

- installation instructions packaged with the thermostat.
- Use #18 AWG wire for 24V control wiring runs not exceeding 75 feet. Use #16 AWG wire for 24V control wiring runs not exceeding 125 feet. Use #14 AWG wire for 24V control wiring runs not exceeding 200 feet. Low voltage wiring may be National Electrical Code (NEC) Class 2 where permitted by local codes.
 - Route thermostat wires from sub-base terminals to the unit. Control wiring should enter through the condenser panel opening or through curb indicated in "Electrical Entrance and Thru Curb" Figure 8B. Connect thermostat and any accessory wiring to low voltage terminal block TB1 in the main control box.

NOTE: FIELD-SUPPLIED CONDUIT MAY NEED TO BE INSTALLED DEPENDING ON UNIT/CURB CONFIGURATION. USE #18 AWG SOLID CONDUCTOR WIRE WHENEVER CONNECTING THERMOSTAT WIRES TO TERMINALS ON SUB-BASE. DO NOT USE LARGER THAN #18 AWG WIRE. A TRANSITION TO #18 AWG WIRE MAY BE REQUIRED BEFORE ENTERING THERMOSTAT SUB-BASE.

NOTE: REFER TO UNIT WIRING DIAGRAMS FOR THERMOSTAT OR REMOTE SENSOR CONNECTIONS.

CIRCULATING AIR AND FILTERS

DUCTWORK

The supply duct from the unit through a wall may be installed without clearance. However, minimum unit clearances must be maintained (see "Clearances" section). The supply duct should be provided with an access panel large enough to inspect the air chamber downstream of the heat exchanger. A cover should be tightly attached to prevent air leaks. False ceilings or drop ceilings may be used as a return air plenum.

NOTE: Adequate return grills have to be supplied for each room for proper return for that space.

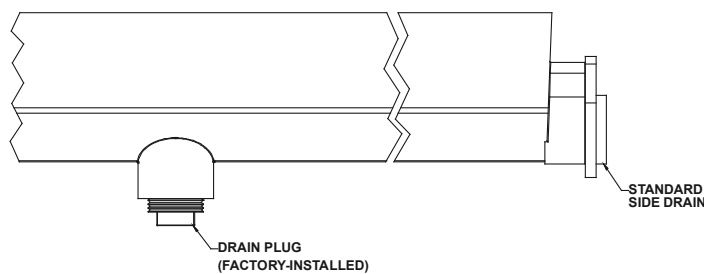
Ductwork dimensions are shown in the roof curb installation manual.

If desired, supply and return duct connections to the unit may be made with flexible connections to reduce possible unit operating sound transmission.

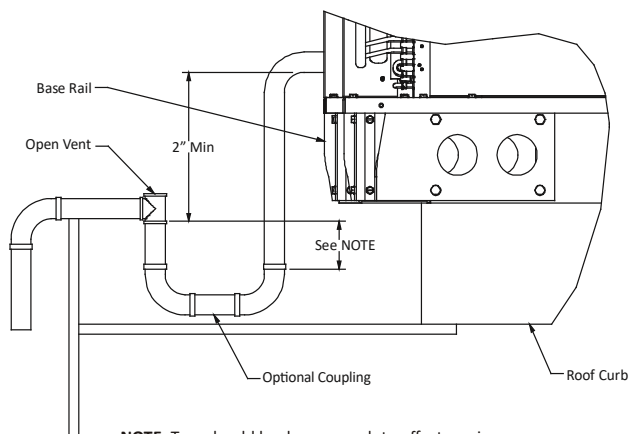
CONDENSATE DRAIN CONNECTION

CONDENSATE DRAIN CONNECTION

A 3/4" female NPT drain connection is supplied on the end of the unit and bottom of the drain pan for condensate piping. An external trap must be installed for proper condensate drainage. Hand tighten drain fitting to the drain connection.



DRAIN PAN (SIDE VIEW)
FIGURE 9



NOTE: Trap should be deep enough to offset maximum unit static difference. A minimum 4" trap is recommended.

DRAIN CONNECTION
FIGURE 10

Install condensate drain trap as shown. Use 3/4" drain line and fittings or larger. Do not operate without trap.

HORIZONTAL DRAIN

Drainage of condensate directly onto the roof may be acceptable; refer to local code. It is recommended that a small drip pad of either stone, mortar, wood or metal be provided to prevent any possible damage to the roof.

VERTICAL DRAIN

To use the bottom drain connection, remove the drain plug from the bottom connection and install it in the horizontal connection. Refer to local code for proper drain routing.

NOTE: ALL THREADED CONNECTIONS USE PIPE SEALER.

CLEANING

Due to the fact that the drain pans in any air conditioning unit will have some moisture in them, algae and fungus will grow due to airborne bacteria and spores. Periodic cleaning is necessary to prevent the build-up from plugging the drain.

To remove the drain pan for cleaning, remove the drain pan cover first (located on duct panel) then slide out the drain pan.

STARTUP, ADJUSTMENTS, AND CHECKS

PRE-STARTUP INSTRUCTIONS - GENERAL

Prior to the beginning of Startup, Adjustment, and Checks procedures, the following warnings, steps, and checks should be read and completed.



WARNING

HIGH VOLTAGE!

TO AVOID PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, BOND THE FRAME OF THIS UNIT TO THE BUILDING ELECTRICAL GROUND BY USE OF THE GROUNDING TERMINAL PROVIDED OR OTHER ACCEPTABLE MEANS. DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING THIS UNIT.



CAUTION

TO PREVENT PROPERTY DAMAGE OR PERSONAL INJURY, DO NOT START THE UNIT UNTIL ALL NECESSARY PRE-CHECKS AND TESTS HAVE BEEN PERFORMED.



WARNING

MOVING MACHINERY HAZARD!

TO PREVENT POSSIBLE PERSONAL INJURY OR DEATH, DISCONNECT POWER TO THE UNIT AND PADLOCK IN THE "OFF" POSITION BEFORE SERVICING FANS.

On new installations, or if a major component has been replaced, the operation of the unit must be checked.

Check unit operation as outlined in the following instructions. If any sparking, odors, or unusual sounds are encountered, shut off electrical power and recheck for wiring errors, or obstructions in or near the blower motors. **Duct covers must be removed before operating unit in horizontal duct applications. (This only applies to units that have horizontal duct attached.)**

The Startup, Adjustments, and Checks procedure provides a step-by-step sequence which, if followed, will assure the proper startup of the equipment in the minimum amount of time. Air balancing of duct system is not considered part of this procedure. However, it is an important phase of any air conditioning system startup and should be performed upon completion of the Startup, Adjustments, and Checks procedure. The Startup, Adjustments, and Checks procedure at outside ambients below 55°F should be limited to a readiness check of the refrigeration system with the required final check and calibration left to be completed when the outside ambient rises above 55°F.

TEMPORARY HEATING OR COOLING

If the unit is to be used for temporary heating or cooling, a "Startup, Adjustments, and Checks" must first be performed in accordance with this manual. Damage or

repairs due to failure to comply with these requirements are not covered under the warranty. **After** the machines are used for temporary heating or cooling, inspect the coils, fans, and motors for unacceptable levels of construction dust and dirt and install new filters.

CONTRACTOR RESPONSIBILITY

The installing contractor must be certain that:

- All supply and return air ductwork is in place, properly sealed, and corresponds with installation instructions.
- All thermostats are mounted and wired in accordance with installation instructions.
- All electric power, all gas, and the condensate drain installation have been made to each unit on the job. These main supply lines must be functional and capable of operating all units simultaneously.
- Air filters are in place.

ROOF CURB INSTALLATION CHECK

Inspect the roof curb for correct installation. The unit and curb assembly should be level. Inspect the flashing of the roof mounting curb to the roof, especially at the corners, for good workmanship. Also check for leaks around gaskets. Note any deficiencies in a separate report and forward to the contractor.

OBSTRUCTIONS, FAN CLEARANCE AND WIRING

Remove any extraneous construction and shipping materials that may be found during this procedure. Rotate all fans manually to check for proper clearances and that they rotate freely. Check for bolts and screws that may have jarred loose during shipment to the job site. Re-tighten if necessary. Re-tighten all electrical connections.

FIELD DUCT CONNECTIONS

Verify that all duct connections are tight and that there is no air bypass between supply and return.

FILTER SECTION CHECK

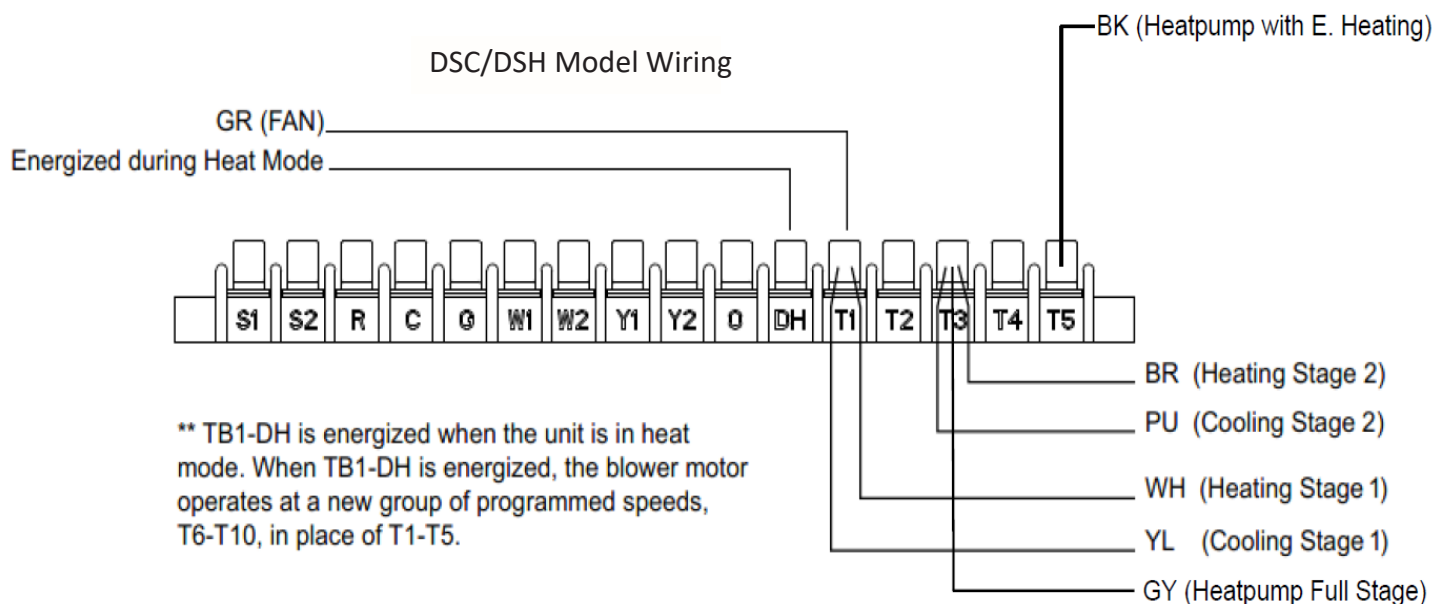
Remove filter section access panels and check that filters are properly installed. Note airflow arrows on filter frames.

PRE-STARTUP PRECAUTIONS

It is important for your safety that the unit has been properly grounded during installation. Check ground lug connection in main control box for tightness prior to closing circuit breaker or disconnect switch. Verify that supply voltage on line side of disconnect agrees with voltage on unit identification plate and is within the utilization voltage range as indicated in Appendix B Electrical Data.

System Voltage - The nominal voltage value assigned to a circuit or system for the purpose of designating its voltage class.

Nameplate Voltage - The voltage assigned to a piece of equipment for the purpose of designating its voltage class and for the purpose of defining the minimum and maximum voltage at which the equipment will operate.



Utilization Voltage - The voltage of the line terminals of the equipment at which the equipment must give fully satisfactory performance. Once it is established that supply voltage will be maintained within the utilization range under all system conditions, check and calculate if an unbalanced condition exists between phases. Calculate percent voltage unbalance as follows.

THREE PHASE MODELS ONLY

$$\text{3) PERCENT VOLTAGE UNBALANCE} = 100 \times \frac{\text{2) MAXIMUM VOLTAGE DEVIATIONS FROM AVERAGE VOLTAGE}}{\text{1) AVERAGE VOLTAGE}}$$

HOW TO USE THE FORMULA:

EXAMPLE: Line to Neutral Voltage of 220, 216, and 213

1) Average Voltage = $220 + 216 + 213 = 649 / 3 = 216$

2) Maximum Voltage Deviations from Average Voltage = $220 - 216 = 4$

$$\text{3) Percent Voltage Unbalance} = 100 \times \frac{4}{216} = \frac{400}{216} = 1.8\%$$

Percent voltage unbalance MUST NOT exceed 2%.

CONTROL VOLTAGE CHECK

Close the disconnect switch to energize control transformer. Check primary and secondary (24V) of control transformer.

AIR FLOW ADJUSTMENTS

When the final adjustments are complete, the current draw of the motor should be checked and compared to the full load current rating of the motor. The amperage

must not exceed the service factor stamped on the motor nameplate. The total airflow must not be less than that required for operation of the electric heater. Refer to Appendix D.

If an economizer is installed, check the unit operating balance with the economizer at full outside air and at minimum outside air.

NOTE: NEVER RUN HIGH STAGE CFM BELOW 300 CFM PER TON, EVAPORATOR FREEZING OR POOR UNIT PERFORMANCE IS POSSIBLE.

EEM - STANDARD STATIC DRIVE MOTOR

Adjust the CFM for the unit by changing the position of the low voltage leads on the terminal block TB1. Refer to Appendix A for blower performance at each speed tap. The table below shows RECOMMENDED SPEED TAPS for heating and cooling. Refer to Appendix D for maximum and minimum allowed airflow for heating and cooling.

BLOWER SPEED SELECTION

The unit has one set of taps for cooling (T1-T5), taps for heatpump (T3-T5) and a second set of taps for electric heater heating - (E.Heat) (T6-T10). When electric heat is called TB1-W1 will also call TB1-DH activating the second set of taps T6-T10. If ever the cooling and E.heating is called at the same time (defrost) heating taps will take priority and T6-T10 will be chosen by default. Tap T1 and T2 are for low cool operation (cooling stage 1) and Taps T3 to T5 are for high cool operation (cooling stage 2). Similar taps Taps T3 to T5 are for heatpump operation (heatpump full stage). Tap T6 and T7 are for low heat operation (electric heat stage 1) and T8 to T10 are for high heat operation (electric heat stage 2). Tap T8 to T10 are for Defrost operation. Tap 10 for heatpump with electric heat. Taps are selected by changing the position of the low voltage leads on the terminal block TB1. Refer to Appendix A for blower performance at each speed tap.

NOTE: IF MORE THAN ONE LEAD IS ENERGIZED SIMULTANEOUSLY, THE MOTOR WILL RUN AT THE HIGHER NUMERICAL SPEED VALUE.

Fan speed for G (GR) is fixed at TB1-T1 and cannot be moved.

Low Cool, Yellow (YL) is moveable and set to TB1-T1.

Low Heat, White (WH) is moveable and set to TB1-T6.

High Cool, Purple (PU) is moveable and set to TB1-T3.

High Heat, Brown (BR) is moveable and set to TB1-T8.

High Cool with EHeat, Purple (PU) is moveable and set to TB1-T8.

Heatpump Heat, Gray (GY) is moveable and set to TB1-T3.

Heatpump with EHeat, Black (BK) is moveable and set to TB1-T10. These wires can be moved together or separately and placed on any unoccupied terminal.

NOTE: YL CAN BE MOVED TO TAP T3 AS LONG AS YL DOES NOT SHARE THE TAP WITH PU. WH CAN BE MOVED TO TAP T7 AS LONG AS WH DOES NOT SHARE THE TAP WITH BR.

If high cool operation is set at Tap T4 or T5, low cool operation must be set at T2.

If high heat operation is set at T9 or T10, low heat operation must be set at T7.

SET EVAPORATOR FAN RPM

Actual RPM's must be set and verified with a tachometer or strobe light. Refer to Appendix A for basic unit fan RPM. Refer also to "Airflow" section of this manual. With disconnect switch open, disconnect thermostat wires from terminals Y and W. This will prevent heating and mechanical cooling from coming on. Place a jumper wire across terminals R and G at TB1 terminal block. Close disconnect switch; evaporator fan motor will operate so RPM can be checked.

ELECTRICAL INPUT CHECK

Make preliminary check of evaporator fan ampere draw and verify that motor nameplate amps are not exceeded. A final check of amp draw should be made upon completion of air balancing of the duct system (see Appendix B).

AIR CONDITIONING START-UP PROCEDURE AND CHECKLIST

Begin with power turned off at all disconnects.

1. Turn thermostat system switch to "Cool," and fan switch to "Auto" and turn temperature setting as high as it will go.
2. Inspect all registers and set them to the normal open position.
3. Turn on the electrical supply at the disconnect.
4. Turn the fan switch to the "ON" position. The blower should operate after a 7 second delay.
5. Turn the fan switch to "Auto" position. The blower should stop after a 60 second delay.

6. Slowly lower the cooling temperature until first stage COOL (LOW COOL) starts. The blower, first stage fan, and first stage compressor should now be operating. Allow the unit to run 10 minutes, make sure cool air is being supplied by the unit. Check compressor rotation by verifying pressure difference between suction and discharge
7. Lower the cooling temperature further until second stage COOL (HIGH COOL) starts. The blower, both fans, and both compressors should now be operating. Allow the unit to run 10 minutes, make sure cool air is being supplied by the unit.
8. Check that each compressor is operating correctly. The scroll compressors in these units MUST operate in the proper rotation. To ensure the compressors are operating in the correct direction, check the compressor discharge line pressure or temperature after the compressor is started. The discharge pressure and discharge line temperature should increase. If this does not occur and the compressor is producing an exceptional amount of noise, perform the following checks
 - If a single compressor is operating backwards, check the power wiring for that compressor and correct any leads that have been interchanged at the contactor.
 - If both of the compressors are operating backward, disconnect the unit power supply and lock-out tagout in the OFF position. Switch two leads of the power supply at the unit Single Point Power Block. Reconnect power and check for compressor operation.
9. Turn the temperature setting to the highest position, stopping the unit. The indoor blower will continue to run for 60 seconds.
10. Turn the thermostat system switch to "OFF" and disconnect all power when servicing the unit.



WARNING

HIGH VOLTAGE!
DISCONNECT ALL POWER BEFORE
SERVICING OR INSTALLING THIS UNIT.
MULTIPLE POWER SOURCES MAY BE
PRESENT. FAILURE TO DO SO MAY CAUSE
PROPERTY DAMAGE, PERSONAL INJURY OR
DEATH.



HEAT PUMP START-UP PROCEDURE

1. Check the cooling mode for the heat pump in the same manner as above. The reversing valve is energized when the thermostat is placed in the cooling position. A clicking sound should be noticeable from the reversing valve. By lowering the temperature setting to call for cooling, the contactor is energized. The compressor, blower and fan should then be running. After the cooling mode is checked out, turn the thermostat system switch to "OFF".

2. Turn the thermostat system switch to "HEAT" and fan switch to "AUTO".
3. Slowly raise the heating temperature setting. When the heating first stage makes contact, stop raising the temperature setting. The compressor, blower and fan should now be running with the reversing valve in the de-energized (heating) position. After giving the unit time to settle out, make sure the unit is supplying heated air.
4. If the outdoor ambient is above 80°F, the unit may trip on its high pressure cut out when on heating. The compressor should stop. The heating cycle must be thoroughly checked, so postpone the test to another day when conditions are more suitable but **DO NOT FAIL TO TEST.**
If the outdoor ambient is low and the unit operates properly on the heating cycle, you may check the pressure cutout operation by blocking off the indoor return air until the unit trips.
5. If unit operates properly in the heating cycle, raise the temperature setting until the heating second stage makes contact. Supplemental resistance heat, if installed should now come on. Make sure it operates properly.
NOTE: If outdoor thermostats are installed the outdoor ambient must be below the set point of these thermostats for the heaters to operate. It may be necessary to jumper these thermostats to check heater operation if outdoor ambient is mild.
6. For thermostats with emergency heat switch, return to step 11. The emergency heat switch is located at the bottom of the thermostat. Move the switch to emergency heat. The heat pump will stop, the blower will continue to run, all heaters will come on and the thermostat emergency heat light will come on.
7. If checking the unit in the wintertime, when the outdoor coil is cold enough to actuate the defrost control, observe at least one defrost cycle to make sure the unit defrosts completely.

REFRIGERATION SEQUENCE CHECK

With the disconnect switch open, remove the field connected thermostat wire from terminal R on TB1 terminal block. Place a jumper across terminals R and G, and across R and Y on TB1 terminal block. Close the disconnect switch. The following operational sequence should be observed:

1. Current through primary winding of transformer TRANS1 energizes the 24-volt control circuit.
2. To simulate a mechanical call for cooling from the wall thermostat, place a jumper across terminals R and Y1 of terminal block TB1.
3. **UNIT WITH ECONOMIZER OPTION:** The compressor circuit is interlocked through terminals 3 and 4 of the economizer module. If the outdoor air enthalpy (temperature and humidity) is not suitable for cooling, the economizer terminals will be closed permitting compressor to be energized.
4. The **blower contactor** closes its contacts L1, L2 and

L3 to T1, T2 and T3 to provide power to the supply fan motor.

5. Supply fan rotation should not be used to identify proper phasing of the unit. For phasing, please refer to step 7 below. If the supply fan is rotating in the wrong direction, please contact your local distributor or tech services for instructions.
6. Compressor contactor closes its contacts L1, L2 and L3 to T1, T2 and T3 to provide power to the compressor motor COMP 1; COMP 2, if conditions are correct. In addition, contactor C1 closes its contact L3 to T3, energizing the condenser fan motor.



WARNING

BURN HAZARD!
DO NOT TOUCH! DISCHARGE LINE MAY BE HOT!

7. Check that each compressor is operating correctly. The scroll compressors in these units **MUST** operate in the proper rotation. To ensure the compressors are operating in the correct direction, check the compressor discharge line pressure or temperature after each compressor is started. The discharge pressure and discharge line temperature should increase. If this does not occur and the compressor is producing an exceptional amount of noise, perform the following checks.
 - Ensure all compressors and the supply fan motor are operating in the proper direction. If a single motor is operating backwards, check the power wiring for that motor and correct any leads that have been interchanged at the contactor or at the motor.
 - If all of the motors are operating backward, disconnect the unit power supply and lock it in the "OFF" position. Switch two leads of the power supply at the unit Single Point Power Block. Reconnect power and check for compressor and supply fan motor operation.
8. With all safety devices closed, the system will continue cooling operation until the thermostat is satisfied.
9. Disconnecting the jumper wire between R and Y1 and Y2 and between R and G on TB1 terminal block will simulate a satisfied thermostat. The compressors will cycle off and IIC (pin 12) will initiate its time delay cycle. The compressor and the supply fan will cycle off.
10. After a time delay of approximately 3 minutes, the compressor control circuits will be ready to respond to a subsequent call for cooling from the wall thermostat.
11. Open disconnect switch. Reconnect the field thermostat wire at terminal R on terminal block TB1.

NOTE: WHILE IN THE COOLING MODE, TO PREVENT FROST FROM FORMING ON THE EVAPORATOR WHILE THE UNIT IS OPERATING IN OUTDOOR TEMPERATURES OF 65°F OR

LOWER, IT IS RECOMMENDED THAT A LOW AMBIENT KIT (LAKT-**) IS USED. THIS IS STRONGLY RECOMMENDED FOR 2 SPEED MODELS DUE TO THE LOWER AIRFLOW WHILE IN THE FIRST STAGE COOLING. TO FURTHER PROTECT THE COMPRESSOR FROM DAMAGE DURING LOW AMBIENT CONDITIONS, A FREEZESTAT KIT (FSK01) CAN BE ADDED THAT TURNS THE COMPRESSOR OFF WHEN THE EVAPORATOR TEMPERATURE DROPS TOO LOW.

	WARNING
HIGH VOLTAGE! DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING THIS UNIT. MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.	
	

FINAL SYSTEM CHECKS

1. Check to see if all supply and return air grilles are adjusted and the air distribution system is balanced for the best compromise between heating and cooling.
2. Check for air leaks in the ductwork. See Sections on Air Flow Adjustments.
3. Make sure the unit is free of "rattles", and the tubing in the unit is free from excessive vibration. Also make sure tubes or lines are not rubbing against each other or sheet metal surfaces or edges. If so, correct the trouble.
4. Set the thermostat at the appropriate setting for cooling and heating or automatic changeover for normal use.
5. Be sure the Owner is instructed on the unit operation, filter, servicing, correct thermostat operation, etc.

CHECKING SUBCOOLING

NOTE: UNITS WITH A TXV SHOULD BE CHARGED TO SUBCOOLING ONLY. MAKE SURE THE AIR FLOW IS CORRECT BEFORE MAKING ANY ADJUSTMENTS.

EXAMPLE:

- a. Liquid Line Pressure = 417 PSI
- b. Corresponding Temp. = 120°F
- c. Thermometer on Liquid line = 109°F.

TO OBTAIN THE AMOUNT OF SUBCOOLING, SUBTRACT 109°F FROM 120°F. THE DIFFERENCE IS 11° SUBCOOLING.

SEE THE SPECIFICATION SHEET OR TECHNICAL INFORMATION MANUAL FOR THE DESIGN SUBCOOLING RANGE FOR YOUR UNIT.

SUBCOOLING FORMULA = SATURATED LIQUID LINE TEMPERATURE - LIQUID LINE TEMPERATURE

CHECKING SUPERHEAT

EXAMPLE:

- a. Suction Pressure = 143 PSI
- b. Corresponding Temp. = 50°F

- c. Thermometer on Suction Line = 59°F

TO OBTAIN THE DEGREES TEMPERATURE OF SUPERHEAT, SUBTRACT 50.0 FROM 59.0°F. THE DIFFERENCE IS 9° SUPERHEAT. THE 9° SUPERHEAT WOULD FALL IN THE ± RANGE OF ALLOWABLE SUPERHEAT.
SUPERHEAT = SUCTION LINE TEMP - SAT. SUCTION TEMP.

SUPERHEAT ADJUSTMENT

NOTE: SUPERHEAT ADJUSTMENTS SHOULD NOT BE MADE UNTIL INDOOR AMBIENT CONDITIONS HAVE STABILIZED AND CORRECT AIRFLOW HAS BEEN VERIFIED. THIS COULD TAKE UP TO 24 HOURS DEPENDING ON INDOOR TEMPERATURE AND HUMIDITY. BEFORE CHECKING SUPERHEAT, RUN THE UNIT IN COOLING FOR 15-20 MINUTES OR UNTIL REFRIGERANT PRESSURES STABILIZE. USE THE FOLLOWING GUIDELINES AND METHODS TO CHECK UNIT OPERATION AND ENSURE THAT THE REFRIGERANT CHARGE IS WITHIN LIMITS.

For TXV systems, to adjust superheat, unscrew the cover from the expansion valve, locate the adjustment screw, and turn it clockwise (in) to increase superheat or counterclockwise (out) to decrease superheat. It is recommended to make small adjustments at a time, 1/8-1/4 turn increments. Replace adjustment cap. Wait a minimum of 15 minutes between adjustments to allow time for the TXV and pressures to stabilize.

REFRIGERANT CHARGE CHECK

NOTE: FOR OPTIMAL PERFORMANCE, FOLLOW CHARGING INSTRUCTIONS BELOW.

(UNITS WITH FIXED ORIFICE DEVICES)

All package units with fixed orifice devices are charged using the superheat method at the compressor suction line. To increase super heat, remove charge and to decrease super heat, add charge. After superheat is adjusted, it is recommended to check unit subcooling at the condenser coil liquid line. See Design Superheat and Subcooling table for targets on each model.

(UNITS WITH EXPANSION VALVE (TXV))

Two Stage Cooling Application : Run unit on HIGH Stage cooling and refer to Design Superheat & Subcooling table

1. Purge gauge lines. Connect service gauge manifold to access fittings. Run system at least 15 minutes to allow pressure to stabilize.
 2. Temporarily install thermometer on liquid (small) line near liquid line access fitting with adequate contact and insulate for best possible reading.
 3. Check subcooling and superheat. System should have a subcooling and superheat within the range listed on the Design Superheat and Subcooling table.
 - a. If subcooling and superheat are low, adjust TXV superheat, then check subcooling.
- NOTE: TO ADJUST SUPERHEAT, TURN THE VALVE STEM CLOCKWISE TO INCREASE AND**

COUNTERCLOCKWISE TO DECREASE.

- If subcooling is low and superheat is high, add charge to raise subcooling then check superheat.
- If subcooling and superheat are high, adjust TXV valve superheat, then check subcooling.
- If subcooling is high and superheat is low, adjust TXV valve superheat and remove charge to lower the subcooling.

NOTE: Do NOT adjust the charge based on suction pressure unless there is a gross undercharge. If an undercharge is suspected recover the charge, re-evacuate the system and recharge per data plate. No adjustments should be made if suspecting a charge issue.

4. Disconnect manifold set, installation is complete.

Design Superheat and Subcooling for AC					
Model	Superheat ±2°F (Circuit 1/2)	Subcooling ±1°F (Circuit 1/2)	Expansion Device	Cooling Stage	Outdoor ambient (°F)
DSC090	17/16	12/14	TXV	High	95
DSC102	16/19	11/12	TXV	High	95
DSC120	18/22	16/15	TXV	High	95
DSC150	17/19	11/12	TXV	High	95

Design Superheat and Subcooling for HP models in Cooling Mode					
Model	Superheat ±2°F (Circuit 1/2)	Subcooling ±1°F (Circuit 1/2)	Expansion Device	Cooling Stage	Outdoor ambient (°F)
DSH090	26/22	12/11	TXV	High	95
DSH102	18/18	10/11	TXV	High	95
DSH120	19/22	8/10	TXV	High	95

HEAT PUMP OPERATION

COOLING CYCLE

When the heat pump is in the cooling cycle, it operates exactly as a Summer Air Conditioner unit. In this mode, all the charts and data for service that apply to summer air conditioning apply to the heat pump. Most apply on the heating cycle except that “condenser” becomes “evaporator”, “evaporator” becomes “condenser”, “cooling” becomes “heating”.

HEATING CYCLE

The heat pump operates in the heating cycle by redirecting refrigerant flow through the refrigerant circuit external to the compressor. This is accomplished with the reversing valve. Hot discharge vapor from the compressor is directed to the indoor coil (evaporator on the cooling cycle) where the heat is removed, and the vapor condenses to liquid. It then goes through the expansion device to the outdoor coil (condenser on the cooling cycle) where the liquid is evaporated, and the vapor goes to the compressor.

When the solenoid valve coil is operated either from heating to cooling or vice versa, the piston in the reversing valve to the low pressure (high pressure) reverse positions in the reversing valve.

Figures 11A and 11B show a schematic of a heat pump on the cooling cycle and the heating cycle. In addition to a reversing valve, a heat pump is equipped with an expansion device and check valve for the indoor coil, and similar equipment for the outdoor coil. It is also provided with a defrost control system.

The expansion devices are flowrator distributors and perform the same function on the heating cycle as on the cooling cycle. The flowrator distributors also act as check valves to allow for the reverse of refrigerant flow.

COOLING

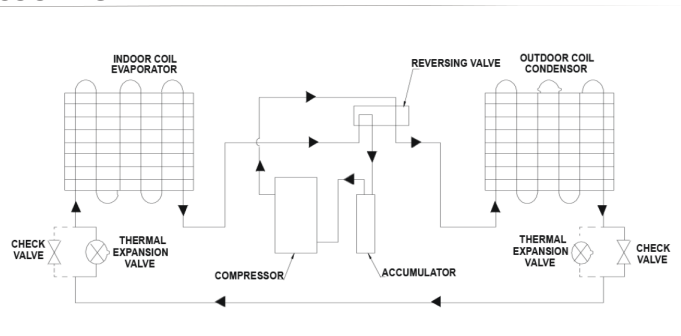
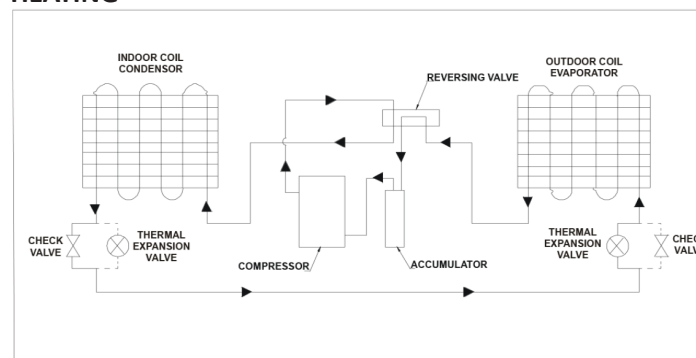


FIGURE 11A

HEATING



UNIT HEATING AND COOLING CYCLES
FIGURE 11B

When the heat pump is on the heating cycle, the outdoor coil is functioning as an evaporator. The temperature of the refrigerant in the outdoor coil must be below the temperature of the outdoor air in order to extract heat from the air. Thus, the greater the difference in the outdoor temperature and the outdoor coil temperature, the greater the heating capacity of the heat pump. This phenomenon is a characteristic of a heat pump. It is a good practice to provide supplementary heat for all heat pump installations in areas where the temperature drops below 45° F. It is also a good practice to provide sufficient supplementary heat to handle the entire heating requirement should there be a component failure of the heat pump, such as a compressor, or refrigerant leak, etc.

Since the temperature of the refrigerant in the outdoor coil on the heating cycle is generally below freezing point,

frost forms on the surfaces of the outdoor coil under certain weather conditions of temperature and relative humidity. Therefore, it is necessary to reverse the flow of the refrigerant to provide hot gas in the outdoor coil to melt the frost accumulation. This is accomplished by reversing the heat pump to the cooling cycle. At the same time, the outdoor fan stops to hasten the temperature rise of the outdoor coil and lessen the time required for defrosting. The indoor blower continues to run and the supplementary heaters are energized.

DEFROST CONTROL

Note: DSH models have one stage of mechanical heating. The defrost accumulation period will start when either first or second stage defrost thermostat closes. Defrost termination occurs when both thermostats open or the 10 minute cycle has completed.

During operation the power to the circuit board is controlled by a temperature sensor, which is clamped to a feeder tube entering the outdoor coil. Defrost timing periods of 30, 60 and 90 minutes may be selected by connecting the circuit board jumper to 30, 60 and 90 respectively. Accumulation of time for the timing period selected starts when the sensor closes (approximately 31° F), and when the wall thermostat calls for heat. At the end of the timing period, the unit's defrost cycle will be initiated provided the sensor remains closed. When the sensor opens (approximately 75° F), the defrost cycle is terminated and the timing period is reset. If the defrost cycle is not terminated due to the sensor temperature, a ten minute override interrupts the unit's defrost period.

RDS FUNCTION

The mitigation system is a stationary device that detects the presence of R-32 refrigerant above 25% LFL using refrigerant sensors and then initiates mitigation actions. The mitigation system's primary function is to reduce the concentration of leaked R-32 refrigerant to prevent serious safety hazards. The mitigation actions are accomplished by halting HVAC operation and continuing indoor blower operation to provide airflow. Once refrigerant concentration reaches below a safe threshold, the unit will remain in mitigation mode for five minutes to evacuate any remaining R-32 refrigerant within the unit. Upon completion, the unit will resume its normal operation.

RDS OPERATION

The mitigation system is controlled by a refrigerant sensor(s), which is secured to a designated location(s) for active monitoring. If a leak is detected, HVAC operation is disabled and the indoor blower fan is activated, providing airflow at or above minimum required airflow to evacuate excess concentration. If a Zone Control system is installed in the

ductwork attached to this system, the Zone controller must be powered through a Daikin Zoning/Accessory PCB to ensure that the Zoning Dampers open during mitigation mode to provide ventilation throughout all ducting. If the unit is installed with a communicating thermostat, the thermostat will display relevant alerts/information concerning mitigation mode. Once sensors read concentration levels below a safe threshold, a five-minute timer will initiate. Once the time is over, the unit will resume back to its normal operation. If the sensors detect another concentration excess, the unit will go back into mitigation mode and will repeat the same process.

MAINTENANCE



WARNING

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD
FAILURE TO FOLLOW SAFETY WARNINGS EXACTLY COULD RESULT IN DANGEROUS OPERATION, SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.
IMPROPER SERVICING COULD RESULT IN DANGEROUS OPERATION, SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

- **BEFORE SERVICING, DISCONNECT ALL ELECTRICAL POWER TO UNIT.**
- **WHEN SERVICING CONTROLS, LABEL ALL WIRES PRIOR TO DISCONNECTING. RECONNECT WIRES CORRECTLY.**
- **VERIFY PROPER OPERATION AFTER SERVICING.**



WARNING

HIGH VOLTAGE!
DISCONNECT ALL POWER BEFORE SERVICING OR INSTALLING THIS UNIT.
MULTIPLE POWER SOURCES MAY BE PRESENT. FAILURE TO DO SO MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.



WARNING

TO PREVENT PERSONAL INJURY OR DEATH DUE TO IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE, REPAIR OR MAINTENANCE, REFER TO THIS MANUAL. FOR ADDITIONAL ASSISTANCE OR INFORMATION, CONSULT A QUALIFIED INSTALLER, SERVICER AGENCY OR THE GAS SUPPLIER.



CAUTION

SHEET METAL PARTS, SCREWS, CLIPS AND SIMILAR ITEMS INHERENTLY HAVE SHARP EDGES, AND IT IS NECESSARY THAT THE INSTALLER AND SERVICE PERSONNEL EXERCISE CAUTION.

Preventive maintenance is the best way to avoid unnecessary expense and inconvenience. Have this system inspected at regular intervals by qualified service personnel, at least twice a year. Routine maintenance should cover the following items:

1. Check and tighten all screws, and wire connections as needed.
2. Clean evaporator and condenser coils mechanically or with cold water, if necessary. Usually any fouling is only matted on the entering air face of the coil and can be removed by brushing.
3. Replace filters as needed (see Filters section).
4. Check for blockage of condensate drain.
5. Check power and control voltages.
6. Check running amperage.
7. Check operating temperatures and pressures.
8. Check and adjust temperature and pressure controls.
9. Check and adjust damper linkages.
10. Check operation of all safety controls.
11. Check condenser fans and tighten set screws.

FILTERS



CAUTION

TO PREVENT PROPERTY DAMAGE DUE TO FIRE AND LOSS OF EQUIPMENT EFFICIENCY OR EQUIPMENT DAMAGE DUE TO DUST AND LINT BUILD UP ON INTERNAL PARTS, NEVER OPERATE UNIT WITHOUT AN AIR FILTER INSTALLED IN THE RETURN AIR SYSTEM.

Every application may require a different frequency of replacement of dirty filters. Filters must be replaced at least every three (3) months during operating seasons.

Dirty filters are the most common cause of inadequate heating or cooling performance. Filter inspection should be made at least every two months; more often if necessary because of local conditions and usage. Dirty throwaway filters should be discarded and replaced with a new, clean filter.

Disposable return air filters are supplied with this unit. See the unit Specification Sheet or Technical Manual for the correct size and part number. To remove the filters, remove the filter access panel on return side of the unit.

CABINET FINISH MAINTENANCE

Use a fine grade automotive wax on the cabinet finish to maintain the finish's original high luster. This is especially important in installations with extended periods of direct sunlight.

CLEAN OUTSIDE COIL (QUALIFIED SERVICER ONLY)

The coil with the outside air flowing over it should be inspected annually and cleaned as frequently as necessary to keep the finned areas free of lint, hair and debris. Clean coil from inside out.

CLEAN INDOOR COIL (QUALIFIED SERVICER ONLY)

Before cleaning the indoor coil, A2L sensor must be removed from the unit to avoid damage and contamination. Air filters should also be removed before performing maintenance. The coil with the filtered air flowing over it should be inspected and cleaned as frequently as necessary to keep the finned areas free of debris. Any air blowing or water rinsing should be performed from inside-out (opposite operating airflow direction) to prevent damage to the tube, fin coil and any other components.

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 labelled 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.

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 minimise 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 grounded 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.

NOTE: Grounding is defined as achieving an earth ground by connecting the equipment supplied grounding lug to the earth. This should be verified by a certified Technician.

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

IMPORTANT: REFER TO THE STANDING PRESSURE TEST/LEAK DETECTION METHOD REFERENCED LATER IN THIS MANUAL

The coil with the outside air flowing over it should be inspected annually and cleaned as frequently as necessary to keep the finned areas free of lint, hair and debris. Clean coil from inside out.

LUBRICATION

The fan shaft bearings, the supply fan motors, the condenser fan motors and compressors are permanently lubricated.

FUNCTIONAL PARTS

Refer to the unit Parts Catalog for a list of functional parts. Parts are available from your distributor.

TROUBLESHOOTING

THE FOLLOWING INFORMATION IS FOR USE BY QUALIFIED SERVICE AGENCY ONLY: OTHERS SHOULD NOT ATTEMPT TO SERVICE THIS EQUIPMENT.

Common Causes of Unsatisfactory Operation of Heat Pump on the Heating Cycle.

INADEQUATE AIR VOLUME THROUGH INDOOR COIL

When a heat pump is in the heating cycle, the indoor coil is functioning as a condenser. The return air filter must always be clean, and sufficient air volume must pass through the indoor coil to prevent excessive discharge pressure, and high pressure cut out.

OUTSIDE AIR INTO RETURN DUCT

Do not introduce cold outside air into the return duct of a heat pump installation. For units with 2-speed motors, do not allow air entering the indoor coil to drop below 65°F. Air below this temperature will cause low discharge pressure, thus low suction pressure, and excessive defrost cycling resulting in low heating output. It may also cause false defrosting.

UNDERCHARGE

An undercharged heat pump on the heating cycle will cause low discharge pressure resulting in low suction pressure and frost accumulation on the outdoor coil.

POOR "TERMINATING" SENSOR CONTACT

The unit's defrost terminating sensor must make good thermal contact with the outdoor coil tubing. Poor contact may not terminate the unit's defrost cycle quickly enough to prevent the unit from cutting out on high discharge pressure.

MALFUNCTIONING REVERSING VALVE - THIS MAY BE DUE TO:

1. **Solenoid not energized** - In order to determine if the solenoid is energized, touch the nut that holds the solenoid cover in place with a screwdriver. If the nut magnetically holds the screwdriver, the solenoid is energized and the unit is in the cooling cycle.
2. **No voltage at unit's solenoid** - Check unit voltage. If no voltage, check wiring circuit.
3. **Valve will not shift:**
 - a. **Undercharged** - check for leaks;
 - b. **Valve Body Damaged** - Replace valve;
 - c. **Unit Properly Charged** - If it is on the heating cycle, raise the discharge pressure by restricting airflow through the indoor coil. If the valve does not shift, tap it lightly on both ends with a screwdriver handle. DO NOT TAP THE VALVE BODY. If the unit is on the cooling cycle, raise the discharge pressure by restricting airflow through the outdoor coil. If the valve does not shift after the above attempts, cut the unit off and wait until the discharge and suction pressure equalize, and repeat above steps. If the valve does not shift, replace it.

SERVICING MEASURES FOR THE REFRIGERANT DETECTION SYSTEM:

BEFORE SERVICING, IDENTIFY THE MODE OF OPERATION OF THE SYSTEM BY READING THE LED FLASHING PATTERN ON THE PCB WITHIN THE CONTROL BOX AND MATCHING THE LED FLASHING PATTERN WITH MODE OF OPERATION IN THE REFRIGERANT DETECTION SYSTEM TROUBLESHOOTING GUIDE ON THE WIRING DIAGRAM WHICH IS ATTACHED ON THE BACK SIDE OF THE CONTROL BOX PANEL (RDS PCB FAULT CODE TABLE). AFTER IDENTIFYING THE MODE OF OPERATION, TAKE RECOMMENDED ACTIONS AS SPECIFIED IN THE RECOMMENDED ACTIONS FOR PCB LED FLASHING CODES TABLE.

REFRIGERANT SENSORS FOR REFRIGERANT DETECTION SYSTEMS SHALL ONLY BE REPLACED WITH SENSORS SPECIFIED BY THE MANUFACTURER. IF THE REFRIGERANT SENSOR REQUIRES REPLACEMENT, PLEASE REPLACE WITH SENSATA R32 SENSOR PN#RGD-00ML12 (DAIKIN PN#SER2A08012).

LED STATUS	
MODE	LED FLASHING PATTERN
NORMAL OPERATION	SLOW LED FLASHING PATTERN (2 SECONDS ON 2 SECONDS OFF)
R-32 LEAK ALARM	FAST LED FLASHING PATTERN
DELAY MODE	LED WILL BE ON CONTINUOUSLY
SYSTEM VERIFICATION MODE	FAST LED FLASHING PATTERN
CONTROL BOARD INTERNAL FAULT	LED WILL FLASH 2 TIMES AND THEN BE OFF FOR 5 SECONDS
R32 SENSOR COMMUNICATION FAULT	LED WILL FLASH 3 TIMES AND THEN BE OFF FOR 5 SECONDS
R32 SENSOR FAULT	LED WILL FLASH 4 TIMES AND THEN BE OFF FOR 5 SECONDS

RDS PCB FAULT CODE TABLE

THE FOLLOWING INSTRUCTIONS ARE MANDATORY FOR A2LSYSTEMS AND SUPERSEDE OTHER INSTRUCTIONS


WARNING

ONLY BRAZING TECHNIQUES OR APPROVED MECHANICAL JOINTS SHOULD BE USED TO CONNECT REFRIGERANT TUBING CONNECTIONS. NON-APPROVED MECHANICAL CONNECTORS AND OTHER METHODS ARE NOT PERMITTED IN THIS SYSTEM CONTAINING A2L REFRIGERANT. APPROVED MECHANICAL JOINTS WILL BE DETAILED IN THE PRODUCT'S SPECIFICATION SHEETS.

STANDING PRESSURE TEST/LEAK DETECTION METHOD

Using dry nitrogen or dry helium, pressurize the system to 450 PSIG. allow the pressure to stabilize and hold for 15 minutes (minimum). The system is considered leak-free if the pressure does not drop below 450 PSIG. If, after 15 minutes, the pressure drops below 450 PSIG, it implies a leak in the system. Proceed with identifying and sealing the leak and repeating the Standing Pressure Test. Leak test the system using dry nitrogen or dry helium and soapy water to identify leaks. **No refrigerant shall be used for pressure testing to detect leaks.** Proceed to system evacuation using the Deep Vacuum Method.

DEEP VACUUM METHOD

The Deep Vacuum Method requires a vacuum pump rated for 500 microns or less. This method effectively and efficiently ensures the system is free of non-condensable air and moisture. The Triple Evacuation Method is detailed in the Service Manual

for this product model as an alternative. To expedite the evacuation procedure, it is recommended that the Schrader Cores be removed from the service valves using a core-removal tool.

1. Connect the vacuum pump, micron gauge, and vacuum-rated hoses to both service valves. Evacuation must use both service valves to eliminate system mechanical seals.
2. Evacuate the system to less than 500 microns.
3. Isolate the pump from the system and hold the vacuum for 10 minutes (minimum). Typically, pressure will rise slowly during this period. If the pressure rises to less than 1000 microns and remains steady, the system is considered leak-free; proceed to system charging and startup.
4. If pressure rises above 1000 microns but holds steady below 2000 microns, non-condensable air or moisture may remain, or a small leak may be present. Return to step 2: If the same result is achieved, check for leaks and repair. Repeat the evacuation procedure.
5. If pressure rises above 2000 microns, a leak is present. Check for leaks and repair them. Then, repeat the evacuation procedure.

ACCESSORY INSTALLATION


WARNING

ALL ACCESSORIES THAT MAY BECOME A POTENTIAL IGNITION SOURCE IF INSTALLED. SUCH AS ELECTRONIC AIR CLEANERS, MUST ONLY BE POWERED THROUGH OUR ACCESSORY CONTROL BOARD KIT. IF AN ELECTRONIC AIR CLEANER IS ALREADY INSTALLED IN THE DUCT WORK AND NOT CONNECTED TO THE ACCESSORY CONTROL BOARD. IT WILL HAVE TO BE DISABLED OR REMOVED. ENSURE THAT ANY ADDITIONAL WIRING FROM THE INDOOR UNIT TO THE ACCESSORY CONTROL BOARD IS ROUTED AND PROTECTED FROM DAMAGE WEAR, AVOIDING THE FLUE PIPE AND ANY JOINTS THAT MAY NEED BRAZED OR DISCONNECTED FOR SERVICE. REFER TO THE PRODUCT SPECIFICATION SHEET FOR THE ACCESSORY CONTROL BOARD KIT PART NUMBER.

ALTITUDE ADJUSTMENT FACTOR TO CALCULATE MINIMUM ROOM AREA

The Indoor equipment mitigation requirements are calculated at sea level. For higher altitudes adjust the minimum room area specified on or near the Serial Plate by the corresponding altitude adjustment factor shown below. This table is provided as a reference.

Adjusted room area ($A_{min\ adj}$) is the product of the minimum room area specified in the serial plate and the adjustment factor AF, as shown in below formula

$$A_{min\ adj} = A_{min} \text{ (serial plate)} * AF$$