Part 1: General

1.1 The HVAC system is based on BULLDOG Heat Pump System.

1.2 The system will automatically provide the availability of heating or cooling functions 24 hours a day, 365 days a year without need for changeover.

1.3 Model selection and performance shall be in accordance with the schedule on the drawings.

1.4 Mechanical cooling shall be enabled with Entering Condenser Water below 125°F. The system is designed to operate on 2 GPM/ton.

1.5 Each unit/chassis shall be pressure tested with Nitrogen on both the refrigerant and fluid (water) circuits followed by a helium leak detection program for both circuits. Units are then attached to the vacuum system for at least 2 hours and monitored.

1.6 Each unit shall be run tested for a minimum of 15 minutes with a water/glycol solution to ensure 100% functionality in all modes of operation. Individual units/chassis shall be self-contained and complete when shipped from the factory.

1.7 Units shall be safety certified and bear a seal of approval from one of UL/ULC/ETL or ESA. All units must be AHRI certified and meet ASHRAE 90.1 minimum standard.

1.8 Manufacturer shall warrant the parts only of each unit for a period of 12 months from the start-up date or 18 months from the unit shipment date whichever occurs first.

1.9 Commissioning of the BULDOG units(s) shall be performed by a CGC trained technician. A commissioning report shall be provided by the commissioning technician for review and approval by the owner’s representative.

1.10 It is the contractor’s responsibility to have the fluid system properly flushed and cleaned prior to commissioning.

1.11 Alternate proposals shall include consideration for equipment space requirements, pipe and equipment sizing, electrical installation impact, operation costs, sound implications and redesign fees.

BULLDOG HEAT PUMP

No other heat pump does more, with less.

Part 2: Mechanical Parts

2.1 Cabinets

2.1.1. The cabinets are fabricated with heavy gauge galvanized steel with all interior of the cabinet lined with
½" acoustic insulation shipped as one complete enclosure.

2.1.2. The supply air openings shall be pre-punched knockout panels to allow easy field selection of available discharge arrangements.

2.1.3. The cabinet shall be designed for direct application of drywall. Studs are only required on the risers side.

2.1.4. The contractor shall ensure unit cabinet is plumb prior to application of drywall.

2.1.5. The universal cabinet is configured on site for either right or left handed units.

2.1.6. Cabinet shall be equipped with electrical box for accepting plug from chassis, wiring and receptacle by other.

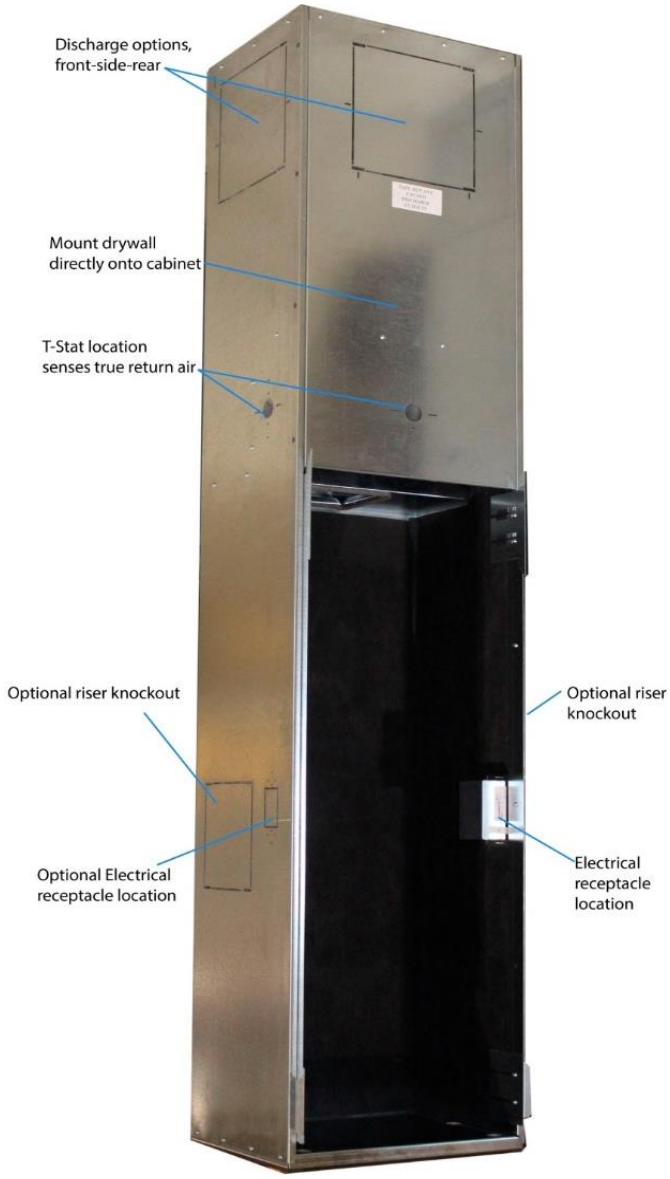
***(Optional)** Receptacles can be provided – wiring by others.

***(Optional)** A baffle shall be installed to provide blocking of sight and sound between adjacent rooms – baffles are field installed by others.

2.1.7. The cabinet shall ship in an enclosed truck to avoid insulation getting wet in transit, tarps not recommended.

2.2 Return Air Panel

2.2.1. The surface mounted front panel shall provide acoustic dampening, front return air and access to facilitate normal unit maintenance and service.



2.2.2. The front panel shall be constructed of heavy gauge steel lined with ½" acoustic insulation. Standard off-white factory painted finish.

2.2.3. A return opening and boot shall be provided in the front panel to allow air to enter at floor level.

(Optional) other panel options are available upon request.

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2.3 Chassis

2.3.1. The chassis must be a complete self-contained unit. Fan and motor integral to cabinet is not acceptable.

2.3.2. The chassis shall be complete with refrigeration circuit, hydronic circuit, blower assembly, controls and an internal corrosion resistant stainless steel insulated condensate drain pan with condensate drain. P-trap is fashioned by factory provided condensate hose in the field.

2.3.3. The chassis shall be fabricated with insulated separate blower and compressor sections to minimize compressor sound transmission. Manufacturers shall provide Ultra Quiet Acoustical Package.

2.3.4. The chassis shall be complete with a control access cover. The cover shall be easily removable to provide access to controls.

2.3.5. The service panel shall be easily removable and sufficiently large to allow access to all refrigeration components. Contractor shall verify location of service panels and assure access.

2.3.6. The chassis shall be completely removable by disconnecting supply and return hoses, condensate hose, thermostat terminal block and line voltage plug-in power connection.

2.3.7. The chassis shall be complete with braided flexible hoses rated at 400psi for supply and return connections. A clear reinforced condensate hose/trap shall be provided with the chassis. The trap must be visible by simply removing the front panel.

2.3.8. The plug connection shall provide positive disconnect of main power to chassis.

2.3.9. The contractor shall ensure chassis including complete operating system, blower and controls is removable with adequate service and access clearance.

2.4 Blower and Motor

2.4.1. The complete blower section including motor shall be easily accessible and removable for service.

2.4.2. The blower shall be statically and dynamically balanced.

2.4.3. The blower motor shall be direct drive, single phase with integral thermal overload protection with standard PSC motor for sizes 008 to 018 and EC motor for HomeKeeper units.

***(Optional)** EC motors are available on InnKeeper units sizes 008-012.

2.4.4. The blower shall be direct drive forward curved, SWSI centrifugal blower for all units except for HomeKeeper unit sizes 016-024 where DWDI centrifugal blower is provided.

2.5 Filter

2.5.1. The filter chamber shall be an integral part of the system located on return air path and should be serviceable from the front of the unit.

2.5.2. The filter shall be standard capacity, polyester type shipped with chassis.

***(Optional)** 1” MERV 7 filter

2.6 Heating Loop

2.6.1. The refrigerant circuit shall not operate in the heating mode.

2.6.2. Heating coil shall be aluminum fin and copper tube construction rated to withstand 300 PSI working pressure.

***(Optional)** The heating coil can be mounted in the reheat position for dehumidification – humidistat by others.

***(Optional)** For cooling only units, the heating coil can be omitted. This option provides a water-regulating valve.

Part 3: Refrigeration Parts

3.1 Refrigeration System

3.1.1. The refrigeration circuit shall be available for operation on non-ozone depleting R410a refrigerant. Refrigeration circuit does not operate in heating mode. Reversing type heat pump unit manufacturer must supply a life time of Parts and Labour Warranty on the reversing valve.

3.1.2. The refrigeration circuit shall have the following components:

- Thermal Expansion Valve with external equalizer
- Filter dryer
- High pressure cut-out
- High pressure service port
- Low pressure cut-out
- Low pressure service port

***(Optional)** Sight glass

3.1.3. The service ports shall be located to facilitate field service with unit in place.

3.1.4. All refrigerant piping shall be of type ACR copper pipe.

3.1.5. The refrigerant circuit and components shall be factory assembled in a sealed, leak and performance tested, properly charged system.

3.1.6. The sealed refrigerant circuit shall be certified for 600 PSIG working condensing pressure.

3.2 Compressor

3.2.1. The compressor shall be high efficient sealed hermetic rotary type for sizes 008-024 and scroll type for sizes 030-036.

3.2.2. The compressor shall be externally isolated on rubber mounts and connected to refrigerant circuit with floating piping to minimize sound transmission.

3.2.3. The compressor motor shall have integral thermal overload protection.

3.2.4. The compressor shall not operate in the heating mode.

3.2.5. The compressor shall be provided with a 5 minute restart delay to avoid compressor short cycling and low pressure lockout.

3.3 Direct Expansion Evaporator Coil

3.3.1. The refrigerant to air heat exchanger shall be aluminum fin and copper tube construction rated to withstand 470 PSI refrigerant working pressure.

3.3.2. The coil shall have a maximum face velocity of 500 FPM.

3.3.3. A stainless steel condensate drain pan shall be provided under the coil.

3.4 Water Cooled Condenser Module

The condenser shall be high efficiency refrigerant-to-water heat exchanger of copper inner water tube, minimum ½" diameter and steel refrigerant outer shell rated to withstand 600 PSI refrigerant working pressure and 300 PSI water pressure.

3.5 Valve Configuration – Factory Installed

All units shall be supplied with a 3 way valve for continuous flow.

*** (Optional)** For variable water flow pumping systems, all units shall be supplied with a flow limiting device and two 2 way control valves (1 for heating and 1 for cooling). If the system is bottom fed, all units at the top of each riser shall only be supplied with a standard 3 way valve for continuous water flow.

Part 4: Control Systems

4.1 System

4.1.1. The unit shall be complete with a standard microprocessor controlled electronic circuit board.

4.1.2. The control panel shall be supplied with individual 24 VAC control transformer.

4.1.3. The control panel shall have LED indicators displaying thermostat call, unit operation and alarms.

4.1.4. The control board shall operate with:

- A 24 volt thermostat
- Onboard fuse protection

***(Optional)** 3rd party provided BACnet controllers supplied by others can be installed and wired inside the cabinet above the chassis.

***(Optional)** A remote alarm contact available for connection to alarm monitor by others – monitored and wired by others.

***(Optional)** BMS override function available to disable compressor only or disable unit. BMS override and wiring by others.

***(Optional)** Condensate High Level Monitor and alarm is available.

***(Optional)** Different types of BULLDOG thermostats are available upon request.

4.2 Alarms

The standard Control Panel shall have the following standard alarms:

- Low coil temperature
- High leaving water temperature
- Low discharge air temperature
- Low refrigerant pressure
- High refrigerant pressure
- High condensate level **(Sensor Optional)**

Part 5: Risers (Optional)

5.1.1. The supply and return risers shall be type "M" copper. Type "L" copper it optional. The condensate riser shall be 1" diameter type "M" copper.

***(Optional)** Closed cell pipe insulation: 3/8", or 1/2" or 1"

5.1.2. Each riser to be supplied with factory swaged expanded top end to accept risers from the unit above and to minimize field brazing.

***(Optional)** Non-swaged ends are optional.

5.1.3. The supply and return risers shall be factory supplied with service isolation ball valves.

5.1.4. The risers shall be pre-bundled with metal channel so that the riser hooks onto the slip fit connection to the left, right, or back side of the cabinet.

5.1.5. The copper risers shall be isolated from the metal channel and cabinet with neoprene isolation. Risers shall not make metal to metal contact with housing.

5.1.6. The riser diameter shall be as shown on plans. Riser length and schedule shall be coordinated with the mechanical contractor.

5.1.7. It is the responsibility of the supplier of the risers to provide a “Riser Schedule” indicating riser diameters, lengths, options, unit size and location.

Part 6: Integrated ERV (Optional)

6.1 System Description

6.1.1. The Energy Recovery Ventilators shall be an integrated part of the Vertical Stack Cabinet and is based on the BULLDOG Heat Pump System. The integrated ERV will consist of a fan box with an exhaust and fresh hair fan and an ERV core.

6.1.2. The entire ERV unit shall be completely removable and accessible from the cabinet`s front panel.

6.1.3. The system will automatically provide fresh air to the space when the Vertical Stacked chassis main supply fan operates. The integrated ERV utilizes an exhaust and fresh air fan as well as a passive energy recovery core. The ERV fans will operate whenever there is a call for heating or cooling from the thermostat, when the thermostat fan selector switch is in the "ON" position or when a remote, field supplied and installed by others, dry contact switch is closed. (Remote switch is optional).

6.1.4. Airflow System:

- The exhaust air enters the top of the integrated ERV whenever the exhaust air fan is operational. If the Vertical Stack chassis main supply fan is off, air from the washroom exhaust fan (by others) bypasses the ERV core and is expelled outside. If the Vertical Stack main supply fan is on then the exhaust bypass damper closes forcing exhaust air to pass through the integrated ERV core which is then expelled outside. The ERV fresh air fan draws outside air into the integrated ERV core and heat and moisture (from the exhaust air) is passed through to the fresh air.

- The fresh air is released inside the Vertical Stack unit cabinet where the main supply fan draws it into the chassis and distributes it to the space.

- In the unlikely event of frost build up on the ERV core, a fresh air discharge air temperature sensor will momentarily stop the fresh air fan unit the air returns to the normal limit.

6.1.5. Model selection and performance shall be in accordance with the schedule on the drawings. The InnKeeper (008-018) Integrated ERV is designed to exhaust 50 CFM (23 L/s) of air at an ESP of 0.25" (62 Pa) W.C.

6.1.6. The HomeKeeper (016-036) Integrated ERV is designed to exhaust 100 CFM (47 L/s) of air at an ESP of 0.25" (62 Pa) W.C.

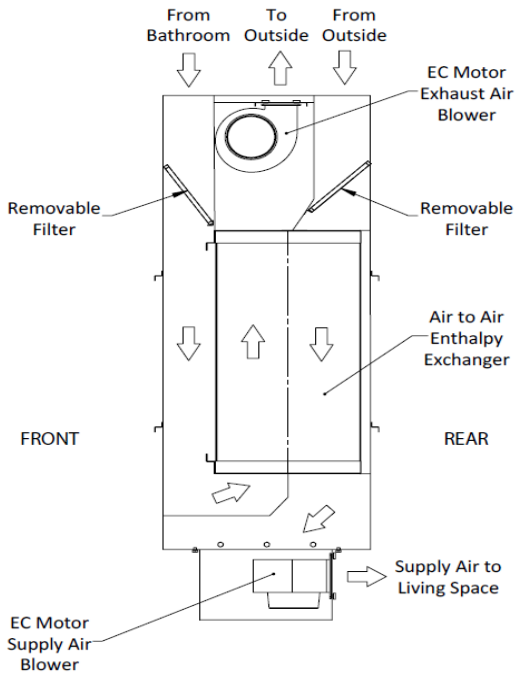
6.1.7. Each ERV shall be run tested to verify proper operation.

6.1.8. The Integrated ERV/Chassis assembly shall be safety certified and bear a seal of approval from one of UL/ULC/ETL or ESA.

6.1.9. Manufacturer shall warrant the parts only of each unit for a period of 12 months from the start-up date or 18 months from the unit shipment date whichever occurs first.

6.1.10. The system shall never be used during the construction phase as fine dust can permeate the ERV core resulting in loss or performance, or failure.

6.1.11. Alternate proposals shall include consideration for equipment space requirements accessibility, pipe and equipment sizing electrical installation impact, operation costs, sound implications and redesign fees.



6.2 Cabinet

6.2.1. The Integrated ERV Cabinet shall be constructed from heavy gauge galvanized steel and has internal channels to direct air from the exhaust and fresh air through the ERV core.

6.2.2. The cabinet incorporates a bypass damper to allow exhaust air to exit the building if the ERV exhaust fan is off.

6.3 ERV Fan Box

6.3.1. The Integrated ERV fan box shall be fabricated from heavy gauge galvanized steel.

6.3.2. The ERV Fan Box connected electrically to the vertical stacked chassis via a two-piece pin and socket interconnection. Connection by others.

6.4 ERV Core

6.4.1. The ERV Core consist of a membrane constructed from a composite polymer material that allows heat and water vapor to transfer from one air stream to the other while preventing cross contamination.

6.4.2. The core shall be encased in a heavy gauge galvanized steel shell and all exterior shell sides are insulated with 1/4" neoprene insulation.

6.4.3. The openings of the core shall be treated with a gasket to ensure tight seal with the air stream channels in the cabinet.

6. 5 Blower and Motor

6.5.1. The ERV fresh air and exhaust air blowers shall be statically and dynamically balanced.

6.5.2. The complete blower section including motor shall be easily accessible and removable for service.

6.5.3. The blower motors shall be direct drive EC motor, single phase with integral thermal overload protection.

6.5.4. The blower wheels shall be a forward curbed, SWSI centrifugal blower.

6.5.5. The fresh air and exhaust air fans speeds are controlled by a single fan speed controller that is adjustable in the field.

6.6 Filter

6.6.1. Both the exhaust and supply air stream entering the ERV core is filtered.

6.6.2. The filters shall be a cleanable wire frame type and easily accessible. They are shipped with the ERV fan box.

6.7 System

6.7.1. The ERV unit shall be controlled by the Vertical Stack unit chassis. The Vertical Stack main supply fan must be operating in order for the ERV apparatus to operate. Other sequence of operations are available as options.

6.7.2. ERV fans will be enabled to operate:

- On a call for heating from the Thermostat
- On a call for cooling from the thermostat
- When thermostat fan selector switch is Placed in the "ON" mode
- When a field mounted remote control Switch, by others is closed (wired by others, for 120 volt by others).

6.7.3. The ERV fan box is powered by line voltage supplied from the Vertical Stack unit chassis.

6.7.4. The defrost sensor will detect a frost build up on the heat exchanger based on temperature and will terminate the operation of the fresh air fan until the temperature restores to normal limits (above 45°F).