CAUTION: READ ALL SAFETY GUIDES BEFORE YOU START TO INSTALL YOUR UNIT.

SAVE THIS MANUAL
GENERAL INFORMATION

The outdoor units are designed to be connected to a matching indoor coil with sweat connect lines. Sweat connect units are factory charged with refrigerant for a matching indoor coil plus 15 feet of field supplied lines.

Matching indoor coils are available with an orifice liquid feed (YORKMATE flow control device) sized for the most common usage. The thermal expansion valve and/or refrigerant charge may need to be changed for some indoor-outdoor unit combinations, elevation differences or total line lengths. Refer to Application Data covering “General Piping Recommendations and Refrigerant Line Length” (Form 690.01-AD1V).

SAFETY

Use this instruction in conjunction with the instruction for the appropriate indoor evaporator coil, variable speed air handler or furnace and other accessories. Read all instructions before installing the unit.

Installer should pay particular attention to the words: NOTE, CAUTION and WARNING.

NOTES are intended to clarify or make the installation easier.

CAUTIONS are given to prevent equipment damage.

WARNINGS are given to alert the installer that personal injury and/or equipment damage may result if installation procedures are not handled properly.

INSPECTION

As soon as a unit is received, it should be inspected for possible damage during transit. If damage is evident, the extent of the damage should be noted on the carrier’s freight bill. A separate request for inspection by the carrier’s agent should be made in writing. See Local Distributor for more information.

LIMITATIONS

The unit should be installed in accordance with all national and local safety codes and the limitations listed below:

1. Limitations for the indoor unit, coil and appropriate accessories must also be observed.
2. The outdoor unit must not be installed with any duct work in the air stream. The outdoor fan is the propeller type and is not designed to operate against any additional external static pressure.
3. Optimal performance is gained by using a variable speed air handler or furnace.
4. The maximum and minimum conditions for operation must be observed to assure a system that will give maximum performance with minimum service.
5. The unit should not be operated in cooling mode at outdoor temperatures below 60°F. The unit is not designed to operate with a low ambient kit. Do not modify the control system to operate with any type of low ambient kit.
6. Indoor evaporator coil orifice must be removed prior to the installation of a factory supplied balanced port TXV kit.

Table 1: APPLICATION LIMITS

<table>
<thead>
<tr>
<th>AIR TEMPERATURE °DB ON OUTDOOR COIL</th>
<th>AIR TEMPERATURE ON INDOOR COIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>Cool</td>
<td>Heat</td>
</tr>
<tr>
<td>60</td>
<td>-10</td>
</tr>
</tbody>
</table>

1. Below -10°F, the unit operates automatically with resistance heat or furnace only.
2. Operation below this temperature is permissible for a short period of time, during morning warm-up.

Incorrect installation may create a condition where the operation of the product could cause personal injury or property damage.
UNIT INSTALLATION

LOCATION

Before starting the installation, select and check the suitability of the location for both the indoor and outdoor unit. Observe all limitations and clearance requirements.

The outdoor unit must have sufficient clearance for air entrance to the condenser coil, for air discharge and for service access. See Figure 1.

NOTE: For multiple unit installations, units must be spaced a minimum of 18 inches apart. (Coil face to coil face.)

If the unit is to be installed on a hot sun exposed roof or a black-topped ground area, the unit should be raised sufficiently above the roof or ground to avoid taking the accumulated layer of hot air into the outdoor unit.

Provide an adequate structural support.

GROUND INSTALLATION

The unit may be installed at ground level on a solid base that will not shift or settle, causing strain on the refrigerant lines and possible leaks. Maintain the clearances shown in Figure 1 and install the unit in a level position. Isolate the base from the structure to avoid noise or vibration transmission.

Normal operating sound levels may be objectionable if the unit is placed directly under windows of certain rooms (bedrooms, study, etc.).

Condensate will drain from beneath the coil of the outdoor unit during the defrost cycle. Normally this condensate may be allowed to drain directly on the ground.

CAUTION

The outdoor unit should not be installed in an area where mud or ice could cause personal injury. Remember that condensate will drip from the unit coils during heat and defrost cycles and that this condensate will freeze when the temperature of the outdoor air is below 32°F.

Elevate the unit sufficiently to prevent any blockage of the air entrances by snow in areas where there will be snow accumulation. Check the local weather bureau for the expected snow accumulation in your area.

ROOF INSTALLATION

When installing units on a roof, the structure must be capable of supporting the total weight of the unit, including a pad, lintels, rails, etc., which should be used to minimize the transmission of sound or vibration into the conditioned space.

Isolate the unit from rain gutters to avoid any possible wash out of the foundation.
UNIT PLACEMENT

1. Provide a base in the pre-determined location.
2. Remove the shipping carton and inspect for possible damage.
3. Compressor tie-down bolts should remain tightened.
4. Position the unit on the base provided.
5. Sit unit on the (4) rubber elevating grommets if provided. Use grommet kit 1SG0601 if not provided. These should be positioned as shown in Figure 2 to reduce noise and allow for proper drainage.

NOTE: The base pan may differ in appearance, but the location of grommets is the same.

6. Make a hole(s) in the structure wall large enough to accommodate the insulated vapor line, the liquid line and the wiring.

HEAT PUMP

This heat pump requires the installation of a thermal expansion valve. The TXV controls the superheat of the refrigerant at the outlet of the evaporator coil, ensuring the proper refrigerant temperature at the compressor suction. Following are the basic steps for installing the TXV. For detailed instructions, refer to the Installation Instructions accompanying the TXV kit.

Install TXV kit as follows:

1. First, relieve the holding charge by depressing the Schrader valve located in the end of the liquid line.
2. After holding charge is completely discharged, loosen and remove the liquid line fitting from the orifice distributor assembly. Note that the fitting has right hand threads.
3. Remove the orifice from the distributor body using a small diameter wire or paper clip. Orifice is not used when the TXV assembly is installed.
4. After orifice is removed, install the thermal expansion valve to the orifice distributor assembly with supplied fittings. Hand tighten and turn an additional 1/8 turn to seal. Do not overtighten fittings.
5. Re-install the liquid line to the top of the thermal expansion valve. Hand modify the liquid line to align with casing opening.
6. Install the TXV equalizer line into the vapor line as follows:
   a. Select a location on the vapor line for insertion of the equalizer line which will not interfere with TXV bulb placement.
   b. Use an awl to punch through the suction tube and insert the awl to a depth to achieve a 1/8 inch diameter hole.
7. Install TXV equalizer line in 1/8 hole previously made in vapor line. Equalizer line can be bottomed out in vapor line as end of equalizer line is cut on 45 degrees angle to prevent blockage. Braze equalizer line making sure that tube opening is not brazed closed.

CAUTION

Dry nitrogen should always be supplied through the tubing while it is being brazed, because the temperature required is high enough to cause oxidation of the copper unless an inert atmosphere is provided. The flow of dry nitrogen should continue until the joint has cooled. Always use a pressure regulator and safety valve to insure that only low pressure dry nitrogen is introduced into the tubing. Only a small flow is necessary to displace air and prevent oxidation. All connections to be brazed are copper-to-copper and should be brazed with a phosphorous-copper alloy material such as Silfos-5 or equivalent. DO NOT use soft solder.

Install the TXV bulb to the vapor line near the equalizer line, using the two bulb clamps furnished with the TXV assembly. Ensure the bulb is making maximum contact. Refer to TXV installation instruction for view of bulb location.

WARNING

The evaporator coil is under 30 psig pressure.

CAUTION

In all cases, mount the TXV bulb after vapor line is brazed and has had sufficient time to cool.
8. Bulb should be installed on a horizontal run of the vapor line if possible. On lines under 7/8" OD the bulb may be installed on top of the line. With 7/8" OD and over, the bulb should be installed at the position of about 4 or 8 o'clock.

9. If bulb installation is made on a vertical run, the bulb should be located at least 16 inches from any bend, and on the tubing sides opposite the plane of the bend. On vertical bulb installations, the bulb should be positioned with the bulb tail at the top, so that the bulb acts as a reservoir.

10. Bulb should be insulated using thermal insulation provided to protect it from the effect of the surrounding ambient temperature.

PIPING CONNECTIONS

The outdoor condensing unit may be connected to the indoor evaporator coil using field supplied refrigerant grade copper tubing that is internally clean and dry. Units should be installed only with the tubing sizes for approved system combinations as specified in Tabular Data Sheet. The charge given is applicable for total tubing lengths up to 15 feet. See Application Data Form 690.01-AD1V for installing tubing of longer lengths and elevation differences.

NOTE: Using a larger than specified line size could result in oil return problems. Using a line size smaller than specified will result in loss of capacity and other problems caused by insufficient refrigerant flow.

PRECAUTIONS DURING PIPE INSTALLATION

1. Install the lines with as few bends as possible. Care must be taken not to damage the couplings or kink the tubing. Use clean, hard drawn copper tubing where no appreciable amount of bending around obstruction is necessary. If soft copper must be used, care must be taken to avoid sharp bends which may cause a restriction.

2. The lines should be installed so that they will not obstruct service access to the coil, air handling system or filter.

3. Care must also be taken to isolate the refrigerant lines to minimize noise transmission from the equipment to the structure.

4. The vapor line must be insulated with a minimum of 1/2" foam rubber insulation (Arm-A-Flex or equivalent). Liquid lines that will be exposed to direct sunlight and/or high temperatures must also be insulated.

5. Use PVC piping as a conduit for all underground installations as shown in Figure 4. Buried lines should be kept as short as possible to minimize the build up of liquid refrigerant in the vapor line during long periods of shutdown.

CAUTION

Dry nitrogen should always be supplied through the tubing while it is being brazed, because the temperature required is high enough to cause oxidation of the copper unless an inert atmosphere is provided. The flow of dry nitrogen should continue until the joint has cooled. Always use a pressure regulator and safety valve to insure that only low pressure dry nitrogen is introduced into the tubing. Only a small flow is necessary to displace air and prevent oxidation.

The outdoor units have re-usable service valves on both the liquid and vapor connections. The total system refrigerant charge is retained within the outdoor unit during shipping and installation. The re-usable service valves are provided to evacuate and charge per this instruction. Serious service problems can be avoided by taking adequate precautions to assure an internally clean and dry system.
PRECAUTIONS DURING BRAZING ANGLE VALVE

Precautions should be taken to prevent heat damage to angle valve by wrapping a wet rag around it as shown in Figure 5. Also, protect all painted surfaces and insulation during brazing. After brazing, cool joint with wet rag.

**WARNING**

*This is not a backseating valve. The service access port has a valve core. Opening or closing valve does not close service access port. If the valve stem is backed out past the retaining ring, the O-ring can be damaged causing leakage or system pressure could force the valve stem out of the valve body possibly causing personal injury. In the event the retaining ring is missing, do not attempt to open the valve.*

Valve can be opened by removing the plunger cap and fully inserting a hex wrench into the stem and backing out counterclockwise until valve stem just touches retaining ring.

Replace plunger cap finger tight, then tighten an additional 1/12 turn (1/2 hex flat). Cap must be replaced to prevent leaks.

Connect the refrigerant lines using the following procedure:

1. Remove the cap and Schrader core from both the liquid and vapor angle valve service ports at the outdoor unit.
2. Connect low pressure nitrogen to the liquid line service port.
3. Carefully remove the brazed plugs from the evaporator liquid and vapor connections after relieving the pressure in the evaporator.
4. Braze the liquid line to the evaporator liquid connection. The nitrogen should now be flowing through the evaporator coil.
5. Slide the grommet away from the vapor connection at the coil. Braze the vapor line to the evaporator vapor connection. After the connection has cooled, slide the grommet back into original position.
6. Protect the vapor valve of the outdoor unit with a wet rag and braze the vapor line connection. The nitrogen flow should be exiting the system from the vapor service port connection. After this connection has cooled, remove the nitrogen source from the liquid fitting service port.
7. Replace the Schrader cores in the liquid and vapor valves.
8. Evacuate the vapor line, evaporator and the liquid line, to 500 microns or less.
9. Leak test all refrigerant piping connections including the service port flare caps to be sure they are leak tight. DO NOT OVERTIGHTEN (between 40 and 60 inch - lbs. maximum).

**NOTE:** Do not use the system refrigerant in the outdoor unit to purge or leak test.

10. Replace caps on service ports. Do not remove the flare caps from the service ports except when necessary for servicing the system.

**CAUTION**

If visual verification of the valve stem reaching the retaining ring is impossible, stop backing out the valve stem when the slightest increase in resistance is felt. Because of the small size and therefore the reduced resistance, back out the liquid valve 5 turns maximum to prevent going past the retaining ring.

3. Carefully remove the brazed plugs from the evaporator liquid and vapor connections after relieving the pressure in the evaporator.

**CAUTION**

The evaporator is pressurized.

4. Braze the liquid line to the evaporator liquid connection. The nitrogen should now be flowing through the evaporator coil.
5. Slide the grommet away from the vapor connection at the coil. Braze the vapor line to the evaporator vapor connection. After the connection has cooled, slide the grommet back into original position.
6. Protect the vapor valve of the outdoor unit with a wet rag and braze the vapor line connection. The nitrogen flow should be exiting the system from the vapor service port connection. After this connection has cooled, remove the nitrogen source from the liquid fitting service port.
7. Replace the Schrader cores in the liquid and vapor valves.
8. Evacuate the vapor line, evaporator and the liquid line, to 500 microns or less.
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**NOTE:** Do not use the system refrigerant in the outdoor unit to purge or leak test.

10. Replace caps on service ports. Do not remove the flare caps from the service ports except when necessary for servicing the system.

**CAUTION**

Do not connect manifold gauges unless trouble is suspected. Approximately 3/4 ounce of refrigerant will be lost each time a standard manifold gauge is connected.
11. Release the refrigerant charge into the system. Open both the liquid and vapor valves by removing the plunger cap and with an allen wrench back out counter-clockwise until valve stem just touches retaining ring. Release the refrigerant charge into the system. See “PRECAUTIONS DURING BRAZING ANGLE VALVE” on Page 6.

Replace plunger cap finger tight, then tighten an additional 1/12 turn (1/2 hex flat). Cap must be replaced to prevent leaks.

If a leak is suspected, leak test to locate the leak. To verify the leak, close the valve to the vacuum pump suction to isolate the pump and hold the system under vacuum. If the micron gauge indicates a steady and continuous rise after a few minutes, it’s an indication of a leak. If the gauge shows a rise, then levels off after a few minutes and remains fairly constant, it is an indication that the system is leak free, but still contains moisture and may require further evacuation if the reading is above 1000 microns.

12. If the refrigerant tubing, indoor evaporator coil or outdoor condensing unit has developed a leak during shipment, or was, for any other reason, opened to the atmosphere for more than four (4) minutes, it is necessary to evacuate the system down to at least 500 microns to eliminate contamination and moisture in the system.

See “SYSTEM START-UP” for checking and recording system charge.

ELECTRICAL CONNECTIONS

GENERAL INFORMATION & GROUNDING

Check the electrical supply to be sure that it meets the values specified on the unit nameplate and wiring label.

Power wiring, control (low voltage) wiring, disconnect switches and over current protection to be supplied by the installer. Wire size should be sized per NEC requirements.

All field wiring must USE COPPER CONDUCTORS ONLY and be in accordance with Local, National Fire, Safety & Electrical Codes. This unit must be grounded with a separate ground wire in accordance with the above codes.

The complete connection diagram and schematic wiring label is located on the inside surface of the unit electrical box cover and this instruction.

POWER WIRING

1. Install the proper size weatherproof disconnect switch outdoors and within sight of the unit.
2. Run power wiring from the disconnect switch to the unit.
3. Remove the control box cover to gain access to the unit wiring. Route wires from disconnect through power wiring opening provided and into the unit control box as shown in Figure 6.
4. Install the proper size time-delay fuses or circuit breaker, and make the power supply connections.
5. Energize the crankcase heater to save time by preheating the compressor oil while the remaining installation is completed.

FIGURE 6: Typical Field Wiring

ACCESSORY WIRING

The electrical accessories available for this unit are a three stage thermostat, an optional De-humidification Control and a Fossil Fuel Relay Kit for use in conjunction with furnace installation. Refer to the individual instructions packaged with the accessories for installation.

THERMOSTAT MOUNTING / WIRING

This heat pump must be installed with the factory recommended thermostat.

The thermostat should be located about 5 ft. above the floor, where it will be exposed to normal room air circulation. Do not place it on an outside wall or where it is exposed to the radiant effect from exposed glass or appliances, drafts from outside doors or supply air grilles.

After the thermostat is mounted, route the 24-volt control wiring (NEC Class 2) from the thermostat to the indoor air handler and outdoor unit. Route the control wiring into the grommeted hole in the bottom of control box of the outdoor unit to the 10 position terminal block. Connect leads to the screw terminals on the terminal block as shown in Figure 7.

Interconnecting control wiring must be a minimum of No. 18 AWG color coded insulated wires. If total wire length (including thermostat, indoor unit, and outdoor unit) increases more than 90 feet, use No. 16 AWG wires to prevent excessive voltage drop.

NOTE: To eliminate erratic operation, seal the hole in the wall at the thermostat with permagum or equivalent to prevent air drafts affecting the anticipators in the thermostat.
DE-HUMIDIFICATION CONTROL

A de-humidification control accessory 2HU06700124 may be used in high humidity areas. This control provides cooling at a reduced air flow, lowering evaporator temperature and increasing latent capacity. The humidistat in this control opens the humidistat contacts on humidity rise. To install, refer to instructions packaged with the accessory and Figure 7. Prior to the installation of the de-humidistat control, the jumper across the HUMIDISTAT terminals on the indoor variable speed air handler or furnace CFM selection board must be removed.

During first or second stage cooling, if the relative humidity in the space is higher than the desired set point of the de-humidistat control, the variable speed blower motor will operate at lower speed until the de-humidification control is satisfied. A 40-60% relative humidity level is recommended to achieve optimum comfort.

NOTE: If a de-humidification control is installed, it is recommended that a minimum air flow of 325 cfm/ton (2-stage operation) be supplied at all times.

FOSSIL FUEL RELAY CONTROL

A Fossil Fuel Relay Control accessory 2FF02700101 is required for use with all furnace applications. To install, refer to the instructions packed with the accessory.

During a call for a third stage of heat, the fossil fuel relay will lock-out compressor operation and utilize furnace operation. This mode will continue until the room thermostat is satisfied. Upon thermostat satisfaction, the fossil fuel relay will de-energize and normal heat pump operation will be restored.

FIELD CONNECTIONS - CONTROL WIRING

The recommended field connections for specified indoor air handlers and furnaces are shown in Figures 7 or 8. Feed all control wiring through the grommet in the bottom of the box.

Variable Speed Air Handler Connections Shown in Figure 7

The first stage thermostat signal is connected to Y1 at the air handler. It is critical that the Y2 OUT signal is connected to Y at the air handler to properly control the blower speed.

Variable Speed Furnace Connections Shown in Figure 8

The first stage thermostat signal is connected to Y1 at the furnace. Y2 OUT must be connected to Y at the furnace to properly control the blower speed. The Fossil Fuel Relay Kit is required for all furnace applications.

NOTE: Figures 7 & 8 reflect wiring connections found on the recommended Honeywell thermostat (Non-Programmable 2ET03700524, Programmable 2ET03700624). When using the optional White Rodgers thermostat (2EP32U70124) W3 shown on the diagram should be replaced with W1.
**CFM SELECTION BOARD SETTINGS**

For proper system operation the CFM Selection Board jumpers must be set properly.

Refer to the Tabular Data Sheet for the recommended airflow settings for each size condensing unit.

Set the high speed cooling speed per the instructions for the air handler or furnace by selecting the correct COOL and ADJ taps. The low speed setting will automatically be programmed for the correct airflow. Verify the airflow by LED display on the CFM selection board.

The HEAT PUMP jumper **MUST** be removed for proper system operation.

The HUMIDISTAT jumper must also be removed if a dehumidistat is installed.

**TRANSFORMER INSTALLATION**

This system requires the use of a 75VA transformer.

*CAUTION*

Failure to install the 75VA transformer may result in premature system failure or damage to the equipment.

The system transformer is typically located within the indoor air handler or furnace and is most commonly rated at 40VA. This heat pump comes from the factory with a 75VA transformer included. The transformer is located behind the compressor access panel and secured to the refrigerant piping. Cut the shipping strap and discard. The supplied transformer can be used with an air handler (208/230 V) or furnace (115 V). Remove the indoor unit transformer and replace with the supplied 75VA transformer. Mounting hole locations may require modifications. Wire the new transformer per the indoor unit’s wiring diagram. Give particular attention to the transformer primary voltage (230/208/115 V) and select the proper primary voltage terminals.

*CAUTION*

Failure to utilize the appropriate transformer primary voltage tap will result in transformer damage and may result in system damage and/or failure.

**SYSTEM CHARGE**

The factory charge in the outdoor unit includes enough charge for the unit and the smallest matched coil. Additional charge may be required.

**REFRIGERANT LINE CHARGES**

The outdoor condensing unit may be connected to the indoor evaporator coil using field supplied refrigerant grade copper tubing that is internally clean and dry. Units should be installed only with the tubing sizes for approved system combinations as specified in Tabular Data Sheet. The charge given is applicable for total tubing lengths up to 15 feet. See Application Data Form 690.01-AD1V for installing tubing of longer lengths and elevation differences.

**NOTE:** Using a larger than specified line size could result in oil return problems. Using a line size smaller than specified will result in loss of capacity and other problems caused by insufficient refrigerant flow.

**Table 2: REFRIGERANT LINE CHARGES**

<table>
<thead>
<tr>
<th>LIQUID OD</th>
<th>VAPOR OD</th>
<th>R-22 CHARGE OZ./FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>5/8&quot;</td>
<td>0.66</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>3/4&quot;</td>
<td>0.68</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>7/8&quot;</td>
<td>0.70</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>1-1/8&quot;</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Sweat connect units also include sufficient charge for 15 feet of lines. Table 2 lists the refrigerant line charges.

Use the following charging method whenever additional refrigerant is required for the system charge.

Measurement Method

A calibrated charging cylinder or accurate weighing device must be used to add refrigerant. This is the only accurate charging method for heat pumps in the heat pump mode.

Check flare caps on service ports to be sure they are leak tight. DO NOT OVERTIGHTEN (between 40 and 60 inch-lbs. maximum).
Subcooling Charging Method

The E*TS heat pump must only be used with the matching thermostatic expansion valve kit listed in the Tabular Data Sheet. The best way to check the system charge is by checking the system subcooling during the second stage cooling of operation.

SERVICING AND VERIFY

For second stage (2 cylinder) cooling operation, the recommended subcooling is 16°F. For first stage (1 cylinder) operation, the recommended subcooling is 10°F for all models.

1. Set the system running in the second stage cooling (2 cylinder operation) by setting the thermostat at least 6°F below the room temperature.
2. Operate the system for a minimum of 15-20 minutes.
3. Refer to the Tabular Data Sheet for the recommended airflow and verify this indoor airflow (it should be about 400 SCFM per ton during 2 cylinder operation).
4. Measure the liquid refrigerant pressure P and temperature T at the service valve.
5. Calculate the saturated liquid temperature ST from Table 3.

Example: The pressure P and temperature T measured at the E*TS030 service port is 223° Psig and 93°F. From Table 3, the saturated temperature for 223 Psig is 109°. The subcooling temperature TC = 109° - 93° = 16°F.

Add charge if the calculated subcooling temperature TC in Step 6 is lower than the recommended level. Remove and recover the refrigerant if the subcooling TC is higher than the recommended level.

ENERGIZE CRANKCASE HEATER

This unit is equipped with a crankcase heater for the compressor.

A warning label with an adhesive back is supplied in the unit installation instruction packet. This label should be attached to the field supplied disconnect switch where it will be easily seen.

IMPORTANT - An attempt to start the compressor without at least 8 hours of crankcase heat will damage the compressor.

In order to energize the crankcase heater, set indoor two stage cooling thermostat to "OFF" position. Close the line power disconnect to the unit.

SYSTEM OPERATION

This heat pump model is equipped with both YorkGuard V heat pump control and TS compressor control. The interface control 6CF board is used to bypass the first stage of heat when the outdoor temperature falls below certain temperatures. The TS control board is used only to switch between 1 and 2 cylinder operation. The fault codes and pressure switch on the TS control board are bypassed using the jumpers between the test and "PS" pins.

1. Anti-short Cycle Timer
   The five-minute time delay on YorkGuard V will be used to prevent the system from short cycling after the thermostat off or power interrupt. This time delay can be bypassed by temporarily shorting the test terminals on YorkGuard V for 3 seconds. Since a jumper was factory installed across the test pins on the TS control board, the anti-short cycle timer on the TS control board is bypassed.

2. First Stage Cooling
   This heat pump model is equipped with a Twin-Single compressor. With a call for first stage cooling, the compressor operates one cylinder. The run winding (R) is connected through the upper left contactor (A) and to the capacitor and the start winding (S) is connected to line voltage. The system operates at low discharge pressure and high suction pressure. See Figure 11.

3. Second Stage of Cooling
   With a call for second stage cooling, the TS control will shut the compressor off for two seconds then energize relays R1 and R2 on the TS control board. This will de-energize (open) the upper left contactor (A) and energize (close) the lower right contactor (B), connecting the compressor run winding (R) to the line voltage and start winding (S) to the capacitor. The compressor runs in the reverse direction with two cylinders compared to the first stage. The system will operate with two cylinders until both first and second stage are satisfied. The Y2OUT signal from the relay board causes the indoor blower to function at high speed.

If the room thermostat calls for second stage cooling (Y2) on two consecutive cooling cycles, the next call for cooling for either first or second stage will energize the unit in second stage mode. The above mode will be reset to permit start up on the first stage with only a Y1 call when the second stage operation cycle runs less than 15 minutes or when 24V to the TS control board is disconnected.

Table 3: R-22 SATURATION TEMPERATURE

<table>
<thead>
<tr>
<th>ST°F</th>
<th>P²</th>
<th>ST°F</th>
<th>P²</th>
<th>ST°F</th>
<th>P²</th>
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<tr>
<td>103</td>
<td>205</td>
<td>118</td>
<td>253</td>
<td>133</td>
<td>309</td>
</tr>
<tr>
<td>104</td>
<td>208</td>
<td>119</td>
<td>257</td>
<td>134</td>
<td>313</td>
</tr>
</tbody>
</table>

1. ST = Saturated Temperature
2. P = Pressure

Example: The pressure P and temperature T measured at the E*TS030 service port is 223° Psig and 93°F. From Table 3, the saturated temperature for 223 Psig is 109°. The subcooling temperature TC = 109° - 93° = 16°F.
4. **6K Relay on the 6CF Control Board**
   The 6K relay on the 6CF interface board operates as follows. See Figure 10:
   a. If the YorkGuard V defrost control balance point setting is 45°F, the 6K relay will be:
      • Energized if liquid temperature goes below 35°F.
      • De-energized if the liquid temperature goes above 35°F AND the ambient is greater than 42°F for five minutes AND the unit is not in defrost.
   b. If the YorkGuard V defrost control balance point setting is at anything but 45°F, the 6K relay will be:
      • Energized if liquid temperature goes below 45°F.
      • De-energized if the liquid temperature goes above 45°F AND the ambient is greater than 55°F AND the unit is not in defrost.

5. **Heating mode with the de-energized 6K relay**
   The TS compressor operates similar to the first and second stage of cooling modes expect there is no O input from the thermostat, the reversing valve is not energized, and the system operates in heating heat pump mode. The YorkGuard V control and the liquid temperature will not allow the system to go into the defrost mode.

6. **Heating mode with the energized 6K Relay**
   The energized 6K relay on the interface board (6CF) will connect Y1 and Y2 and disconnect Y2OUT from the TS control to the indoor blower if the J1 pin is not in the ON position. The compressor will operate only in second stage regardless of the first or second stage call from the thermostat. The indoor blower will operate in low air mode. The indoor discharge air temperature should be about 10°F hotter than a normal heat pump. If high-speed air is preferred, move J1 pin to the ON position at the interface board (6CF). This will send the Y2OUT signal back to the indoor blower for the high speed air.

**NOTE:** High-speed air will lower discharge temperature approximately 10°F and increase the heating capacity approximately 10%.

---

**FIGURE 10 : 6CF Interface Board**

**Table 4: NORMAL HEAT PUMP APPLICATION**

<table>
<thead>
<tr>
<th>SYSTEM MODE</th>
<th>TSTAT INPUTS</th>
<th>INDOOR AIR</th>
<th>SYSTEM OPERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Cooling</td>
<td>G, Y1, O</td>
<td>Lo Air</td>
<td>1st Stage 1 Cylinder</td>
</tr>
<tr>
<td>2nd Cooling</td>
<td>G, Y1, Y2, O</td>
<td>Hi Air</td>
<td>2nd Stage 2 Cylinders</td>
</tr>
<tr>
<td>1st Heating De-energized 6K</td>
<td>G, Y1</td>
<td>Lo Air</td>
<td>1st Stage 1 Cylinder</td>
</tr>
<tr>
<td>2nd Heating De-energized 6K</td>
<td>G, Y1, Y2</td>
<td>Hi Air</td>
<td>2nd Stage 2 Cylinders</td>
</tr>
<tr>
<td>1st Heating Energized 6K</td>
<td>G, Y1</td>
<td>Lo Air(*)</td>
<td>2nd Stage 2 Cylinders</td>
</tr>
<tr>
<td>2nd Heating Energized 6K</td>
<td>G, Y1, Y2</td>
<td>Lo Air(*)</td>
<td>2nd Stage 2 Cylinders</td>
</tr>
<tr>
<td>Heating with Aux. Heat</td>
<td>G, Y1, Y2, W3</td>
<td>Indoor Air: Greater of High Cooling or High Heating</td>
<td></td>
</tr>
</tbody>
</table>

(*) Move J1 pin to the ON position at relay board, 6CF to obtain the high air speed.
LOCKOUT MODES

A jumper is factory installed across the pressure switch connection on the TS control board (6CC). The system will use the entire lockout mode of the YorkGuard V. The YorkGuard V monitors system operation and will lock out the outdoor unit if it detects a malfunction. When a lockout occurs, the emergency heat light will flash at the thermostat and the fault indicator light on the YorkGuard V will flash the code, separated by a pause, indicating the failure mode as shown in Table 5.

Table 5: FLASHING LIGHT CODES

<table>
<thead>
<tr>
<th>FAULT</th>
<th>FAILURE MODE</th>
<th>COOLING MODE</th>
<th>HEATING MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Discharge Pressure reaches 400 +/- 10 PSIG</td>
<td>Compressor Off</td>
<td>Compressor Off</td>
</tr>
<tr>
<td>3</td>
<td>Discharge temp. did not reach approx. 90°F within 1hr. of compressor operation</td>
<td>Compressor Off</td>
<td>Compressor Off</td>
</tr>
<tr>
<td>5</td>
<td>Two default defrosts within 1hr.</td>
<td>Not Applicable</td>
<td>Compressor Off</td>
</tr>
<tr>
<td>6</td>
<td>Shorted 1 or shorted to ground2 or opened3 discharge sensor.</td>
<td>Compressor Off</td>
<td>Compressor Off</td>
</tr>
<tr>
<td>7</td>
<td>Shorted 1 or shorted to ground2 or opened3 outdoor sensor.</td>
<td>Not Applicable</td>
<td>Utilizes liquid sensor at end of each compressor off period.</td>
</tr>
<tr>
<td>8</td>
<td>Shorted or shorted to ground or opened liquid sensor.</td>
<td>Not Applicable</td>
<td>Use 30 time/ temp defrost back-up, 5 min. defrost time.</td>
</tr>
<tr>
<td>9</td>
<td>Shorted or shorted to ground bonnet sensor</td>
<td>Not Applicable</td>
<td>Compressor Off</td>
</tr>
<tr>
<td>9</td>
<td>Opened bonnet sensor</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

1. Shorted - A resistance of less than 100 Ohm across a sensor terminal.
2. Shorted to ground - A resistance of 1 Mega Ohm or less to ground on either side of the sensor terminal.
3. Opened - A resistance of over 200000 Ohm across a sensor terminal.

The control can be reset from a fault or lockout condition and the X/L LED indicator on the thermostat cleared when any of the following conditions occur.

1. Power is interrupted and restored for at least two seconds.
2. The TEST terminal is connected through a 400 Ohm or less resistance for at least two seconds and then increased to 1.5K Ohm or greater.
3. Or Y on the wall thermostat goes from an ON-OFF transition (valid for fault codes 2 - 5 only).

NOTE: The thermistor (codes 6-8 only) errors cannot be reset until the errors are corrected.

If the fault code 2, 3, and 4 occur in a 12 hour period, the control will go into a hard lockout mode that can only be cleared by:

1. Removal of 24VAC control voltage or
2. Jump the TEST pin

OPERATION BELOW LOW-TEMPERATURE CUT-OFF

At an outdoor temperature below the cut-off point, (See Figure 11) the compressor operation cannot be justified due to the small amount of heat generated.

The YorkGuard senses this and performs the following functions:

1. De-energizes compressor circuit.
2. Changes the first step of supplemental heat so that it is controlled by the first stage of the thermostat along with the fan.
3. Energizes standby heat (if installed) under control of third stage of heating thermostat.

OPERATION IN EMERGENCY HEAT POSITION

When switch on thermostat is placed in emergency heat position:

1. Compressor circuit is locked out.
2. Gas furnace or standby heaters (if installed) will be controlled by first stage of heating thermostat.
3. Indoor blower will operate on demand for heat and cycle off with the last heater element or furnace when in "AUTO" position.

SUPPLEMENTAL ELECTRIC HEAT

Supplemental electric heaters are energized by third stage of heating thermostat. YorkGuard V will permit operation of supplemental heaters below balance point. At all outdoor temperatures above balance point, supplemental heaters are not permitted to operate.

OPERATION BELOW BALANCE POINT: With third stage of heating thermostat contact closed, a circuit is made through YorkGuard V to energize the supplemental heaters.

When third stage of heating thermostat becomes satisfied, contact will open to de-energize supplemental heaters.

GAS FURNACE HEAT

Gas furnace operation will occur at all temperatures below the low-temperature cut-off point or when there is a call for third stage heat. Gas furnace operation will also occur during the defrost cycle and if there is a call for emergency heat.

DEFROST CYCLE

Frost and ice which forms on the outdoor coil during the heating cycle must be defrosted when it blocks the air flow through the coil.

Due to the arrangement of the refrigerant circuit within the outdoor coil of these units, frost may accumulate unevenly in different sections of the coil. However, a normal defrost may occur even though the coil is not completely covered with frost.

The YorkGuard V continuously monitors temperature sensors which measure outdoor ambient temperature and the temperature of the refrigerant liquid at the outdoor coil. When the relationship between these temperatures reaches a value which has been determined by the electronic control to be indicative of need for defrost, the defrost cycle is initiated provided the liquid sensor temperature is colder than 35°F.
The YorkGuard V energizes the fan relay which stops the outdoor fan and energizes the reversing valve relay to switch the refrigerant circuit to cooling. YorkGuard V also energizes supplemental heat (either electric heat or fossil fuel) to prevent cold drafts in the conditioned space.

The defrost cycle is terminated when:
1. The liquid line temperature exceeds 70°F, or,
2. 14 1/2 minutes from the initiation of the defrost cycle, or,
3. the liquid line reaches 45°F and holds above 45°F for a continuous 3 minutes.

The YorkGuard V de-energizes the fan relay and reversing valve relay to return unit to normal heating cycle.

**INDICATIONS OF PROPER COOLING OPERATION**

Cooling operation is the same as any conventional air conditioning unit.

1. The outdoor fan should be running, with warm air being discharged from the top of the unit.
2. The indoor blower (furnace or air handler) will be operating, discharging cool air from the ducts, coils or other parts in the air circuit. Clean as often as necessary to keep the unit clean. Use a brush, vacuum cleaner attachment, or other suitable means.
3. The vapor line at the outdoor unit will feel cool to the touch.
4. The liquid line at the outdoor unit will feel warm to the touch.

**INDICATIONS OF PROPER HEATING OPERATION**

Indications of proper heating operation is as follows:

1. The outdoor fan should be running, with cool air being discharged from the top of the unit.
2. The indoor blower (furnace or air handler) will be operating, discharging warm air from the ducts.
3. The vapor line at the outdoor unit will feel warm to the touch.
4. The liquid line at the outdoor unit will feel cool to the touch.

**NOTICE TO OWNER**

If lockout occurs, check the following before calling a service man:

1. Indoor section for dirty filter.
2. Outdoor section for snow accumulation.
3. Outdoor section for leaf or debris blockage.

Eliminate problem, turn off the thermostat for 10 seconds and attempt start. Wait 5 minutes. If system does not start, call serviceman.

**MAINTENANCE**

1. Dirt should not be allowed to accumulate on the outdoor coils or other parts in the air circuit. Clean as often as necessary to keep the unit clean. Use a brush, vacuum cleaner attachment, or other suitable means.
2. The outdoor fan motor is permanently lubricated and does not require periodic oiling.
3. If the coil needs to be cleaned, it should be washed with Calgon CalClean (mix one part CalClean to seven parts water). Allow solution to remain on coil for 30 minutes before rinsing with clean water. Solution should not be permitted to come in contact with painted surfaces.
4. Refer to the furnace or air handler instructions for filter and blower motor maintenance.
5. The evaporator coil drain pan should be inspected and cleaned regularly to prevent odors and assure proper drainage.

**WARNING**

It is unlawful to knowingly vent, release or discharge refrigerant into open air. It is necessary to recover the refrigerant during any repair or installation of the system.

WHEN THE SYSTEM IS FUNCTIONING PROPERLY AND THE OWNER HAS BEEN FULLY INSTRUCTED, SECURE THE OWNER’S APPROVAL.
SERVICE RECORDS