

SPLIT SYSTEM AIR CONDITIONER AND HEAT PUMP INSTALLATION / START-UP INFORMATION

These instructions must be read and understood completely before attempting installation.
ISSUE 9851

These units are designed for use in residential and commercial type buildings with a wide variety of Furnace/Air Handlers and Evaporator Coil combinations. Air-conditioners can be used with conventional forced warm air heating systems and/or straight cooling systems independent of the heating. Heat pumps are sensitive to indoor units and may only be installed with combinations listed in the Air-Conditioning and Refrigeration Institute (ARI) Directory of Certified Products.

After uncrating unit, inspect thoroughly for hidden damage. If damage is found, notify the transportation company immediately and file a concealed damage claim.

WARNING

Installation or repairs made by unqualified persons can result in hazards to you and others. Installation **MUST** conform with local building codes or, in the absence of local codes, with the National Electrical Code NFPA 70/ANSI C1-1993 or current edition and Canadian Electrical Code Part 1 CSA C22.1.

The information contained in this manual is intended for use by a qualified service technician familiar with safety procedures and equipped with the proper tools and test equipment.

Failure to carefully read and follow all instructions in this manual can result in equipment malfunction, property damage, personal injury and/or death.

CAUTION

Improper installation, adjustment, alteration, service or maintenance can void the warranty.

NOTE: These instructions are intended as a general guide and do not supersede national, state or local codes in any way.

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Safety Precautions

1. Always wear safety eye wear, work gloves and protective clothing when installing equipment.
2. Never assume electrical power is disconnected. Use a meter to verify power is disconnected.
3. Keep hands out of fan areas when power is connected to equipment.
4. Have a fire extinguisher available.
5. R-22 causes frost-bite burns.
6. R-22 is toxic when burned.
7. The weight of the unit requires caution and proper handling procedures when lifting or moving to avoid personal injury. Use care to avoid contact with sharp or pointed edges.

NOTE TO INSTALLING DEALER:

These instructions and warranty are to be given to the owner or prominently displayed near the indoor furnace/air handler unit.

Unit Location

The remote condensing unit is to be installed on a solid foundation. This foundation should extend a minimum of 2" (inches) beyond the sides of the condensing unit and must be level. To reduce the possibility of noise transmission, the foundation slab should NOT be in contact with or be an integral part of the building foundation.

The "top discharge" condenser air is taken in through the condenser coil and is discharged out the top. For quiet operation and maximum efficiency, eliminate any obstructions which might interfere with air discharge.

Zoning ordinances may govern the minimum distance the condensing unit can be installed from the property line. Check before proceeding.

Locate the outdoor unit as close to the indoor unit as possible to avoid any long refrigeration line runs. Allow a minimum of 36" (inches) on the service panel side of the unit for service. Ensure there is a minimum of 24" (inches) clearance on the remaining three sides. A minimum vertical clearance of 60" (inches) is required to overhang. Allow at least 24" (inches) between multiple units.

DO LOCATE THE UNIT:

- with proper clearances on sides and top of unit.
- on a solid, level foundation or pad
- to minimize refrigerant line lengths.
- to allow for drainage of defrost water and prevent ice build-up (heat pump only)
- above expected snowfall levels (heat pump only).

DO NOT LOCATE THE UNIT:

- on brick, concrete blocks or unstable surfaces.
- near clothes dryer exhaust vents.
- near sleeping area or near windows.
- under eaves where water, snow or ice can fall directly on the unit.

Roof Top Installations

If necessary to install units on a roof structure, be sure to elevate and level the units. The unit must be installed at least 6" (inches) above the roof surface. Ensure the roof structure and anchoring method is adequate for unit location. Isolate unit and tubing from building structure. Consult local codes regarding rooftop mounting.

Evaporator Piston Selection

The condensing unit must be matched to an approved evaporator. Refer to the unit specification sheet furnished with the unit or unit rating plate for proper size piston. If the evaporator coil does not have a piston already installed or if the piston installed is not the one indicated, a replacement piston is required. The correct number piston is included with unit or may be purchased from a wholesale distributor. See the evaporator coil (indoor unit) instructions for details of changing the piston.

The evaporator coil may also use a thermal expansion valve (TXV) in place of a piston.

NOTE:

The proper piston or thermostatic expansion valve MUST be installed in the indoor coil prior to installation of refrigerant lines.

Refrigeration Line Sets

Fully annealed refrigeration lines should be used when installing the system. DO NOT use copper water pipe. Refer to unit specification sheet for proper line set sizes. **Table 1** lists line set sizes if specification sheet is not available. Split systems may be installed with up to 50 feet of line set (no more than 20 feet vertical) without special consideration. For other lengths, contact your distributor technical service.

Unit Size	Liquid Line	Vapor Line
18	3/8" *	5/8"
24	3/8" *	5/8"
30	3/8"	3/4"
36	3/8"	3/4"
42	3/8"	7/8"
48	3/8"	7/8"
60	3/8"	1-1/8" **

* Up to 25 feet of 1/4" line is permissible

** 7/8" permissible, resulting in 3-4% capacity reduction

It is important that no tubing be cut or seals broken until you are ready to actually make connections to the evaporator and to the condenser section. DO NOT remove rubber plugs or copper caps from the tube ends until ready to make connections at evaporator and condenser. Under no circumstances leave the lines open to the atmosphere for any period of time.

Be *extra careful* with sharp bends. Tubing can "kink" very easily, and if this occurs, the entire tube length will have to be replaced. *Extra care* at this time will eliminate future service problems.

It is recommended that vertical suction risers not be up-sized. Proper oil return to the compressor should be maintained with suction gas velocity. Contact your distributor technical service for line sets longer than 50 feet or with more than 20 feet vertically between the indoor and outdoor unit.

On applications where liquid floodback to the compressor may occur, a suction line accumulator is recommended. Please note accumulators are factory installed in heat pumps, if required. Contact your distributor technical service for further information.

Installation Of Line Sets

DO NOT fasten liquid or suction lines in direct contact with the floor or ceiling joist. Use an insulated or suspension type of hanger. Keep both lines separate, and always insulate the suction line. Long liquid line runs (30 feet or more) in an attic will require insulation. Route refrigeration line sets to minimize length.

DO NOT let refrigerant lines come in direct contact with foundation. When running refrigerant lines through the foundation or wall, openings should allow for a sound and vibration absorbing material to be placed or installed between tubing and foundation. Any gap between foundation or wall and refrigerant lines should be filled with a pliable silicon-based caulk, RTV or a vibration damping material.

Service Valve Type

The outdoor condensing unit is supplied with sweat brass service valves with copper stubs. All service valves are positioned to seal refrigerant in the unit with gauge ports open to connecting lines. Gauge ports have Schraeder valve core installed and require use of charging hoses with depressors. DO NOT heat valve body above 250 degrees F. Service valves must be wrapped with wet rags or otherwise protected from heat during brazing. Use care to ensure no moisture enters valves or Schraeder valve cores if wet rags are used.

Brazing Connections

WARNING FIRE HAZARD!

Refrigerant and oil mixture under pressure could ignite as it escapes and contacts brazing torch resulting in FIRE. Make sure the refrigerant charge is properly removed from both the high and low sides of the system before brazing any component or lines.

FAILURE TO DO SO COULD RESULT IN BODILY INJURY OR DEATH.

Before making braze connections, be sure all joints are clean. Before heat is applied for brazing, dry nitrogen should be flowing through the tubing to prevent oxidation and scale formation on the inside of the tubing.

The following is the recommended method for making braze connections at the refrigerant line connections:

1. Debur and clean refrigerant tube end with emery cloth or steel brush.
2. Insert tubing into swage fitting connection.
3. Apply heat absorbing paste or heat sink product to prevent damage to the service valve.
4. Braze joint, using a suitable brazing alloy for copper to copper joints.
5. Quench the joint and tubing with water using a wet rag. Leave rag on fitting body and re-wet with water to help cool area.

Leak Check

Refrigeration lines and indoor coil must be checked for leaks after brazing and before evacuation. The recommended procedure is to apply a trace amount of vapor refrigerant (approximately two ounces or 3 psig) into the line set and indoor coil, then pressurize with 150 psig of dry nitrogen. Use a refrigerant leak detector to check all joints. The system may also be checked for leaks using a halide torch or pressure and soapy solution. After completion of leak check, relieve all pressure from system before evacuation.

Evacuating And Charging Instructions

NOTE: Intentional release of CFC or HCFC refrigerant to the atmosphere violates Federal Law. It may also violate State and Local Codes. Check all Federal, State and Local Codes before proceeding.

These condensing units are pre-charged at the factory with adequate refrigerant to handle 15 feet of refrigerant tubing.

NOTE: DO NOT use any portion of the charge for purging or leak testing. It is mandatory that a thorough evacuation of the refrigeration lines and indoor coil be performed.

The liquid line and suction line service valves have been closed after final testing at the factory. *DO NOT disturb these valves until the lines have been leak checked and evacuated or the charge in the unit may be lost.*

1. Connect the vacuum pump to the center hose of the manifold gauge set, the low-pressure manifold gauge to the vapor service valve and the high pressure manifold gauge to the liquid service valve.

NOTE: Unnecessary switching of hoses can be avoided and complete evacuation of all lines can be achieved by also connecting a branch hose from the manifold gauge center port to a cylinder of R-22. Provide a separate shut-off valve to vacuum pump to avoid contaminating vacuum pump oil with refrigerant.

2. The valves should be kept in the "front seated" (closed) position. This will allow evacuation of the refrigeration lines and the indoor coil, without disturbing the factory charge in the outdoor unit.
3. Follow the vacuum pump manufacturer's instructions. Allow the pump to operate until the system has been evacuated down to 300 microns. Allow the pump to continue running for an additional 15 minutes. Turn OFF the pump and leave the connections secured to the two (2) service valves. After 5 minutes, if the system fails to hold 500 microns or less, check all connections for tight fit and repeat the evacuation procedure.
4. Isolate the vacuum pump from the system by closing the shutoff valves on the gauge-set. Disconnect the vacuum pump.

Opening Service Valves

After evacuation of the connecting lines, remove the service valve cap and fully insert the hex wrench into the stem. A back-up wrench is required on the valve body to open the valve stem. Back-out counterclockwise until the valve stem just touches the retaining ring.

CAUTION

BODILY INJURY HAZARD!

This is not a backseating valve. Care must be taken to prevent dislodging retainer ring when opening valve.

FAILURE TO DO SO COULD RESULT IN BODILY INJURY.

Replace service valve cap and torque to 8-11 ft-lb on 1/4" and 3/8" valves; 12-15 ft-lb on 5/8" and 3/4" valves; 15-20 ft-lb on 7/8" valves.

NOTE: The cap is the primary seal and must be tightened to prevent leaks.

Torque gauge port caps hand tight after adjusting charge per "Adjusting Charge" section.

Electrical Connections

WARNING

ELECTRICAL SHOCK HAZARD!

Turn OFF electric power before connecting unit, performing any maintenance or removing panels or doors.

FAILURE TO DO SO COULD RESULT IN BODILY INJURY OR DEATH.

Be sure to check all local codes to determine that the unit is installed accordance with local requirements. Consult the National Electric Code for wire size requirements. Use 60° C wire or higher. Always provide ground connections to the outdoor unit. Power supply must agree with rating on unit nameplate.

Provide line voltage power supply to unit from a properly sized disconnect switch. Route power and ground wires from disconnect switch to unit. Line voltage connections are made at the line side of the contactor in the electrical box of the condensing unit. Follow the appropriate wiring diagram attached to inside of the access door of the unit.

Proper fusing recommendations are also indicated on Unit Rating Plate. In general, the best fuse for any unit is the smallest fuse that will hold equipment on line under normal use and service without nuisance tripping breakers or blowing of fuses. Time delay fuses are recommended to prevent blowing due to starting current (the current in rush when equipment starts is referred to as the Locked Rotor Amps or (LRA). A fuse of this kind properly sized will give maximum equipment protection.

Control Wiring

The control voltage is 24 Vac. High quality insulated 18 AWG is recommended for control wiring. **Table 2** provides a guideline for wire size and distance. For lengths longer than 150 feet, contact your local distributor for technical service.

Table 2 - Control Wiring Size

For length of wire up to:	Use minimum wire size of:
30 feet	22 AWG*
100 feet	20 AWG
150 feet	18 AWG

* Use only high quality 22 AWG wire

Ensure room thermostat is properly installed per instructions shipped with room thermostat. Generally, thermostat should not be exposed to sunlight, drafts or vibration and should not be mounted on exterior walls.

Low voltage control wire connections should be made as noted on the wiring diagram on the inside cover of the outdoor unit. Generally, the connections from room thermostat to indoor unit and indoor unit to outdoor unit are connected point to point (Y to Y, C to C, etc.), with points as follows:

- "Y" (compressor) - yellow
- "C" (common) - black or brown
- "G" (indoor fan) - green
- "R" (24 Vac) - red
- "O" (reversing valve) - orange (heat pump only)
- "W" (first stage heat) - white (furnace only)
- "W1" / "W2" (supplemental heat) - white (heat pump only)

Pre-Start Procedure

1. Check to ensure:
 - service valve caps are installed and tightened
 - voltage supply at unit agrees with nameplate rating
 - all factory and field wiring connections are tight
 - indoor fan motor is on correct speed tap
2. Close electrical disconnects to energize system.
3. Energize crankcase heater, on units so equipped, for 8 hours before operating the units.

Start-Up Procedure

1. Set thermostat selector switch to OFF.
2. Set room thermostat at desired temperature. Be sure set point is below indoor ambient temperature.
3. Set the system switch of the thermostat on COOL and fan switch for continuous operation or AUTO, as desired. Operate unit for 15-20 minutes, then check the system refrigerant charge.
4. Adjust refrigerant charge per "Adjusting Charge" section.

Adjusting Charge

All split system units are factory charged for 15 feet of connecting line set and matched evaporator coil. Refrigerant charge should initially be adjusted for line set

lengths other than 15 feet. For line sets shorter than 15 feet in length, remove charge per **Table 3**. For line sets longer than 15 feet, add charge per **Table 3**. Oil charge is sufficient for all line lengths.

Final charge adjustments must be in the cooling mode by subcooling / superheat check, only when outdoor ambient is above 60°F. If the outdoor ambient is below 60°F, adjust charge only by weight and recheck later when ambient is above 60°F.

Heat pumps should also have performance checked in heating mode. The only acceptable method to charge a heat pump in the heating mode is by weight.

Table 3 — Refrigeration Charge Adjustment

Liquid Line Diameter	Oz. Per Linear Foot *
1/4"	.25
5/16"	.45
3/8"	.60
1/2"	1.20

* Factory charge for series is for 15' (ft.) line sets and evaporator coil.

Before final adjustment is made to the refrigerant charge, it is imperative proper indoor airflow be established. Airflow will be higher across a dry coil versus a wet coil. Blower charts are usually calculated with a dry coil. Recommended airflow is 350-450 CFM per ton (12,000 Btuh) through a wet coil. Refer to indoor unit instructions for methods of determining air flow and blower performance.

With outdoor ambient above 60°F, the refrigerant charge should be adjusted first by weight, then final adjustment by super heat (for piston systems) or subcool (for TXV systems).

Piston System Charging

1. Operate unit for minimum of 10 minutes.
2. Measure pressure and temperature at vapor valve service port. Use a good thermistor or electronic thermometer.
3. Subtract saturation temperature (of measured pressure) from temperature measured to obtain superheat. Refer to **Table 4** for saturation temperatures of R-22.
4. Measure outdoor dry bulb using a good thermometer and indoor wet bulb using a sling psychrometer.
5. Using measured temperatures, find closest outdoor dry bulb and indoor wet bulb temperatures in the chart inside control cover and locate required superheat.

6. If measured superheat is:
- more than required, slowly add refrigerant to obtain required superheat.
 - Less than required, slowly recover refrigerant to obtain required superheat.

NOTE: Each time charge is added to or removed from the system, allow the system to run approximately 15 minutes before pressure/temperature readings are re-taken and superheat calculations made.

TXV System Charging

1. Operate unit for minimum of 10 minutes.
2. Measure pressure and temperature at liquid valve service port. Use a good thermistor or electronic thermometer.
3. Subtract measured temperature from saturation temperature (of measured pressure) measured to obtain subcooling. Refer to **Table 4** for saturation temperature of R-22.
4. The subcooling level should be as specified on the unit specification sheet. In the absence of the specification sheet, use 12-14°F subcooling.
5. If measured subcooling is:
 - more than required, slowly recover refrigerant to obtain required subcooling.
 - less than required, slowly add refrigerant to obtain required subcooling.

Defrost System (Heat Pumps Only)

A defrost system consisting of a defrost thermostat (mounted to the outdoor coil) and a defrost control board (in the control box) provides automatic defrosting of the

outdoor unit when required. The defrost function is initiated and terminated based on time and temperature. During frosting conditions, the compressor will operate for 30, 60 or 90 minutes (field adjustable, factory set for 90 minutes) before switching to the defrost mode.

In geographical areas where heavy snowfall, freezing rain, or extensive operation in 20°F-40°F range is expected, the setting should be changed to 30 or 60 minutes. This is performed by relocating the "RUN TIME" jumper on the defrost board from the pins labelled "90" to either the "30" or "60" pins.

The defrost board provides a five (5) minute time delay for compressor short cycle protection. To bypass this delay, short the two "TEST" terminals together for 2 seconds.

For defrost system checkout, with the system running in the heating mode, short the two "TEST" terminals together. The heat pump will go into the defrost mode for as long as the "TEST" terminals are shorted together.

Unit Maintenance

The unit should be inspected and cleaned on an annual basis by a qualified technician. This should include checking for adequate clearances, electrical connections, duct connections/blockages, air filters, airflow, lubrication, and operational performance of system. **Coils may require cleaning. The coil should always be cold when cleaning. Use an alkaline-based cleaner only. Cleaning a hot coil or using an acid based cleaner will remove the paint from the fins and may clog the coil.**

Table 4 - R-22 Saturation Temperature / Pressure Chart

Pressure (psig)	Temp. (°F)	Pressure (psig)	Temp. (°F)	Pressure (psig)	Temp. (°F)	Pressure (psig)	Temp. (°F)	Pressure (psig)	Temp. (°F)	Pressure (psig)	Temp. (°F)
19.3	-6	31.8	9	44.1	21	58.8	33	76.0	45	155.7	85
20.8	-4	32.8	10	45.3	22	60.1	34	77.6	46	168.4	90
22.4	-2	33.7	11	46.4	23	61.5	35	79.2	47	181.8	95
24.0	0	34.7	12	47.6	24	62.8	36	80.8	48	195.9	100
24.8	1	35.7	13	48.8	25	64.2	37	82.4	49	210.8	105
25.6	2	36.7	14	49.9	26	65.6	38	84.0	50	226.4	110
26.4	3	37.7	15	51.2	27	67.1	39	92.6	55	242.7	115
27.3	4	38.7	16	52.4	28	68.5	40	101.6	60	259.8	120
28.2	5	39.8	17	53.6	29	70.0	41	111.2	65	277.8	125
29.1	6	40.8	18	54.9	30	71.4	42	121.4	70	296.7	130
30.0	7	41.9	19	56.2	31	73.0	43	132.2	75	316.5	135
30.9	8	43.0	20	57.5	32	74.5	44	143.6	80	337.4	140