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| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | November 16, 2009 | Modified ‘Related Sections’ |
| 3 | December 8, 2014 | First draft review (AV) |
| 4 | June 8, 2015 | Second Draft for Review (AV) |
| **5** | **September 16, 2015** | **Updated, Finalized Specification – Reference eDOCS #5823610-v5 (AV)** |
| 6 | May 30, 2017 | Updated references to standards ASTM B117-16, ASTM D2370-16, ASTM E84-16, ASTM G154-16 (AAM) |
| 7 | August 17, 2017 | Updated listed products. Those that were removed were replaced with performance specifications and standards. |

NOTE:

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**The on-line copy is the current version of the document.**

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## Related Sections

### *[Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.*

### *Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.*

### *Contractor is responsible for coordination of the Work.*

### *This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the Section for the specific project, it may be deleted.]*

### *[List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### *[List Sections specifying products installed but not supplied under this Section and indicate specific items.]*

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### [List Sections specifying related requirements.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

#### Section 01300 – Submittals

#### Section 01425 – Computerized Maintenance Management System Data Requirements

#### Section 01430 – Operation and Maintenance Data

#### Section 01640 – Manufacturers’ Services

#### Section 01780 – Contract Closeout

#### Section 01810 – Equipment Testing and Facility Commissioning

#### Section 01820 – Demonstration and Training

#### Section 03300 – Cast-in-Place Concrete

#### Section 05500 – Metal Fabrications General

#### Section 09900 – Painting and Protective Coatings

#### Section 15200 – Process Piping and Fittings

#### Section 15205 – Process Valves and Operators

#### Section 15900 – HVAC Instrumentation and Control

#### Section 15950 – HVAC Systems Testing, Adjusting, and Balancing

#### Section 16050 – Basic Materials and Methods

#### Section 16222 – Motors: 1 to 200 kW, 575V

#### Division 1 – General Requirements

#### Division 16 – Electrical

## References

*[Delete .1 if Section 01060 – Regulatory Requirements is included in Contract Documents.]*

### Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

#### Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

##### ANSI/AHRI Standard 210/240 with Addenda 1 and 2 (2008) Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

#### Canadian Gas Association (CGA).

##### *[Consultant to add specific standards from CGA for the project]*

#### Air Moving and Conditioning Association (AMCA):

##### ANSI/AMCA Standard 300-14, Reverberant Room Method for Sound Testing Fans, Setup No. 1 *[Consultant to confirm set-up No. 1 details].*

#### American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

##### ASHRAE Standard 52.2-2012, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

##### ASHRAE Standard 90.1-2013 (I-P), Energy Standard for Buildings Except Low-Rise Residential Buildings.

##### Practical Guide to Seismic Restraint, 2nd Edition (2012).

#### ASTM International (ASTM):

##### ASTM B117-16, Standard Practice for Operating Salt Spray (Fog) Apparatus.

##### ASTM D2370-16), Standard Test Method for Tensile Properties of Organic Coatings.

##### ASTM D4060-14, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

##### ASTM E84-16, Standard Test Method for Surface Burning Characteristics of Building Materials.

##### ASTM G154-16, Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials. .

#### Canadian Standards Association (CSA).

##### *[Consultant to add specific requirements from CSA pertaining to this specification]*

#### Intertek ETL listed Testing Laboratories (ETL Listed Mark):

##### *[Consultant to add specific requirements from an ETL Mark pertaining to this specification]*

#### International Organization for Standardization (ISO):

##### ANSI/AHRI/ASHRAE/ISO 13256-1:1998 (R2012), Water-Source Heat Pumps—Testing and Rating for Performance—Part 1: Water-to-Air and Brine-to-Air Heat Pumps.

#### National Fire Protection Association (NFPA)

##### NFPA 255 (2006) Standard Method of Test of Surface Burning Characteristics of Building Materials

#### National Electrical Manufacturers Association (NEMA):

##### *[Consultant to add specific requirements from NEMA pertaining to this specification]*

#### Underwriters Laboratories Inc. (UL):

##### UL 94, Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances (2013 edition).

##### UL 723, Standard Test Method for Surface Burning Characteristics of Building Materials.

## Definitions

### The following is a list of abbreviations which may be used in this Section:

#### AC: Air Conditioning.

#### COP: Coefficient of Performance.

#### EER: Energy Efficiency Ratio.

#### DX: Direct Expansion.

#### HP: Heat Pump.

#### IR: Infra Red.

#### LED: Light Emitting Diode.

#### MDFT: Minimum Dry Film Thickness

#### PSC: Permanent Split Capacitor.

#### PTAC: Packaged Terminal Air Conditioner.

#### SPST: Single Pole, Single Throw.

#### TXV: Thermostatic Expansion Valve.

#### UV: Ultra Violet.

#### WSHP: Water Source Heat Pump

## Submittals

### Action Submittals, in accordance with Section 01300 - Submittals:

#### Complete specifications, descriptive drawings, catalog cuts, and descriptive literature which shall include make, model, dimensions, weight of equipment, and electrical schematics for all Products specified.

#### Manufacturer’s standard finish color selection for enclosure finishes.

#### Complete performance data that will indicate full compliance with the Specification Sections; include fan sound power level data (ref. 10 to 12 watts) at design operating point, based on ANSI/AMCA 300-14, Setup No. 1. *[Consultant to confirm set-up No. 1 details].*

#### [Factory dip-applied protective coating product data.]

### Informational Submittals, in accordance with Section 01300 - Submittals:

#### Manufacturer’s Certificate of Compliance, Certificate of Proper Installation in accordance with Section 01640 - Manufacturers’ Services, for heat pumps, air conditioning units, and motors.

#### Detailed information on structural, mechanical, electrical, or other modifications necessary to adapt arrangement or details shown to equipment furnished.

#### Sample copy of guarantee.

#### Test reports.

#### Provide all other required information as detailed in the Equipment Information Template and electronically up-loadable to the Region’s CMMS (Maximo) in accordance with Section 01425 - Computerized Maintenance Management System Data Requirements.

#### Operation and Maintenance Data in conformance with Section 01430 - Operation and Maintenance Data.

##### Include wiring and control diagrams for equipment.

##### Include as-built version of equipment schedules.

## Quality Assurance

### Heating and Cooling Equipment: Minimum operating efficiencies, defined as COP and EER, as specified in ASHRAE 90.1-2013 (I-P).

### Unit shall be rated (when matched with appropriate outdoor unit) per AHRI 210/240 (2008).

### Units shall be certified by UL and CSA, and shall be UL/ULC listed and labeled.

### Cooling performance rated in accordance with AHRI 210/240 (2008) testing procedures.

## Delivery, Storage and Handling

### Storage:

#### Products shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

### Protection of Equipment:

#### Box, crate, or otherwise protect from damage and moisture during shipment, handling, and storage.

#### Protect from exposure to corrosive fumes and keep thoroughly dry at all times.

#### Store motors, drives, electrical equipment, and other equipment with anti-friction or sleeve bearings in weather tight and heated storage facilities prior to installation.

#### For extended storage periods, plastic equipment wrappers shall not be used to prevent accumulation of condensate in gears and bearings. Rotating equipment shall be manually rotated to prevent damage to bearings.

## Special Guarantee

### Refrigerant Compressors:

#### Furnish the manufacturer’s extended guarantee or warranty, with the Region named as beneficiary, in writing, as a special guarantee.

#### The special guarantee shall provide for correction, or at the option of the Region, removal and replacement of compressors specified in this Section found defective during a period of 5 years after the date of Total Performance of the Work.

#### Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.

## Extra Materials

### Tools:

#### Furnish one complete set of special tools recommended by the manufacturer for maintenance, dismantling, or repair of each separate type of equipment.

#### Furnish a tool box for storage of the special tools.

#### Identify with the associated equipment number by means of a stainless steel or solid plastic nametag attached to the box.

# PRODUCTS

## General

### Specified components of this Section, including insulation, facings, mastics, and adhesives, shall have a maximum fire hazard rating of 25 for flame spread without evidence of continued progressive combustion, and 50 for smoke developed, as per testing conducted in accordance with ASTM E84-16 and NFPA 255 2006 Edition methods.

### Multiple Compressor Units:

#### Provide completely independent refrigeration circuits and controls.

#### Indoor unit air coils shall have intermingled circuits, unless specified otherwise in the Contract Documents.

## Equipment Schedules

### Refer to [the Drawings] [the Equipment Schedule(s) attached at the end of this Specification Section (see subsection 3.6 – Supplements)].

## Split System AC Indoor Unit, Ducted (up to 17.5 Nominal kW)

### This subsection applies to ACU-[ ]. *[Consultant to amend with actual ACU tag number for the project]*

### General:

#### Indoor mounted, draw-through, packaged air-handling unit consisting of forward-curved centrifugal fan(s), motor and drive assembly, prewired fan motor contactor, factory-installed refrigerant metering devices, cooling coil, disposable air filters, and condensate drain pan.

#### Suitable for use with air conditioner or heat pump outdoor unit.

#### Indoor unit shall be of the same manufacturer as the associated outdoor unit.

#### Modular design vertical up-flow, field convertible for vertical down-flow, or horizontal flow.

### Unit Cabinet:

#### Heavy gauge galvanized steel sheets.

#### Phosphatized and factory finished in manufacturer’s standard enamel paint.

#### Sufficient removable panels for access to all internal components.

#### Interior of casing insulated with 25 mm, 16 kg/m3 density coated glass fiber insulation attached with adhesive material.

#### Duct flanges for connection of supply and return ductwork, and filter racks.

#### Knockouts for unit electrical power and condensate piping connections.

### Evaporator Fan:

#### Double-inlet, double-width, forward-curved fans mounted on rubber isolators.

#### Direct-drive or belt-drive as standard with the unit furnished.

#### Fan Motor:

##### Totally enclosed and permanently lubricated with inherent protection.

##### Three-speed.

### DX Evaporator Coil:

#### Copper tube with aluminum fins and galvanized steel tube sheets.

#### Fins bonded to tubes by mechanical expansion.

#### Condensate Drain Pan: High-impact thermoplastic, insulated, with primary and secondary brass drain fittings.

#### Refrigerant piping sweat connections.

### Electric Heating Coil:

#### UL listed.

#### Heavy-duty nickel-chromium elements.

#### Contactors with 24 volt coils, power wiring, 24 volt control wiring terminal blocks, and a hinged access panel.

#### Individual line-break HIGH limit control for each stage.

#### HIGH limit control operating through heating element contactors, equipped with automatic reset.

#### [Internally factory-wired to provide single-point power connection with unit.]

### Controls:

#### Refrigerant Metering:

##### Factory installed refrigerant metering device.

##### Heat Pump Applications: Reverse flow bypass refrigerant metering device with internal check valves.

#### Magnetic contactor for fan.

#### Overload protection in each leg.

#### Control voltage transformer.

#### Terminal strip for connection of remote controls.

#### Control board fusing.

### Air Filters: Disposable 25 mm thick strainer type with pleated nonwoven fabric media.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Hard Shutoff TXV: Hard shutoff TXV refrigerant metering device.]

#### [Premium Electronic Thermostat: Factory provided programmable thermostat with 7 day clock, auto-changeover, multi-stage capability, holiday scheduling, large LCD display, remote sensor capability.]

#### [Electro-Mechanical Thermostat: Factory provided nonprogrammable thermostat with fan switch sub-base.]

### Manufacturers:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Split System AC Indoor Unit, Ducted (Over 17.5 Nominal kW)

### This subsection applies to ACU-[ ] *[Consultant to amend with actual ACU tag number for the project]*.

### General:

#### Indoor-mounted, draw-through, packaged air-handling unit consisting of forward-curved belt-driven centrifugal fan(s), motor and drive assembly, prewired fan motor contactor, factory-installed refrigerant metering devices, cooling coil, disposable air filters, and condensate drain pan for vertical or horizontal configurations.

#### Suitable for use with air conditioner or heat pump outdoor unit.

#### Indoor unit shall be of the same manufacturer as the associated outdoor unit.

#### Modular design vertical up-flow, field convertible for vertical down-flow, or horizontal flow.

### Unit Cabinet:

#### Heavy gauge galvanized steel sheets.

#### Phosphatized and factory finished in manufacturer’s standard enamel paint.

#### Sufficient removable panels for access to all internal components.

#### Interior of casing insulated with 25 mm, 16 kg/m3 density, coated glass fibre insulation attached with adhesive material.

#### Duct flanges for connection of supply and return ductwork, and filter racks.

#### Knockouts for unit electrical power and condensate piping connections.

### Evaporator Fan:

#### Double-inlet, double-width, forward-curved fans mounted on rubber isolators.

#### Belt-drive.

### DX Evaporator Coil:

#### Minimum three-row configuration, copper tube with aluminum fins and galvanized steel tube sheets.

#### Fins bonded to tubes by mechanical expansion.

#### Refrigerant piping sweat connections.

#### Condensate Drain Pan:

##### High-impact thermoplastic, insulated, with primary and secondary brass drain fittings.

##### Sloped toward right or left side of unit to prevent standing water from accumulating.

### Electric Heating Coil:

#### UL/ULC listed.

#### Heavy-duty nickel-chromium elements.

#### Contactors with 24 volt coils, power wiring, 24 volt control wiring terminal blocks, and a hinged access panel.

#### Individual line-break HIGH limit control for each stage.

#### HIGH limit control operating through heating element contactors, equipped with automatic reset.

#### [Internally factory-wired to provide single-point power connection with unit.]

### Controls:

#### Refrigerant Metering:

##### Factory installed TXV for refrigerant control.

##### TXV shall be capable of external adjustment.

##### Heat Pump Applications: Reverse flow bypass TXV with internal check valves.

#### Magnetic contactor for fan.

#### Overload protection in each leg.

#### Control voltage transformer.

#### Terminal strip for connection of remote controls.

#### Control board fusing.

### Air Filters:

#### Disposable 50 mm-thick strainer type with pleated non-woven fabric media.

#### Filter access from either the right or left side of the unit.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).] [as follows:]

#### [Dual Refrigeration Circuits:

##### Two independent refrigeration circuits.

##### DX evaporator coil of face split configuration.]

#### [Hot Gas Reheat Coil: Same construction standards as the evaporator coil.]

#### [Air Discharge Plenum:

##### Factory supplied, to provide free-blow air distribution for vertical floor-mounted units.

##### Air supply grille with moveable vanes for horizontal or vertical airflow adjustment.

##### Plenum shall not be used with electric heaters.]

#### [Return-Air Grille: Factory supplied for field installation on the unit’s return air opening.]

#### [Unit Sub-base:

##### Factory supplied for field installation.

##### To elevate floor-mounted vertical units to provide access for correct condensate drain connection.]

#### [Economizer: Modulating outside air and return air dampers, barometric relief, inlet hood, enthalpy controller, and damper actuator.]

#### [Overhead Suspension Package: Brackets to support units in horizontal ceiling installation.]

#### [Premium Electronic Thermostat: Factory provided programmable thermostat with 7 day clock, auto-changeover, multi-stage capability, holiday scheduling, large LCD display, remote sensor capability.]

#### [Electro-Mechanical Thermostat: Factory provided nonprogrammable thermostat with fan switch sub-base.]

### Manufacturers:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Split System In-Ceiling Cassette AC Unit, Ductless

### This subsection applies to ACU-[ ] *[Consultant to amend with actual ACU tag number for the project]*.

### General:

#### Split system, indoor, DX, ductless, fan coil AC unit, complete with DX coil, fan, fan motor, piping connectors, electrical controls, condensate pump, and hanging brackets.

#### Suitable for use with air conditioner or heat pump outdoor unit.

#### Indoor unit shall be of the same manufacturer as the associated outdoor unit.

### Unit Cabinet:

#### Constructed of zinc-coated steel.

#### Fully insulated.

#### Discharge and inlet grilles, high-impact polystyrene.

#### Adjacent room cooling to be provided by a simple knockout in cabinet side panel.

### Evaporator Fan:

#### Centrifugal, direct-drive blower type with air intake in center of unit and discharge on perimeter.

#### Air louvers shall be adjustable for 2, 3, or 4 way discharge.

#### Motors:

##### Totally enclosed and permanently lubricated with inherent protection.

##### Three-speed.

### DX Evaporator Coil:

#### Copper tube with aluminum fins and galvanized steel tube sheets.

#### Fins bonded to tubes by mechanical expansion.

#### Condensate Drip Pan: Locate under coil with drain connection for hose attachment to remove condensate.

### Internal Condensate Pump:

#### To remove condensate from drain pan when gravity drainage cannot be used.

#### Lift capability of condensate pump shall be 5 kPa.

### Electric Heater: Units shall be equipped with factory-mounted electric heaters. Minimum protection shall include overcurrent and high temperature protection.

### Controls:

#### Refrigerant Metering:

##### Factory installed refrigerant metering device.

##### Heat Pump Applications: Reverse flow bypass refrigerant metering device with internal check valves.

#### 24V wall-mounted thermostat with three fan speed selections and auto/manual switch.

#### Automatic restart after power failure at same operating conditions as at failure.

#### Float control in condensate sump to shut unit down in case of pump malfunction.

#### Evaporator coil freeze protection.

### Air Filters: Filter tracks and cleanable filters, accessible from below with a 1/4 turn fastener.

### Accessories: *Provide* [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Fresh Air Intake and Power Ventilation Kit: Filter, booster fan, controls and duct connections.]

#### [Electronic Programmable Thermostat:

##### Commercial grade, 7 day, four-event scheduling.

##### Integral sub-base, three-speed fan control, heating/cooling switchover capability, air sweep auto changeover.

##### Shall not require battery to retain memory.]

### Manufacturers and Products:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Split System High Wall AC Unit, Ductless

### This subsection applies to ACU-[ ] *[Consultant to amend with actual ACU tag number for the project]*.

### General:

#### Split system, indoor, DX, ductless, fan coil AC unit, complete with DX coil, fan, fan motor, piping connectors, electrical controls, and microprocessor control system.

#### Suitable for use with air conditioner or heat pump outdoor unit.

#### Indoor unit shall be of the same manufacturer as the associated outdoor unit.

### Unit Cabinet:

#### High-impact plastic or painted galvanized steel.

#### Fully insulated.

#### Discharge and inlet grilles, high-impact polystyrene.

### Evaporator Fan:

#### Tangential direct-drive blower type with air intake at upper front face of unit and discharge at bottom front.

#### Air Sweep:

##### Provide automatic, motor-driven horizontal air sweep as standard.

##### Air sweep operation shall be user selectable.

##### Vertical direction may be manually adjusted and horizontal air sweep may be manually set.

#### Motor:

##### Open drip-proof, permanently lubricated ball bearing with inherent overload protection.

##### Three speed.

### DX Evaporator Coil:

#### Copper tube with aluminum fins and galvanized steel tube sheets.

#### Fins bonded to tubes by mechanical expansion

#### Condensate Drip Pan:

##### Locate under coil with drain connection for hose attachment to remove condensate.

##### Provide internal trap and auxiliary drip pan under coil header.

### Electric Heater: Units shall be equipped with factory-mounted electric heaters. Minimum protection shall include overcurrent and high temperature protection.

### Controls:

#### Refrigerant Metering:

##### Factory installed refrigerant metering device.

##### Heat Pump Applications: Reverse flow bypass refrigerant metering device with internal check valves.

#### Automatic restart after power failure at same operating conditions as at failure.

#### Timer function to provide a minimum 15 hour timer cycle for system AUTO/START/STOP.

#### Temperature sensing controls shall sense return air temperature. Provide indoor air high discharge temperature shutdown.

#### Indoor coil freeze protection.

#### Wireless infrared remote control to enter set points and operating conditions.

#### Filter status indication after 250 hours of indoor fan operation.

#### Test mode button to run self-diagnostics and aid in troubleshooting.

#### AUTO/STOP features shall have integral setback control.

#### Automatic air sweep control provides ON or OFF activation of air sweep louvers.

#### Dehumidification mode provides increased latent removal capability by modulating fan speed and set point temperature.

#### Fan only operation provides room air circulation when no cooling is required.

#### Diagnostics to provide continuous checks of unit operation and warn of possible malfunctions. Error message shall be displayed at the unit and at the remote controller.

#### Fan Speed Control: User-selectable for high, medium, low or microprocessor automatic operation during all operating modes.

#### Time delay shall prevent compressor restart in less than 3 minutes.

#### Provide outdoor unit high temperature protection to detect excessive outdoor unit discharge temperatures.

#### Automatic heating-to-cooling changeover to provide automatic heating and cooling operation. Control shall include dead-band to prevent rapid mode cycling.

#### Manual defrost button to initiate defrost cycle from handset.

#### Demand defrost shall be provided and shall minimize defrost cycles by internally adjusting defrost timing based on frost accumulation.

#### Provide indoor coil high temperature protection to detect excessive indoor discharge temperature when unit is in heat pump mode.

### Air Filters: Filter track with factory-supplied cleanable filters.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached as supplements to this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Internal Condensate Pump:

##### To remove condensate from drain pan when gravity drainage cannot be used.

##### Lift Capability: 75 kPa.

##### Float control in condensate drain pan to shut unit down in case of pump malfunction.]

#### [Wall Mount Thermostat Mounting Kit: Locking cover kit available for IR controller.]

### Manufacturers and Products:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Split System Under-Ceiling AC Unit, Ductless

### This subsection applies to ACU-[ ] *[Consultant to amend with actual ACU tag number for the project]*.

### General:

#### Split system, indoor, DX, ductless, ceiling-suspended fan coil, complete with DX coil, fan, fan motor, piping connectors, electrical controls, and hanging brackets.

#### Suitable for use with air conditioner or heat pump outdoor unit.

#### Indoor unit shall be of the same manufacturer as the associated outdoor unit.

### Unit Cabinet:

#### Zinc-coated bonderized steel, finished with baked enamel paint.

#### Inlet grilles of high-impact polystyrene

#### Mounting brackets.

### Evaporator Fan:

#### Centrifugal blower type with air intake in bottom rear of unit and discharge in front.

#### Automatic, motor-driven vertical air sweep system.

#### Motors:

##### Permanently lubricated ball bearing with inherent overload protection.

##### Three speed.

### DX Evaporator Coil:

#### Copper tube with aluminum fins and galvanized steel tube sheets.

#### Fins bonded to tubes by mechanical expansion.

#### Condensate Drain Pan: Under coil with drain connection for hose attachment to remove condensate.

### Electric Heater: Factory-mounted electric heaters, with overcurrent and high temperature protection.

### Controls:

#### Refrigerant Metering:

##### Factory installed refrigerant metering device.

##### Heat Pump Applications: Reverse flow bypass refrigerant metering device with internal check valves.

#### 24V wall-mounted electromechanical thermostat with three fan speed selections, and an auto/manual switch.

#### Evaporator coil freeze protection.

#### Automatic restart after power failure set to same operating conditions as at failure.

#### Filter status indication after 250 hours of indoor fan operation.

#### Automatic air sweep control to provide ON or OFF activation of air sweep louvres.

#### Cooling mode to provide modulating fan speed based on difference between temperature set point and space temperature.

#### Fan only operation to provide room air circulation when no cooling is required.

#### Fan Speed Control: User-selectable for high, medium, low, or automatic operation during all operating modes.

#### Time delay shall prevent compressor restart in less than 3 minutes (adjustable).

#### Automatic heating-to-cooling changeover to provide automatic heating and cooling operation. Control shall include dead-band to prevent rapid mode cycling.

### Air Filters: Filter track with factory-supplied cleanable filters.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Internal Condensate Pump:

##### For condensate removal from drain pan when gravity drainage cannot be used.

##### Lift Capability: 5 kPa.

##### Float control in condensate pan to shut down fan coil unit in case of pump malfunction.]

#### [Fresh Air Intake and Power Ventilation Kit: Filter, booster fan, controls and duct connections.]

#### [Electronic Programmable Thermostat:

##### Commercial grade, 7-day, 4-event scheduling.

##### Integral sub-base, three-speed fan control, heating/cooling switchover capability, air sweep auto changeover.

##### Shall not require battery to retain memory.]

#### [Indoor Guard Kit: Guard for discharge grille to prevent objects from entering air sweep mechanism.]

### Manufacturers and Products:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Split System AC Outdoor Units

### This subsection applies to CU-[ ]*[Consultant to amend with actual CU tag number for the project]*.

### General:

#### Factory assembled, single piece, air-cooled air conditioner outdoor unit.

#### Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, and holding charge of R-22 refrigerant. *[Consultant to specify an appropriate alternative since R22 is being phased out]*

#### Outdoor unit shall be of the same manufacturer as the associated indoor unit.

### Unit Cabinet:

#### Constructed of galvanized steel, phosphatized and coated with a baked enamel finish.

#### Removable access panels for access to all internal components.

#### Outdoor Compartment: Isolated, with acoustic lining to assure quiet operation.

#### Knockouts for unit electrical power.

### Condenser Fans:

#### Direct-drive propeller type shall discharge air horizontally and shall blow air through outdoor coil.

#### Motors:

##### Totally enclosed, with Class B insulation and permanently lubricated bearings.

##### Thermal overload protection.

#### Shaft shall have inherent corrosion resistance.

#### Fan blades shall be corrosion-resistant and shall be statically and dynamically balanced.

#### Equip openings with PVC coated protection grille over fan and coil.

### Compressor:

#### Fully hermetic reciprocating or scroll type.

#### Equipped with oil system, operating oil charge, and motor.

#### Internal overloads shall protect compressor from over-temperature and overcurrent.

#### Motor: NEMA rated, Class F, suitable for operation in a refrigerant atmosphere.

#### Scroll compressors shall have high discharge gas temperature protection.

#### Reciprocating compressors shall be equipped with crankcase heaters to minimize liquid refrigerant accumulation in compressor during shutdown and to prevent refrigerant dilution of oil.

#### Installed on rubber vibration isolators and shall have internal spring isolation.

### Condenser Coil:

#### Constructed of aluminum fins mechanically bonded to internally enhanced seamless copper tubes that are cleaned, dehydrated, and sealed.

#### [Coat entire coil with anti-corrosion protective coating, [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).] [in accordance with subsection 2.16 - Factory Dip-Applied Protective Coating]].

### Refrigeration Components:

#### Brass external liquid line service valve with service gauge port connections.

#### Suction line service valve with service gauge connection port.

#### Service gauge port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps.

#### Suction Line: Accumulator.

#### Pressure relief.

### Controls:

#### Factory selected, assembled, and tested.

#### Refrigerant Metering:

##### Reversing valve for heat pump units.

##### Heating mode metering device for heat pump units.

#### Automatic restart on power failure.

#### Three-pole contactors.

#### Time delay control sequence shall be provided standard through control board on indoor units.

#### High pressure and liquid line low pressure switches.

#### Automatic outdoor fan motor protection.

#### Start capacitor and relay (single-phase units without scroll compressors).

#### Defrost board shall provide defrost control.

#### Safeties:

##### Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.

##### Safety lockout if any outdoor unit safety is open.

##### High condensing temperature protection.

##### System diagnostics.

##### Compressor motor current and temperature overload protection.

##### High pressure relief.

##### Outdoor fan failure protection.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Low-Ambient Cooling Kit:

##### Solid state condenser fan motor [fully modulating speed] [cycling] controller; responds to saturated condensing pressure/temperature of unit.

##### Maintains a saturated condensing temperature of 37.5 degrees Celsius plus or minus 5 degrees Celsius with outdoor temperatures down to minus 28 degrees Celsius.

##### Includes winter start control package, to bypass low-pressure switch temporarily to allow compressor start during low load conditions.

##### Includes ball bearing condenser fan motor.]

#### [Compressor Cycle Delay: Compressor prevented from restarting for a minimum of 5 minutes after shutdown.]

#### [Hot Gas Bypass: Cooling capacity modulation with hot gas solenoid valve and bypass piping [on lead compressor] [on both compressors].]

#### [Hot-Gas Reheat: Solenoid valve and controls shall allow redirection of refrigerant hot gas to reheat coil located in associated indoor unit.]

#### [Wall-Mount Kit: Steel frame, baked enamel finish.]

#### [Compressor Start Assist: Capacitor/relay type.]

#### [Evaporator Freeze Thermostat: SPST temperature activated switch, shuts down unit upon evaporator freeze-up.]

#### [Filter Drier: Liquid line mounted, bi-flow type for heat pumps.]

#### [Liquid Solenoid Valve: Electric operated shutoff valve, bi-flow for heat pumps, interlocked with compressor operation.]

### Manufacturers:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Split System Heavy Duty AC Outdoor Units

### This subsection applies to CU-[ ] *[Consultant to amend with actual CU tag number for the project]*.

### General:

#### Units shall be completely factory assembled, wired, piped, pre-charged with R-22 *[Consultant to specify an appropriate alternative since R22 is being phased out]* and fully tested in all modes of operation.

#### Match with associated indoor unit.

#### [Units with multiple compressors shall have completely independent refrigeration circuits and controls to balance heat rejection of each compressor.]

#### Refrigerant pipes shall be copper type “L” and vinyl coated for corrosion prevention.

#### Factory test reports shall be available on request. The Consultant reserves the right to witness factory performance testing.

#### Manufacturer shall have a minimum of 5 years’ experience in the production of dehumidification systems.

### Unit Cabinet:

#### Weatherproof.

#### Supported on steel full-length mounting rails.

#### Removable access panels to all internal components and the electrical panel without impairing unit operation.

#### Knockouts for unit electrical power.

#### Protective guards on each fan discharge and each coil inlet.

#### Unit shall be constructed of G-90 galvanized steel with minimum gauge thickness of:

##### Bases: 16 gauge.

##### Corner Posts and Tops: 18 gauge.

##### Access Panels: 20 gauge.

#### Base:

##### Unit base pan shall be poured with minimum 6 mm hot asphalt (tar) to prevent rain or condensate from contacting steel on bottom of base pan.

##### Asphalt shall be poured prior to final factory assembly to assure protection of all steel areas.

#### Paint Finish:

##### Painted internally and externally.

##### Exterior parts shall be thoroughly cleaned chemically, zinc-phosphate coated, and sealed with chromic rinse.

##### Paint shall be electrically deposited by immersion dipping in a cationic electro-deposition paint system.

##### Paint shall be baked for a minimum of 20 minutes at 204 degrees Celsius.

##### MDFT: 1 mil.

##### Finish shall meet or exceed a 1,000 hour salt spray test in accordance with ASTM B117-16.

##### [Cabinet Corrosion Protection:

###### Cabinet paint finish shall be coated with an acrylic resin that provides protection against UV, sea atmosphere, chlorine vapours, and chlorinated solvents.

###### Acrylic resin coating shall meet or exceed the following criteria:

Weather-ability: 7 to 10 years in accordance with ASTM G154-16.

Abrasion: 1,120 cyc/mil in accordance with ASTM D4060-14.

Filtration: 230 percent in accordance with ASTM D2370-16

Tensile Strength: 12410 kPa in accordance with ASTM D2370-16

3,600 hours Salt Spray Test in accordance with ASTM B117-16.

UV inhibited life of minimum 7 years when exposed to the sun.]

#### Hardware:

##### Exterior nuts, bolts and washers shall be Type 304 stainless steel.

##### Exterior screws shall be either Type 304 stainless steel or coated with an epoxy finish that meets or exceeds minimum 4,000 hours Salt Spray Test in accordance with ASTM B117-16.

### Compressor:

#### Hermetic, reciprocating or scroll type.

#### Provide with crankcase heaters and motors equipped with internal overheat-overload protection.

#### Provide a 5 year compressor warranty.

### Condenser Coil:

#### Coils shall be [aluminum] [copper]plate fins formed on multiple rows of seamless copper tubing arranged in a staggered tube configuration.

#### Tubes shall be mechanically expanded, firmly bonding tube to shoulder of each fin.

#### [Coat entire coil with anti-corrosion protective coating, [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).] [in accordance with subsection 2.16 - Factory Dip-Applied Protective Coating]].

### Condenser Fan:

#### Propeller type, electronically balanced and direct-driven by fan motor.

#### Motor:

##### Fan motor(s) and compressor(s) shall be UL/ULC or CSA listed.

##### Corrosion resistant motor shaft.

##### Totally enclosed, Class B insulation, sealed ball bearings.

##### Thermal overload protection.

#### Outdoor air shall be discharged through a vinyl coated fan guard.

### Refrigeration Components:

#### Spring mounted hermetic compressor.

#### Crankcase heater.

#### Liquid line solenoid.

#### Suction line accumulator.

#### Condenser coil.

#### Rubber mounted up-flow propeller condenser fans.

#### Connections for refrigerant piping and specialties.

#### Filter-drier.

#### Sight glass-moisture indicator.

#### Refrigerant pressure service valves.

### Controls:

#### Factory adjusted and preset to design conditions.

#### Complete with transducers, thermostats, and electrical control circuit factory pre-wired in control panel.

#### Compressor and fan motor contactors or starters.

#### Terminal strip for connection of remote controls.

#### Refrigerant controls shall include a high pressure control (manual-reset), low pressure control (auto-reset), head pressure control, field adjustable refrigerant system lock-out and compressor anti-short cycle timer.

#### Safeties:

##### Compressor winding and overheat protection.

##### Thermal protection (auto-reset) on all inductive loads.

##### Overload protection in each leg.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Low-Ambient Cooling Kit:

##### Solid state condenser fan motor [fully modulating speed] [cycling] controller; responds to saturated condensing pressure/temperature of unit.

##### Maintains a saturated condensing temperature of 37.7 degrees Celsius plus or minus 5 degrees Celsius with outdoor temperatures down to minus 28 degrees Celsius.

##### Includes winter start control package, to bypass low-pressure switch temporarily to allow compressor start during low load conditions.

##### Includes ball bearing condenser fan motor.]

#### [Compressor Cycle Delay: Compressor prevented from restarting for a minimum of 5 minutes after shutdown.]

#### [Hot Gas Bypass: Cooling capacity modulation with hot-gas solenoid valve and bypass piping [on lead compressor.] [on both compressors.]]

#### [Hot-Gas Reheat: Solenoid valve and controls shall allow redirection of refrigerant hot gas to reheat coil located in the associated indoor unit.]

#### [Evaporator Freeze Thermostat: SPST temperature activated switch, shuts down unit upon evaporator freeze-up.]

#### [Filter Drier: Liquid line mounted, bi-flow type for heat pumps.]

#### [Liquid Solenoid Valve: Electric operated shutoff valve, bi-flow for heat pumps, interlocked with compressor operation.]

### Manufacturer:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Packaged Indoor Water-Source Heat Pump Units (WHSP)

### This subsection applies to WSHP-[ ] *[Consultant to amend with actual WSHP tag number for the project]*.

### General:

#### Factory assembled, packaged indoor water-source heat pump unit.

#### Contained within unit enclosure shall be all factory wiring, piping, controls, compressor, and holding charge of R-22 refrigerant *[Consultant to specify an appropriate alternative since R22 is being phased out]*

#### Factory run-tested in both heating and cooling modes with full water flow.

#### Unit capable of starting with 4 degrees Celsius entering air temperature and 4 degrees Celsius entering water temperature in heating mode with ARI water and airflow rates.

#### Unit Configuration: Packaged, [console type] [vertical type.] [horizontal type] [configuration as indicated in the Equipment Schedules attached at the end of this Specification Section].]

### Unit Cabinet:

#### Fabricated from G-90 galvanized steel, phosphatized, and coated with baked enamel finish.

#### Insulated sheet metal panel separating fan compartment from compressor compartment.

#### Removable access panels providing full access to compressor, and control and fan sections.

#### Separate openings and knockouts for entrance of line voltage, condensate piping, and low voltage control wiring.

#### Water connections and electrical knockouts located so as to not interfere with serviceability of unit.

#### Interior insulated with 25 mm thick, 24 kg per cubic meter density, coated glass fibre insulation, attached with adhesive material.

#### Fiberglass insulation exposed edges tucked under flanges to prevent introduction of glass fibers into airstream.

#### [Console Type Units:

##### Components contained in a galvanized steel decorative room enclosure.

##### Casing finish color selected by Region.

##### Stamped return and linear discharge grilles.]

#### [Ducted Units: Provide duct flanges for connection of supply and return ductwork, and filter racks.]

#### [Horizontal Units: Factory-mounted, heavy steel hanger brackets secured to top of unit complete with rubber isolators to suspend unit from ceiling.]

### Evaporator Fan:

#### Double-inlet, double-width, forward-curved fan.

#### Direct-drive or belt-drive as standard with unit.

#### Motor:

##### Totally enclosed and permanently lubricated, with integral overload protection.

##### Three speed.

### Compressor:

#### Fully hermetic reciprocating or scroll type.

#### Equipped with oil system, operating oil charge, and motor.

#### Internal overload and over-temperature protection.

#### Motor shall be NEMA rated, Class F, suitable for operation in a refrigerant atmosphere.

#### Reciprocating compressors shall be equipped with crankcase heaters.

#### Scroll compressors shall have high discharge gas temperature protection.

#### Compressor assembly shall be installed on rubber vibration isolators.

### Refrigerant to Air Coil:

#### Constructed of aluminum, fins mechanically bonded to internally enhanced seamless copper tubes, with galvanized steel tube sheets.

#### Condensate Drain Pan: Plastic, extending full length of air coil, insulated, with primary and secondary drain fittings, minimum 19 mm (3/4-inch) copper drain tube, extending outside unit casing.

### Water to Refrigerant Coil:

#### Co-axial tube-within-a-tube or shell-and-tube water-cooled type.

#### Supply and return water connections with female NPT copper fittings located outside cabinet for connection to flexible hoses.

### Refrigeration Components:

#### Brass liquid line and suction line service valves with service gauge port connections.

#### Accumulator.

### [Electric Heating Coil:

#### Heavy-duty nickel-chromium elements.

#### Individual line-break HIGH limit control for each stage.

#### HIGH limit control operating through heating element contactors, equipped with automatic reset.

#### Internally factory-wired to provide single-point power connection with unit.]

### Controls:

#### Factory selected, assembled, and tested.

#### Refrigerant Metering:

##### Reverse flow bypass metering device with internal check valves.

##### Heating mode metering device.

#### Control box within unit cabinet containing 24 volt transformer, 24 volt activated 2 or 3 pole compressor contactor, low voltage terminal junction block.

#### Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.

#### Automatic restart on power failure.

#### Safety lockout if any outdoor unit safety is open.

#### Start capacitor and relay (single-phase units without scroll compressors).

#### Safeties:

##### Reversing valve shall be energized in cooling mode, with “fail-safe” to heating mode.

##### Circuit-breaker protected control circuit.

##### High condensing temperature protection.

##### Compressor motor current and temperature overload protection.

##### High refrigerant pressure relief.

##### Low voltage protection.

##### High voltage protection.

##### Unit shutdown on high or low refrigerant pressures. Low-pressure switch shall not be monitored for the first 90 seconds after a compressor start command to prevent nuisance safety trips.

##### Unit shutdown on low water temperature.

##### Water coil freeze protection (selectable for water or antifreeze).

##### Air coil freeze protection (check filter switch).

##### Condensate overflow shutdown.

##### Automatic intelligent reset. The unit shall automatically reset 5 minutes after trip if the fault has cleared. Should a fault reoccur three times sequentially then permanent lockout will occur.

##### Ability to defeat time delays for servicing.

##### Selectable 24 volt or pilot duty dry contact alarm output.

##### 24 volt output to cycle a motorized water valve with compressor contactor.

#### [Floor Mounted Console Type Units:

##### Integral manual changeover control switch.

##### HIGH/LOW/OFF capacity control switches.

##### Factory mounted and wired heat-anticipating thermostat for heating cycle.

##### Controls mounted in accessible location on exterior of cabinet.]

### Filters:

#### Rack mounted.

#### 25 mm thick strainer type with pleated non-woven fabric media.

#### Rated at 30 percent efficiency and 90 percent average arrestance in accordance with ASHRAE 52.2-2012

#### Maximum continuous operating temperature of [ ]˚C.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Compressor Cycle Delay: Compressor prevented from restarting for a minimum of 5 minutes after shutdown.]

#### [Hot Gas Bypass: Cooling capacity modulation with hot-gas solenoid valve and bypass piping [on lead compressor.] [on both compressors.]

#### [Evaporator Coil Freeze Thermostat: SPST temperature activated switch, shuts down unit upon evaporator freeze-up.]

#### [Filter Drier: Liquid line mounted, bi-flow type for heat pumps.]

#### [Corrosion Resistant Heat Exchanger: Cupro-nickel heat exchanger, 90 percent copper and 10 percent nickel alloy material.]

#### [Insulated Heat Exchanger: Factory blanket insulation cover.]

#### [Auxiliary Relays: One or more relays for random-start, alarm signal, or auxiliary dry contact.]

#### [Auxiliary Transformer: 24 volt with circuit breaker, minimum 75 VA, for additional power to operate auxiliary devices.]

#### [Factory Wall-Mount Thermostat:

##### Manual changeover thermostat with ON-AUTO fan switch and HEAT-OFF-COOL system switch.

##### Automatic changeover thermostat with ON-AUTO fan switch, AUTO-OFF system switch, and fault or dirty filter LED.

##### Automatic changeover with night setback thermostat, ON AUTO fan switch, AUTO-OFF system switch, and fault or dirty filter LED.

##### 7 day automatic changeover programmable thermostat with on-auto fan switch and auto-off system switch.]

#### [Condenser Specialties:

##### Combination shut-off/balancing ball valves on supply and return water connections.

##### Flowmeter and thermometer with well to monitor water conditions.

##### Condenser Water Solenoid Valve: 24 volt, plastic body solenoid valve to open/close water flow with compressor operation.

##### Flexible Piping Connectors:

###### Minimum 600 mm long stainless steel braided supply and return water hoses with male NPT brass fittings and a swivel at one end.

###### Hoses rated at minimum 2,068 kPa working pressure.

##### Condenser Water Regulating Valve: Dual-acting, water regulating valve to maintain constant head or suction pressure in cooling and heating modes and to close off water flow when compressor is off.]

#### [De-super-heater Package:

##### Pump kit to circulate water through de-super-heater and hot water tank.

##### Double-wall de-super-heater for heating domestic hot water during compressor operation.]

#### [Filter Upgrade:

##### 50 mm filter rack with 50 mm thick pleated throwaway filters.

##### Dirty filter switch.

##### 25 mm thick cleanable filter media.]

#### [Geothermal Unit Package:

##### ANSI/AHRI/ASHRAE/ISO 13256 1:1998 (R2012) certified for operation at minus 3 degrees Celsius to 43 degrees Celsius entering brine temperature.

##### Insulated refrigerant piping, water, and condensate piping.

##### Low water temperature (freezestat) safety switch.]

### Manufacturers and Products:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Packaged Rooftop AC Units

### This subsection applies to HP-[ ] *[Consultant to amend with actual HP tag number for the project]*.

### General:

#### Factory assembled, packaged rooftop air-cooled air-conditioning unit.

#### Contained within unit enclosure shall be all factory wiring, piping, controls, compressor, holding charge of R-22 refrigerant. *[Consultant to specify an appropriate alternative since R22 is being phased out]*

#### Unit Configuration: Packaged, [roof-mount type] [ground-mount type] [configuration as indicated in the Equipment Schedule(s) attached at the end of this Specification Section].

### Unit Cabinet:

#### Constructed of galvanized steel, phosphatized and coated with a baked enamel finish.

#### Removable access panels with access to all internal components.

#### Outdoor Compartment: Isolated with minimum 12 mm thick acoustic lining to assure quiet operation.

#### Knockouts for unit electrical power and condensate piping connections.

#### Supported on steel full-length mounting rails.

#### Indoor compartment interior insulated with 25 mm thick, 16 kg per cubic metre density, coated glass fibre insulation, attached with adhesive material.

#### Duct flanges for connection of supply and return ductwork.

#### Weatherproof indoor section.

### Evaporator Fan:

#### Double-inlet, double-width, forward-curved fan.

#### Direct-drive or belt-drive as standard with the unit.

#### Motor:

##### Totally enclosed and permanently lubricated, with integral overload protection.

##### Three speed.

### DX Evaporator Coil:

#### Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced seamless copper tubes, with galvanized steel tube sheets.

#### Condensate drain pan shall be plastic, insulated, with primary and secondary drain fittings.

### Condenser Fan:

#### Direct-drive propeller type.

#### Motors:

##### Totally enclosed, single-phase motors with Class B insulation and permanently lubricated sleeve bearings.

##### Protected by internal thermal overload protection.

#### Shaft shall have inherent corrosion resistance.

#### Fan blades shall be corrosion-resistant and shall be statically and dynamically balanced.

#### Equip openings with PVC coated protection grille over fan and coil.

### Compressor:

#### Fully hermetic reciprocating or scroll type.

#### Equipped with oil system, operating oil charge, and motor.

#### Internal overloads shall protect the compressor from over-temperature and over-current.

#### Motor: NEMA rated, Class F, suitable for operation in a refrigerant atmosphere.

#### Reciprocating compressors shall be equipped with crankcase heaters to minimize liquid refrigerant accumulation in compressor during shutdown and to prevent refrigerant dilution of oil.

#### Scroll compressors shall have high discharge gas temperature protection, if required.

#### Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.

### Condenser Coil:

#### Constructed of aluminum fins mechanically bonded to internally enhanced seamless copper tubes, with galvanized steel tube sheets.

#### [Coat entire coil with anti-corrosion protective coating, [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).] [in accordance with subsection 2.16 - Factory Dip-Applied Protective Coating.]]

### Refrigeration Components:

#### Brass external liquid line service valve with service gauge port connections.

#### Suction line service valve with service gauge connection port.

#### Service gauge port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps.

#### Accumulator.

#### Filter drier, bi-flow type for heat pump units.

#### Pressure relief.

#### Reversing valve, for heat pump units

#### Heating mode metering device, for heat pump units

### [Electric Heating Coil [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### Heavy-duty nickel-chromium elements.

#### Individual line-break HIGH limit control for each stage.

#### HIGH limit control operating through heating element contactors equipped with automatic reset.

#### Internally factory-wired to provide single-point power connection with unit.

#### UL/ULC listed.]]

### Controls:

#### Factory selected, assembled, and tested.

#### Refrigerant Metering:

##### Factory installed refrigerant metering device.

##### Heat Pump Applications: Reverse flow bypass TXV refrigerant metering device with internal check valves.

#### Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.

#### Automatic restart on power failure.

#### Three-pole contactors.

#### Safety lockout if any outdoor unit safety is open.

#### Time delay control sequence shall be provided standard through control board.

#### High pressure and liquid line low pressure switches.

#### Automatic outdoor fan motor protection.

#### Start capacitor and relay (single-phase units without scroll compressors).

#### Automatic demand-type defrost start and termination.

#### Safeties:

##### High condensing temperature protection.

##### System diagnostics.

##### Compressor motor current and temperature overload protection.

##### High pressure relief.

##### Outdoor fan failure protection.

### Air Filters:

#### Rack-mounted.

#### 25 mm thick strainer type with pleated nonwoven fabric media.

#### Rated at 30 percent efficiency and 90 percent average arrestance in accordance with ASHRAE 52.2-2012.

#### Maximum continuous operating temperature of [ ]˚C.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Low-Ambient Cooling Kit:

##### Solid state condenser fan motor [fully modulating speed] [cycling] controller; responds to saturated condensing pressure/temperature of unit.

##### Maintains a saturated condensing temperature of 37.7 degrees Celsius plus or minus 5 degrees Celsius with outdoor temperatures down to minus 28 degrees Celsius.

##### Includes winter start control package, to bypass low-pressure switch temporarily to allow compressor start during low load conditions.

##### Includes ball bearing condenser fan motor.]

#### [Compressor Cycle Delay: Compressor prevented from restarting for a minimum of 5 minutes after shutdown.]

#### [Hot Gas Bypass: Cooling capacity modulation with hot-gas solenoid valve and bypass piping [on lead compressor.] [on both compressors.]

#### [Hot-Gas Reheat:

##### Solenoid valve and controls shall allow redirection of refrigerant hot gas to reheat coil located in associated indoor unit.

##### Reheat coil located in the indoor section, same construction as evaporator coil.]

#### [Compressor Start Assist: Capacitor/relay type.]

#### [Evaporator Coil Freeze Thermostat: SPST temperature activated switch, shuts down unit upon evaporator freeze-up.]

#### [Filter Drier: Liquid line mounted, bi-flow type for heat pumps.]

#### [Liquid Solenoid Valve: Electric operated shutoff valve, bi-flow for heat pumps, interlocked with compressor operation.]

#### [Roof Curb: Factory provided, [12] [ ] mm high, welded [galvanized steel] [aluminum] construction, with insulation, and wooden nailer strip.]

#### [Economizer: Modulating outside air and return air dampers, barometric relief, inlet hood, enthalpy controller and damper actuator.]

### Manufacturers:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Packaged Rooftop Gas Heat AC Units

### This subsection applies to ACU-[ ] *[Consultant to amend with actual ACU tag number for the project]*.

### General:

#### Factory assembled, packaged rooftop air-cooled air conditioning unit with gas heat.

#### Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, holding charge of R 22 refrigerant. [Consultant to specify an appropriate alternative since R22 is being phased out]

#### Unit Configuration: Packaged, [roof-mount type] [ground-mount type] [configuration as indicated in the Equipment Schedules attached at the end of this Specification Section].

### Unit Cabinet:

#### Constructed of galvanized steel, phosphatized and coated with a baked enamel finish.

#### Removable access panels with access to all internal components.

#### Outdoor Compartment: Isolated, with minimum 12 mm thick acoustic lining to assure quiet operation.

#### Provide knockouts for unit electrical power and condensate piping connections.

#### Supported on steel full-length mounting rails.

#### Indoor compartment interior insulated with 25 mm thick, 16 kg per cubic meter density, coated glass fiber insulation, attached with adhesive material.

#### Duct flanges for connection of supply and return ductwork.

#### Weatherproof indoor section.

### Evaporator Fan:

#### Double-inlet, double-width, forward-curved fan.

#### Direct-drive or belt-drive as standard with the unit.

#### Motor:

##### Totally enclosed and permanently lubricated, with integral overload protection.

##### Three speed.

### DX Evaporator Coil:

#### Constructed of aluminum fins mechanically bonded to internally enhanced seamless copper tubes, with galvanized steel tube sheets.

#### Condensate drain pan shall be plastic, insulated, with primary and secondary drain fittings.

### Condenser Fan:

#### Direct-drive propeller type.

#### Motors:

##### Totally enclosed, single-phase motors with Class B insulation and permanently lubricated sleeve bearings.

##### Protected by internal thermal overload protection.

#### Shaft shall have inherent corrosion resistance.

#### Fan blades shall be corrosion-resistant and shall be statically and dynamically balanced.

#### Equip openings with PVC coated protection grille over fan and coil.

### Compressor:

#### Fully hermetic reciprocating or scroll type.

#### Equipped with oil system, operating oil charge, and motor.

#### Internal overloads shall protect compressor from over-temperature and over-current.

#### Motor: NEMA rated, Class F, suitable for operation in a refrigerant atmosphere.

#### Reciprocating Compressors: Equipped with crankcase heaters to minimize liquid refrigerant accumulation in compressor during shutdown and to prevent refrigerant dilution of oil.

#### Scroll Compressors: High discharge gas temperature protection, if required.

#### Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.

### Condenser Coil:

#### Constructed of aluminum fins mechanically bonded to internally enhanced seamless copper tubes, with galvanized steel tube sheets.

#### [Coat entire coil with anti-corrosion protective coating, [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).] [in accordance with subsection 2.16 - Factory Dip-Applied Protective Coating.]]

### Refrigeration Components:

#### Brass external liquid line service valve with service gauge port connections.

#### Suction line service valve with service gauge connection port.

#### Service gauge port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps.

#### Accumulator.

#### Filter drier.

#### Pressure relief.

### Gas Heating Section:

#### CGA certified. *[Consultant to provide details of CGA certification]*

#### Gas-fired furnace with [aluminized steel] [stainless steel]heat exchanger and burners.

#### [Power vent.] [Gravity vent.]

#### Manual shutoff valve.

#### Automatic gas valve.

#### Electronic ignition.

#### Suitable for use on natural gas with a heating value of [37,250] [ ] Kj/m3 supplied at 1.75 kPa of water column gas pressure.

### Controls:

#### Factory selected, assembled, and tested.

#### Refrigerant Metering:

##### Factory installed refrigerant metering device.

##### Heat Pump Applications: Reverse flow bypass TXV refrigerant metering device with internal check valves.

#### Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.

#### Automatic restart on power failure.

#### Three-pole contactors.

#### Safety lockout if any outdoor unit safety is open.

#### Time delay control sequence shall be provided standard through the control board.

#### High pressure and liquid line low pressure switches.

#### Automatic outdoor fan motor protection.

#### Start capacitor and relay (single-phase units without scroll compressors).

#### Safeties:

##### High condensing temperature protection.

##### System diagnostics.

##### Compressor motor current and temperature overload protection.

##### High pressure relief.

##### Outdoor fan failure protection.

### Air Filters:

#### Rack mounted.

#### 25 mm thick strainer type with pleated non-woven fabric media.

#### Rated at 30 percent efficiency and 90 percent average arrestance in accordance with ASHRAE 52.2-2012.

#### Maximum continuous operating temperature of [ ]˚C.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Low-Ambient Cooling Kit:

##### Solid state condenser fan motor [fully modulating speed] [cycling] controller; responds to saturated condensing pressure/temperature of unit.

##### Maintains a saturated condensing temperature of 37.7 degrees Celsius plus or minus 5 degrees Celsius with outdoor temperatures down to minus 28 degrees Celsius.

##### Includes winter start control package, to bypass low-pressure switch temporarily to allow compressor start during low load conditions.

##### Includes ball bearing condenser fan motor.]

#### [Compressor Cycle Delay: Compressor prevented from restarting for a minimum of 5 minutes after shutdown.]

#### [Hot Gas Bypass: Cooling capacity modulation with hot-gas solenoid valve and bypass piping [on lead compressor.] [on both compressors.]

#### [Hot-Gas Reheat: Solenoid valve and controls shall allow redirection of refrigerant hot gas to reheat coil located in the associated indoor unit.]

#### [Compressor Start Assist: Capacitor/relay type.]

#### [Evaporator Coil Freeze Thermostat: SPST temperature activated switch, shuts down unit upon evaporator freeze-up.]

#### [Filter Drier: Liquid line mounted.]

#### [Roof Curb: Factory provided, [300] [ ] mm high, welded [galvanized steel] [aluminum] construction, with insulation, and wooden nailer strip.]

#### [Economizer: Economizer with modulating outside air and return air dampers, barometric relief, inlet hood, enthalpy controller, and damper actuator.]

### Manufacturers:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Room AC Units

### This subsection applies to ACU-[ ] *[Consultant to amend with actual ACU tag number for the project]*.

### General:

#### Packaged through-the-wall [air conditioning] [heat pump] unit.

#### Operating charges of refrigerant and oil.

#### UL/UCL labeled.

### Unit Cabinet:

#### Constructed of zinc-coated steel finished with the manufacturer’s standard baked enamel paint.

#### Contained in a decorative room enclosure.

#### Adjustable discharge air grille.

#### Air filter, cleanable.

#### Internal sound attenuation.

### Electric Heating Section:

#### Low-density electric heating elements.

#### Built-in overheat protection.

### Refrigeration Components:

#### Hermetic compressor.

#### Air-cooled Condenser Coil: Aluminum fins, copper tubes.

#### DX Evaporator Coil: Aluminum fin, copper tubes.

#### Drain pan with drain line connections.

#### Direct-drive evaporator fan.

#### Condenser fan.

#### Fan motors with integral overload protection.

#### Operating and safety controls.

### Controls:

#### Refrigerant Metering :

##### Factory installed refrigerant metering device.

##### Heat Pump Applications: Reverse flow bypass refrigerant metering device with internal check valves.

#### Controls with adjustable thermostat.

#### Fan speed switch with three-speed manual selections.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Window Installation Kit.]

### Manufacturers and Products:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Wall Mount AC Units

### This subsection applies to ACU-[ ]*[Consultant to amend with actual ACU tag number for the project]*.

### General

#### Self-contained wall mounted air conditioner suitable for outdoor use, specifically designed for telecommunications/electrical enclosure climate control.

#### Unit shall be completely factory assembled and tested, and shall include compressor, indoor and outdoor coils, fans, motors, prewired controls, interconnecting refrigerant tubing, wiring, circuit breaker, and other necessary components mounted in a corrosion resistant cabinet.

#### Unit shall be shipped from the factory with a full operating refrigerant and oil charge.

### Unit Cabinet:

#### Constructed of [galvanized steel sheet metal with factory applied paint finish] [Type 304 stainless steel sheet metal].

#### Sloped top with built in mounting flanges.

#### Unit Mounting Brackets: Full-length bracket shall be factory provided.

#### Conditioned air section shall be insulated with 12 mm, 32 kg/m3 dual density fiberglass.

#### Supply Grille: Adjustable aluminum double deflection type, factory installed.

#### Return Grille: Aluminum, fixed blade type, factory installed.

### Compressor:

#### Hermetic type, equipped with an immersion type self regulating crankcase heater.

#### Motor shall be protected by an internal line-break thermostat.

#### Electrical wiring connections at the compressor shall be protected by receptacle housing.

### Refrigeration Components:

#### Refrigeration Circuit:

##### Liquid filter dryer.

##### Suction and liquid access valves.

### Condenser Section:

#### Condenser Coil: Constructed of aluminum plate fins mechanically bonded to seamless copper tubes.

#### [Entire condenser coil coated with anti-corrosion protective coating, [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).] [in accordance with subsection 2.16 - Factory Dip-Applied Protective Coating.]]

#### Fan:

##### Direct driven, slow speed propeller type for quiet operation.

##### Motor shall be equipped with a thermal protector.

### Evaporator Section:

#### Evaporator Coil: Constructed of aluminum plate fins mechanically bonded to seamless copper tubes.

#### Two direct driven evaporator blowers shall be of centrifugal type, forward curved.

#### Indoor motor shall be equipped with a thermal protector.

### Electric Heat Coil:

#### UL/ULC listed.

#### Heavy-duty nickel-chromium elements.

#### Individual line-break HIGH limit control for each stage.

#### HIGH limit control operating through heating element contactors, equipped with automatic reset.

#### Internally factory-wired to provide single-point power connection with unit.

### Controls:

#### Refrigerant Metering: Factory installed refrigerant metering device.

#### Internal control circuit of a current limiting type transformer to generate 24 VAC, switching devices to operate compressor, indoor fan motor, and electrical heater(s).

#### Access to electrical control box, including the low voltage compartment, shall be from the front of the air conditioner. Side mounted control boxes shall not be permitted.

#### Provide, automatic resetting adjustable time delay circuit to prevent rapid compressor cycling and to delay startup of compressor on a call for cooling.

#### Low pressure bypass shall be factory installed for startup of unit down to minus 17 degrees Celsius.

#### Safeties:

##### Control circuit shall incorporate manual reset safety circuit to render refrigerant system (compressor and outdoor fan motor) inoperative should there be a loss of airflow or refrigerant.

##### System lockout condition shall be indicated by contact closure available at low voltage terminal block.

##### Safety circuit shall be resettable at wall thermostat.

##### Refrigeration circuit shall include high and low pressure switches with lockout relay.

### Filters: 50 mm pleated throwaway type filter, mounted internally, factory supplied, and accessible through access panel.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Factory installed disconnect.]

#### [Fresh Air Damper:

##### Factory provided.

##### Manually adjustable to allow for 0 to 25 percent of outside air.]

#### [Desert Duty Kit: Factory installed refrigerant controls and components allow operation up to 54 degrees Celsius in dry dusty environments.]

#### [Cold Weather Kit: Factory installed controls and components permit unit cooling operation down to outdoor temperatures of minus 28 degrees Celsius.]

#### [Dehumidification Package: Field or factory installed controls allow humidity to be maintained at or below a specified humidity set point. Dehumidification is achieved by operating mechanical cooling in conjunction with electric reheat.]

#### [Hot Gas Bypass: Factory installed refrigeration controls permit near continuous operation of the compressor.]

### Manufacturers and Products:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Packaged Terminal AC (PTAC) Units

### This subsection applies to HP-**[A: ]** ]*[Consultant to amend with actual HP tag number for the project]*.

### General:

#### Factory-assembled, single-piece heating and DX cooling unit.

#### Contained within unit cabinet shall be compressor, coils, fans and fan motor, heating means, controls, all wiring and piping, and a full R 22 refrigerant charge. *[Consultant to specify an appropriate alternative since R22 is being phased out]*

### Unit Cabinet:

#### General:

##### Constructed of galvanized steel, phosphatized and coated with a baked enamel finish.

##### Internal 12 mm minimum sound attenuation.

##### Access doors to controls.

##### Slide out configuration for access to serviceable components.

##### Weather-proof indoor section.

##### Outdoor Compartment: Isolated, with acoustic lining to assure quiet operation.

#### Discharge Grille:

##### Polymer construction.

##### Bi-directional.

##### Easily set to direct air at 40 degrees from horizontal or 80 degrees from horizontal.

#### Wall Sleeve:

##### Constructed from molded polymer.

##### Factory-installed closed cell elastomeric insulation with a minimum flammability rating of UL 94-5V.

##### Sleeve surface textured to prevent shine and hide scratches.

#### Front Panel:

##### Constructed of a polymer material to resist breakage and corrosion.

##### Front louvered surface with integrated control door and air filters.

#### Ventilation:

##### Chassis shall have an adjustable fresh air vent with a concealed manual control.

##### Vent control shall allow a maximum of 25 L/s of fresh air to be drawn into the room when the evaporator fan is operating and vent door is open.

#### Condensate Removal System:

##### Condensate suction port to draw and atomize condensate.

##### Slinger ring integrated in outdoor fan to disperse condensate onto condenser coil to be evaporated.

#### Snow Baffle: To prevent melting snow from freezing and potentially damaging condenser fan.

### Fans:

#### Condenser Fan: Dynamically balanced, corrosion-resistant polymer multi-blade axial flow design, with integrated slinger ring.

#### Evaporator Fan: Dynamically balanced, polymer, reverse curve blower wheel.

#### Fan Motor: One, totally enclosed, permanent split-capacitor, direct drive, permanently lubricated, two-speed fan motor for evaporator and condenser fans.

### Coils: Condenser and evaporator coils shall be constructed of high-efficiency, sine wave enhanced aluminum fins and seamless axial grooved copper tubing.

### Compressor: Rotary-type, fully hermetic with internal and external vibration isolation.

### [Electric Heating Coil: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### Factory-installed, open coil type.

#### Containing both an automatic reset and a one-shot over-temperature protection device.]

### Controls:

#### Refrigerant Metering:

##### Factory installed refrigerant metering device.

##### Heat Pump Applications: Reverse Flow Bypass TXV refrigerant metering device with internal check valves.

#### Electro-mechanical control architecture.

#### Accessible and covered by hinged door.

#### Mode Selection Control: Mechanical rotary selector switch, which provides OFF, FAN ONLY, HEAT or COOL operations.

#### Temperature Selection Control: Adjustable thermostat with upper and lower limits.

#### Continuous/Fan Cycle Selector Switch:

##### Located behind front panel.

##### Allows selection of continuous fan operation for maximum comfort or cycle operation (fan only runs with cooling or heating operation).

#### Temperature Limiter Control:

##### Located behind front panel.

##### Allows room temperature range to be set, to avoid extreme temperature settings.

#### Emergency Heat Switch (Heat Pump Models Only):

##### To disable compressor in heating mode and only allow the use of electric heat during heating cycles.

##### Active at all outdoor ambient temperatures.

#### Anti-Theft Control Knobs:

##### Resist breakage and corrosion.

##### Mount on control box section and captured behind front panel, to prevent unauthorized removal.

#### Safeties:

##### Compressor shall have automatic reset, over temperature and over current protection.

##### Fan motor shall have an inherent, automatic reset over temperature protection

##### Electric heater shall have two over temperature protectors.

### Electrical:

#### Chassis shall be equipped with a minimum 1.5 m long power cord for 208/230V models.

#### Power cord plug configuration shall conform to NEMA standards and rating shall support electrical current draw of resistance heater. *[Consultant to provide NEMA details with respect to power cord plugs]*

### Air Filters: Easily accessible without removing front panel from the chassis.

### Accessories: Provide [as scheduled in the Equipment Schedule(s) attached at the end of this Specification Section (See subsection 3.6 – Supplements).][as follows:]

#### [Lateral Duct System:

##### Allows one system to heat or cool two adjacent rooms.

##### Plenum and extension duct.

##### Adjustable chassis discharge air grille.

##### Adjustable wall register.

##### Decorative wall molding for duct extension.

##### Adaptable for either right or left side ducting, with a maximum duct extension of 1.2 m.]

#### [Corrosion Protection:

##### Coat outdoor-exposed sheet metal parts with polyester powder coat paint.

##### Compressor and outdoor-fan motor finish capable of withstanding 500 hours of salt spray testing in accordance with ASTM B117-16.

##### Compressor mounting screws coated.

##### Outdoor coil fin stock shall be coated and able to withstand 1,000 hours of salt spray testing in accordance with ASTM B117-16.

##### Outdoor coil tube sheets of Type 316L stainless steel.]

#### [Deep Wall Metal Wall Sleeve: One-piece, extended wall sleeve, with factory installed insulation and deep wall baffles integrated.]

#### [Exterior Architectural Grille:

##### [Wall Grille: Decorative high performance discharge air grille of polymer construction.]

##### [Wall Grille: Painted aluminum discharge air grille for color match to building.]]

#### [Sub-base:]

##### [Nonelectrical Sub-base: Preassembled, provides mechanical support, and requires no wiring.]

##### [Electrical Sub-base: Preassembled and UL/ULC listed with factory-installed electrical junction box containing receptacle for corded units.]

##### [Hardwired Sub-base: Preassembled and UL/ULC listed with factory installed electrical junction box containing 0.48 m of flexible conduit and all mating connections.]

#### [Hardwire Kit :

##### Permanent electrical connection to unit.

##### Mount on front right side of unit.

##### Minimum 0.9 m flexible steel conduit and a Molex connector.]

#### [Condensate Drain: Universal drain kit, used internally or externally to route excess condensate to a drainage system.]

#### [Energy Management Interface:

##### Allows individual units to be turned on and off from a remote location or by a motion sensing device.

##### Compatible with control system specified in Section 15900 - HVAC Instrumentation and Control.]

#### [Lateral Air Deflector: Allow right or left air distribution from chassis.]

#### [Security Door: Key-locking security door kit to prevent unauthorized access to the unit’s heating and cooling controls; with two keys.

#### [Wall Thermostat Option:

##### Wall thermostat, digital display, 24 VAC, non-programmable.

##### Includes a blank out plate in place of PTAC unit control knobs.]

#### [Sleeve Molding: To trim wall sleeve to existing wall to hide wall joints and irregularities due to sleeve opening.]

#### [Power Fresh Air Vent Kit:

##### Shall provide approximately 45 L/s of outdoor air for ventilation.

##### Door that opens when PTAC fan is on and closes when PTAC fan is off.]

### Manufacturers:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Factory Dip-Applied Protective Coating

### General:

#### Factory dip-applied protective coating for application to plate fin and tube coils.

#### Coil factory assembled and tested before coating application.

#### Coating suitable for coils with maximum 30 fins per inch fin density. Bridging of product across coil fins is unacceptable.

#### After application and proper curing, the Product shall endure bending of coil assembly in standard manufacturing process without cracking.

#### [Apply coating to coil before final factory assembly of equipment. Coating process that requires disassembly of equipment for removal of coil to be coated is not acceptable.] [If protective coating is applied to coil after factory assembly of the equipment, cost for shipping unit to coating factory, disassembly, coating process, reassembly, and delivery to Site shall be borne by the Contractor.]

### Coating Material: Use one of the following materials:

#### Epoxy Modified Phenolic. Straight phenolic materials are not acceptable.

#### Epoxy or Epoxy-Urethane.

#### Polyelastomer: Complex chain linked polyelastomer material.

### Coating Process:

#### Coil Inspection and Sealing:

##### Inspect coil for open tubes, headers, capillary tubes; repair as necessary.

##### Fill with dry nitrogen, cap and seal, to prevent contamination of internal coil surfaces with cleaning or coating solutions.

#### Coil Cleaning:

##### Immerse coil in heated alkaline cleaning solution to remove lubricants, machining oils, and residual factory contamination.

##### Followed with immersion in potable water bath to neutralize and remove cleaning solution.

#### Coating Application:

##### Immerse coil assembly in coating bath, including headers, casing, and heat exchange surfaces.

##### Coil shall be completely removed from the equipment during coating application.

##### Spray-on coatings are not acceptable.

#### Curing: Oven baked at a metal temperature shall not exceed 204 degrees Celsius.

#### Quality Control: Free from voids, checks, cracks and blisters.

### Performance: Coil finish shall meet or exceed the following criteria:

#### Salt Spray Test: In accordance with ASTM B117-16, minimum 3,000 hour duration, with no fin corrosion or degradation.

#### Thermal Efficiency: Loss no greater than 1 percent after coating application.

#### Exposure to UV Light: UV inhibited life of minimum 10 years.

## Electrical

### General:

#### Units shall include high and low voltage terminal block connections.

#### Control voltage to indoor unit fan shall be 24 volts.

#### Motor Starters/Contactors: Factory installed with unitary equipment, unless otherwise noted in the Contract Documents.

#### Disconnects: Factory installed non-fused disconnects or circuit breakers on each unit, unless otherwise noted in the Contract Documents.

### Motors:

#### Refer to Section 16222 – Motors: 1 to 200 kW, 575V, for general requirements.

#### Unless otherwise stated in the Contract Documents, electric motors shall comply with the following:

##### Voltage, Phase, Horsepower, Synchronous Speed: Refer to the Equipment Schedule for motor driven equipment.

##### Enclosure: ODP, unless specified otherwise.

##### Torque Characteristics: Sufficient to accelerate driven loads satisfactorily.

##### Winding Thermal Protection: Manufacturer’s standard.

##### Space Heater: Manufacturer’s standard.

##### Multispeed Motors, Synchronous Speed, Number of Windings: Manufacturer’s standard.

##### Efficiency: Minimum efficiency in accordance with Section 16222 – Motors: 1 to 200 kW, 575V.

## Accessories

### Lifting Lugs: Provide suitably attached for equipment assemblies and components weighing over 45 kg.

### Equipment Identification Plates: Furnish 16 gauge [Type ] stainless steel identification plate securely mounted on each separate equipment component [and control panel] in a readily visible location. Plate shall bear [9.5] [6.4] mm high [engraved] [die-stamped] block type [black enamel filled] equipment [identification number] [and letters] indicated in this Section.

### Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer, 12 mm minimum diameter, and as specified in Section 05500 - Metal Fabrications General. Quantity as recommended by the manufacturer.

## Source Quality Control

### Factory Tests:

#### Direct expansion coils leak tested underwater with 1,378 kPa air. Pressure tested to 3,102 kPa.

#### Electric heating coils tested with 2,000 volt dielectric test.

# EXECUTION

## Installation

### Set and install equipment so that equipment is level and properly supported.

### Make certain that piping connections to equipment do not cause any strain on the equipment.

### Make certain that vibration isolation has been installed in accordance with the manufacturer’s instructions and that isolation devices are performing satisfactorily.

### Install equipment in accordance with the manufacturer’s recommendations, and these Specification Sections.

### Install all safety devices as recommended by the manufacturer and/or required by the applicable codes and standards referenced in these Specification Sections. *[Consultant to provide details of applicable codes and standards with respect to safety equipment]*

### Initial equipment startup shall be made by an authorized representative of the unit manufacturer.

### Air-cooled outdoor unit shall not be started without complete prestart checkout of entire refrigerant piping system and charging of system with refrigerant as recommended by the equipment manufacturer.

### Startup: Ensure that the manufacturer provides a factory-trained representative employed by the equipment manufacturer to perform the following listed services. Supervision only, of Contractor personnel, will not be acceptable.

#### Leak test.

#### Refrigerant pressure test.

#### Evacuate (if required).

#### Dehydrate (if required).

#### Charge condensing unit with refrigerant and oil (if required).

### Factory Checkout:

#### The Contractor shall secure the services of a factory trained and qualified service engineer employed by the equipment manufacturer who shall inspect the installation including external interlock, power connections; supervise initial operation, calibration of operating and safety controls and supervise electrical testing including insulation resistance of motors and voltage balance between phases during starting and running.

#### This Contractor’s service engineer shall forward a report in three copies to the Consultant when the unit is in safe and proper operating condition. This report shall contain all pressure and control settings, meg readings, voltage readings per phase during START and RUN, suction temperature and pressure, liquid temperature and pressure, and shall list minor discrepancies to be corrected which do not affect safe and reliable operation.

#### One additional copy of report shall be left in the unit control panel. One copy of bound installation operation and maintenance service, and parts brochures, including applicable serial numbers, full unit description, parts ordering sources, shall be placed in the unit control panel at the time of starting.

### Locate units to provide access for filter changing; motor, drive, and bearing servicing; and fan shaft and coil removal.

### Seal outside air intake watertight to roof curb.

### Isolate sheet metal duct connections from all portions of the unit not internally spring-isolated from fans, or other vibrating or rotating equipment.

### Inspect internal casing insulation, seal all exposed edges, and butt joints with mastic to ensure that insulation will not be loosened during operation.

### Provide all other required information as detailed in the Equipment Information Template and in a format electronically up-loadable to the Region’s CMMS (Maximo) in accordance with Section 01425 - Computerized Maintenance Management System Data Requirements.

## Adjusting and Cleaning

### Air System Balancing: As specified in Section 15950 - HVAC Systems Testing, Adjusting, and Balancing.

### Lubricate unsealed bearings prior to startup.

### Do not operate units until filters are installed. If operated without filters, completely clean ductwork, coils, and interior of units.

## Filters

### Install a complete set of filters in each unit before operating, and leave in place during startup and testing to keep the equipment and ductwork clean.

### Install a complete set of filters at the time of final cleaning as defined in Section 01780 - Contract Closeout.

## Manufacturer’s Services

### Manufacturer's Services and Certificate of Proper Installation: Provide manufacturer's services and Manufacturer's Certificate of Proper Installation in conformance with the requirements of Section 01640 - Manufacturers' Services. Manufacturers’ representation shall provide supervision of equipment installations, field inspection of equipment before startup, and the executed copies manufacturer's services and Certificate of Proper Installation.

### Duration of Training: The training of Region's personnel shall include, but not limited to, one hour for each air handling unit.

### Training shall be in accordance with Section 01820 - Demonstration and Training.

## Commissioning

### For all commissioning activities on systems where components of this Specification Section are integral to functionality, refer to Section 01810 – Equipment Testing and Facility Commissioning. All inspection and testing activities shall be completed in accordance with documentation provided to the Consultant prior to start of commissioning activities.

## Supplements – Equipment Schedules

### [The supplemental Equipment Schedules listed below, attached following “End of Section,” form a part of this Section.

#### 15730-01: Split System DX Indoor Units Schedule.

#### 15730-02: Ductless Split System DX Indoor Units Schedule.

#### 15730-03: Split System DX Outdoor Units.

#### 15730-04: Packaged Indoor Water Source Heat Pump Units Schedule.

#### 15730-05: Packaged Rooftop Gas Unit DX AC Units Schedule.

#### 15730-06: Packaged DX Air Conditioning Units Schedule.

#### 15730-07: Room Air Conditioner Schedule.

#### 15730-08: Wall Mount Air Conditioner Schedule.

#### 15730-09: Packaged Terminal Air Conditioner Schedule.]

**END OF SECTION**