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# Installation, Operation, & Maintenance Manual

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## KlassKeeper Heat Pump



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KlassKeeper  
Models: KKV024 – KKV048

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## INFORMATION

### Handling

Care must be taken in handling the cabinet, chassis, built in ERV and other accessories to ensure that this equipment does not sustain any damage.

The protective shipping packaging should be kept on until unit is ready for installation. During construction, the equipment must be sheltered from contaminants and debris such as drywall dust, wood chips, or paint as these may damage the fan, or block the cooling / heating coil and diminish unit performance.

### Storage

The unit must, at all times, be stored in an upright position with the compressor section at the bottom and the fan section oriented up.

Failure to maintain the chassis in an upright position may result in permanent damage to the unit. Dropping the chassis or exposing it to extreme shock or vibration may also result in permanent damage to the interior components and piping.

Both the chassis and cabinet should be stored in a non-corrosive environment sheltered from conditions of extreme temperature or humidity. Subjecting the unit to conditions of this nature may result in significantly reduced performance, reliability, and operational life.

The unit is intended for interior use only and should be stored indoors at all times to protect it from the elements and to help eliminate the potential growth of indoor air quality (IAQ) contaminants.

If indoor storage is not possible, the equipment may be stored outdoors during the summer months only, if the following provisions are met:

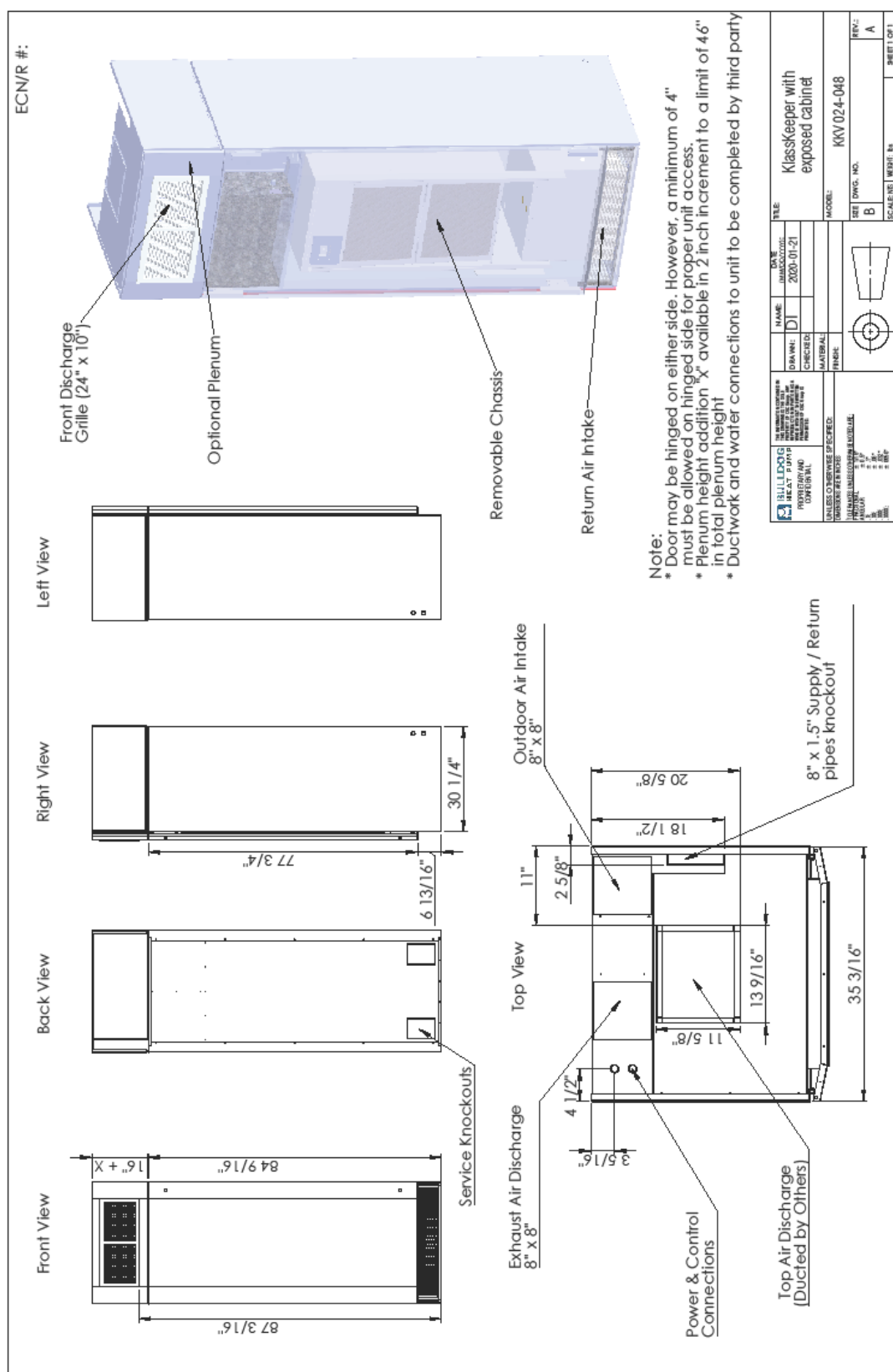
1. The equipment must be placed on a dry surface, or raised off the ground in a manner which allows for air-circulation beneath the unit.
2. A waterproof tarp must be used to cover the equipment in order to provide protection from the elements.
3. Continuous ventilation to the units must be provided to help prevent moisture accumulation on the interior and exterior surfaces. Moisture buildup on, or within the unit's insulation may result in microbial growth that can lead to odors and serious health-related IAQ problems.
4. The chassis must be stored in their original packaging.
5. The individual units shall not be stacked on top of one another.
6. If the unit was previously in use, ensure that all water in the coil has been blown out and that all hose connections are plugged during storage.

### Weight

Model	KKV024	KKV030	KKV036	KKV042	KKV048
Chassis Weight (lbs)	280	280	280	300	300
Cabinet Weight (lbs)	480				
Standard Plenum Weight (lbs)	60				



### Unit Dimensions



Last saved on: January 21, 2020; in the interest of continuous improvement, drawing subject to change without notice.



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Last Revised April 2020

**No other heat pump does more, with less.**

**Installation, Operation, and Maintenance Manual is Subject to Change without Notice.**

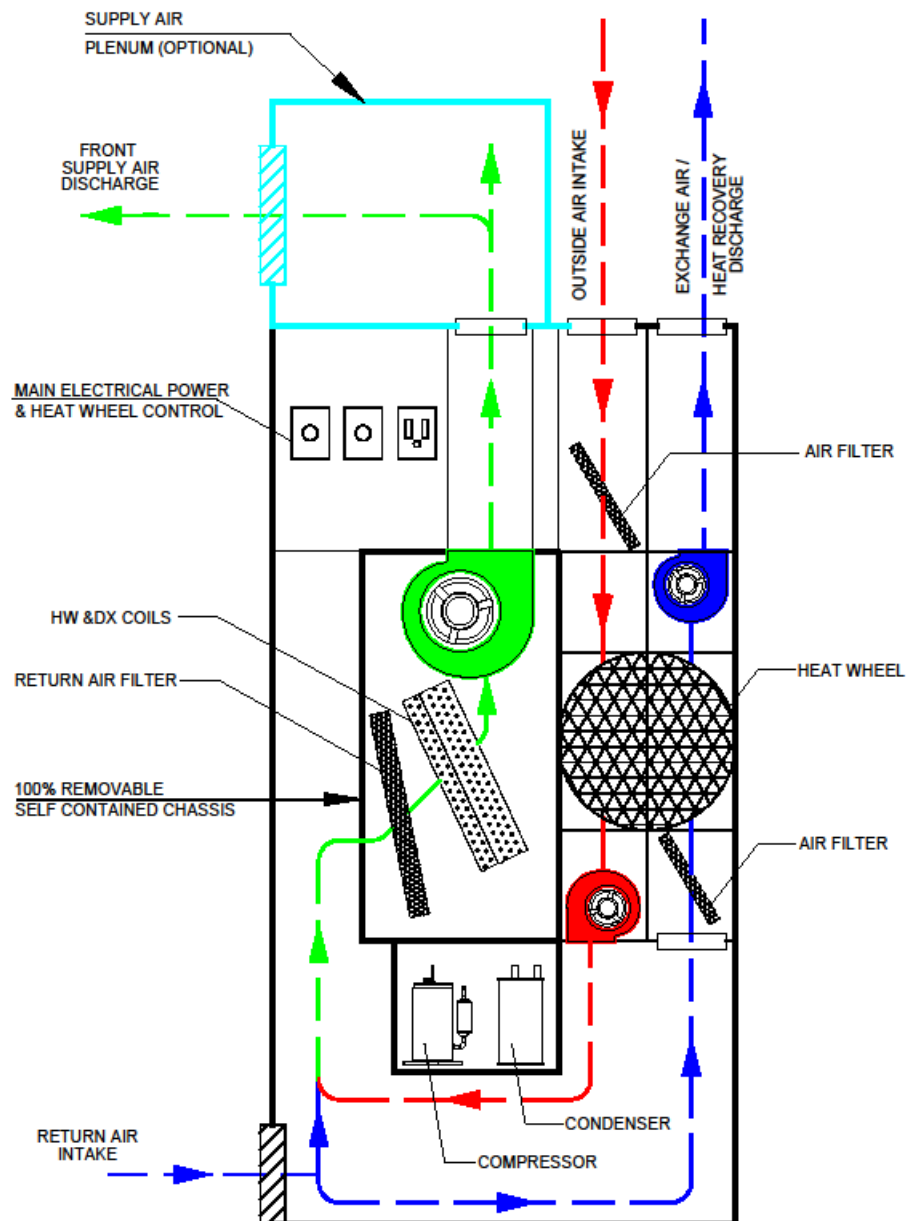
### Refrigerant Charge

Model	KKV024	KKV030	KKV036	KKV042	KKV048
R410A Charge (oz.)	40	45	50	60	Consult factory

### Unit Clearances

Clearances for the KlassKeeper units shall be provided such that the access panel swinging door opens and closes without obstruction to allow service access to the filters, the unit disconnect, fans and fan motors, and unit chassis.

In the event of chassis replacement, the front service entrance must permit straight horizontal removal of the chassis. The return air path must be unobstructed during operation.



## INSTALLATION

The Installation of KlassKeeper units and accessories must be in accordance with all local codes and regulations of all relevant governing authorities having jurisdiction. The following installation procedures are recommended by the Manufacturer.

**It is the responsibility of the installing contractor to comply with all applicable codes and regulations. It is the responsibility of the installing contractor to ensure adequate service clearance for regular maintenance or for repair in place, is exercised. The installing contractor will be responsible for removing the unit if it is not repairable in place.**

### *Delivery and General Installation Checklist*

The information below details the correct installation procedure for a KlassKeeper unit. Please read this document in its entirety prior to proceeding with unit installation. Specific site conditions may warrant variations in locations and dimensions.

1. Remove packaging and inspect the unit. Check for shipping damage or material shortage; file a freight claim and notify your sales representative if damage or deficiency is found.
2. Verify the correct model and voltage as indicated by the model number.
3. Verify the installation location of the unit.
4. Verify that the power supply complies with the nameplate specification.
5. Connect properly sized and protected power supply wiring to the disconnect in the cabinet.
6. Install proper grounding wires to an earth ground on the cabinet as well as the receptacle.

### *Location*

Locate the unit in an indoor area. The indoor air temperature surrounding and being supplied to the unit must, at all times, be above 45F (7C). Do not locate the unit in areas subject to freezing.

### *Cabinet Placement*

1. Ensure that there is sufficient clearance in front of the unit to allow the swinging access door to open freely. A minimum of 5 feet shall be left unoccupied in front of the unit at the same width as the unit.
2. Plenum (when ordered) is factory assembled and shipped loose for field installation by others. Plenum is mounted on the cabinet's top.



### *Dry Walling (when required)*

It is permissible to glue or screw drywall directly to the side of the cabinet. Please note that the drywall screw must not be longer than the drywall thickness plus a maximum 3/8".

Ensure drywall is not obstructing the swinging access door.

### *Piping*

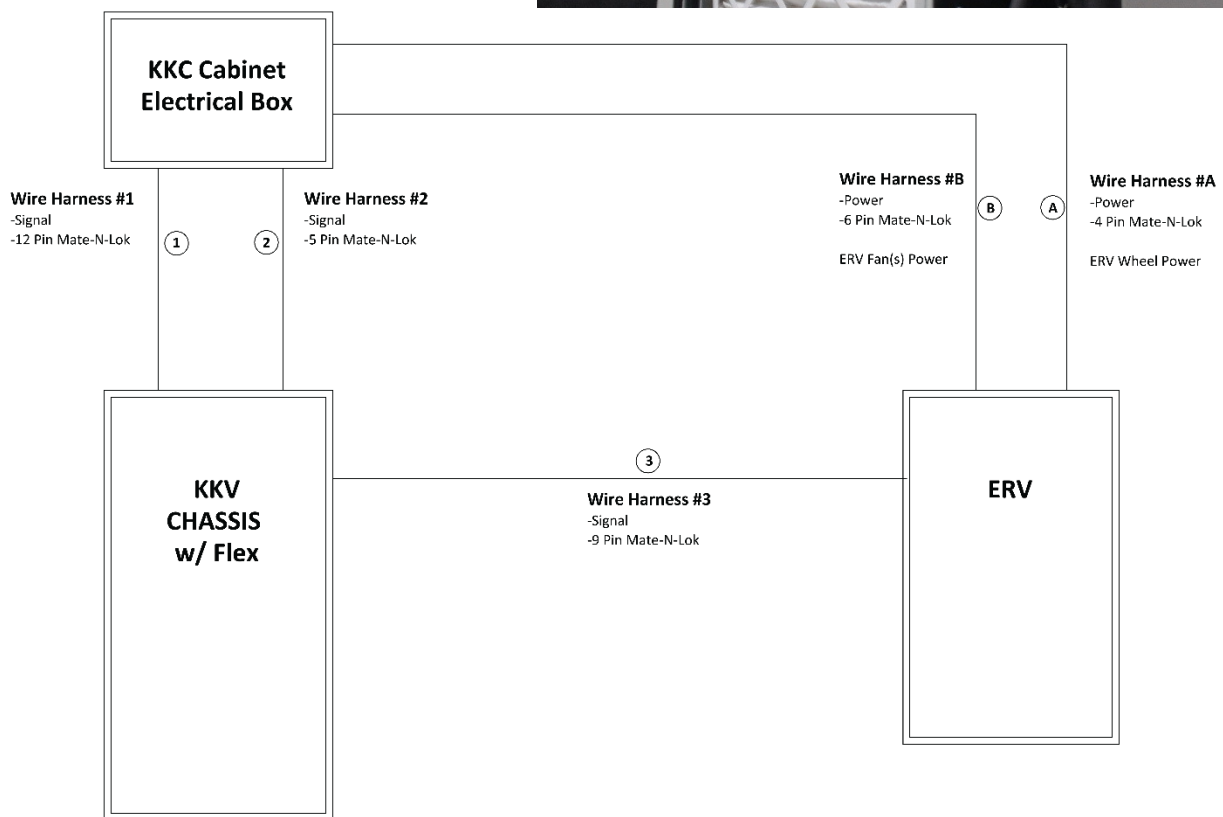
**CAUTION: Piping must comply with all applicable codes and regulations.**

1. Run supply, return and condensate pipe inside the cabinet through the top knockouts
2. Install isolation valves to permit unit removal for servicing.
3. DO NOT bend or kink supply lines or hoses (If supplied). Supply and return hoses are fitted with swivel joint fittings at one end to allow removal for future servicing.



## Wiring

1. Connect the wire harnesses between the chassis, ERV and cabinet as per the below diagram.
2. Connect the power plug to the receptacle in the cabinet.



Wire Harness	Type	Harness Length	Harness Pin #	I/O
1	Signal	42"	12	DI 1-5, AN1, AN3, K7
2	Signal	42"	5	K5, K8, spare
3	Signal	18"	9	TH4-TH7
A	Power	42"	4	ERV Power
B	Power	42"	6	Fan(s) Power



## OPERATION

### *Inputs & Outputs*

The KlassKeeper can be completely controlled by a BAS without a third party controller or a thermostat. Modbus RTU is standard. BACnet gateway is optional.

The controller within the KlassKeeper heat pump controls the operation of the unit and has several sets of inputs and outputs, both digital and analog. Their assignments are outlined below:

#### Digital Inputs

- DI1 = Heat Call
- DI2 = Cool Stage 1
- DI3 = Cool Stage 2
- DI4 = Fan Call
- DI5 = ERV Call
- DI6 = High Pressure Switch
- DI7 = Low Pressure Switch
- DI8 = Condensate Detector

Note: Inputs DI1 - DI5 are connected to dry-contacts on the third party controller or thermostat.

#### Analog Inputs

- TH1 = Discharge Air Temperature – “TA”
- TH2 = Refrigerant Temperature – “TR”
- TH3 = Leaving Water Temperature – “TW”
- TH4 = Exhaust Entering Air Temperature on ERV – “EX-EAT”
- TH5 = Exhaust Leaving Air Temperature on ERV – “EX-LAT”
- TH6 = Fresh Air Entering Temperature on ERV – “FRSH-EAT”
- TH7 = Fresh Air Leaving Temperature on ERV – “FRSH-LAT”
- TH8 = Mixed Air Temperature (Space Return + Fresh Air Leaving) – “MIX-AT”

Note: All temperatures are measured using 10K $\Omega$  Type II thermistors.

#### Digital Outputs

- K1 = Compressor Stage 2
- K2 = Compressor Stage 1
- K3 = Main Fan - Low Speed
- K4 = Main Fan - High speed
- K5 = ERV Fan
- K6 = Cooling Valve
- K7 = General Alarm Contact
- K8 = ERV Heat wheel

Note: Outputs K2, and K7 are dry-contacts; K1, K3, K4, K5, K6, and K8 provide 24VAC.

#### Analog Outputs

- AN1 = Alarm Flash Code Status Indicator (0-10VDC)
- AN2 = Modulating Heat Valve (0-10VDC).
- AN3 = DAT Setpoint Signal (0-10VDC). It scales DAT setpoint setting on screen to 0-10VDC where 0V= 50°F and 10V = 100°F



## Operating Modes

The KlassKeeper heat pump has several modes of operation including: heating, cooling (first stage), cooling (second stage), and fan. The unit is also equipped with an energy recovery ventilator (ERV). Each of these modes of operation is invoked by closing the associated digital input on the internal unit controller or via BAS, third party controller or thermostat.

### Heating

In order to put the unit into heating mode, contact DI1 on the unit controller must be closed through a dry contact on the thermostat or the unit-mounted third party controller by others or BAS. This will first activate the main fan in low-speed, followed by high-speed if the heat call remains in place for 10 minutes or more. A modulating heat valve that controls the flow of hot water through the unit's heating coil is opened 100% whenever a heat call is in place.

### Cooling

In order to put the unit into cooling mode, contact DI2 on the unit controller must be closed through a dry contact on the thermostat or the unit-mounted third party controller by others. This will activate the fan in high speed, and will also start the first stage of the compressor for cooling. A cooling valve that directs water to the condenser will also be opened whenever there is a cool call in place.

To bring on the second stage of cooling, contact DI3 on the unit controller must be closed through a dry contact on the unit mounted third party controller by others. In order for second stage cooling to commence, first stage cooling must first be activated.

Note that each compressor stage has a minimum off-time of one minute between calls. There is no minimum on-time.

During cooling operation, if the fresh air entering temperature (FRSH-EAT) is cooler than the exhaust entering air temperature (EX-EAT) by 5°F or more, the heat wheel will be deactivated to allow “free cooling” to take place.

### Fan

The main fan can be activated in low speed at any time by closing contact DI4 on the unit controller through a dry contact on the unit mounted third party controller by others. If there is a heat or cool call in place, the operation of the fan is automatic.

### Energy Recovery Ventilator (ERV)

The KlassKeeper heat pump is equipped with an energy recovery ventilator that brings in fresh outside air, while simultaneously exhausting indoor air. A heat wheel is used to pre-condition the incoming fresh air, by recovering/rejecting heat from/to the outgoing exhaust air.

To activate the ERV function, digital input DI5 on the unit controller must be closed through a dry-contact on the unit-mounted third party controller by others. This will activate both the ERV fan as well as the main fan (in low speed), while also energizing the heat wheel. The hot water valve modulates to maintain the discharge air temperature of 72°F (adjustable on the display or BAS)



During ERV operation, if the fresh air leaving temperature (FRSH-LAT) drops below 40°F, both the heat wheel and ERV fan will be de-energized and an alarm will be activated. This condition may be an indication of a heat wheel malfunction.

## Alarms

The KlassKeeper heat pump is monitored during its operation for correct performance. In the event that a potentially damaging or harmful situation is encountered, the unit will be deactivated and an alarm will be generated.

### General Alarm Contact – K7

Digital output relay K7 is a dry-contact that is energized whenever an alarm is currently in place. Once the alarm condition has been alleviated, this alarm contact will be de-energized.

### Alarm LED – Flashcode

The Flex controller has a multi-colored Alarm LED that is used to communicate the previous alarm (if any) through the use of flashcodes. If there have been no alarms, this LED will be green. If an alarm has occurred, this LED will flash red. The flashcodes are listed below:

- Green = OK, no alarms have occurred since reset.
- 1 = Low Discharge Air Temperature
- 2 = Low Refrigerant Temperature
- 3 = Low Water Temperature
- 4 = High Water Temperature
- 5 = Low Refrigerant Pressure
- 6 = High Refrigerant Pressure
- 7 = Heatwheel Malfunction
- 8 = Condensate Alarm
- 10 = System Lockout

### Alarm Output (0-10VDC)

Analog Output 1 (AN1) will also output a voltage between 0-10VDC (+/- 0.2VDC) which serves as an indicator of previous alarms (if any). The output voltages associated with each alarm are outlined below:

- 0 VDC = OK, no alarms have occurred since reset.
- 1 VDC = Low Discharge Air Temperature
- 2 VDC = Low Refrigerant Temperature
- 3 VDC = Low Water Temperature
- 4 VDC = High Water Temperature
- 5 VDC = Low Refrigerant Pressure
- 6 VDC = High Refrigerant Pressure
- 7 VDC = Heatwheel Malfunction
- 8 VDC = Condensate Alarm
- 10 VDC = System Lockout



### Low Discharge Air Temperature

If at any point the discharge air temperature (TA) drops below 40°F, the compressors will be turned off, the general alarm contact (K7) will be energized, a flashcode of 1 will be displayed, and the alarm output (AN1) will produce 1 VDC.

### Low Refrigerant Temperature

If at any point the refrigerant temperature (TR) drops below 35°F, the compressors will be turned off, the general alarm contact (K7) will be energized, a flashcode of 2 will be displayed, and the alarm output (AN1) will produce 2 VDC.

### Low Water Temperature

If at any point the water temperature (TW) drops below 60°F, the compressors will be turned off, the general alarm contact (K7) will be energized, a flashcode of 3 will be displayed, and the alarm output (AN1) will produce 3 VDC.

### High Water Temperature

If at any point the water temperature (TW) rises above 140°F, the compressors will be turned off, the general alarm contact (K7) will be energized, a flashcode of 4 will be displayed, and the alarm output (AN1) will produce 4 VDC.

### Low Refrigerant Pressure

If the low pressure switch opens after the compressor has been running for three minutes, a low pressure alarm will be activated, the compressor will be turned off, the general alarm contact (K7) will be energized, a flashcode of 5 will be displayed, and the alarm output (AN1) will produce 5 VDC.

A low pressure alarm will also be activated if the low pressure switch opens without the compressor running.

### High Refrigerant Pressure

If the high pressure switch opens at any time, the compressors will be turned off, the general alarm contact (K7) will be energized, a flashcode of 6 will be displayed, and the alarm output (AN1) will produce 6 VDC.

### Heat Wheel Malfunction

During ERV operation, if the fresh air leaving temperature (FRSH-LAT) drops below 40°F, both the heat wheel and ERV fan will be de-energized and an alarm will be activated. The general alarm contact (K7) will be energized, a flashcode of 7 will be displayed, and the alarm output (AN1) will produce 7 VDC.

### Condensate Overflow

If there is water accumulated in the drain an alarm will be activated. The general alarm contact (K7) will be energized, a flashcode of 8 will be displayed, and the alarm output (AN1) will produce 8 VDC.

The fan should stop for 30 seconds to refill the condensate trap.

### System Lockout

If there are three low pressure alarms or three high pressure alarms in a 24-hour period, the system will go into a hard lockout.

If either the high pressure switch or the low pressure switch remains open for 10 minutes, the system will also go into a hard lockout.



When the system is locked out, all of the output relays will be de-energized except for the general alarm contact (K7) which will be energized. A flashcode of 10 will be displayed, and the alarm output (AN1) will produce 10 VDC. In order to clear a system lockout, power must be cycled to the KlassKeeper unit.

### *LCD Display Module*

Within the electrical compartment of the KlassKeeper heat pump, there is a LCD display module that provides information about the unit's operation. The first button on the left allows the user to scroll through three separate screens.

#### Screen 1:

This screen provides information on the alarm status of the unit. Both the current alarm (if active) and the previous alarm is displayed.

#### Screen 2:

This screen provides the current temperature readings of the various sensors within the unit. Please refer to "Analogue Inputs" section for more details. The temperatures are updated every 10 seconds.

#### Screen 3:

This screen provides the open/closed status of the digital inputs on the controller. Please refer to "Digital Inputs" section for further details. A "1" signifies a closed input, while a "0" signifies an open input.

#### Screen 4:

This screen provides the discharge air temperature setpoint (DAT SP) which is adjustable using 'UP' and 'DOWN' button.



## COMMISSION & STARTUP

### **CAUTION:**

**To avoid fouled machinery, extensive unit clean up and void warranty, do not operate units without filters in place or use as a temporary heat source during construction.**

The Bulldog KlassKeeper Heat Pump provides year round cooling and heating as controlled by unit thermostat or by a direct digital controller.

It provides cooling using a water-cooled refrigeration circuit and provides heating using a hydronic coil. The compressor operates during cooling operation only and does not operate during heating operation thereby providing quieter operating sound levels and energy cost savings. The heat recovery module adds additional energy savings by transferring energy from the exhaust air to the supply air stream.

Central heat injection and rejection equipment is automatically controlled via a CGC control panel (or equivalent) to provide the required loop water temperature for correct KlassKeeper Bulldog Heat Pump units operation.

### *System Flushing*

Proper system cleaning and flushing is an important aspect of the commissioning and start up procedure for KlassKeeper Units. Ensure the system has been flushed properly. This prevents fouling of the unit heat exchangers.

NOTE: Hydronic coils are not 100% drainable.

### *System Fluid*

Ensure that system water temperature is within an acceptable range to facilitate start-up (80-120F) for cooling and (100F – 140F) for heating

### *System Water pH*

System water should have a neutral pH balance of approximately 7.5, which will extend the life of the hoses, heat exchangers, and other water side accessories.

### *Water Flow Rate*

Open all isolation valves to the unit. Ensure that the entering and leaving fluid temperatures of the unit in operation are acceptable. Typically there is an 8-15°F (4.4-8.3°C) drop in heating and 10-15°F (5.5-8.3°C) rise in cooling. Under extreme conditions, slight variances in the temperature may be noted.



### *Water System Freeze Protection*

Ensure that freeze protection is provided for the outdoor portion of the water loop system. Inadequate freeze protection can lead to coil damage.

NOTE: A potential situation may occur during construction where the system fluid loop is drained after being cleaned, flushed and tested. KlassKeeper unit will not completely drain and may hold fluid in the condenser or the heating coil. Extensive damage may result to internal components if the system fluid freezes – an adequate glycol concentration must be added if a possibility of freezing exists.

### *Remove Air from System fluid Loop*

Air in the system impairs unit operation and can cause erosion in the system piping.

### *Air Balancing*

Air balancing of the system should be performed while the unit's fan is operating at high-speed. In order to ensure the fan is operating at high-speed, the unit must be placed into cool mode.

### *Clean Unit Filters*

Check to ensure the unit filters are clean: each KlassKeeper unit is equipped with three filters – a pleated supply air filter and a wire-frame fresh and return air filters. This contributes to the proper operation of the unit by ensuring adequate air flow across the coil. For wire-frame filter only, a vacuum may be used to remove any debris or dirt.

**SAFETY NOTE: In the following part of the procedure it will be necessary to access the areas around the electrical wiring and the circuit board. Do not adjust or remove any board connections or wiring connections to other components without first powering down the unit. Disconnects are usually within reach of the unit. Exercise caution at all times.**

### *Fan Rotation:*

Inspect all fans (circulating, outside air supply and exhaust air fans) in the unit to ensure they are clean of any debris and rotate freely.

NOTE: This equipment is designed for indoor installation ONLY.

### *Start-up:*

To register the unit warranty proper start-up is required by a factory approved technician. The following items must be recorded and returned to the factory to register the warranty. The factory reserves the right to refuse warranty if these details are not provided.



**Start Up Record**

Page \_\_\_\_\_

Project: \_\_\_\_\_ Date: \_\_\_\_\_ Tech: \_\_\_\_\_

Location _____	<b>H</b> EWT _____	<b>C</b> EWT _____	Fan Amps _____
Model No. _____	<b>E</b> EAT _____	<b>O</b> LWT _____	Compr Amps _____
Serial No. _____	<b>A</b> LAT _____	<b>O</b> EAT _____	Cond.Trap _____
Voltage _____	<b>T</b> Valve <input type="checkbox"/>	<b>L</b> LAT _____	S/R Correct <input type="checkbox"/>
Remarks	Sight Glass <input type="checkbox"/> Fan Rotation <input type="checkbox"/> Belt Tension <input type="checkbox"/> Comp Rotation <input type="checkbox"/>		

S/R = Supply and Return

Location _____	<b>H</b> EWT _____	<b>C</b> EWT _____	Fan Amps _____
Model No. _____	<b>E</b> EAT _____	<b>O</b> LWT _____	Compr Amps _____
Serial No. _____	<b>A</b> LAT _____	<b>O</b> EAT _____	Cond.Trap _____
Voltage _____	<b>T</b> Valve <input type="checkbox"/>	<b>L</b> LAT _____	S/R Correct <input type="checkbox"/>
Remarks	Sight Glass <input type="checkbox"/> Fan Rotation <input type="checkbox"/> Belt Tension <input type="checkbox"/> Comp Rotation <input type="checkbox"/>		

S/R = Supply and Return

Location _____	<b>H</b> EWT _____	<b>C</b> EWT _____	Fan Amps _____
Model No. _____	<b>E</b> EAT _____	<b>O</b> LWT _____	Compr Amps _____
Serial No. _____	<b>A</b> LAT _____	<b>O</b> EAT _____	Cond.Trap _____
Voltage _____	<b>T</b> Valve <input type="checkbox"/>	<b>L</b> LAT _____	S/R Correct <input type="checkbox"/>
Remarks	Sight Glass <input type="checkbox"/> Fan Rotation <input type="checkbox"/> Belt Tension <input type="checkbox"/> Comp Rotation <input type="checkbox"/>		

S/R = Supply and Return

**Operational Expectations**

The BULLDOG KlassKeeper Heat Pump is designed to provide reliable heating and cooling right out of the box. However, transportation and handling damage, service valve leakage, or system problems may cause less than optimum operation. In the event that the qualified commissioning agents suspect there is an operational problem with the heat pump, they need to inform the factory immediately for direction. In certain instances, the factory may request a manifold refrigeration gauge be attached to the heat pump along with thermo-couples to determine the operating parameters of high and low pressure, and super heat and sub cooling. Based on this information the factory may request the charge be adjusted or the refrigeration components be adjusted to optimize cooling operation.



## MAINTENANCE

### **WARNING:**

**To prevent injury or death due to electrical shock or contact with moving parts, disable the unit using the electrical disconnect before servicing.**

### *Inspect Filters*

Establish a regular maintenance schedule. Clean filters frequently and replace as needed.

#### Supply air filter removal:

To remove the supply filter from the unit lift the filter up, pull the bottom towards self, and pull the filter down and out of the unit. Replace the old filter by sliding the top edge of a new filter up into the rack, then pushing in the bottom of the filter away from self and drop it into place.

#### ERV Return air filter removal:

To remove the fresh air filter unscrew the corresponding access panel on the left of the cabinet and slide the filter out. Slide a new filter into place; make certain the arrow on the filter is pointing in the direction of the airflow.

#### ERV Fresh air filter removal:

To remove the fresh air filter unscrew the corresponding access panel of the cabinet and slide the filter out. Slide a new filter into place; make certain the arrow on the filter is pointing in the direction of the airflow.

### *Check Fan motors annually*

Make sure to inspect fan motors for unusual signs of wear. All BULLDOG KlassKeeper Heat Pump fan motors are permanently lubricated when shipped from the factory. Do not oil the fan motors.

### *Visual Inspection*

Visually inspect units and give special attention to hose assemblies. Note any signs of deterioration or cracking and repair leaks immediately.

### *Amperage Check on compressor and fan motor*

Current draw on this equipment should not exceed normal full load or rated load amps by more than 10 percent of the values noted on the unit nameplate.



### *Safety Control Reset*

All BULLDOG Heat Pump Systems include high and low pressure switches to prevent the machine from operating under abnormal conditions of temperature or water flow. If multiple pressure alarms occur in 24 hours, the compressor operation will be permanently locked out until the unit is reset, or power is disconnected for 20 seconds.

NOTE: If the heat pump must be reset more than twice, check the unit for a dirty air filter, abnormal entering water temperature, inadequate water flow (delta T method), or internal malfunctions that may be causing high or low pressure conditions. If the unit continues to alarm, contact a trained service technician and ensure the problems are resolved before re-setting the unit again.

$\Delta T$  Method: The normal water temperature differential for a BULLDOG Heat Pump is 8-15°F (4.4-8.3°C) in heating and 10-15°F (5.5-8.3°C) in cooling.

### *Drain Pan and Condensate Hose*

Make sure to inspect and clean if necessary, the condensate hose and drain pan on a regular basis.

