.5 The outdoor unit shall have one liquid discharge pipe which shall supply high pressure liquid to the indoor units. Refrigerant return to the outdoor unit shall be via one suction pipe. Both pipes shall be insulated.

.6 Outdoor units shall be capable of operating in temperatures down to -20.0°C (amb) while maintaining 60 percent of unit heating capacity.

.7 Outdoor unit shall be equipped with wind baffles. Baffles shall be field supplied, and

2.2 OUTDOOR UNIT (Cont'd)

.7 (Cont'd) fabricated as per manufacturer's specifications and instructions. Baffles shall be manufactured using stainless steel aluminum, or other non-corroding materials subject to the approval of the Departmental Representative. Submit shop drawings prior fabrication in accordance with Section 01 33 00 - Submittal Procedures.

.8 Capacity: as indicated on drawing schedules.

2.3 INDOOR UNITS

.1 Each indoor unit shall have a heat exchanger which shall be constructed from copper tubing with aluminium fins. The flow of refrigerant through the heat exchanger shall be controlled by a proportional expansion valve. This valve shall be controlled by two pipe thermistors and a return air thermistor and shall be capable of controlling the variable capacity of the indoor unit.

.2 Each indoor unit will require a 208-230 vac power supply. Control shall be via the data control signal from the outdoor unit.

.3 The following types of indoor units shall be utilized:

.1 Above Ceiling Ducted Units:

.1 The units shall be manufactured from galvanised steel plate partially insulated with closed cell expanded polyurethane foam.

.2 Air shall be discharged by a forward curved centrifugal fan horizontally out of the front of the unit to allow for field supply ductwork and diffusers to distribute the air into the room. Return air shall be brought in through the rear of the unit. Unit shall be complete with a synthetic fibre washable filter and filter casement and drain lift up pump.

.2 Wall Mounted Unit:

.1 The unit shall be manufactured from ABS plastic.

.2 Air shall be discharged by fan through an outlet in the bottom front

2.3 INDOOR UNITS (Cont'd)

.3 (Cont'd)

.2 Wall Mounted Unit:(Cont'd)

edge of the unit. The outlet shall have electronically adjustable vanes to enable variable air discharge through the horizontal to vertical downward planes. The outlet shall also include manually adjustable guide vanes to alter the airflow pattern in the horizontal directional plane.

.3 Air shall be returned to the unit through grilles mounted in the front face of the unit above the outlet. The return air shall be filtered by synthetic fibre washable filters mounted behind the return air grilles. Unit shall be complete with drain lift-up pumps.

.3 4-way ceiling cassette unit:

.1 The units shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

.2 Return air shall be brought in through the bottom centre of the unit.

.3 Air shall be dishcarged through the four adjustable louvres.

.4 Unit to be equipped with MERV-13 filter kit and drain lift pump.

2.4 SPACE TEMPERATURE CONTROLLER (AUTO SYSTEM ADDRESS)

.1 This controller shall be wall mounted and hard wired to the indoor fan coil units. It shall be manufactured in ABS plastic with an LCD display and shall be the manufacturers standard colour.

.2 The controller shall be capable of altering the following functions on indoor fan coil units:

.1 On/Off.

.2 Operating mode.

.3 Set point.

.4 Fan speed.

.5 Test run.

2.5 CONTROLS

.1 VRV Centralized Controller:

.1 This controller shall be wall mounted and hard wired to the outdoor unit(s). It shall be manufactured in ABS plastic with an LCD display and shall be the manufacturers standard colour. The controller will require an additional power pack which will be housed in a galvanised steel box.

.2 The controller shall be capable of individually controlling the following functions on all indoor fan coil units:

- .1 On/Off.
- .2 Operating mode.
- .3 Set point.
- .4 Fan speed.
- .5 Louvre position.
- .6 Timer settings.
- .7 Test run.

.3 The controller shall also be capable of displaying the following information individually for all indoor fan coil units:

- .1 On/Off.
- .2 Operting mode.
- .3 Set point
- .4 Fan speed.
- .5 Louvre position.
- .6 Time settings.
- .7 Test run.
- .8 Fault diagnosis.

.2 Programmable Control Units (PCU):

.1 Provide multiple control functions for typical built-up and package HVAC systems, heatingc systems and electrical systems.

.2 Expandable I/O points cards.

.3 Points integral to one Building System to be resident on only one controller.

.4 Microprocessor capable of supporting necessary software and hardware to meet specified requirements following additions:

- .1 Include minimum 2 interface ports for connection of local computer terminal.
- .2 Design so that shorts, opens or grounds on input or output will not interfere with other input or output signals.
- .3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either

2.5 CONTROLS (Cont'd)

.2 Programmable Control Units (PCU):(Cont'd)

.4 (Cont'd)

circuit with minimum hazards to technician and equipment.

.4 Include power supplies for operation of PCU and associated field equipment.

.5 In event of loss of communications with, or failure of, Centralized Controller, PCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.

.6 Provide conveniently located screw type or spade lug terminals for field wiring.

.5 Temperature Sensors: to Section 23 90 01 - Mechanical Control System.

.6 Field Control Devices: to Section 23 90 01 - Mechanical Control System.

.7 Control Wiring:

.1 The contractor shall be responsible for the interconnecting control wiring between the indoor and outdoor units and control wiring between remote controllers, centralized control and relevant components. This work shall be co-ordinated with the Electrical Contractor for the routing and trunking of the cables.

.2 All control wiring is to be carried out in accordance with manufacturer's requirements. Where recommended, wiring to be 2 core 16 AWG non-shielded cabling with colour coding and tagged with ID number at 2.75 m. intervals as per schematics for ease of identification and maintenance.

.3 Control wiring shall not be run next to power wiring. A minimum space of 100 mm between both control and power cables shall apply.

2.6 INSTALLTION

.1 The installation of all air conditioning equipment, installation of all refrigerant pipework and full commissioning shall be performed by a specialist refrigerant

2.6 INSTALLTION (Cont'd)

.1 (Cont'd) installer who shall be authorized to install electric VRF equipment. The installation of all internal and external units, refrigerant pipework, inter-connecting wiring, commissioning and testing shall be carried out by an approved refrigerant systems installer. Qualifications of installers shall be provided upon request and subject to the approval of the Departmental Representative.

.2 Full access shall be afforded to site during the installations stage of the project to allow them to verify that installation methods are fully in accordance with all requirements and that the equipment warranties shall not be invalidated.

2.7 REFRIGERANT PIPEWORK

.1 To Section 23 23 00 - Refrigerant Piping.

.2 Supply, install, test and commission all interconnecting refrigeration pipework between the outdoor and indoor units.

.3 All pipework must be suitable for R410A.

.4 Longest possible straight lengths of copper pipe should be utilized to minimize joints on site.

.5 After installation of pipework, and prior to sealing of insulation joints and starting of equipment, pipework should be tested as follows:
.1 Pressure test: 310 kPa, 1,515 kPa and 3,275 kPa tests for a minimum 3 minute duration each.
.2 Strength test: 4,135 kPa and check the system for leaks and deformation, then lower the pressure back to 3,275 kPa and pressure test for 24 hours and checked for leaks.
.3 Vacuum test: vacuumed/dehydrated to 300 microns, and hold at that vacuum for 12 hours (minimum).

.6 Refrigerant (R410A) charge weight must be calculated, to the actual installed length of

2.7 REFRIGERANT PIPEWORK (Cont'd)

.6 (Cont'd) pipework in accordance to Daikin recommendations.

.7 The charging should be carried out with an appropriate charging station.

.8 Pipework to be properly fixed and supported at a minimum of 1.5 m. centres or as specified by local code and where required should be run on galvanised trays. All pipework to be labelled with ID number (condensing units ref.) at 2.75 m. intervals.

.9 Joints in copper pipe shall be brazed. Brazing shall be carried out to the requirements of the local code and as per the Canadian Copper & Brass Development Association recommendations.

2.8 CONDENSATE PIPEWORK

.1 A condensate line shall be installed to each fan coil unit. This shall be installed and insulated all as per the standard specification. Minimum size of condensate pipes to be 25 mm copper, insulated and pumped or by gravity from each fan coil/cassette, drains to run 1:80 min falls as indicated on drawings.

2.9 LOG BOOKS

.1 Full Commissioning Logs shall be supplied by the local distributor. These shall be completed fully and included with the main Installation and Operation Manuals prior to hand over.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air conditioning components installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GENERAL

.1 Install as indicated, to manufacturer's recommendations, and to EPS 1/RA/2.

.2 Manufacturer to certify installation.

.3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.

3.3 EQUIPMENT PREPARATION

.1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

3.4 COMMISSIONING

.1 To Section 01 91 13 - General Commissioning (CX) Requirements.

.2 All operating controls shall be packaged and fully wired.

3.5 BALANCING

.1 Balance in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 CONTROLS

.1 General:
.1 In accordance with Section 23 90 01 - Mechanical Control System.
.2 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
.3 Install field control devices in accordance with manufacturer's recommended methods, procedures and instructions.
.4 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.
.5 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.
.6 Fire stopping: provide space for fire stopping in accordance with Section 07 84 00 - Firestopping. Maintain fire rating integrity.
.7 Electrical:
.1 Complete installation in accordance with Section 26 05 00 - Common Work Results - Electrical.
.2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

3.7 CONTROLS (Cont'd)

.1 General: (Cont'd)

.7 Electrical: (Cont'd)

.3 Refer to control schematics included as part of drawings and Sequences of Operation.

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

.5 Install communication wiring in conduit.

.6 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise.

.2 Programable Control Units:

.1 Install Controllers in secure locking enclosures.

.2 Provide necessary power from local 120 V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.3 Temerature 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 Duct installations:

.1 Do not mount in dead air space.

.2 Locate within sensor vibration and velocity limits.

.3 Securely mount extended surface sensor used to sense average temperature.

.4 Thermally isolate elements from brackets and supports to respond to air temperature only.

.5 Support sensor element separately from coils, filter racks.

.5 Averaging duct type temperature sensors.

.1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more

3.7 CONTROLS (Cont'd)

.3 Temerature and Humidity Sensors:(Cont'd)

.5 (Cont'd)

than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

.2 Wire multiple sensors in series for low temperature protection applications.

.3 Wire multiple sensors separately for temperature measurement.

.4 Use software averaging algorithm to derive overall average for control purposes.

.4 Systems Sequences of Operation: in accordance with Section 23 90 01 - Mechanical Control System.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by computer room air conditioning installation.

END