GBA
GEOTHERMAL HEAT PUMP
WITH PURON ADVANCE™ (R-454B) REFRIGERANT
Sizes 18, 24, 30, 36, 42, 48, 60

Installation Instructions

NOTE: Read the entire instruction manual before starting the installation.

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SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and current editions of the National Electrical Code (NEC) NFPA 70. In Canada, refer to current editions of the Canadian electrical code CSA 22.1.

Recognize safety information. This is the safety-alert symbol When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies hazards which could result in personal injury or death. CAUTION is used to identify unsafe practices which would result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.

⚠ WARNING

EXPLOSION HAZARD

Failure to follow this warning could result in death, serious personal injury, and/or property damage.

Never use air or gases containing oxygen for leak testing or operating refrigerant compressors. Pressurized mixtures of air or gases containing oxygen can lead to an explosion.

⚠ WARNING

Refrigerant Safety Group A2L

FIRE HAZARD

Failure to follow this warning could result in personal injury, property damage and/or equipment damage.

- Risk of fire. Flammable refrigerant used.
- To be repaired only by trained service personnel. Do not puncture refrigerant tubing.
- Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.
- Dispose of refrigerant properly in accordance with federal or local regulations.
- Failure to follow proper R-454B mitigation system installation instructions can result in property damage, personal injury, or death. If any fault codes are listed, please troubleshoot to prevent system malfunction.
- Do not use means to accelerate the defrosting process or to clean, unless recommended in these instructions.
- The appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater).
- Do not pierce or burn refrigerant lines.
- Be aware that refrigerants may not contain an odor.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could result in personal injury or equipment damage.

Puron® Advance (R-454B) refrigerant systems are not compatible with any other refrigerants. Do not use Puron® (R-410A) to service equipment or components on Puron® Advance (R-454B) refrigerant equipment.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

INSTALLATION RECOMENDATIONS

The GBAWater-to-Air Heat Pumps are performance certified to American Heating and Refrigeration Institute (AHRI) ISO Standard 13256-1. All GBA water-to-air heat pumps are certified to UL60335-2-40 Standard. The Water-to-Air Heat Pumps are designed to operate with entering fluid temperature between 20°F to 80°F in the heating mode and between 45°F to 110°F in the cooling mode.

Safety devices are built into each unit to provide the maximum system protection possible when properly installed and maintained.

IMPORTANT: 50° Min. EWT (entering water temperature) for well water applications with sufficient water flow to prevent freezing. Antifreeze solution is required for all closed loop applications. Earth Coupled (Geothermal) applications should have sufficient antifreeze solution to protect against extreme conditions and equipment failure. **Frozen water coils are not covered under warranty.**

IMPORTANT: This product should not be used for temporarily heating or cooling during construction. Doing so may effect the unit's warranty.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Discharge air configuration change is not possible on Heat Pumps equipped with Electric Heat Option.

Check Equipment and Job Site

Moving and Storage

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area. Units must only be stored or moved in the normal upright position as indicated by the "UP" arrows on each carton at all times.

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

If unit stacking is required for storage, stack units as follows:

Do not stack units larger than 6 tons!

Vertical units: less than 6 tons, no more than two high. Horizontals units: less than 6 tons, no more than three high.

Inspect Equipment

Be certain to inspect all cartons or crates on each unit as received at the job site before signing the freight bill. Verify that all items have been received and that there are no visible damages; note any shortages or damages on all copies of the freight bill. In the event of damage or shortage, remember that the purchaser is responsible for filing the necessary claims with the carrier. Concealed damages not discovered until after removing the units from the packaging must be reported to the carrier within 24 hours of receipt.

Location / Clearance

Locate the unit in an indoor area that allows easy removal of the filter and access panels, and has enough room for service personnel to perform maintenance or repair. Provide sufficient room to make fluid, electrical, and duct connection(s). If the unit is located in a confined space such as a closet, provisions must be made for return air to freely enter the space. On horizontal units, allow adequate room below the unit for a condensate drain trap and do not locate the unit above supply piping.

⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in equipment damage and/or improper equipment operation.

It is extremely important to take the proper precautions to insure that the heat pump unit is installed in the proper location and that measures have been taken to prevent rupturing the water coil due to freezing conditions.

Frozen water coils are not covered under the limited product warranty.

Operating Limits

Environment

This equipment is designed for indoor installation only. Extreme variations in temperature, humidity and corrosive water or air will adversely affect the unit performance, reliability and service life.

NOTE: Two factors determine the operating limits of a unit: entering-air temperature and water temperature. Whenever any of these factors are at a minimum or maximum level, the other two factors must be at a normal level to ensure proper unit operation (see Tables 26-37).

POWER SUPPLY

A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

UNIT STARTING CONDITIONS

Depending on the model, units should start and operate with entering water temperature temperatures between 20 and 110°F and entering air temperatures between 45°F and 95°F. Water flow rates should be between 1.5 and 3.0 GPM/nominal cooling ton.

NOTE: These operating limits are not normal or continuous operating conditions. Assume that such a start-up is for the purpose of bringing the building space up to occupancy temperature. See Table 1 for operating limits.

Table 1 – Operating Limits

FLUID TYPE	LIMIT		COOLING	HEATING
AIR	Minimum Ambient (F)		50	40
	Maximum Ambient (F)		100	85
	Rated Ambient (F)		80	68
	Minimum Entering (F db/wb)		65/57	45
	Maximum Entering (F db/wb)		95/85	80
	Rated Entering (F)		80/67	68/57
LIQUID	Minimum Entering (F)		45	20
	Max Entering (F)		110	80
	Typical Entering Range (°F)	Water Loop	-	-
		Ground Loop	50-80	25-50
		Ground Water	50-70	40-60
	Rated Entering (°F)	Water Loop	86	68
		Ground Loop	77	32
		Ground Water	59	50
	Anti-Freeze Requirement (LWT / EWT F)		<40 / <50	
	Maximum operating water pressure (PSI/kPa)		400 psi/2,758 kPa (Standard unit) 300 psi/2,068 kPa (with water valve option)	
	Minimum operating Flow Rate (GPM/Ton)		1.5	

LEGEND
DB = Dry Bulb
EWT = Entering Water Temperature
LWT = Leaving Water Temperature
WB = Wet Bulb

Application Considerations

Earth Coupled Geothermal Systems

Closed loop and pond applications require specialized design knowledge. No attempt at these installations should be made unless the dealer has received specialized training.

Anti-freeze solutions are utilized when low evaporating conditions are expected to occur. Refer to the Flow Center installation manuals for more specific instructions. (See Fig. 1)

If the unit will be installed in a new installation, which includes new duct work, the installation should be designed using current Air Conditioning Contractors of America (ACCA), North American Technician Excellence (NATE), or other applicable standards. It is recommend that design and installation of the ground loop be per International Ground Loop Heat Pump (IGSPHA) standards.

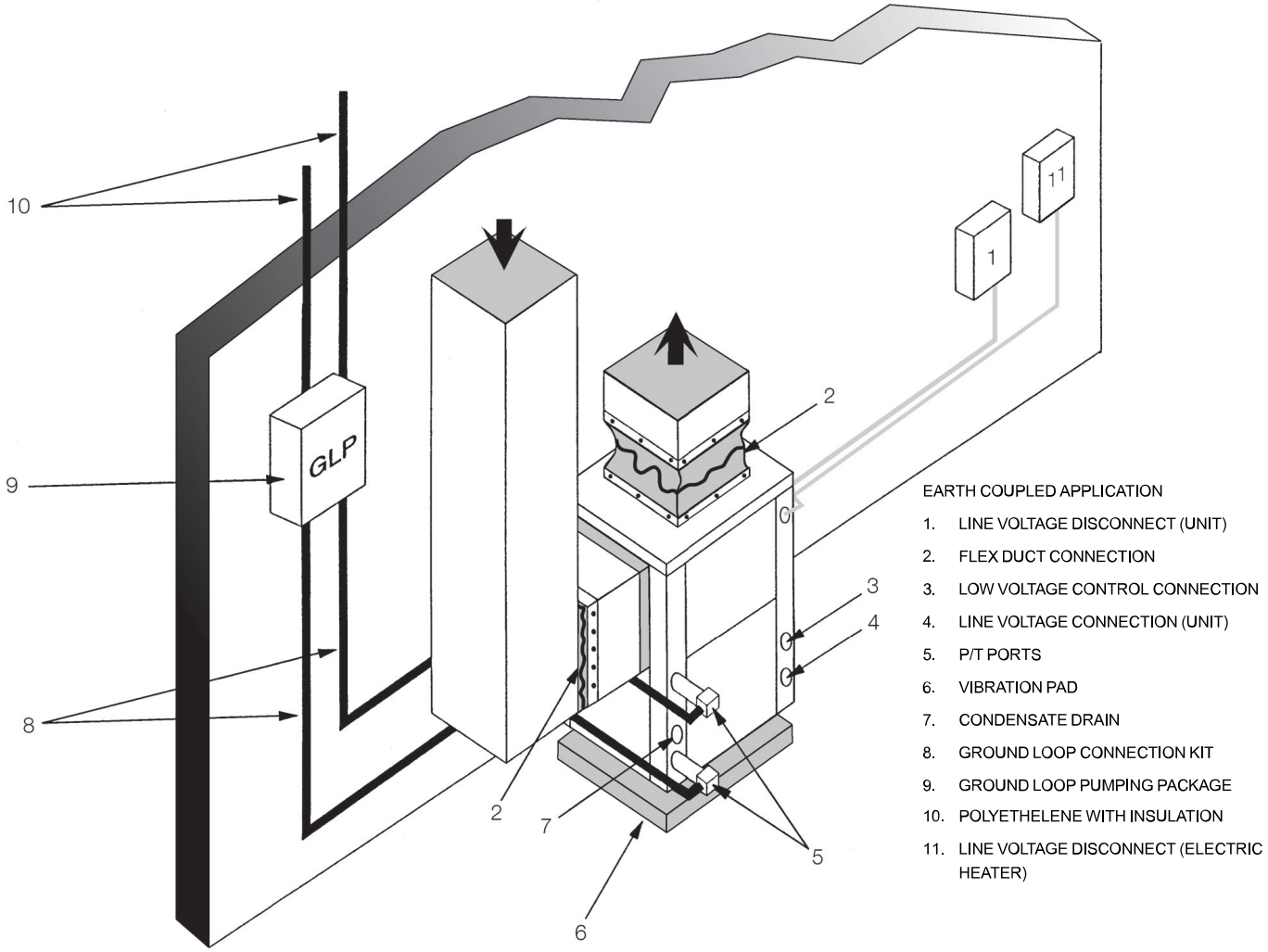

Fig. 1 – Example Geothermal System Setup

Well Water Systems

IMPORTANT: Table 2 must be consulted for water quality requirements when using open loop systems. A water sample must be obtained and tested, with the results compared to the table. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH is <7.5 and the calcium hardness is <100 ppm, the potential for scaling is low. For numbers out of the range listed, a monitoring plan must be implemented due to probable scaling.

Other potential issues such as iron fouling, corrosion, erosion and clogging must be considered. Careful attention to water conditions must be exercised when considering a well water application.

Failure to perform water testing and/or applying a geothermal heat pump to a water supply that does not fall within the accepted quality parameters will be considered a mis-application of the unit and resulting heat exchanger failures will not be covered under warranty. Where a geothermal system will be used with adverse water conditions, a suitable plate-frame heat exchanger MUST be used to isolate the well water from the geothermal unit.

Proper testing is required to assure the well water quality is suitable for use with water source equipment.

In conditions anticipating moderate scale formation or in brackish water, a cupronickel heat exchanger is recommended. Copper is adequate for ground water that is not high in mineral content.

In well water applications, water pressure must always be maintained in the heat exchanger. This is accomplished either a control valve or a bladder type expansion tank

When well water is used exclusively for supplying water to the heat pump, the pump should operate only when the heat pump operates. A 24 volt double pole single throw (DP/ST) contactor (Fig. 2) can be used to operate the well pump with the heat pump.

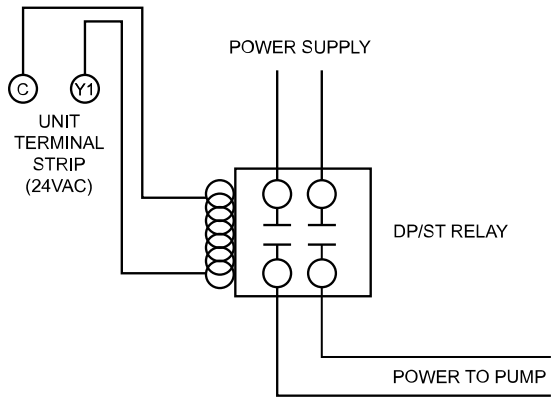

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Fig. 2 – 24V DP/ST Contactor

When two or more units are supplied from one well, the pump can be wired to operate independently from either unit (see Fig. 3). An up--sized VA transformer may be required in either case.

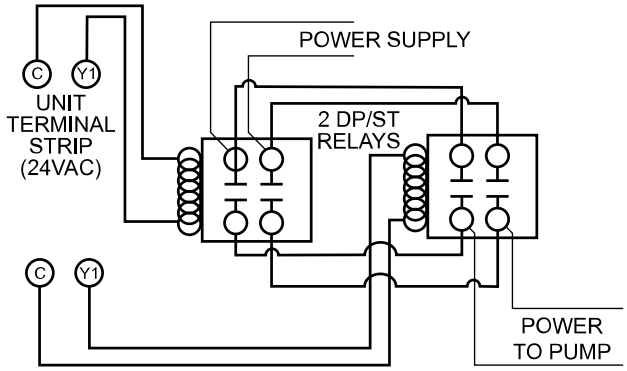

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Fig. 3 – Independent Wiring

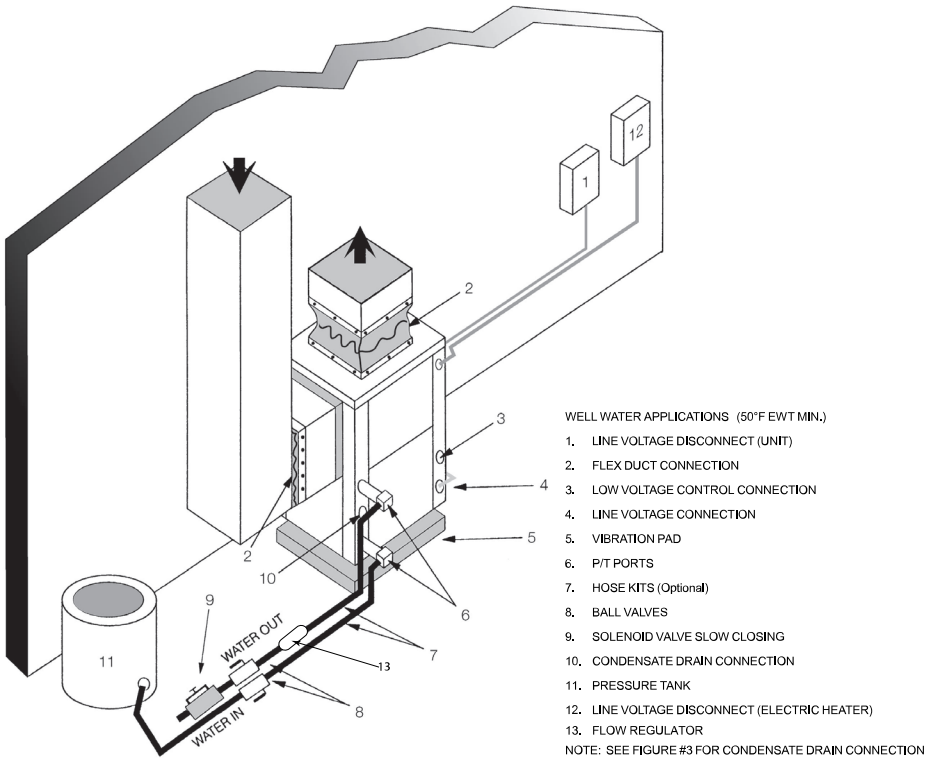

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Fig. 4 – Example Well Water System Setup

Pressure/temperature ports are recommended in both the supply and return lines for system flow balancing. The water flow can be accurately set by measuring the water--to--refrigerant heat exchangers water side pressure drop. See the unit specification sheets for the water flow and pressure drop information in the back of this manual.

The discharge water from the heat pump is not contaminated in any manner and can be disposed of in various ways depending on local codes (i.e. discharge well, dry well, storm sewer, drain field, stream, pond, etc.)

When using a single water well to supply both domestic water and the heat pump care must be taken to insure that the well can provide sufficient flow for both. In well water applications a slow closing solenoid valve must be used to prevent water hammer.

Solenoid valves should be connected across Y and C on the interface board for all. Make sure that the VA draw of the valve does not exceed the contact rating of the thermostat.

Pressure/temperature ports are recommended in both supply and return lines for system flow balancing. Water flow can be accurately set by measuring the water--to--refrigerant heat exchangers water side pressure drop. See specification sheets for water flow vs. pressure drop information in the back of this manual.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Water piping exposed to extreme low ambient temperatures is subject to freezing.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Discharge air configuration change is not possible on Heat Pumps equipped with Electric Heat Option.

Table 2 – Water Quality Requirements for Open-Loop Geothermal Heat Pump System

POTENTIAL PROBLEM	WATER CHARACTERISTIC	ACCEPTABLE VALUE	
		COPPER	CUPRO-NICKEL
SCALING	pH (Acidity / Alkalinity)	7-9	7-9
	Hardness (CaCO3, MgCO3)	< 350 ppm	< 350 ppm
	Ryznar Stability Index	6.0 - 7.5	6.0 - 7.5
	Langelier Saturation Index	-0.5 - +0.5	-0.5 - +0.5
CORROSION	Hydrogen Sulfide (H2S)	< 0.5 ppm*	10-50 ppm
	Sulfates	< 125 ppm	< 125 ppm
	Chlorine	< 0.5 ppm	< 0.5 ppm
	Chlorides	< 20 ppm	< 150 ppm
	Carbon Dioxide	< 50 ppm	< 50 ppm
	Ammonia	< 2 ppm	< 2 ppm
	Ammonia Chloride	< 0.5 ppm	< 0.5 ppm
	Ammonia Nitrate	< 0.5 ppm	< 0.5 ppm
	Ammonia Hydroxide	< 0.5 ppm	< 0.5 ppm
	Ammonia Sulfate	< 0.5 ppm	< 0.5 ppm
	Dissolved Solids	< 1,000 ppm	< 1,500 ppm
IRON FOULING	Iron (Fe2+ Iron Bacteria Potential)	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	< 1 ppm	< 1 ppm
EROSION	Suspended Solids	< 10 ppm, < 600 µm size**	< 10 ppm, < 600 µm size**
	Maximum Water Velocity	6 ft. / sec.	6 ft. / sec.

* No “rotten egg” smell present at < 0.5 ppm H2S.

** Equivalent to 30 mesh strainer

INSTALLATION

Vertical Units

GBA Vertical units up to five tons are available in left or right air return configurations. Vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to minimize vibration transmission to the building structure. It is not necessary to anchor the unit to the floor. See Fig. 5.

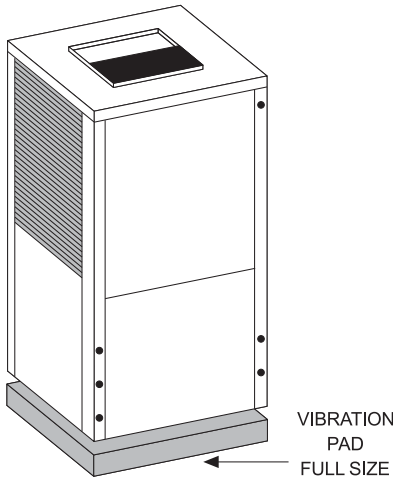

Fig. 5 – Vibration Absorbing Pad

Horizontal Units

While horizontal units may be installed on any level surface strong enough to hold their weight, they are typically suspended above a ceiling by threaded rods. All horizontal units come with a Hanging Bracket Kit to facilitate suspended unit mounting. Hanging brackets are installed as shown in Fig. 6.

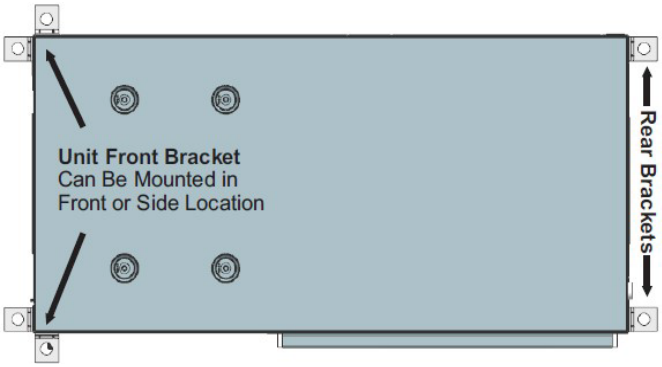

Fig. 6 – Hanging Bracket Locations

The hanging bracket kit includes the following:

- (5) brackets
- (5) rubber vibration isolators
- (8) screws no. 10 x 1/2 in.
- (10) Bolts 1/4 – 28 x 1/2 in. hex bolt (not used on this model)

The following additional materials are needed and must be field supplied:

- threaded rod (3/8 in. maximum diameter)
- hex nuts
- washers (1-3/4 in. minimum O.D.)

Hanging Bracket Installation

1. Remove and discard factory-provided screws from location where hanging brackets will be installed. See Fig. 7.

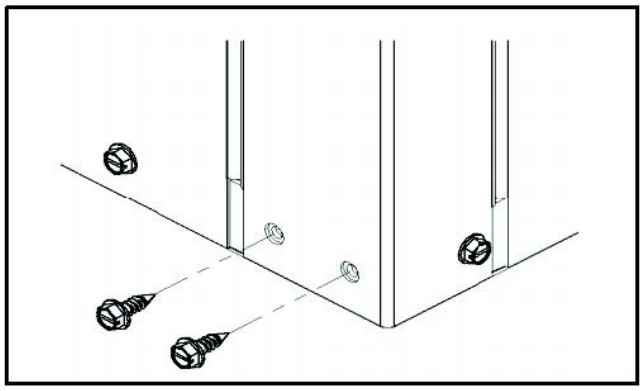

Fig. 7 – Removing Factory Screws

2. Mount 4 brackets to unit corner post using the bolts provided in the kit, as shown in Fig. 8. DO NOT re-use the screws removed from the unit during Step 1 to mount the hanging brackets on the unit.

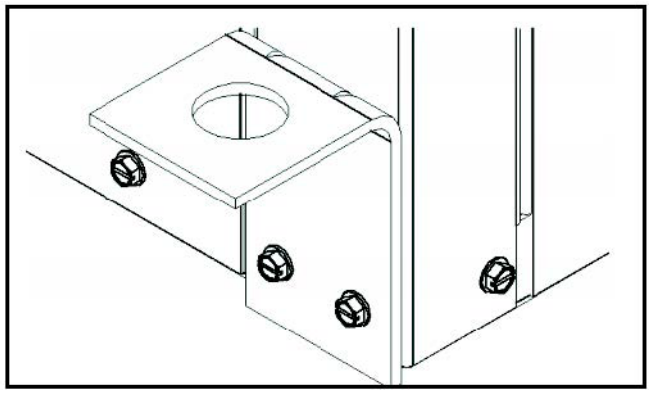

Fig. 8 – Mounting Brackets

3. Install rubber grommet on the bracket as shown in Fig. 9.
4. Hang the unit and assemble the field-provided threaded rod, nuts, and washers on the brackets as shown in Fig. 9.

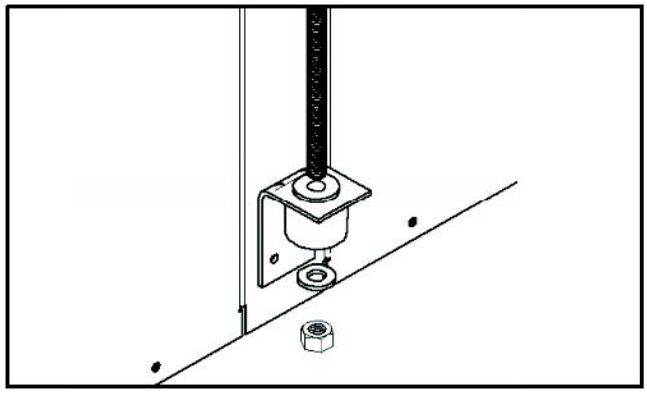

Fig. 9 – Hanging the Unit

IMPORTANT: larger than six tons include an integral angle iron frame with mounting holes present.

Horizontal units installed above the ceiling must conform to all local codes. An auxiliary drain pan, if required by code, should be at least 4 in. larger than the bottom of the heat pump.

Plumbing connected to the heat pump must not come in direct contact with joists, trusses, walls, etc. Some applications require an attic floor installation of the horizontal unit. In this case the unit should be set in a full size secondary drain pan on top of a vibration absorbing mesh.

The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing mesh. In both cases, a 3/4 in. drain connected to this secondary pan should be run to an eave at a location that will be noticeable.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

If the unit is located in a crawl space, the bottom of the unit must be at least 4-in. above grade to prevent flooding of the electrical parts due to heavy rains.

Mounting Horizontal Units

Horizontal Supply Air Configuration

The supply air location can be field converted from end blow (back discharge) to straight through or vice-versa.

NOTE: Blower configuration changes should be done prior to unit being installed in the final location.

NOTE: EH not available if unit is converted to side.

To convert the supply air direction, follow the steps below (see Fig. 10 - Fig. 12):

1. If the unit is connected to power, shut Off the unit and disconnect switch or circuit breaker.
2. Locate the motor access panel (A). Remove the three screws at top and the three screws at the bottom of the panel.
   Remove the access panel and place it aside.
3. Be careful not to damage the refrigerant coils or any other internal unit components.
4. Locate blower panel (B). Remove the three screws from top and the three screws from bottom of the panel. Leave the blower panel in place on the base pan.
5. Locate access panel corner post (C). Remove the four screws from top and the four screws from the bottom. Remove the corner post and set it aside.
6. Locate blower support bracket (D). Remove the one screw and set it aside.
7. Move blower panel (B) with blower to desired location, rotating it 180°. (See Fig. 12.) The motor power and control harness can be unplugged to facilitate blower relocation.
8. Reinstall access panel corner post (C) using the eight screws previously removed.
9. Fasten blower panel (B) using the six screws previously removed.
10. Reinstall and fasten blower support bracket (D) using the one screw previously removed.
11. Reattach the motor power and control harness if disconnected earlier.
12. Reinstall and fasten motor access panel (A) using the six screws previously removed.

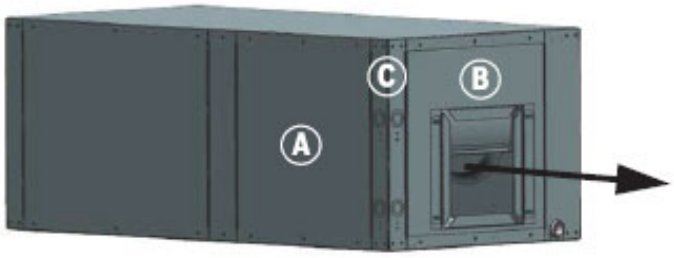

Fig. 10 – End Blow (back discharge) Orientation

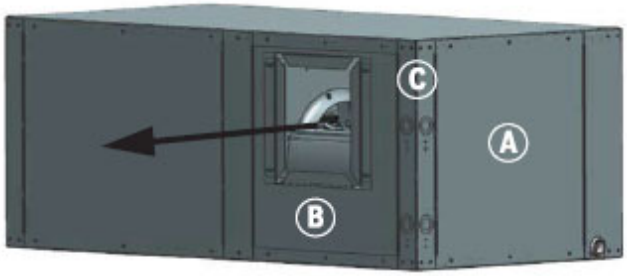

Fig. 11 – Straight Through Orientation

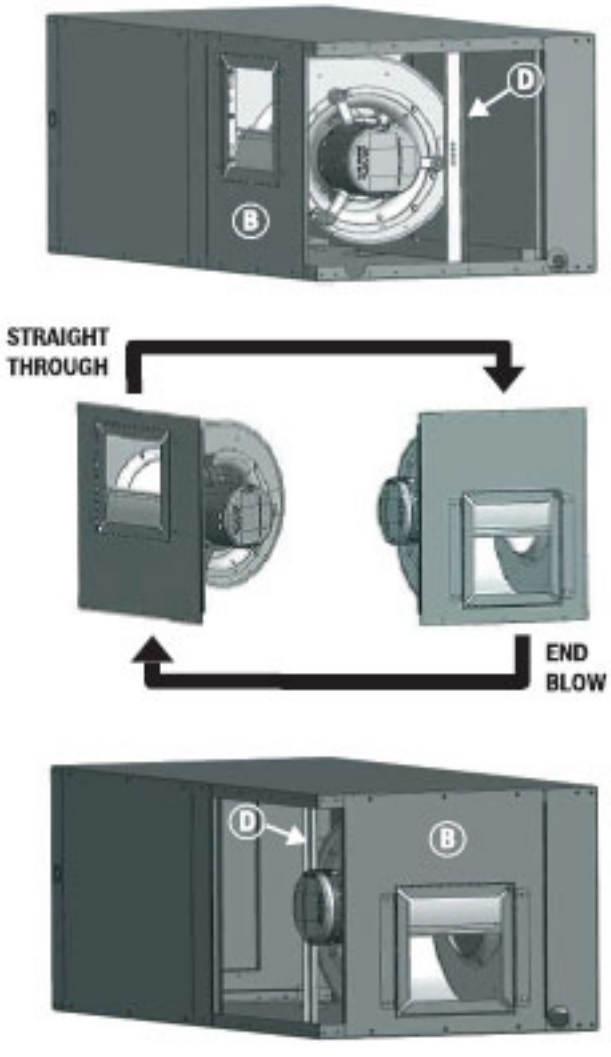

Fig. 12 – Blower Configuration

Condensate Drain

IMPORTANT: If equipped with float style condensate overflow switch, final adjustment must be made in the field.

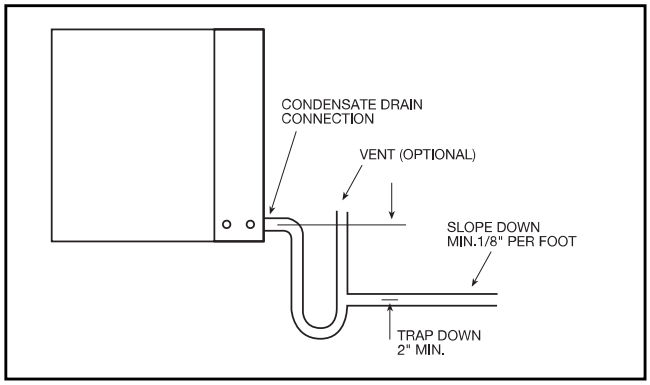

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Fig. 13 – Condensate Drain

A drain line must be connected to the heat pump and pitched away from the unit a minimum of 1/8" per foot to allow the condensate to flow away from the unit.

IMPORTANT: This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to insure free condensate flow.

A vertical air vent is sometimes required to avoid air pockets (see Fig. 13). The length of the trap depends on the amount of positive or negative pressure on the drain pan. A second trap must not be included.

DUCT SYSTEM

A supply air outlet collar and return air duct flange are provided on all units to facilitate duct connections. Refer to the individual Product Data for physical dimensions of collar and flange.

NOTE: Supply air duct and return air duct flanges are shipped unfolded with unit.

Fold the duct flange outwards along the perforated line. Refer to unit Dimensional Drawings for physical dimensions of the collar and flange. A flexible connector is recommended for supply and return air duct connections on metal duct systems. All metal ducting should be

insulated with a minimum of one inch duct insulation to avoid heat loss or gain and prevent condensate from forming during the cooling operation.

Application of the unit to uninsulated duct work is not recommended as the unit's performance will be adversely affected.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in improper equipment operation.

Do not connect discharge ducts directly to the blower outlet.

The factory provided air filter must be removed when using a filter back return air grill. The factory filter should be left in place on a free return system.

If the unit will be installed in a new installation which includes new duct work, the installation should be designed using current ASHRAE procedures for duct sizing.

If the unit is to be connected to existing duct work, a check should be made to assure that the duct system has the capacity to handle the air required for the unit application.

If the duct system is too small, larger duct work should be installed. Check for existing leaks and repair.

The duct system and all diffusers should be sized to handle the designed air flow quietly. To maximize sound attenuation of the unit blower, the supply and return air plenum should be insulated. There should be no direct straight air path through the return air grille into the heat pump. The return air inlet to the heat pump must have at least one 90 degree turn away from the space return air grille. If air noise or excessive airflow is a problem, the blower speed can be changed to a lower speed to reduce airflow.

Airflow

GBA units have constant airflow motors that deliver a nominal 400 SCFM per ton. If desired, a ±15% adjustment to CFM can be made. During fan-only operation, airflow is 69^ of the tabulated value, and when passive dehumidification mode is enabled, airflow is 85% of the tabulated value. See unit Product Data sheet for airflow table.

CONSTANT AIRFLOW (ECM) MOTOR

GBA units are available with a constant airflow ECM blower motor. These motors dynamically adjust their power output to precisely match the desired airflow on a preprogrammed fan curve. See Blower Performance Table for blower performance by speed setting, and for the factory default motor setting. These motors include the following features:

1. Three Speed Settings: Units are factory set to "NORM" but can be field adjusted to "+" to increase CFM by 15% or to "-" to reduce CFM by 15%. See the constant airflow ECM motor blower performance table for complete details on available CFM for each unit size (refer to the Wire Control Connections section of this manual).
2. Low CFM Ventilation: Units circulate air at 70% of full airflow rate when there is a call for fan only.
3. Passive Dehumidification: Reduces airflow during a cooling call when dehumidification is also required. This reduces the sensible heat ratio of the cooling coil and extends cooling run time to dehumidify more effectively (refer to the Wire Control Connections section of this manual).
4. Test Mode: Operates the motor at a 70% torque setting. This setting can be used to diagnose programming problems in the motor itself (refer to the Wire Control Connections section of this manual).
5. CFM Indicator Light: indicator light blinks for each 100 CFM of air delivered.

NOTE: This blink code is approximate and should not replace test and balance.

PIPING

Supply and return piping must be as large as the unit connections on the heat pump (larger on long runs).

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in improper equipment operation.

Never use flexible hoses of a smaller inside diameter than that of the fluid connections on the unit.

GBA units are supplied with either a copper or optional cupronickel Coaxial condenser. Copper is adequate for ground water that is not high in mineral content.

NOTE: Proper testing is recommended to assure the well water quality is suitable for use with water source equipment. When in doubt, use cupronickel.

In conditions anticipating moderate scale formation or in brackish water, a cupronickel heat exchanger is recommended.

Both the supply and discharge water lines will sweat if subjected to low water temperature. These lines should be insulated to prevent damage from condensation.

All manual flow valves used in the system must be ball valves. Globe and gate valves must not be used due to high pressure drop and poor throttling characteristics.

⚠ CAUTION

EQUIPMENT DAMAGE AND/OR UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage and/or improper operation.

Never exceed the recommended water flow rates as serious damage or erosion of the water--to--refrigerant heat exchanger could occur. Improper heat exchanger water flow due to piping, valve arrangement or improper pump operation is hazardous to the unit and constitutes abuse which will void the heat exchanger and compressor warranty.

Always check carefully for water leaks and repair appropriately. Units are equipped with female pipe thread fittings. Consult Product Data for sizes.

NOTE: Teflon tape sealer should be used when connecting water piping connections to the units to insure against leaks and possible heat exchanger fouling.

NOTE: The unit is shipped with water connection O--rings. A 10-pack of O--rings (part #4026) can be ordered through Replacement Components (RC).

IMPORTANT: Do not over--tighten connections.

Flexible hoses should be used between the unit and the rigid system to avoid possible vibration. Ball valves should be installed in the supply and return lines for unit isolation and unit water flow balancing (on open-loop systems).

No unit should be connected to the supply or return piping until the water system has been completely cleaned and flushed to remove any dirt, piping chips or other foreign material. Supply and return hoses should be connected together during this process to ensure the entire system is properly flushed. After the cleaning and flushing has taken place the unit may be connected to the water loop and should have all valves wide open.

ELECTRICAL

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position.

There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.

⚠ CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage and/or improper operation.

- Field wiring must comply with local and national electrical codes.
- Power to the unit must be within the operating voltage range indicated on the unit nameplate.
- On three--phase units, phases must be balanced within 2%.
- Operation of unit on improper line voltage or with excessive phase imbalance will be hazardous to the unit, constitutes abuse, and may void the warranty.

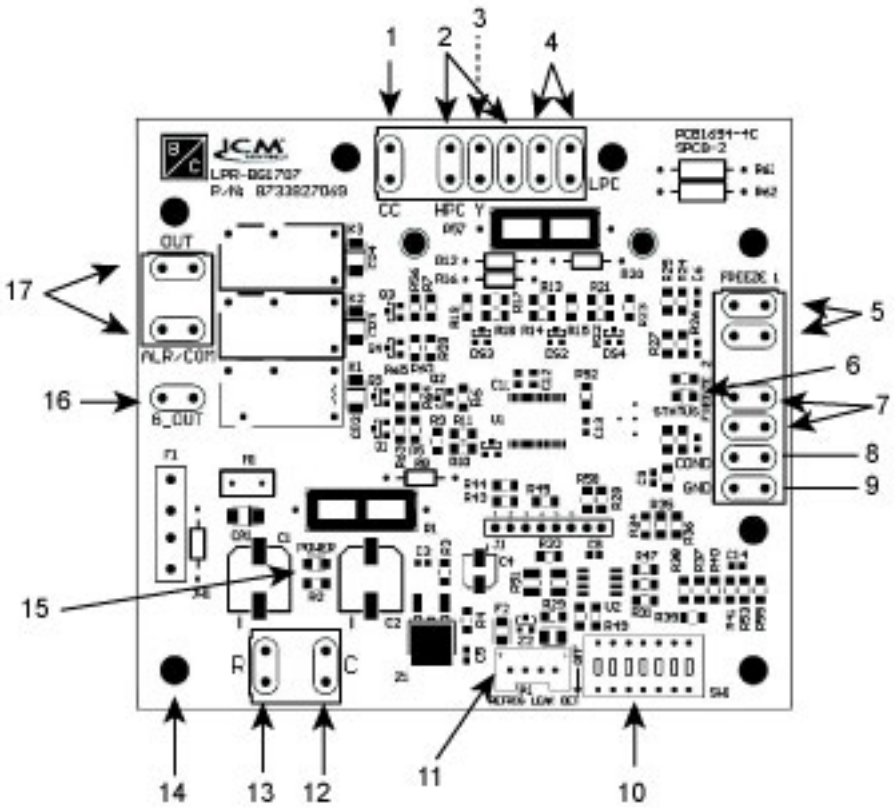
Properly sized fuses or HACR circuit breakers must be installed for branch circuit protection. See unit nameplate for maximum fuse or breaker size.

The unit is provided with a concentric knock--out for attaching common trade sizes of conduit, route power supply wiring through this opening. Flexible wiring and conduit should be used to isolate vibration and noise from the building structure. Always connect the ground lead to the grounding lug provided in the control box and power leads to the line side of compressor contactor as indicated on the wiring diagrams.

IMPORTANT: Units supplied with internal electric heat require two (2) separate power supplies:

1) Unit compressor

2) Electric Heat, blower motor and control circuit. Refer to the ELECTRIC HEATER PACKAGE OPTION section. See data plate for minimum circuit ampacities and maximum fuse/breaker sizing.



LEGEND

1. Compressor Contact Output
2. High Pressure Switch Connection
3. Call for Compressor (Y1)
4. Low Pressure Switch Connection
5. Water Coil Freeze Connection (Freeze 1)
6. UPM Status LED Indicator (Fault Status)
7. Air Coil Freeze Connection (Freeze 2)
8. Condensate Overflow Sensor Connection
9. Ground
10. UPM Settings DIP Switch SW2)
11. A2L Sensor
12. 24 vac Power Common
13. 24 vac Power Input
14. UPM Standoff
15. Power LED
16. Fan
17. Dry Contact

Fig. 14 – Unit Protection Module (UPM)

UPM Standard Safeties and Alarms

Hi And Low Refrigerant Pressure Protection

- High-pressure switch located in the refrigerant discharge line and wired across the HPC (High-Pressure Switch Connection) terminals on the UPM.
- Low-pressure switch located in the unit refrigerant suction line and wired across the LPC (Low-Pressure Switch Connection) terminals (LPC1 and LPC2) on the UPM.

Water Coil Freeze Protection

Waterside freeze protection sensor, mounted close to condensing water coil, monitors refrigerant temperature between condensing water coil and thermal expansion valve. (See Fig. 15.)

If temperature drops below or remains at freeze limit trip for 120 seconds, the controller will shut down the compressor and enter into a soft-lockout condition. The default freeze limit trip is 25°F; however, this can be changed to 15°F by flipping DIP switch SW1.

NOTE: The UPM Board Dry Contacts are Normally Open (NO).

IMPORTANT: The freeze sensor will not guard against the loss of water. A flow switch is recommended to prevent the unit from running if water flow is lost or reduced.

IMPORTANT: If the unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze 1 set to 25°F (DIP Switch SW1 set to Off) in order to shut down the unit at the appropriate leaving water temperature and protect your heat pump from freezing if a freeze sensor is included.

Air Coil Freeze Protection

Air coil freeze protection sensor, mounted between the thermal expansion device and the evaporator, monitors refrigerant temperature between the evaporator coil and thermal expansion valve. (See Fig. 16.) If temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 25°F, this can be changed to 15°F by flipping DIP switch SW1. (See Fig. 14, Item 10, Fig. 17, and Table 4.

Refrigerant Leak Detection System (Optional)

All units are shipped with an factory installed A2L sensor that switches off the compressor and turns on the blower system when a refrigerant leak is detected. The A2L sensor must be installed and operational for the unit to function properly.

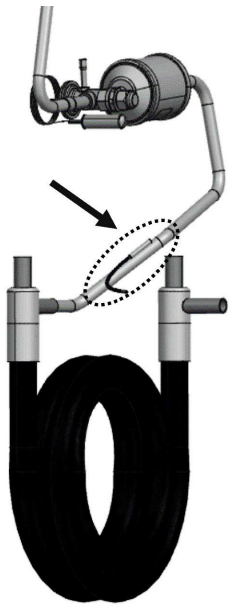


Fig. 15 – Waterside Freeze Sensor Location (FREEZE 1) - Vertical Configuration Shown

Considerations

1. Always check incoming line voltage power supply and secondary control voltage for adequacy. Transformer primaries are dual tapped for 208 and 230 volts. Connect the appropriate tap to ensure a minimum of 18 volts secondary control voltage. 24 volts is ideal for best operation.
2. Long length thermostat and control wiring leads may create voltage drop. Increase wire gauge or up--size transformers may be required to insure minimum secondary voltage supply.
3. The following guidelines are recommended for wiring between a thermostat and the unit: 18 GA up to 60 foot, 16 GA up to 100 ft and 14 GA up to 140 ft.
4. Do not apply additional controlled devices to the control circuit power supply without consulting the factory. Doing so may void equipment warranties.
5. Check with all code authorities on requirements involving condensate disposal/ over flow protection criteria.

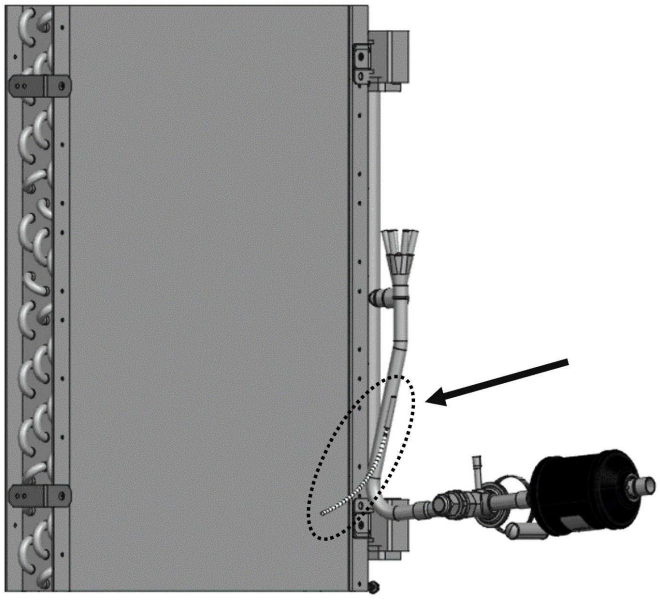


Fig. 16 – Air Coil Freeze Sensor Location (FREEZE 2) - Vertical Configuration Shown

High Condensate Level Shutdown

The condensate overflow protection sensor is located in the drain pan of the unit and connected to the "COND" terminal on the UPM board. (See Fig. 14, item 8.)

Anti-Short Cycle Timer

Five minute delay on break timer to prevent compressor short cycling.

Compressor Run Time

The UPM has a minimum compressor run time of five minutes. If Y-call is removed the compressor will remain energized until the five minutes have expired.

Random Start Time Delay

Each controller has an unique random start delay ranging from 270 to 300 seconds on initial power up to reduce the chance of multiple unit simultaneously starting at the same time after power up or after a power interruption, in order to avoid creating a large electrical spike.

Low-Pressure Bypass Timer

If the compressor is running and the low pressure switch opens, the controller will keep the compressor On for 120 seconds. After two minutes if the low-pressure switch remains open, the controllers will shut down the compressor and enter a soft lockout. The compressor will not be energized until the low-pressure switch closes and the anti-short cycle time delay expires. If the low-pressure switch opens two or four times in one hour, the unit will enter a hard lockout. In order to exit hard lockout power to the unit would need to be reset. The reset signal is either a Y or R signal depending on the position of the DIP switch as shown in Table 14.

If the reset is set to R, the board must be manually powered off and powered back on to exit the hard lock out.

Brownout/Surge/Power Interruption Protection

The brownout protection in the UPM board will shut down the compressor if the incoming power falls below 18 vac. The compressor will remain Off until the voltage is above 18 vac and Anti-Short Cycle Timer (300 seconds) times out. The unit will not go into a hard lockout.

Alarm Output

Alarm output is Normally Open (NO) dry contact. If pulse is selected the alarm output will be pulsed. The fault output will depend on the DIP switch setting for "Alarm". If it is set to "CONST", a constant signal will be produced to indicate a fault has occurred and the unit re-quires inspection to determine the type of fault. If it is set to "PULSE" a pulse signal is produced and a fault code is detected by a remote device indicating the fault.(For blink code explanation, see Table 15). The remote device must have a analog input with malfunction detection capability to interpret PULSE signal when the UPM board is set to "PULSE

IMPORTANT: If 24 VAC output is needed R must be wired to ALR-COM terminal; 24 VAC will be available to the ALR-OUT terminal when the unit is in the alarm condition.

Test Mode

A test DIP switch is provided to reduce all time delays settings to 10 seconds during troubleshooting or verification of unit operation.

IMPORTANT: Operation of unit in test mode can lead to accelerated wear and premature failure of components. The "TEST" switch must be set back to "NO" after troubleshooting/servicing.

Intelligent Alarm Reset

If a fault condition is initiated, the five minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs two or four times (depending on "2" or "4" settings for Lockout DIP Switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset. See Fig. 17.

Hard Lockout Reset

A hard lockout can be reset by turning the unit thermostat off and then back on when the "RESET" DIP switch is set to "Y" or by shutting off unit power at the circuit breaker when the "RESET" DIP switch is set to "R".

NOTE: The blower motor will remain active during a lockout condition

Table 3 – UPM Fault Blink Codes

BLINKS	FAULT	FAULT CRITERIA
None	None	All fault conditions normal.
1	High Pressure	Refrigerant discharge pressure has
2	Low Pressure	Refrigerant suction pressure has
3	Water Coil Freeze Condition	Refrigerant temperature to the water coil has fallen below 25°F for 120
4	Condensate Overflow	Condensate levels in the unit drain
5	Brown Out	Control voltage has fallen below 18
6	Air Coil Freeze Condition	Refrigerant temperature to the air coil has fallen below 25°F for 120
7	Refrigerant Leak	Refrigerant LFL% is more than 15%.

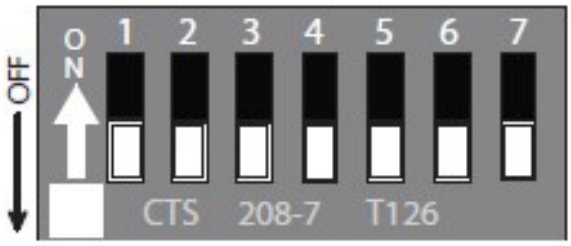


Fig. 17 – UPM Settings DIP Switch (SW1)

Table 4 – DIP Switch Selectable Positions

TOGGLE	FUNCTION	ON	OFF	FACTORY DEFAULT
1	Lockout	4	2	2
2	Reset	R	Y	Y
3	Alarm	Cont	Pulse	Pulse
4	Test	Yes	No	No
5	Freeze 1	15°F	25°F	25°F
6	Freeze 2	15°F	25°F	25°F
7	Pump	ON	OFF	OFF

The UPM includes the following features:

- **ANTI--SHORT CYCLE TIME**—5 minute delay on break timer to prevent compressor short cycling.
- **RANDOM START**—Each controller has a unique random start delay ranging from 270 to 300 seconds to reduce the chances of multiple units simultaneously starting after initial power up or after a power interruption, creating a large electrical spike.
- **LOW PRESSURE BYPASS TIMER**—If the compressor is running and the low pressure switch opens, then the control will keep the compressor on for 120 seconds. After 2 minutes, if the low pressure switch remains open, the control will shut down the compressor and enter a soft lockout. The compressor will not be energized until the low pressure switch closes and the anti--short cycle time delay expires. If the low pressure switch opens 2–4 times in 1 hour, the unit will enter a hard lockout. In order to exit hard lockout, power to the unit would need to be reset.
- **BROWNOUT / SURGE / POWER INTERRUPTION PROTECTION**—The brownout protection in the UPM board will shut down the compressor if the incoming power falls below 18 VAC. The compressor will remain off until the voltage goes above 18 VAC and the Anti Short Cycle Timer (300 seconds) times out. The unit will not go into a hard lockout.

- **MALFUNCTION OUTPUT**—Alarm output is Normally Open (NO) dry contact. If pulse is selected the alarm output will be pulsed. The fault output will depend on the dip switch setting for “ALARM”. If it is set to “CONT”, a continuous signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to “PULSE”, a pulse signal is produced and a fault code is detected by a remote device indicating the fault. See LED Fault Indication below for blink code explanation. The remote device must have a malfunction detection capability when the UPM board is set to “PULSE”.

NOTE: If 24 VAC output is needed, R must be wired to ALR--COM terminal; 24 VAC will be available on the ALR--OUT terminal when the unit is in the alarm condition.

- **LED FAULT INDICATION** — Two LED Indicators are provided.
  GREEN: Power LED indicates 118--30 VAC present at the board.
  RED: Fault indicator with blink codes as follows:
  – One Blink -- High pressure lockout
  – Two Blinks -- Low pressure lockout
  – Three Blinks -- Freeze sensor lockout
  – Four Blinks -- Condensate overflow
  – Five Blinks -- Brownout
- **TEST DIP SWITCH**—A test dip switch is provided to reduce all time delay settings to 10 seconds during troubleshooting or verification of unit operation.Note that operation of the unit while in test mode can lead to accelerated wear and premature failure of the unit. The “TEST” switch must be set back to “NO” for normal operation.

Refrigerant Leak Detection System

The A2L sensor continually samples the air and if the concentration of refrigerant detected is higher than the preset threshold (15% LFL), it sends a signal to the UPM which then switches off the compressor and turns on the blower. The compressor will remain off until saturation level is within acceptable range (12% LFL). The A2L sensor is connected to the UPM, it must always remain connected. If communication is lost, the UPM will enter refrigerant leak hard lockout fault and energize the alarm contact.

To test that the communication between the sensor and board is active, the sensor can be disconnected from the UPM, which should simulate a fault. The A2L sensor for the refrigerant leak detection system shall only be replaced with the part specified on the spare parts list.

- **FREEZE SENSOR**—The freeze sensor input is active all the time, if a freeze option is not selected the freeze terminals will need a jumper. There are 2 configurable freeze points, 26°F and 15°F. The unit will enter a soft lock out until the temperature climbs above the set point and the anti--short cycle time delay has expired. The freeze sensor will shut the compressor output down after 90 seconds of water flow loss and report a freeze condition. It is recommended to have a flow switch to prevent the unit from running if water flow is lost. (Refer to Table 3)

⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

If unit is employing a fresh water system (no anti--freeze protection), it is extremely important to have the “Freeze” jumper R30 resistor set to 26°F in order to shut down the unit at the appropriate leaving water temperature and protect your heat pump from freezing if a freeze sensor is included.

- **EVAPORATOR FREEZE SENSOR**—Evaporator freeze protection sensor, mounted after the thermal expansion device and the evaporator, monitors refrigerant temperature between the evaporator coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 30_F. (Refer to Table 3)
- **HIGH PRESSURE SWITCH**—The high pressure switch safety is designed to shut down the compressor if it exceeds limits. Cut in 420 +/- 15 psig and cut out 600 +/- psig.
- **LOW PRESSURE SWITCH**—The low pressure switch safety is designed to shut down the compressor of loss of charge. Cut in 60 +/-15 psig and cut out 40 +/- psig.
- **INTELLIGENT RESET**—If a fault condition is initiated, the 5 minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs 2 or 4 times (depending on 2 or 4 setting for Lockout dip switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset. A single condensate overflow fault will cause the unit to go into a hard lockout immediately, and will require a manual lockout reset.
- **LOCKOUT RESET**—A hard lockout can be reset by turning the unit thermostat off and then back on when the “RESET” dip switch is set to “Y” or by shutting off unit power at the circuit breaker when the “RESET” dip switch is set to “R”.

NOTE: The blower motor will remain active during a lockout condition.

- **ECM TEST MODE**—ECM test mode is to override the motor to constant torque mode for motor troubleshooting. If the motor runs in ECM test mode, the module and motor are good. To engage in ECM test mode, only one switch can be selected. Select

TEST ON and all others OFF. Reset the board to NORMON and

TEST OFF when test is complete.

If the unit remains in test mode for normal operation, the system will not run different CFMs based on thermostat call such as Y1,

Y2 or dehumidify. It may also experience problems with nuisance strip during electric heat operation.

There is no way to check CFM based on number of blinks if the board is set to test mode.

Table 5 – 10K Temperature Sensor Resistance

°C	°F	OHM	°C	°F	OHM	°C	°F	OHM	°C	°F	OHM
-55	-67	963,800	-9	16	52,410	37	99	6,015	83	181	1,141
-54	-65	895,300	-8	18	49,660	38	100	5,774	84	183	1,105
-53	-63	832,100	-7	19	47,070	39	102	5,545	85	185	1,071
-52	-62	776,800	-6	21	44,630	40	104	5,326	86	187	1,038
-51	-60	719,900	-5	23	42,330	41	106	5,116	87	189	1,006
-50	-58	670,200	-4	25	40,160	42	108	4,916	88	190	975
-49	-56	624,200	-3	27	38,120	43	109	4,725	89	192	945
-48	-54	581,600	-2	28	36,190	44	111	4,542	90	194	916
-47	-53	542,200	-1	30	34,370	45	113	4,368	91	196	889
-46	-51	505,800	0	32	32,650	46	115	4,201	92	198	862
-45	-49	472,000	1	34	31,030	47	117	4,041	93	199	836
-44	-47	440,700	2	36	29,500	48	118	3,888	94	201	811
-43	-45	411,600	3	37	28,050	49	120	3,742	95	203	787
-42	-44	384,700	4	39	26,690	50	122	3,602	96	205	764
-41	-42	359,700	5	41	24,400	51	124	3,468	97	207	741
-40	-40	336,500	6	43	24,170	52	126	3,339	98	208	720
-39	-38	314,900	7	45	23,020	53	127	3,216	99	210	699
-38	-36	294,900	8	46	21,920	54	129	3,099	100	212	679
-37	-35	276,200	9	48	20,890	55	131	2,986	101	214	659
-36	-33	258,800	10	50	19,900	56	133	2,878	102	216	640
-35	-31	242,700	11	52	18,970	57	135	2,774	103	217	622
-34	-29	227,600	12	54	18,090	58	136	2,674	104	219	604
-33	-27	213,600	13	55	17,260	59	138	2,579	105	221	587
-32	-26	200,500	14	57	16,470	60	140	2,488	106	223	571
-31	-24	188,300	15	59	15,710	61	142	2,400	107	225	555
-30	-22	177,000	16	61	15,000	62	144	2,316	108	226	539
-29	-20	166,400	17	63	14,330	63	145	2,235	109	228	525
-28	-18	156,400	18	64	13,380	64	147	2,157	110	230	510
-27	-17	147,200	19	66	13,070	65	149	2,083	111	232	496
-26	-15	138,500	20	68	12,490	66	151	2,011	112	234	483
-25	-13	130,400	21	70	11,940	67	153	1,942	113	235	470
-24	-11	122,800	22	72	11,420	68	154	1,876	114	237	457
-23	-9	115,800	23	73	10,920	69	156	1,813	115	239	445
-22	-8	109,100	24	75	10,450	70	158	1,752	116	241	433
-21	-6	102,900	25	77	10,000	71	160	1,693	117	243	422
-20	-4	97,080	26	79	9,573	72	162	1,637	118	244	411
-19	-2	91,620	27	81	9,166	73	163	1,583	119	246	400
-18	0	86,500	28	82	8,778	74	165	1,531	120	248	389
-17	1	81,700	29	84	8,409	75	167	1,480	121	250	379
-16	3	77,190	30	86	8,057	76	169	1,432	122	252	370
-15	5	72,960	31	88	7,722	77	171	1,386	123	253	360
-14	7	68,980	32	90	7,402	78	172	1,341	124	255	351
-13	9	65,250	33	91	7,098	79	174	1,298	125	257	342
-12	10	61,740	34	93	6,808	80	176	1,256	126	259	333
-11	12	58,440	35	95	6,531	81	178	1,216	127	261	325
-10	14	55,330	36	97	6,267	82	180	1,178	128	262	317

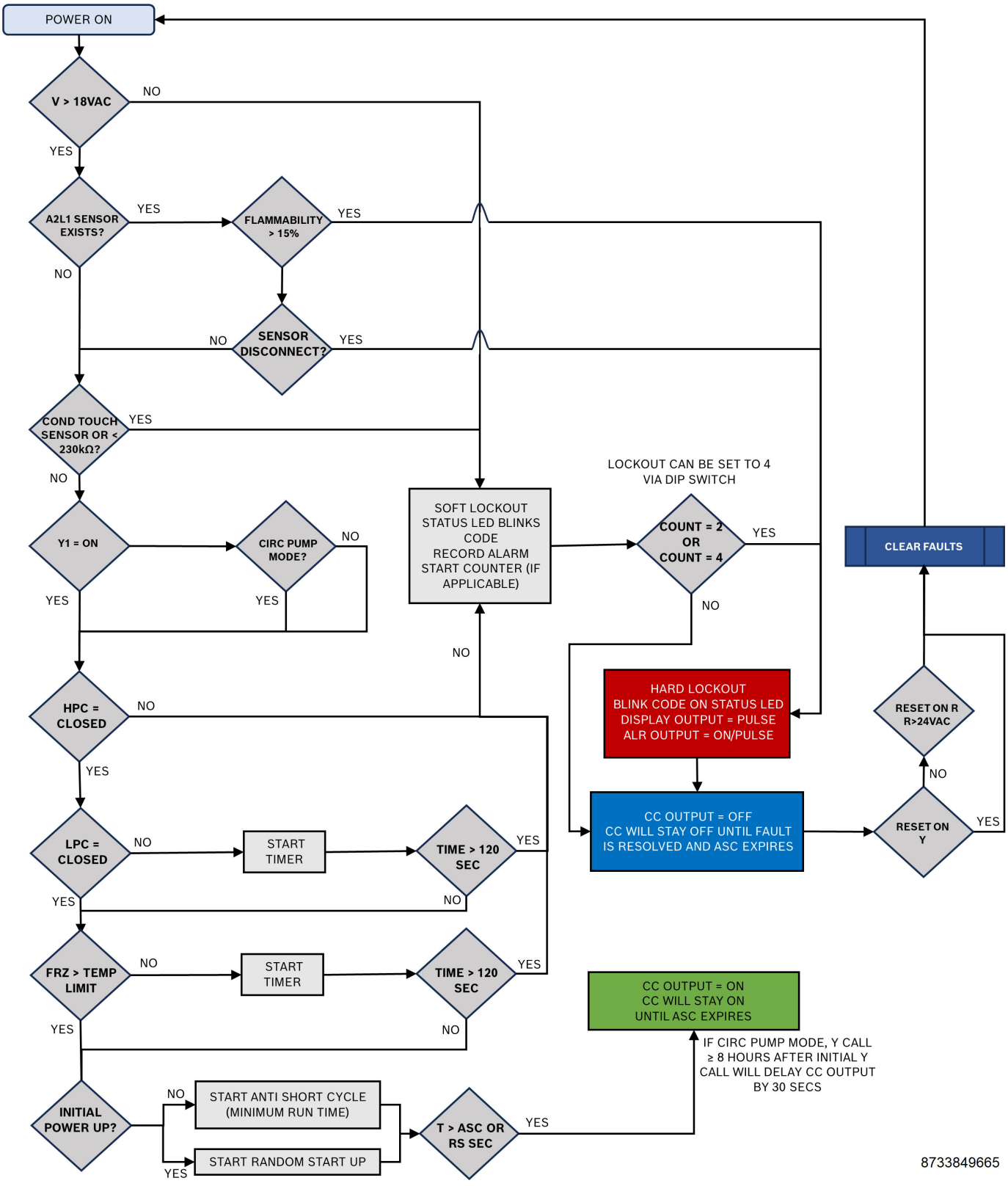


Fig. 18 – UPM Sequence of Operation (SOO) Flow chart

Optional Heat Recovery Package (HRP)

The heat recovery package is a factory installed option on GBA series heat pumps. The HRP can be used to heat potable water during unit operation using waste heat from the compressor discharge gas. In some cases the HRP can provide most or all of the hot water requirements for a typical home.

The HRP consists of three major components:

1. Double wall, vented refrigerant to water heat exchanger
2. Circulating pump
3. Control circuit

The heat exchanger is rated for use with potable water and is acceptable for use as a domestic water heating device in most building codes.

The pump circulates water between the domestic hot water tank and HRP heat exchanger in the Heat Pump. The control circuit ensures that the HRP only operates when there is available heat from the compressor and when the water is within a safe temperature range of below 140°F. When the heat pump compressor operates, the HRP will monitor the temperature of the discharge gas from the compressor. Once discharge gas is hot enough to provide useful heat to the domestic water tank, the circulating pump will be enabled, drawing water from the tank, through the HRP heat exchanger and then depositing the heated water back into the tank.

If the water temperature reaches 140_F, the circulating pump is disabled to prevent over heating of the domestic water. The HRP is provided with an on/off switch in case the end user desires that the HRP be inactivated (typically during the winter months when space heating is most important).

⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

If heat recovery unit is installed in an area where freezing may occur, the unit must be drained during winter months to prevent heat exchanger damage. Heat exchanger ruptures that occur due to freezing will void the heat recovery package warranty along with the heat pump warranty

Water Tank Preparation

1. Turn off electrical or fuel supply to the water heater.
2. Attach garden hose to water tank drain connection and run other end of hose out doors or to an open drain.
3. Close cold water inlet valve to water heater tank.
4. Drain tank by opening drain valve on the bottom of the tank, then open pressure relief valve or hot water faucet.
5. Once drained the tank should be flushed with cold water until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HRP water piping.

HRP Water Piping

All hot water piping MUST be a minimum of 3/8” O.D. copper tube to a maximum distance of 15 feet. For distances beyond 15 feet, but not exceeding 60 feet, use 1/2” copper tube. Separately insulate all exposed surface of both connecting water lines with 3/8” wall closed cell insulation. Install isolation valves on supply and return to the heat recovery. (See Fig. 19)

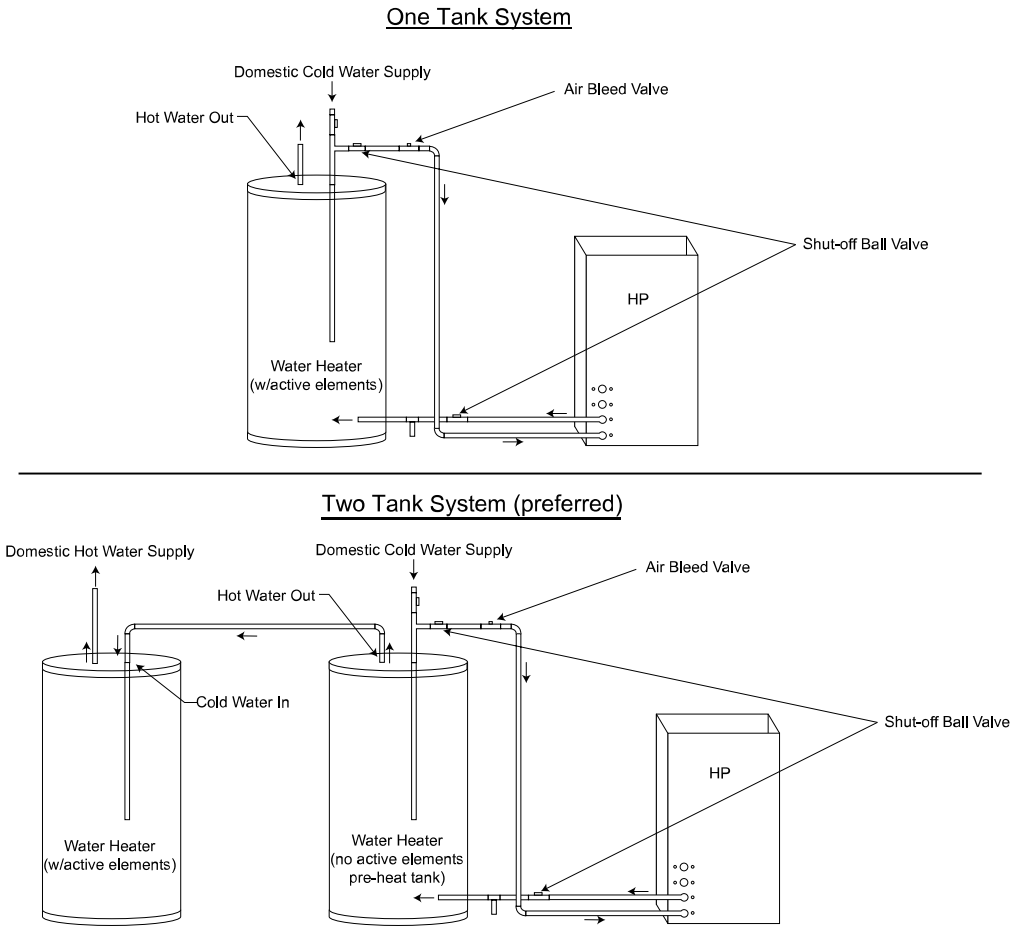


Fig. 19 – HRP Water Piping

Water Tank Refill

1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Carefully inspect all plumbing for water leaks. Correct as required.
5. Purge all air from HRP by depressing the Schrader valve on the HR unit. Allow all air to bleed out until water appears at the valve.
6. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to ensure maximum utilization of heat available from the refrigeration system and to conserve the most energy.
   On tanks with thermostats and both upper and lower elements, the lower element should be turned down to 100°F, while the upper element should be adjusted to 120_F. Depending upon the specific needs of the customer, you may need to adjust the upper element differently.
   On tanks with a single thermostat, lower the thermostat setting to 120°F or the "LOW" position. After thermostat adjustments are completed, replace access cover and restore electrical or fuel supply to water heater.

IMPORTANT: Copper should be used for piping from HRP to domestic water tank(s). Use 5/8" (16mm) O.D. copper or larger. Refer to local codes for hot water piping. Insulate the water lines between the GHP and the water heater with a minimum of 3/8" (10mm) closed cell insulation.

Initial Start-Up

⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

Make sure all valves in heat recovery water piping system are open. **NEVER OPERATE HR PUMP DRY**.

1. Turn on the heat pump. The HR pump should not run if the compressor is not running.
2. Turn HR switch to the "ON" position. The pump will operate if entering water temperature to HR is below 120°F.
3. The temperature difference between the water entering and leaving the heat recovery should be 5°F to 15°F.
4. Allow the unit to operate for 20 to 30 minutes to ensure it is functioning properly. The pump should shut off when the water temperature entering the heat recovery reaches 120°F.

FIELD INSTALLED ACCESSORIES

Auxiliary Heaters

Internally mounted auxiliary heaters are available in 5, 10, 15 and 20 Kw sizes. For installation procedures, refer to the instructions shipped with the heaters. Table 4 lists compatible heaters with GBA units.

Table 6 – Electric Heater Compatibility

Aux. Heat Size Compatibility				
GHP Model	**5 Kw**	**10 Kw**	**15 Kw**	**20 Kw**
GB018	•	—	—	—
GB024	•	•	—	—
GB030	•	•	•	—
GB036	•	•	•	—
GB042	•	•	•	—
GB048	•	•	•	•
GB060	•	•	•	•

Flow Centers and Associated Loop Accessories

A wide variety of flow centers are available for both closed and open loop installations, along with hose kits, fittings, solenoid valves, etc. Refer to the instructions shipped with these components for further details.

SEQUENCE OF OPERATION

Cooling Mode

Energizing the "O" terminal energizes the unit reversing valve thus placing the unit into cooling mode. The fan motor starts when the "G" terminal is energized.

When the thermostat calls for cooling (Y), the loop pump or solenoid valve, if present, is energized and compressor will start.

Once the thermostat is satisfied, the compressor shuts down accordingly and the fan ramps down to either FAN ONLY mode or OFF over a span of 30 seconds (ECM Motors).

NOTE: A fault condition initiating a lockout will de-energize the compressor.

Heating Mode

Heating operates in the same manner as cooling, but with the reversing valve de-energized. The compressor will run until the desired set-point temperature on the thermostat is achieved.

Once the thermostat is satisfied, the compressor shuts down and the fan ramps down in either FAN ONLY mode or turns off over a span of 30 seconds.

Thermostat Connections

Thermostat wiring is connected to a 7 position low voltage terminal block in the electrical box. The thermostat connections and their functions are as follows:

Y Compressor Operation
G Fan
O Reversing Valve (energized in cooling)
C Transformer 24 VAC Common - 3 Connections
R Transformer 24 VAC Hot

If the unit is being connected to a thermostat with a malfunction light, this connection is made at the unit alarm output.

IMPORTANT: If the thermostat is provided with a malfunction light powered off of the common (C) side of the transformer, a jumper between "R" and "COM" terminal of "ALR" contacts must be made.

IMPORTANT: If the thermostat is provided with a malfunction light powered off of the hot (R) side of the transformer, then the thermostat malfunction light connection should be connected directly to the (ALR) contact on the unit's UPM board.

SYSTEM CHECKOUT

After completing the installation, and before energizing the unit, the following system checks should be made:

1. Verify that the supply voltage to the heat pump is in accordance with the nameplate ratings.
2. Make sure that all electrical connections are tight and secure.
3. Check the electrical fusing and wiring for the correct size.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

Ensure cabinet and electrical box are properly grounded

4. Verify that the low voltage wiring between the thermostat and the unit is correct.
5. Verify that the water piping is complete and correct.
6. Check that the water flow is correct, and adjust if necessary.
7. Check the blower for free rotation, and that it is secured to the shaft.
8. Verify that vibration isolation has been provided.
9. Unit is serviceable. Be certain that all access panels are secured in place.
10. Verify that blower support has been removed.
11. Verify that ductwork has been properly fastened to supply and return duct collars.
12. Make sure return air filters are positioned correctly in the filter rack.

System Flushing and Filling

Once the piping is complete, units require final purging and loop charging. A flush cart pump of at least 1.5 hp is needed to achieve adequate flow velocity in the loop to purge air and dirt particles from the loop. Flush the loop in both directions with a high volume of water at a high velocity. Follow the steps below to properly flush the loop:

1. Verify power is off.
2. Fill loop with water from hose through flush cart before using flush cart pump to ensure an even fill. Do not allow the water level in the flush cart tank to drop below the pump inlet line to prevent air from filling the line.
3. Maintain a fluid level in the tank above the return tee to avoid air entering back into the fluid.
4. Shutting off the return valve that connects into the flush cart reservoir will allow 50 psig surges to help purge air pockets. This maintains the pump at 50 psig.
5. To purge, keep the pump at 50 psig until maximum pumping pressure is reached.
6. Open the return valve to send a pressure surge through the loop to purge any air pockets in the piping system.
7. A noticeable drop in fluid level will be seen in the flush cart tank. This is the only indication of air in the loop.

NOTE: If air is purged from the system while using a 10 in. PVC flush tank, the level drop will only be 1 to 2 in. since liquids are incompressible. If the level drops more than this, flushing should continue since air is still being compressed in the loop. If level is less than 1 to 2 in., reverse the flow.

8. Repeat this procedure until all air is purged.
9. Restore power.

Antifreeze may be added before, during or after the flushing process. However, depending on when it is added in the process, it can be wasted. Refer to the Antifreeze section on page 55 for more detail.

Loop static pressure will fluctuate with the seasons. Pressures will be higher in the winter months than during the warmer months. This fluctuation is normal and should be considered when charging the system initially. Run the unit in either heating or cooling for several minutes to condition the loop to a homogeneous temperature.

When complete, perform a final flush and pressurize the loop to a static pressure of 40 to 50 psig for winter months or 15 to 20 psig for summer months.

After pressurization, be sure to remove the plug from the end of the loop pump motor(s) to allow trapped air to be discharged and to ensure the motor housing has been flooded. Be sure the loop flow center provides adequate flow through the unit by checking pressure drop across the heat exchanger. Compare the results to the data in Fig. 20 and Fig. 21.

System Flow

FLOW VERIFICATION

The GBA WSHP units ordered without a factory flow switch as standard. It is recommend to field installed a flow switch or special order a flow switch as factory installed to prevent the compressor from operating without loop flow.

IMPORTANT: It is recommended to have a flow switch to prevent the unit from running if water flow is lost.

FLOW REGULATION

Flow regulation can be accomplished by two methods. Most water control valves have a flow adjustment built into the valve. By measuring the pressure drop through the unit heat exchanger, the flow rate can be determined. Adjust the water control valve until the desired flow rate is achieved. Since the pressure constantly varies, two pressure gauges may be needed in some applications. See Fig. 20 and Fig. 21 for waterside pressure drop.

An alternate method of flow regulation is to install an automatic flow control valve. These valves feature a removable cartridge that controls the maximum flow through the valve assembly. Verify that the water flow control cartridge matches the application flow requirement.

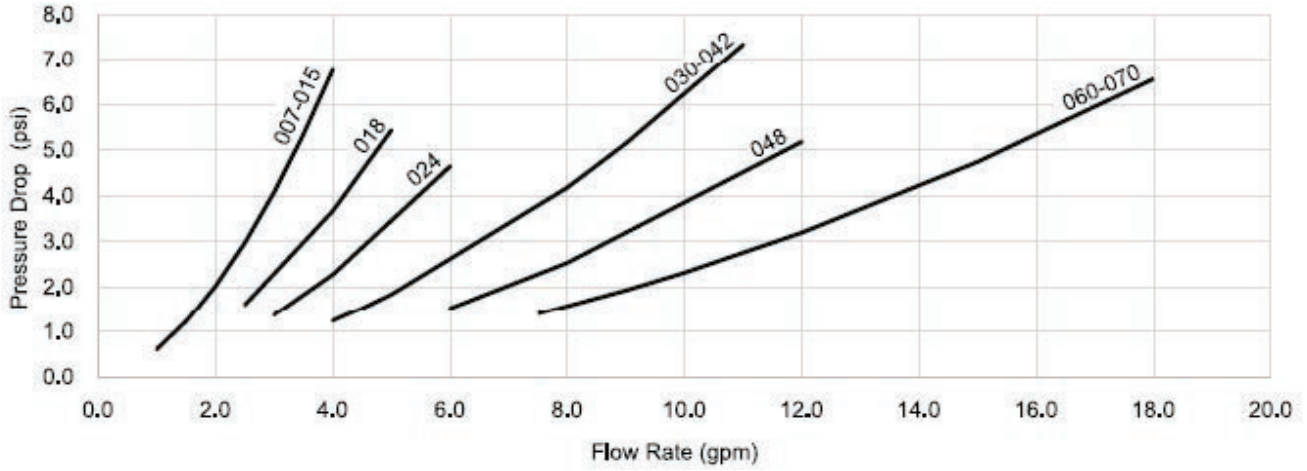


Fig. 20 – Water Pressure Drop Curve for Units Without 2-Way Valve

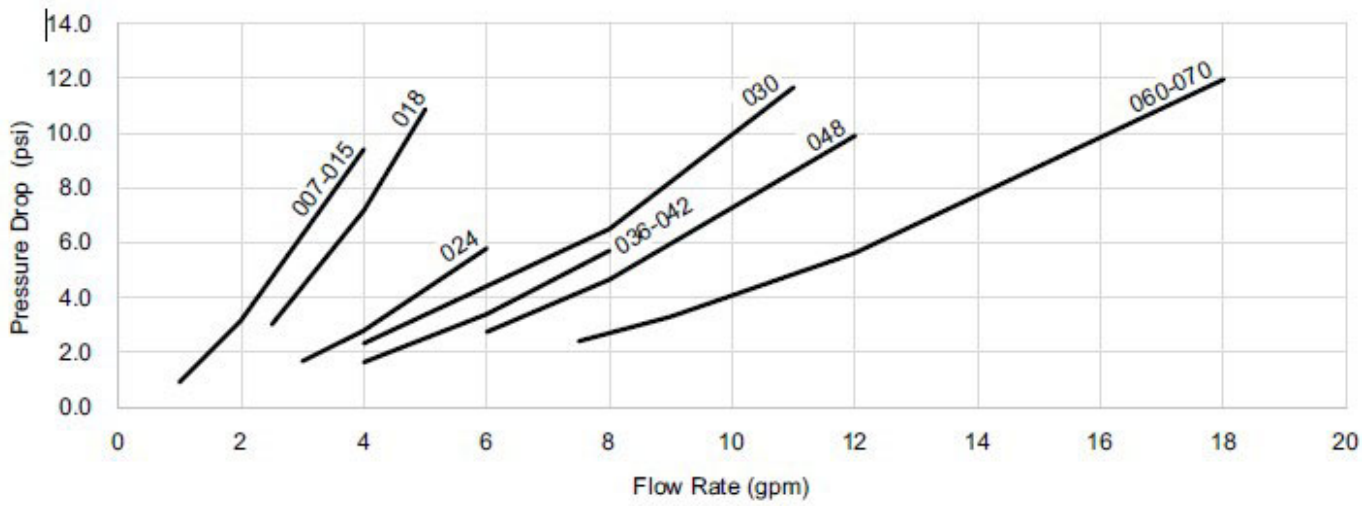


Fig. 21 – Water Pressure Drop Curve for Units With 2-Way Valve

Antifreeze

In areas where leaving water temperatures drop below 40°F or where piping will be routed through areas subject to freezing, antifreeze is needed.

Alcohols and glycols are commonly used as antifreeze agents. Freeze protection should be maintained to 15°F below the lowest expected entering loop temperature. For example, if the lowest expected entering loop temperature is 30°F, the leaving loop temperature would be 22 to 25°F. Therefore, the freeze protection should be at 15°F (30°F – 15°F = 15°F).

NOTE: All alcohols should be pre-mixed and pumped from a reservoir outside of the building or introduced under water level to prevent fuming.

Calculate the total volume of fluid in the piping system. (See Table 7.) Use the percentage by volume in Table 8 to determine the amount of antifreeze to use. Antifreeze concentration should be checked from a well-mixed sample using a hydrometer to measure specific gravity.

Table 7 – Approximate Fluid Volume (gal.) per 100 Ft. of Pipe[a]

PIPE	DIAMETER (in.)	VOLUME (gal.)
Copper	1	4.1
	1.25	6.4
	1.5	9.2
Rubber Hose	1	3.9
Polyethylene	3/4 IPS SDR11	2.8
	1 IPS SDR11	4.5
	1-1/4 IPS SDR11	8.0
	1/2 IPS SDR11	10.9
	2 IPS SDR11	18.0
	1-1/4 IPS SCH40	8.3
	1-1/2 IPS SCH40	10.9
	2 IPS SCH 40	17.0

NOTES:

[a] Volume of heat exchanger is approximately 1.0 gallon.

LEGEND

IPS — Internal Pipe Size
SCH — Schedule
SDR — Standard Dimensional Ratio

Table 8 – Antifreeze Percentages by Volume

ANTIFREEZE	MINIMUM TEMPERATURE FOR FREEZE PROTECTION (°F)			
	10	15	20	25
Methanol (%)	25	21	16	10
100% USP Food Grade Propylene Glycol (%)	38	30	22	15
Ethanol (%)	29	25	20	14

Freeze Protection Selection

The 25°F FP1 factory setting (water) should be used to avoid freeze damage to the unit.

Once antifreeze is selected, refer to Step 9 of this manual for FREEZE Protection settings on the UPM board.

Start-up

Use the procedure outlined below to initiate proper unit start-up.

Operating Limits

ENVIRONMENT

This equipment is designed for indoor installation only. Extreme variations in temperature, humidity and corrosive water or air will adversely affect the unit performance, reliability and service life. NOTE: Two factors determine the operating limits of a unit: entering-air temperature and water temperature. Whenever any of these factors are at a minimum or maximum level, the other two factors must be at a normal level to ensure proper unit operation.

Power Supply

A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

Unit Starting Conditions

Depending on the model, units should start and operate with entering water temperature temperatures between 20 and 110°F and entering air temperatures between 45 and 95°F. Water flow rates should be between 1.5 and 3.0 GPM/nominal cooling ton.

NOTE: These operating limits are not normal or continuous operating conditions. Assume that such a start-up is for the purpose of bringing the building space up to occupancy temperature. See Table 1 for operating limits.

MAINTENANCE

1. Filter changes or cleanings are required at regular intervals. The time period between filter changes will depend upon type of environment the equipment is used in.
   In a single family home, that is not under construction, changing or cleaning the filter every 60 days is sufficient. In other applications such as motels, where daily vacuuming produces a large amount of lint, filter changes may need to be as frequent as biweekly.

NOTE: Horizontal units containing two filters are taped together at the factory to facilitate removal. This should be done by end user as new filters are installed.

⚠ CAUTION

UNIT DAMAGE AND/OR OPERATION HAZARD

Failure to follow this caution may result in unit damage and/or improper equipment operation.

Equipment should never be used during construction due to likelihood of wall board dust accumulation in the air coil of the equipment which permanently affects the performance and may shorten the life of the equipment.

2. An annual “checkup” is recommended by a licensed refrigeration mechanic. Recording the performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended.
   This data should be compared to the information on the unit’s data plate and the data taken at the original startup of the equipment.
3. Lubrication of the blower motor is not required, however may be performed on some motors to extend motor life. Use SAE--20 non-detergent electric motor oil.
4. The condensate drain should be checked annually by cleaning and flushing to insure proper drainage.
5. Periodic lockouts are commonly caused by air or water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur, call a mechanic immediately and have them check for the following:
   – Water flow problems
   – Water temperature problems
   – Air flow problems
   – Air temperature problems.
   Use of the pressure and temperature charts for the unit may be required to properly determine the cause.

Servicing And Repair

Checks to the area

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. For repair to the refrigerating system the following precautions shall be completed prior to conducting work on the system.

Work procedure

Work shall be undertaken under a controlled procedure to minimize the risk of a flammable gas or vapor being present while the work is being performed.

General work area

All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.

Checking for presence of refrigerant

The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with R-454B refrigerant, i.e. non-sparking, adequately sealed or intrinsically safe.

Presence of fire extinguisher

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available to hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.

No ignition sources

No person carrying out work in relation to a refrigerating system which involves exposing any pipe work shall use any sources of ignition in such a manner that it may lead to the risk of fire or explosion. All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space. Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. “No Smoking” signs shall be displayed.

Ventilated area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

Checks to the refrigeration equipment

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer’s maintenance and service guidelines shall be followed. If in doubt, consult service and support for assistance.

The following checks shall be applied to installations using flammable refrigerants:

- The actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed;
- The ventilation machinery and outlets are operating adequately and are not obstructed;
- If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant;
- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected;
- Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.

Checks to electrical devices

Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.

Initial safety checks shall include:

- That capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking;
- That no live electrical components and wiring are exposed while charging, recovering or purging the system;
- That there is continuity of earth bonding.

Repairs to sealed components

Sealed electrical components shall be replaced.

Repair to intrinsically safe components

Intrinsically safe components must be replaced.

Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

Detection of flammable refrigerants

Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used.

The following leak detection methods are deemed acceptable for all refrigerant systems:

- Electronic leak detectors may be used to detect refrigerant leaks but, in the case of flammable refrigerants, the sensitivity may not be adequate, or may need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.). Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak detection equipment shall be set at a percentage of the LFL gas (25% maximum) is confirmed.
- Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

NOTE Examples of leak detection fluids are

- bubble method,
- fluorescent method agents.

If a leak is suspected, all naked flames shall be removed/extinguished.

If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.

Removal and evacuation

When breaking into the refrigerant circuit to make repairs – or for any other purpose – conventional procedures shall be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure shall be adhered to:

- safely remove refrigerant following local and national regulations;
- evacuate;
- purge the circuit with inert gas (optional for A2L);
- evacuate (optional for A2L);
- continuously flush or purge with inert gas when using flame to open circuit; and
- open the circuit.

The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by local and national codes. For appliances containing flammable refrigerants, the system shall be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen shall not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerants purging shall be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process shall be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system shall be vented down to atmospheric pressure to enable work to take place.

The outlet for the vacuum pump shall not be close to any potential ignition sources, and ventilation shall be available.

Charging procedures

In addition to conventional charging procedures, the following requirements shall be followed.

- Ensure that contamination of different refrigerants does not occur when using charging equipment.
- Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
- Cylinders shall be kept in an appropriate position according to the instructions.
- Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
- Label the system when charging is complete (if not already).
- Extreme care shall be taken not to overfill the refrigerating system. Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition.

The recovered refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

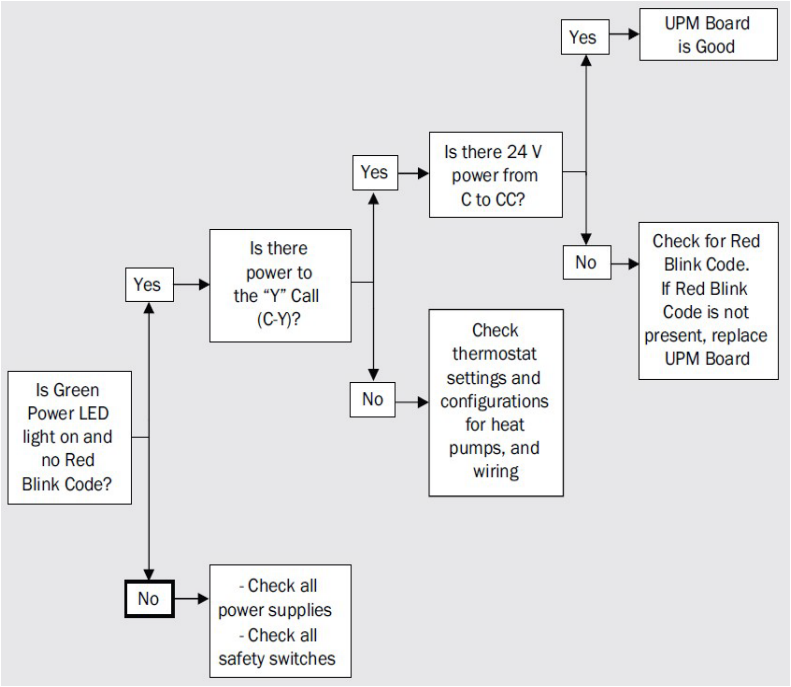
If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body shall not be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

IMPORTANT: The following Troubleshooting table is designed to help identify possible causes and solutions for problems. There could be more than one cause/solution to a problem that can be applied. Check each cause and adopt "process of elimination" and/or verification of each before making a conclusion.

TROUBLESHOOTING

Problem	Possible Cause	C hecks and Corrections
Entire unit does not run	Power Supply Off	Apply power, close disconnect
	Blown Fuse	Replace fuse or reset circuit breaker. Check for correct fuses
	Voltage Supply Low	If voltage is below minimum voltage specified on unit data plate, contact local power company.
	Thermostat	Set the fan to "ON", the fan should run. Set thermostat to "COOL" and lowest temperature setting, the unit should run in the cooling mode (reversing valve energized). Set unit to "HEAT" and the highest temperature setting, the unit should run in the heating mode (reversing valve de-energized). If neither the blower or compressor run in all three cases, the thermostat could be miswired or faulty. To ensure miswired or faulty thermostat verify that 24 volts is available at the low voltage terminal strip between "R" and "C", "Y" and "C", and "O" and "C". If the blower does not operate, verify 24 volts between terminals "G" and "C". Replace the thermostat if defective.
Blower operates but compressor does not	Thermostat	Check setting, calibration, and wiring
	Wiring	Check for loose or broken wires at compressor, capacitor, or contactor
	Safety Controls	Check UPM board red default L.E.D. for Blink Code
	Compressor overload open	If the compressor is cool and the overload will not reset, replace compressor
	Compressor motor grounded	Internal winding grounded to the compressor shell. Replace compressor.
	Compressor windings Open	After compressor has cooled, check continuity of the compressor windings. If the windings are open, replace the compressor
Unit off on high pressure control	Discharge pressure too high	In "COOLING" mode: Lack of or inadequate water flow. Entering water temperature is too warm. Scaled or plugged condenser. In "HEATING" mode: Lack of or inadequate air flow. Blower inoperative, clogged filter or restrictions in ductwork.
	Refrigerant charge	The unit is overcharged with refrigerant. Reclaim refrigerant, evacuate and recharge with factor recommended charge.
	High pressure	Check for defective or improperly calibrated high pressure switch.
Unit off on low pressure control	Suction pressure too low	In "COOLING" mode: Lack of or inadequate air flow. Entering air temperature is too cold. Blower inoperative, clogged filter or restrictions in ductwork In "HEATING" mode: Lack of or inadequate water flow. Entering water temperature is cold.Scaled or plugged condenser.
	Refrigerant charge	The unit is low on refrigerant. Check for refrigerant leak, repair, evacuate and recharge with factory recommended charge.
	Low pressure switch	Check for defective or improperly calibrated low pressure switch.
Unit short cycles	Unit oversized	Recalculate heating and or cooling loads. If excessive, possibly adding insulation and shading will rectify the problem adding insulation and shading will rectify the problem
	Thermostat	Thermostat installed near a supply air grill; relocate thermostat. Readjust heat anticipator.
	Wiring and controls	Check for defective or improperly calibrated low pressure switch.
Insufficient cooling or heating	Unit undersized	Recalculate heating and or cooling loads. If excessive, possibly adding insulation and shading will rectify the problem
	Loss of conditioned air by leakage	Check for leaks in duct work or introduction of ambient air through doors or windows
	Airflow	Lack of adequate air flow or improper distribution of air. Replace dirty filter.
	Refrigerant charge	Low refrigerant charge causing inefficient operation.

TROUBLESHOOTING (Continued)

Problem	Possible Cause	C hecks and Corrections
	Compressor	Check for defective compressor. If discharge is too low and suction pressure is too high, compressor is not pumping properly. Replace compressor.
	Reversing Valve	Defective reversing valve creating bypass of refrigerant from discharge of suction side of compressor. Replace reversing valve
	Operating pressures	Compare unit operation pressures to the pressure/temperature chart for the unit.
	TXV	Check T XV for possible restriction or defect. Replace if necessary.
	Moisture, non-condensables	The refrigerant system may be contaminated with moisture or non-condensables. Reclaim refrigerant, replace filter dryer, evacuate the refrigerant system, and recharge with factory recommended charge.
UPM board trouble shooting	Compressor will not run, no fault blink code	

WIRING DIAGRAMS

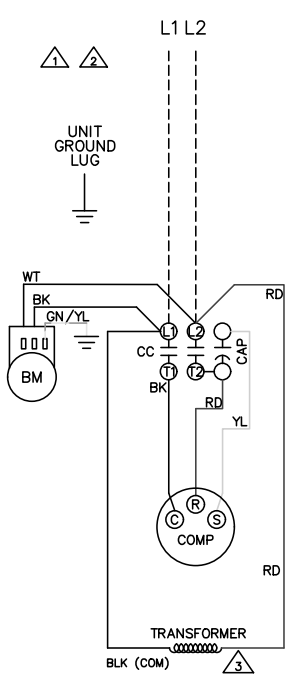
UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

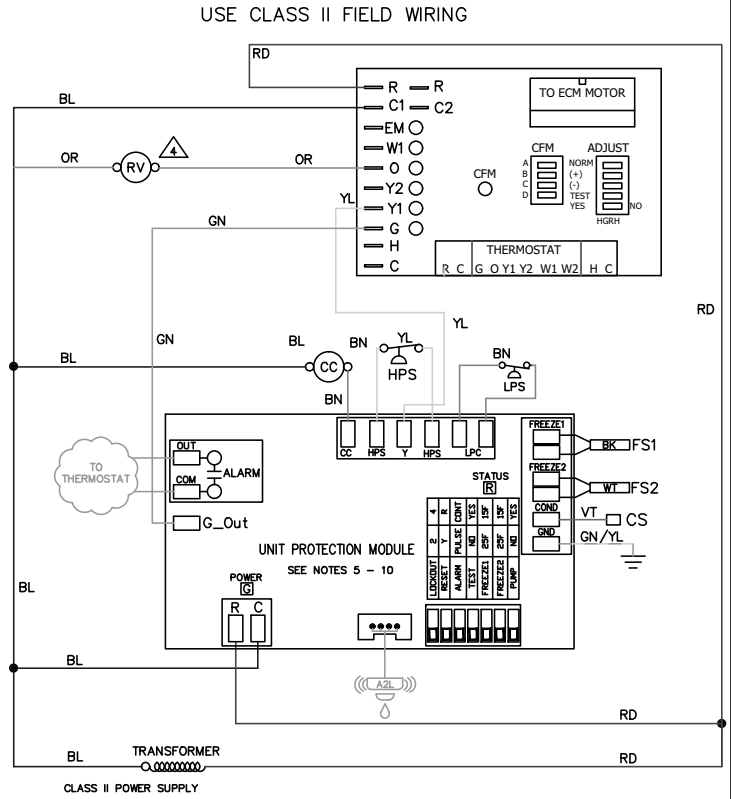
FACTORY WIRE ————————
FIELD WIRE --------

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY

STANDARD COMPONENTS LEGEND:
BM – BLOWER MOTOR
CAP – COMPRESSOR CAPACITOR
CC – COMPRESSOR CONTACTOR
CS – CONDENSATE SENSOR (IN DRAIN PAN)
FS – FREEZE SENSOR
HPS – HIGH PRESSURE SWITCH
LPS – LOW PRESSURE SWITCH
RV – REVERSING VALVE (HEAT PUMPS)

OPTIONAL COMPONENTS LEGEND:
[ ] A2L – AIR TO LIQUID REFRIGERANT LEAK SENSOR





NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.–N.F.P.A. #70, COPPER CONDUCTORS ONLY – CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE PRIMARY LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
4. REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
5. UPM–I INCLUDES BUILT IN: 270–300 SECOND RANDOM START
   300 SECOND DELAY ON BREAK
   120 SECOND LOW PRESSURE BYPASS
6. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
7. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F OPERATION BY DEFAULT, IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
8. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T–STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
9. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
10. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR–COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR–OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.

1 STAGE – 1 PHASE – CA MOTOR 1 1/2 TONS CAPACITY UPM I – STD			
PART No.	8 733 842 369		
DWG No. GB111001	DRAWN BY: NAH	DATE 11/4/2024	REV 1
E–MAIL:			

Fig. 22 – 1-1/2 Tons

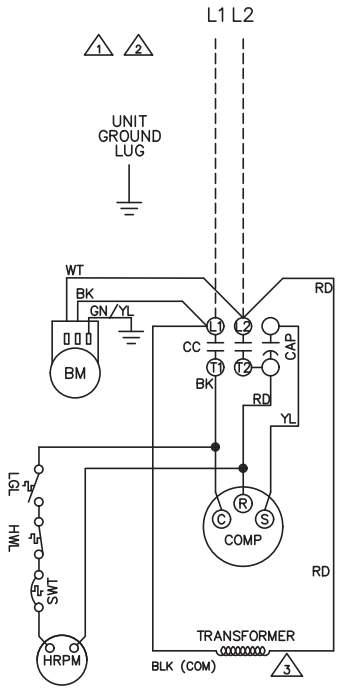
UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	CONDENSER FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	EVAPORATOR FREEZE CONDITION
7	REFRIGERANT LEAKAGE

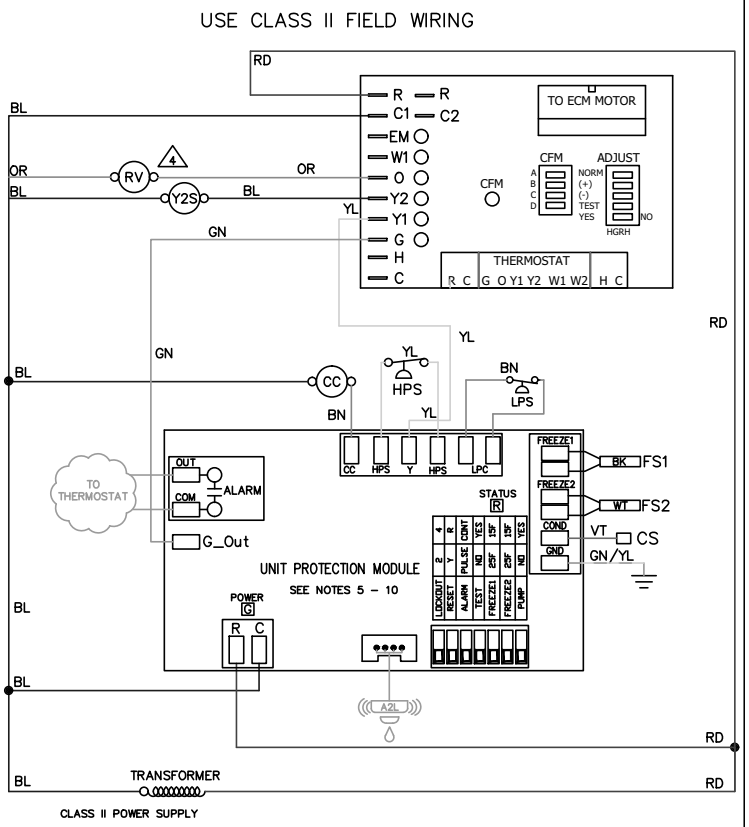
COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GN	GREEN
OR	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW
GY	GREY

FACTORY WIRE ————————
FIELD WIRE --------

STANDARD COMPONENTS LEGEND:
BM – BLOWER MOTOR
CAP – COMPRESSOR CAPACITOR
CC – COMPRESSOR CONTACTOR
CS – CONDENSATE SENSOR (IN DRAIN PAN)
FS – FREEZE SENSOR
HPS – HIGH PRESSURE SWITCH
LPS – LOW PRESSURE SWITCH
RV – REVERSING VALVE (HEAT PUMPS)
Y2S – COMPRESSOR 2ND STAGE

OPTIONAL COMPONENTS LEGEND:
[ ] A2L – AIR TO LIQUID REFRIGERANT LEAK SENSOR
[ ] HRP – HEAT RECOVERY PACKAGE:
HRPM– HEAT RECOVERY PUMP MOTOR
HWL – HOT WATER LIMIT
LGL – LOW GAS TEMPERATURE LIMIT
SWT – ON/OFF SWITCH AND OVERLOAD





NOTES:
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING.
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.–N.F.P.A. #70, COPPER CONDUCTORS ONLY – CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE PRIMARY LEAD FROM 240 TERMINAL AND CONNECT IT TO 208. CAP ALL UNUSED TERMINALS.
4. REVERSING VALVE NOT PRESENT ON UNITS WITH STRAIGHT COOL.
5. UPM–I INCLUDES BUILT IN: 270–300 SECOND RANDOM START
   300 SECOND DELAY ON BREAK
   120 SECOND LOW PRESSURE BYPASS
6. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
7. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F OPERATION BY DEFAULT, IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
8. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T–STAT SERVICE LIGHT IS DESIRED OR IF DDC CONNECTION IS AVAILABLE. CONT FOR NON BLINKING THERMOSTAT CONNECTION.
9. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
10. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM TERMINAL BLOCK TO ALR–COM TERMINAL, 24VAC WILL BE SENSED ON THE ALR–OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.

2 STAGE – 1 PHASE – CA MOTOR 2 THROUGH 6 TONS CAPACITY UPM I – STD			
PART No.	8 733 848 954		
DWG No. GB121001	DRAWN BY: NAH	DATE 11/4/2024	REV 1
E–MAIL:			

Fig. 23 – 2 Through 6 Tons

Table 9 – WATER SIDE PRESSURE DROP TABLE

Model	Water Flow Rate (GPM)	Water Side Pressure Drop with out Internal Valve (PSI)	Water Side Pressure Drop with Internal Valve (PSI)
GBA018	2.3	0.9	1.4
	3.4	1.9	2.6
	4.5	3.1	4.0
	6.0	5.1	6.4
GBA024	3.0	1.1	1.2
	4.5	2.2	2.3
	6.0	3.6	3.8
	8.0	6.0	6.2
GBA030	3.8	1.6	1.7
	5.6	3.3	3.4
	7.5	5.4	5.6
	10.0	8.9	9.1
GBA036	4.5	2.2	2.3
	6.8	4.4	4.6
	9.0	7.2	7.5
	12.0	11.9	12.3
GBA042	5.3	2.0	2.2
	7.9	4.1	4.3
	10.5	6.7	7.0
	14.0	11.0	11.5
GBA048	6.0	1.2	1.4
	9.0	2.4	2.7
	12.0	4.0	4.4
	16.0	6.6	7.1
GBA060	7.5	1.8	1.9
	11.3	3.6	3.8
	15.0	6.1	6.3
	20.0	10.1	10.4

All values based upon pure water at 70° F.

Table 10 – AIR TEMPERATURE RISE/FALL and REFRIGERANT PRESSURE RANGES

			Cooling				Heating			
Model	**Enter Fluid Temp (°F)**	**Water Flow (GPM)**	**Suction Pressure (PSIG)**	**Discharge Pressure (PSIG)**	**Water Temp Rise °F**	**Air Temp Drop °F**	**Suction Pressure (PSIG)**	**Discharge Pressure (PSIG)**	**Water Temp Rise °F**	**Air Temp Drop °F**
GBA018	30	3					57-67	250-270	6-7	18-22
		5					63-73	256-276	4-5	20-24
	40	3	109-127	177-197	15-18	23-27	70-80	264-284	7-8	21-25
		5	108-126	159-179	9-12	23-27	77-87	271-291	4-5	23-27
	50	3	111-129	204-224	15-18	22-26	84-94	278-298	8-9	24-28
		5	109-127	186-206	9-12	22-26	93-103	287-307	5-6	26-30
	60	3	113-131	235-255	14-17	22-26	99-109	293-313	10-11	28-32
		5	111-129	217-237	8-11	22-26	110-120	304-324	6-7	30-34
	70	3	115-133	269-289	14-17	21-25	116-126	310-330	11-12	31-35
		5	113-131	251-271	8-11	22-26	129-139	323-343	7-8	33-37
	80	3	116-134	307-327	13-16	21-25	135-145	329-349	12-13	35-39
		5	116-134	289-309	8-11	21-25	150-160	344-364	8-9	37-41
	90	3	119-137	348-368	13-16	21-25	155-165	349-369	13-14	38-42
		5	118-136	331-351	7-10	21-25				
	100	3	121-139	393-413	12-15	20-24				
		5	120-138	377-397	7-10	20-24				
GBA024	30	3					60-70	260-280	8-9	19-23
		6					67-77	267-287	4-5	21-25
	40	3	108-125	188-206	19-22	21-25	73-83	274-294	10-11	22-26
		6	106-123	160-178	9-12	21-25	82-92	283-303	5-6	24-28
	50	3	109-126	215-233	19-22	21-25	87-97	289-309	12-13	25-29
		6	108-125	187-205	9-12	21-25	98-108	300-320	6-7	27-31
	60	3	111-128	245-263	18-21	21-25	102-112	305-325	13-14	28-32
		6	109-126	217-235	9-12	21-25	115-125	319-339	7-8	31-35
	70	3	112-129	279-297	18-21	20-24	119-129	323-343	15-16	32-36
		6	111-128	250-268	9-12	21-25	135-145	340-360	8-9	35-39
	80	3	114-131	315-333	17-20	20-24	137-147	342-362	17-18	35-39
		6	113-130	288-306	8-11	20-24	157-167	364-384	9-10	39-43
	90	3	116-133	354-372	17-20	19-23	164-174	371-391	19-20	40-44
		6	115-132	330-348	8-11	20-24				
	100	3	118-135	397-415	16-19	19-23				
		6	117-134	376-394	8-11	19-23				

Table 10 – AIR TEMPERATURE RISE/FALL and REFRIGERANT PRESSURE RANGES (Continued)

			Cooling				Heating			
Model	**Enter Fluid Temp (°F)**	**Water Flow (GPM)**	**Suction Pressure (PSIG)**	**Discharge Pressure (PSIG)**	**Water Temp Rise °F**	**Air Temp Drop °F**	**Suction Pressure (PSIG)**	**Discharge Pressure (PSIG)**	**Water Temp Rise °F**	**Air Temp Drop °F**
GBA030	30	4					57-67	259-279	8-9	20-24
		7.5					63-73	264-284	4-5	21-25
	40	4	108-126	195-213	19-22	22-26	69-79	269-289	9-10	23-27
		7.5	106-124	169-187	10-13	22-26	77-87	275-295	5-6	24-28
	50	4	110-128	222-240	19-22	22-26	83-93	281-301	10-11	26-30
		7.5	108-126	195-213	10-13	22-26	92-102	289-309	6-7	28-32
	60	4	111-129	252-270	18-21	22-26	98-108	295-315	12-13	29-33
		7.5	110-128	225-243	9-12	22-26	109-119	306-326	7-8	32-36
	70	4	113-131	285-303	17-20	21-25	114-124	311-331	14-15	33-37
		7.5	112-130	258-276	9-12	21-25	128-138	325-345	8-9	36-40
	80	4	114-132	322-340	17-20	21-25	136-146	331-351	15-16	37-41
		7.5	113-131	296-314	9-12	21-25	150-160	345-365	9-10	40-44
	90	4	116-134	362-380	16-19	20-24	153-163	335-355	17-18	41-45
		7.5	115-133	337-355	8-11	21-25				
	100	4	118-136	405-423	16-19	20-24				
		7.5	117-135	383-401	8-11	20-24				
GBA036	30	4.5					55-65	240-260	8-9	18-22
		9					61-71	246-266	4-5	19-23
	40	4.5	113-129	198-222	20-23	22-26	66-76	251-271	9-10	21-25
		9	111-127	166-190	10-13	23-27	74-84	258-278	5-6	22-26
	50	4.5	114-130	224-248	19-22	22-26	79-89	263-283	11-12	23-27
		9	113-129	192-216	9-12	22-26	89-99	272-292	6-7	25-29
	60	4.5	116-132	254-278	19-22	22-26	93-103	276-296	12-13	26-30
		9	114-130	221-245	9-12	22-26	105-115	288-308	7-8	29-33
	70	4.5	117-133	287-311	18-21	21-25	109-119	291-311	14-15	29-33
		9	116-132	254-278	9-12	22-26	123-133	306-326	8-9	32-36
	80	4.5	119-135	323-347	18-21	21-25	126-136	308-328	16-17	33-37
		9	117-133	291-315	9-12	21-25	144-154	325-345	8-9	36-40
	90	4.5	120-136	363-387	17-20	20-24	144-154	326-346	17-18	37-41
		9	119-135	332-356	8-11	21-25	167-177	347-367	9-10	41-45
	100	4.5	122-138	405-429	16-19	20-24				
		9	121-137	376-400	8-11	20-24				

Table 10 – AIR TEMPERATURE RISE/FALL and REFRIGERANT PRESSURE RANGES (Continued)

			Cooling				Heating			
Model	**Enter Fluid Temp (°F)**	**Water Flow (GPM)**	**Suction Pressure (PSIG)**	**Discharge Pressure (PSIG)**	**Water Temp Rise °F**	**Air Temp Drop °F**	**Suction Pressure (PSIG)**	**Discharge Pressure (PSIG)**	**Water Temp Rise °F**	**Air Temp Drop °F**
GBA042	30	6					55-65	255-279	7-8	19-23
		10.5					60-70	260-284	4-5	20-24
	40	6	109-125	202-226	17-20	22-26	67-77	268-292	8-9	21-25
		10.5	107-123	173-197	10-13	22-26	73-83	275-299	5-6	23-27
	50	6	110-126	229-253	17-20	21-25	80-90	282-306	10-11	24-28
		10.5	109-125	199-223	9-12	22-26	88-98	291-315	6-7	26-30
	60	6	112-128	258-282	16-19	21-25	94-104	298-322	11-12	27-31
		10.5	110-126	228-252	9-12	21-25	104-114	310-334	7-8	30-34
	70	6	113-129	291-315	16-19	21-25	143-153	353-377	1-2	37-41
		10.5	112-128	260-284	9-12	21-25	123-133	330-354	8-9	33-37
	80	6	115-131	328-352	15-18	20-24	128-138	336-360	14-15	34-38
		10.5	114-130	296-320	9-12	21-25	143-153	353-377	9-10	37-41
	90	6	117-133	368-392	15-18	20-24	148-158	358-382	16-17	38-42
		10.5	115-131	337-361	8-11	20-24	166-176	378-402	9-10	42-46
	100	6	118-134	411-435	14-17	19-23				
		10.5	117-133	381-405	8-11	20-24				
GBA048	30	8					54-74	268-288	6-7	20-24
		12					57-77	272-292	4-5	20-24
	40	8	105-121	183-203	14-17	21-25	67-87	283-303	8-9	23-27
		12	104-120	169-189	9-12	22-26	71-91	288-308	5-6	24-28
	50	8	106-122	210-230	14-17	21-25	81-101	300-320	9-10	26-30
		12	106-122	196-216	9-12	21-25	86-106	306-326	6-7	27-31
	60	8	108-124	241-261	14-17	21-25	97-117	319-339	10-11	29-33
		12	108-124	227-247	9-12	21-25	104-124	327-347	7-8	31-35
	70	8	110-126	275-295	13-16	20-24	115-135	340-360	11-12	33-37
		12	109-125	261-281	9-12	20-24	123-143	350-370	8-9	35-39
	80	8	112-128	313-333	13-16	20-24	134-154	364-384	13-14	37-41
		12	111-127	300-320	8-11	20-24	145-165	376-396	9-10	39-43
	90	8	113-129	354-374	12-15	19-23	156-176	390-410	14-15	41-45
		12	113-129	342-362	8-11	20-24	169-189	404-424	10-11	43-47
	100	8	115-131	399-419	12-15	19-23				
		12	115-131	388-408	8-11	19-23				

Table 10 – AIR TEMPERATURE RISE/FALL and REFRIGERANT PRESSURE RANGES (Continued)

			Cooling				Heating			
Model	**Enter Fluid Temp (°F)**	**Water Flow (GPM)**	**Suction Pressure (PSIG)**	**Discharge Pressure (PSIG)**	**Water Temp Rise °F**	**Air Temp Drop °F**	**Suction Pressure (PSIG)**	**Discharge Pressure (PSIG)**	**Water Temp Rise °F**	**Air Temp Drop °F**
GBA060	30	10					49-65	217-274	5-7	18-22
		15					53-69	219-277	4-5	18-23
	40	10	106-131	185-224	14-20	22-26	60-78	225-287	7-8	21-25
		15	106-130	171-207	10-13	22-26	63-82	228-291	5-6	21-26
	50	10	107-133	209-255	13-19	22-26	71-92	235-301	8-9	23-28
		15	107-132	196-239	9-12	22-27	75-97	239-307	5-6	23-29
	60	10	108-135	237-290	13-19	21-26	84-107	247-318	9-11	25-31
		15	109-134	223-273	9-13	22-26	89-114	251-324	6-7	27-33
	70	10	110-137	268-329	13-19	21-25	98-125	260-336	10-12	29-35
		15	110-136	254-311	8-13	21-25	105-133	266-344	7-8	30-37
	80	10	111-139	302-370	12-18	21-25	115-144	275-355	11-14	32-39
		15	112-138	290-353	9-12	21-25	123-154	282-365	8-10	34-41
	90	10	113-141	339-415	12-18	20-24	134-166	291-377	12-15	35-43
		15	113-140	328-398	8-11	20-24	144-178	301-388	9-11	38-46
	100	10	114-143	381-464	12-16	20-24				
		15	115-142	370-447	8-11	20-24				

BLOWER PERFORMANCE

Model	Model Size	Fan Speed	Default factory motor setting	CFM											
				0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20
Horizontal / Vertical	018	A -		510	510	510	510	510	510	510	510				
		A Norm	X	600	600	600	600	600	600	600	600				
		A +		700	700	700	700	700	700	700	700				
	024	A -		680	680	680	680	680	680	680	680				
		A Norm (Full)	X	800	800	800	800	800	800	800	800				
		A +		920	920	920	920	920	920	920	920				
		A -		510	510	510	510	510	510	510	510				
		A Norm (Part)	X	600	600	600	600	600	600	600	600				
		A +		690	690	690	690	690	690	690	690				
	030	A -		810	810	810	810	810	810	810	810				
		A Norm (Full)	X	950	950	950	950	950	950	950	950				
		A +		1095	1095	1095	1095	1095	1095	1095	1095				
		A -		610	610	610	610	610	610	610	610				
		A Norm (Part)	X	720	720	720	720	720	720	720	720				
		A +		830	830	830	830	830	830	830	830				
	036	A -		1020	1020	1020	1020	1020	1020	1020	1020	1020	1020		
		A Norm (Full)	X	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200		
		A +		1380	1380	1380	1380	1380	1380	1380	1380	1380	1380		
		A -		765	765	765	765	765	765	765	765	765	765		
		A Norm (Part)	X	900	900	900	900	900	900	900	900	900	900		
		A +		1035	1035	1035	1035	1035	1035	1035	1035	1035	1035		
	042	A -		1190	1190	1190	1190	1190	1190	1190	1190	1190	1190		
		A Norm (Full)	X	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400		
		A +		1610	1610	1610	1610	1610	1610	1610	1610	1610	1610		
		A -		950	950	950	950	950	950	950	950	950	950		
		A Norm (Part)	X	1120	1120	1120	1120	1120	1120	1120	1120	1120	1120		
		A +		1290	1290	1290	1290	1290	1290	1290	1290	1290	1290		
	048	A -		1360	1360	1360	1360	1360	1360	1360	1360	1360	1360		
		A Norm (Full)	X	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600		
		A +		1840	1840	1840	1840	1840	1840	1840	1840	1840	1840		
		A -		1020	1020	1020	1020	1020	1020	1020	1020	1020	1020		
		A Norm (Part)	X	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200		
		A +		1380	1380	1380	1380	1380	1380	1380	1380	1380	1380		
	060	A -		1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
		A Norm (Full)	X	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
		A +		2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300
		A -		1275	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275	1275
		A Norm (Part)	X	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
		A +		1725	1725	1725	1725	1725	1725	1725	1725	1725	1725	1725	1725

Edition Date:12/24
Catalog No: IM-GBA-01
A Proud Member of the Carrier Family
Replaces: New