1. GENERAL

1.01 SECTION INCLUDES

.1 Variable Refrigerant Flow (VRF) air conditioning system consisting of one or more outdoor compressor units and multiple indoor fan coil units.

1.02 RELATED REQUIREMENTS

.1 Section 23 23 00 – Refrigerant Piping.

1.03 SUBMITTALS

.1 Submit shop drawings/product data sheets, complete with control components, and piping and wiring schematics.

.2 Prepare and submit a schematic layout of refrigerant piping showing all piping components required for satisfactory operation and maintenance of the system(s), including but not limited to pipe sizes, charging valve, CSA B52 refrigerant charge analysis, isolating valves, sight glasses, strainers, driers, traps, etc. Schematic diagram must be reviewed with and approved by air conditioning equipment supplier prior to submittal to the Consultant.

1.04 CLOSEOUT SUBMITTALS

.1 Submit a start-up and certification letter from equipment supplier as specified in Part 3 of this Section.

1.05 QUALITY ASSURANCE

.1 Split system air conditioning equipment and installation of equipment are to be in accordance with requirements of following:

.1 All applicable provincial codes and standards;

.2 ANSI/AHRI Standard 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

.3 ANSI/AHRI Standard 1230. Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment

.2 Split system air conditioning system installation tradesmen are to be journeyman refrigeration mechanics.

2. PRODUCTS

2.01 GENERAL

.1 VRF system shall automatically vary the target evaporating and condensing temperatures based on building load and weather conditions to increase part load efficiency (Variable Refrigerant Temperature). The condensing unit shall also feature customizable operating modes which allows for the manual setting of target evaporating and condensing temperatures.

.2 System shall permit simultaneous heating and cooling of each indoor unit. Multiple indoor units connected to a single branch selector port shall operate in the same mode (heating or cooling), similar to a two pipe heat pump system. Refer to article "central controls" in this section for any central controller and/or mode switchover sequence.

2.02 MANUFACTURERS

.1 Daikin Industries Ltd.;

.2 Mitsubishi Electric Sales Canada Inc.;

.3 LG Canada.

.4 Hitachi

2.03 VRF FAN COILS

.1 VRF fan coils shall monitor and maintain the unit superheat (cooling mode) or subcooling (heating mode) using a computerized PID control. Internal unit components shall be factory wired and piped, and complete with electronic proportional expansion valve, flare connections, condensate drain pan, self-diagnostics, and auto-restart function.

.2 Wall Mounted Unit

.1 Wall mounted fan coil unit for installation onto a wall within a conditioned space. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment.

.2 The indoor unit's sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 1 m (3.3 feet) below and 1 m (3.3 feet) away from the unit.

.3 The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing.

.4 The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.

.5 The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

.6 The fan type shall be direct-drive cross-flow with statically and dynamically balanced impeller with high and low fan speeds available.

.7 Units shall be provided with a loose field installed condensate pump.

.3 Ceiling Mounted Ducted Unit

.1 Ceiling mounted ducted fan coil unit with variable speed direct drive DC type fan and auto CFM adjustment at commissioning. Casing shall be constructed of galvanized steel. Configuration shall be horizontal discharge air with horizontal return air, with a maximum height of 9-5/8'' and be designed to fit in tight ceiling plenums.

.2 The indoor unit's sound pressure shall range from 28 dB(A) to 36 dB(A) at low speed measured 5 feet below the ducted unit.

.3 The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 25" of lift from the center of the drain outlet and have a built-in safety shutoff and alarm.

.4 The fan shall have a variable speed direct drive DC motor with statically and dynamically balanced impeller with 3 user-selectable fan speeds. The automatic fan speed mode shall allow the fan to vary between 5 speeds based on space load. The unit shall have logic for automatically adjusting external static pressure settings of the fan motor (selectable during commissioning).

.5 The unit shall ship from the factory in a rear return configuration and shall be field convertible to a bottom return configuration.

2.04 <u>WATER COOLED CONDENSING UNIT</u>

.1 The condenser heat exchanger shall be a stainless brazed plate type designed for closed loop/dry cooler applications.

.2 Heat generated by the compressor, inverter board, and any other components shall be rejected to the refrigerant loop via an internal DX heat exchanger.

.3 Each condensing unit water-loop shall also be installed with a field supplied flow switches wired into each condensing unit module to ensure flow prior to energization of unit.

.4 Condensing units shall be supported according to manufacturers requirements.

2.05 BRANCH SELECTOR BOX

.1 Selector box cabinets shall have a galvanized steel plate casing and shall house multiple electronic expansion valves and a sub-cooling loop. The unit shall contain sound absorption thermal insulating material made of flame and heat resistant foamed polyethylene.

.2 Branch selector boxes shall not require drain pan and drain connections. Manufacturers with branch selector boxes requiring secondary drain pans and drain connections shall coordinate with the installing contractor at no extra cost to the owner.

.3 Manufacturers with branch selector box sizes, arrangements, or locations that differ from what is specified shall make the necessary arrangements to ensure their alternative branch selector boxes both fit in the space and that CSA B52 compliance is still met (CSA compliance shall include the life-safety maximum refrigerant charge allowance).

.4 Manufacturers shall provide sound data for all branch selector boxes. If sound data is unavailable or exceeds the values below, or if branch boxes make use of solenoid valves instead of electronic expansion valves, necessary precautions shall be taken. Precautions shall include the supply and install of sound blankets, or the relocation of branch boxes away from the occupied spaces, or extra insulation to the ceilings and walls around the branch selector boxes, all at no extra cost to the owner.

2.06 LOCAL CONTROLS

.1 Fan coil units shall be supplied with individual zone controllers.

.2 Zone controllers shall be hard wired by installing contractor.

.3 Controllers shall be able to function as follows:

.1 The controller shall have single and dual setpoints for occupied periods, and independent setback setpoints for unoccupied periods.

.2 The controller shall have the ability to digitally prohibit individual buttons and functions, including custom mode selection.

.3 The controller shall have a self diagnosis function that constantly monitors the system for malfunctions.

.4 The controller shall be equipped with a thermostat sensor.

.5 Controller shall have built-in 7 day, weekday plus Saturday Sunday (5+1+1), weekday plus weekend (5+2) and everyday (1) scheduler.

2.07 CENTRAL CONTROLS

.1 Provide an advanced multi-zone controller for installation in a common area as shown on the plans. The controller shall have a display with the following screen views and functionalities:

.1 Central control of set points, schedules, fan speeds, heat/cool mode, and of setback (override) temperature settings during unoccupied periods.

.2 Adjustable temperature limits to restrict local wall mounted thermostat setpoint ranges.

.3 Visible and audible alarm indication of any system malfunctions with error code.

.4 Tiered hierarchy allowing for control of fan coil units independently or as a group.

.5 Remotely disable individual functions of the wall mounted zone controllers.

.6 Web enabled for remote access from PC, tablet or portable device and automatic alert and error emails.

.2 The following two automatic changeover methods shall be available. One shall be selected upon commissioning.

.1 Averaging Method – the central controller shall sum up the difference between room temperatures and set points for all indoor units in the system. Once this delta reaches the primary changeover dead band of ± 2°F (adjustable), the central controller shall change over the system automatically.

.2 Voting Method – The central controller shall evaluate the difference between individual room temperatures and set points, and only include a fan coil in the algorithm if the difference has passed the primary dead band for more than the guard timer, or past the secondary dead band. Heating priority option shall be available.

.3 For both automatic changeover options, a weight (0-3) can be added to each indoor unit. The automatic changeover algorithm shall use this weighting to prioritize changeover for the more heavily weighted fan coils.

.4 Upon any changeover, a guard timer shall prevent another changeover for a period of 15, 30, or 60 (default) minutes.

.5 The guard timer shall be ignored by a change of setpoint manually from either the central controller or the remote controller, by schedule, or if the secondary dead band is reached with either of the automatic changeover algorithms. The secondary changeover dead band shall be the sum of the primary changeover dead band (adjustable) ± 1°F (adjustable)

.6 The central controller shall have the capability for site floor plans to be uploaded as a background to create a graphics interface. Background shall be project specific floor plans rendered in "2D" or "3D".

.7 Floor plan layout shall be displayed both on the local central controller, as well as accessible from the web.

.8 Floor plan will include capability to control indoor unit, and auxiliary inputs / outputs, such as designated lighting control, as follows:

.9 Up to 4 status points to be assigned to the control point icon (room name, room temperature, set point, and mode).

.10 Status and control points to display on corresponding location of zone served on floor plan.

.11 Digital input and output icons will display On/Off status.

.12 Analog input icons will display analog value.

.13 Up to 60 floor layout sections shall be possible depending on project scope.

.14 The BACnet Server Gateway Option shall be capable of making the controller work as a BACnet gateway using the BACnet/IP protocol. The BACnet Server Gateway Option shall be capable of exposing indoor unit management points as BACnet objects to the BMS.

.15 The BACnet Server Gateway Option shall allow the following functions:

.1 Support Change of Value (COV) notifications.

.2 Provide unique virtual BACnet device identification number (ID) for every indoor unit group address.

.3 The BACnet Server Gateway Option shall be capable of being configured as a foreign device. It shall be capable of communicating across BACnet Broadcast Management Devices (BBMD) in different subnet networks.

.16 In addition to the standard BACnet VRF points, the Building Management System shall monitor and/or control the following BACnet objects for indoor units:

.1 Occupancy Mode: Unoccupied, Occupied, Standby

.2 Cooling and heating setpoints during occupied and unoccupied modes.

.17 The Building Management System may choose to monitor and control the following BACnet objects linked to controller control logic:

.1 Enable/Disable Schedule operation.

.2 Enable/Disable Auto Changeover Operation.

.3 Set Timed Override Minutes - Monitor and configure timer extension for the indoor unit on controller (30, 60, 90, 120, 150, 180 minutes)

.4 System forced off - Enable/Disable all emergency stop programs that are registered on the controller.

.18 The BMS shall have the ability to utilize scheduling functions on the controller.

.19 The BMS shall have the ability to utilize automatic changeover function on the controller, removing the need to program automatic changeover sequences on the BMS.

.20 VRF manufacturer shall commission the BACnet server. BMS contractor shall provide VRF manufacturer with static IP address and instance number for commissioning. IP connection shall be by BMS contractor.

.21 All programming for monitoring and control of VRF system via the BACnet server shall be by BMS contractor, as per the Sequence of Operation.

2.08 ELECTRICAL

.1 Provide Independent electrical power for fan coils and branch selector boxes.

.2 Provide individual disconnect switches for each fan coil.

.3 Control wiring shall be installed in a daisy chain configuration between all VRF components as per Manufacturer.

.4 If power is lost or disconnected to any of the fan coils, the condenser shall have the capability to remain in operation at all times.

3. EXECUTION

3.01 INSTALLATION

.1 Provide VRF equipment consisting of indoor water source condensing units and indoor evaporator units as scheduled and/or indicated on the drawings.

.2 Units shall be stored and handled according to the manufacturer's recommendations. Units shall be kept clean and isolated from dust and debris.

.3 Contractor shall inspect all equipment upon delivery and notify shipping company and manufacturer immediately of any damage.

.4 Install condensing units on a flat surface level within 1/8 inch and elevate a minimum of 18" from ground or roof surface, on vibration isolation pads. Provide intermediate supports as recommended by the equipment manufacturer.

.5 Indoor evaporator units to be installed as located on the drawings. Confirm exact location prior to roughing-in.

.6 Install loose control components and perform required control wiring (except building automation system connections) between condensing unit and evaporator in conduit in accordance with manufacturer's control wiring schematic and wiring standards of electrical work.

.7 Connect condensing unit and indoor evaporator units with refrigerant piping in accordance with piping shop drawing schematic. Refer to Section 23 23 00. Provide any required additional refrigerant.

.8 High/low pressure gas line, liquid, and suction lines must be individually insulated between the outdoor and indoor units.

.9 Use refrigeration best practice to allow pipes to expand and contract freely. Review manufacturer installation instructions to ensure expansion joints are properly designed.

.10 Connect water cooled condensing unit with hydronic piping in accordance with piping specification section.

3.02 STARTUP AND ADJUSTING

.1 Pressure test all systems to 550 psi after system has been vacuumed and held to below 500 microns for at least one hour. Review manufacturer installation instructions for proper pressure test procedures.

.2 Design and install all piping as per TSSA and CSA B52 regulations and apply and obtain TSSA certification for all systems.

.3 Contractor to carry the cost of a minimum of two (2) manufacturer field inspection to review installation and startup. Notify consultant minimum of five days prior to inspection.

.4 Refer to Section 20 05 00 – Common Work Results for Mechanical; for equipment/system manufacturer certification and start-up requirements.

End of Section