38C Top Discharge Condensing Units – 50Hz

Quality Assurance
Certificate Reg. No:
04 100 950420

Puron
the environmentally sound refrigerant

Subject to change without notice

Installation, Operation and Maintenance Manual

Manufacturer's Name: Saudi Airconditioning Manufacturing Co. Ltd.
Country of origin : Jeddah, Saudi Arabia
Nearest port of embarkation: Jeddah Islamic port
Product classification: Commercial and Residential

38C – 50Hz

Nominal Cooling Capacity 1.5 – 5.0 Tons
HFC R-410A Refrigerant

The 38C series energy efficient split top discharge condensing units incorporate innovative technology to provide reliable summer cooling performance. The units are pre-wired, pre-charged with Puron® R-410A refrigerant, and tested at the factory, designed to occupy a minimal space. These units are matched with Carrier direct expansion fan coil units that provides economical performance now and in the future.

Contact your local Carrier representative for additional support.

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1 – SAFETY CONSIDERATIONS

1.1 – General

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

The appliance is not to be used by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction. Children should be supervised not to play with the appliance.

Follow all the safety codes. Wear safety glasses and work gloves. Use quenching cloths for brazing operations and have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes for special requirements. In absence of local codes, it is recommended that the USA standard ANSI/NFPA 70, National Electrical Code (NEC), be followed.

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

1.2 – Installation Safety Considerations

After the unit has been received and when it is ready to be installed or reinstalled, it must be inspected for damage. If damage is detected upon receipt, immediately file a claim with the shipping company or repair. This machine must be installed in a location that is not accessible to the public and protected against access by non-authorized people. This machine must not be installed in an explosive atmosphere.

Do not remove the skid or the packaging until the unit is in its final position. The units can also be lifted with slings, using only the designated lifting points marked on the unit (labels on the chassis and a label with all unit handling instructions are attached to the unit). Use slings with the correct capacity, and always follow the lifting instructions on the certified drawings supplied for the unit.

Safety is only guaranteed, if these instructions are carefully followed. If this is not the case, there is a risk of material deterioration and injuries to personnel. These units are not designed to be lifted from above.

1.3 – Warranty

Warranty is based on the general terms and conditions of the manufacturer. Any modifications to the design and/or installation made without discussion with Carrier and without advance written agreement will result in the loss of the right to any warranty claims and any claim for injury to personnel as a result of these modifications.

Physical Data

38C Model	18	24	30	36-1Ph	36-3Ph	42	48	60
Unit Size (Tons)	1.5	2.0	2.5	3.0		3.5	4.0	5.0
Unit Operating Weight Cool Only (kg)	62.0		81.9	86.5	87.5	86.1	91.1	100.9
Unit Color	Grey Enamel Finish							
Maximum Cooling Ambient (°F)	125							
Minimum Cooling Ambient (°F)	55							
Sound Power (dBA)	68.8	70.5	72.0	74.0	74.0	75.0	76.0	76.0

Compressor		
Cool Only	Reciprocating	Scroll

Metering Device	
Ducted Application	Nozzle In The Indoor Unit
High Pressure Switch (Trip / Reset) - PSIG	630 / 505
Low Pressure Switch (Trip / Reset) - PSIG	54 / 117

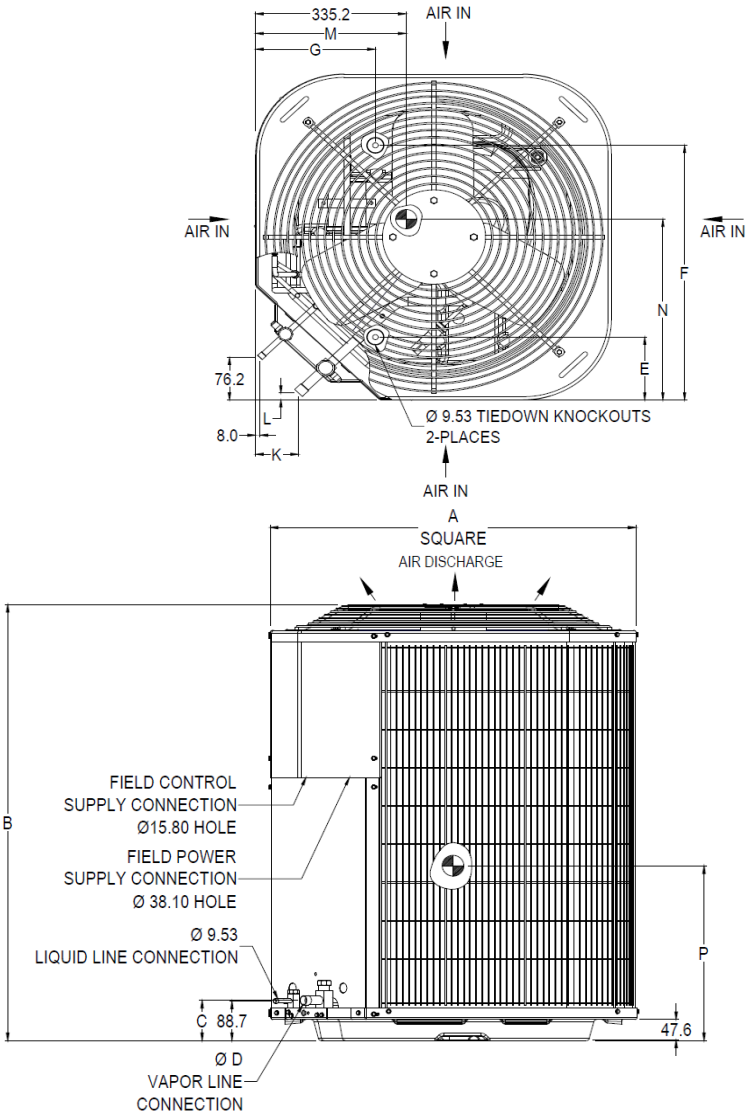
Refrigeration System*								
Refrigerant Type	Puron® R-410A							
Refrigerant Charge (kg)	2.31	2.44	3.12	3.40		4.05	4.17	4.52
Connection Type	Sweat							
Liquid Line	3/8"							
Vapour Line	5/8"		3/4"			7/8"		
Max Length - ft	80							
Max Lift - ft	20							

Outdoor Fan		
Motor Type	Permanent Split Capacitor	
Motor Voltage	220 - 240V	400 - 415V
RPM	920	940
CFM	2000	3000
Diameter, No. Blades	18", 3	24", 3
Motor Horsepower	1/10	1/4

Condenser Coil	
Standard Coil Material (Pipes/Fins)	Cu/Al
Coil test Pressure (PSIG)	400 - 450

* For Long line application refer to Long Line Guide Line (Single Stage Only) - Avalilable in the Installation, Operation & Maintenance manual.

Base Unit Dimensions



Notes:
1. Allow 762.0 clearances to service side of unit, 1219.2 above unit, 152.4 on one side, 304.8 on remaining side and 609.6 between units for proper air flow.
2. Center of gravity
3. All dimensions are in "mm" unless noted.

38C Model Size	A	B	C	D	E	F	G	K	L	M	N	P
18	587.4	722.3	95.2	15.8	112.7	458.8	198.4	71.4	12.7	304.8	298.4	317.5
24	587.4	722.3	95.2	15.8	112.7	458.8	198.4	71.4	12.7	304.8	298.4	317.5
30	792.2	808.0	98.4	19.0	166.7	627.1	231.8	74.6	15.9	406.4	393.7	349.2
36	792.2	981.1	98.4	19.0	166.7	627.1	231.8	74.6	15.9	406.4	393.7	393.7
42	792.2	722.3	98.4	22.2	166.7	627.1	231.8	74.6	15.9	406.4	393.7	323.8
48	792.2	722.3	98.4	22.2	166.7	627.1	231.8	74.6	15.9	406.4	393.7	323.8
60	792.2	808.0	98.4	22.2	166.7	627.1	231.8	74.6	15.9	406.4	393.7	349.2

38C Model Size	Unit Weight (Kgs.)	Shipping Weight (Kgs.)	Shipping Dimensions (L x W x H)
18	62.0	68.0	612.8 x 612.8 x 777.9
24	62.0	68.0	612.8 x 612.8 x 777.9
30	81.9	91.0	817.6 x 817.6 x 863.6
36	86.5	96.0	817.6 x 817.6 x 1036.6
42	86.1	95.0	817.6 x 817.6 x 777.9
48	91.1	100.0	817.6 x 817.6 x 777.9
60	100.9	110.0	817.6 x 817.6 x 863.6

Note: Shipping and Unit Weights are approximate.

Combination Matrix and Ratings

Outdoor Model	Indoor Model	Voltage	Indoor Type	Capacity (Btu/hr)		EER (Btu/hr) / W		Power Input (kW)		kWh/Yr		AMPS	
				T1	T3	T1	T3	T1	T3	T1	T3	T1	T3
38CKPC18DS70	42TPM018-71	230/1/50	Ducted	18,800	16,500	11.8	9.0	1.593	1.833	4,301	1,833	7.5	8.5
38CKPC24DS70	42TPM024-71	230/1/50	Ducted	25,000	21,500	11.8	8.8	2.119	2.443	5,721	2,443	9.5	10.8
38CKPC30DS70	42TPM030-71	230/1/50	Ducted	33,000	28,500	12.0	9.0	2.750	3.167	7,425	3,167	12.0	13.8
38CKPC36DS70	42TPM036-71	230/1/50	Ducted	37,000	32,500	12.2	9.5	3.033	3.421	8,189	3,421	13.2	15.2
38CKPC36DS90	42TPM036-71	400/3/50	Ducted	37,000	32,500	12.2	9.5	3.033	3.421	8,189	3,421	5.0	5.7
38CKPS42DS90	42TPM042-71	400/3/50	Ducted	42,000	39,500	12.7	9.6	3.307	4.115	8,929	4,115	5.5	6.5
38CKPS48DS90	42TPM048-71	400/3/50	Ducted	47,500	43,000	12.2	9.0	3.893	4.778	10,511	4,778	6.6	7.8
38CKPS60DS90	42TPM060-71	400/3/50	Ducted	60,000	51,000	11.8	8.3	5.085	6.145	13,730	6,145	8.5	10.0
38CKPC18DS10	42TPM018-11	240/1/50	Ducted	18,800	16,500	11.5	9.0	1.628	1.833	4,396	1,833	7.5	8.4
38CKPC24DS10	42TPM024-11	240/1/50	Ducted	25,000	21,500	11.8	9.0	2.119	2.389	5,721	2,389	9.5	10.8
38CKPC30DS10	42TPM030-11	240/1/50	Ducted	33,000	28,500	12.0	9.0	2.750	3.167	7,425	3,167	12.0	13.8
38CKPC36DS10	42TPM036-11	240/1/50	Ducted	37,000	32,500	12.2	9.5	3.033	3.421	8,189	3,421	13.2	15.2
38CKPC36DS40	42TPM036-11	415/3/50	Ducted	37,000	32,500	12.2	9.5	3.033	3.421	8,189	3,421	5.0	5.7
38CKPS42DS40	42TPM042-11	415/3/50	Ducted	42,000	39,500	12.7	9.6	3.307	4.115	8,929	4,115	5.5	6.5
38CKPS48DS40	42TPM048-11	415/3/50	Ducted	47,500	43,000	12.2	9.0	3.893	4.778	10,511	4,778	6.6	7.8
38CKPS60DS40	42TPM060-11	415/3/50	Ducted	60,000	51,000	11.8	8.3	5.085	6.145	13,730	6,145	8.5	10.0

Legend for Combination Matrix and Ratings
CFM — Cubic Feet per Minute
EER — Energy Efficiency Ratio
kWh/Yr — kilowatt-hour/Year
Annual Consumption @ T1 kWh/Year — 2,700 x T1
Annual Consumption @ T3 kWh/Year — 1,000 x T3
Notes: Testing as per ISO 13253 testing standard at T1 and T3 conditions.

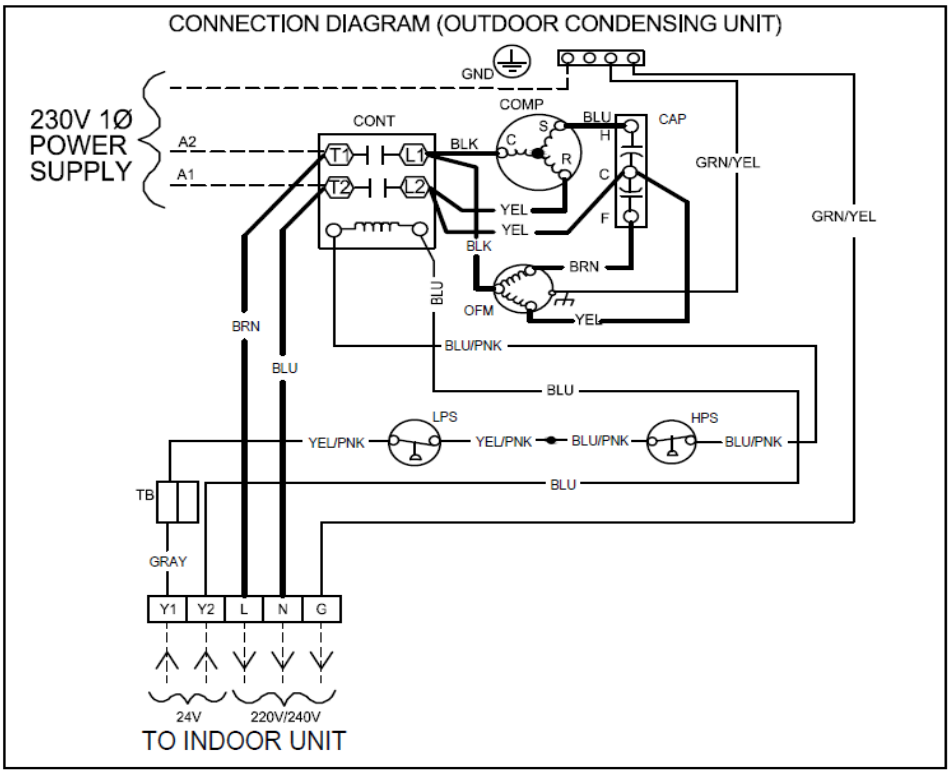
Electrical Data

Outdoor Model	Power Supply (V/Ph/Hz)	Voltage		Compressor		FAN	MCA	MOCP
		Min	Max	RLA	LRA	FLA		
38CKPC18DS10	240/1/50	207	253	6.2	48.0	0.52	8.3	15
38CKPC24DS10		207	253	8.6	48.0	0.52	11.3	15
38CKPC30DS10		207	253	11.4	64.0	1.50	15.8	25
38CKPC36DS10		207	253	12.8	64.0	1.50	17.5	30
38CKPC18DS70	230/1/50	207	253	6.2	48.0	0.52	8.3	15
38CKPC24DS70		207	253	8.6	48.0	0.52	11.3	15
38CKPC30DS70		207	253	11.4	64.0	1.50	15.8	25
38CKPC36DS70		207	253	12.8	64.0	1.50	17.5	30
38CKPC36DS40	415/3/50	360	440	4.5	35.0	0.80	6.4	15
38CKPS42DS40		360	440	6.8	43.0	0.80	9.3	15
38CKPS48DS40		360	440	7.1	52.0	0.80	9.7	15
38CKPS60DS40		360	440	9.5	67.1	0.80	12.7	20
38CKPC36DS90	400/3/50	360	440	4.5	35.0	0.80	6.4	15
38CKPS42DS90		360	440	6.8	43.0	0.80	9.3	15
38CKPS48DS90		360	440	7.1	52.0	0.80	9.7	15
38CKPS60DS90		360	440	9.5	67.1	0.80	12.7	20

Legend for Electrical Data Table
RLA — Rated Load Amps
LRA — Locked Rotor Amps
FLA — Full Load Amps
MCA — Minimum Circuit Amps
MOCP — Maximum Overcurrent Protection

Typical Wiring Schematic

38CKP18-24-30-36 (230V/240V-1PH-50Hz) - Ducted



-LEGEND-

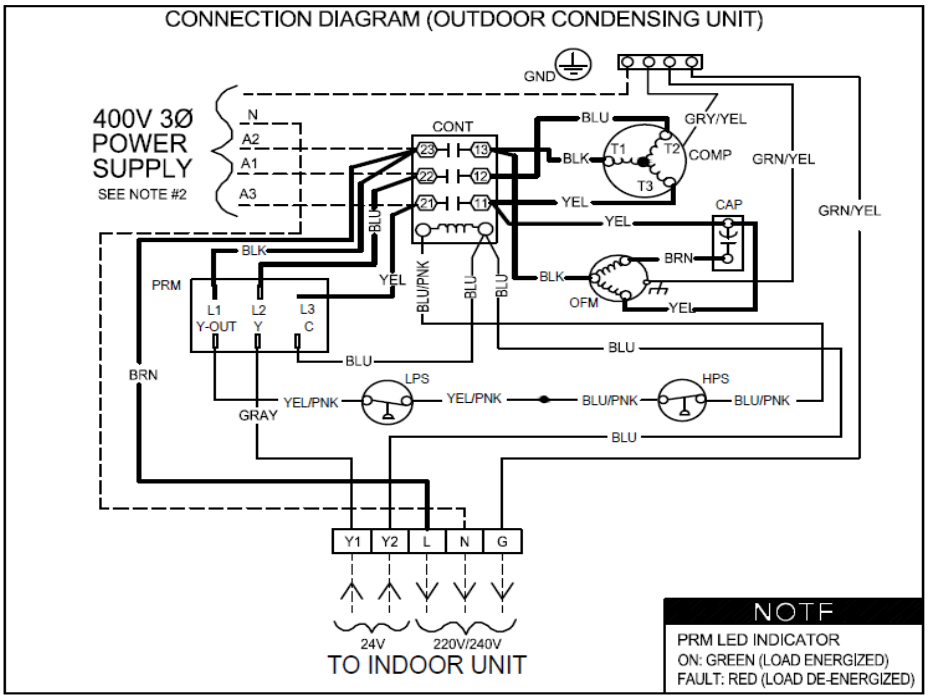
———	FACTORY POWER WIRING
- - -	FIELD POWER WIRING
———	FACTORY CONTROL WIRING
- - - -	FIELD CONTROL WIRING
○	COMPONENT CONNECTION
—●—	JUNCTION
CAP	CAPACITOR
COMP	COMPRESSOR
CONT	CONTACTOR
GND	GROUND
HPS	HIGH PRESSURE SWITCH
LPS	LOW PRESSURE SWITCH
OFM	OUTDOOR FAN MOTOR
TB	TERMINAL BLOCK

NOTES

1. THE CONNECTION SEQUENCE DOESN'T REPRESENT THE PHYSICAL LAYOUT

ATTENTION: ANY WARRANTY IS DECLINED IN CASE OF FIELD CHANGES OF FACTORY WIRING AND SETTINGS.

38CKP36-42-48-60 (400V/415V-3PH-50Hz) - Ducted



-LEGEND-

———	FACTORY POWER WIRING
- - -	FIELD POWER WIRING
———	FACTORY CONTROL WIRING
- - - -	FIELD CONTROL WIRING
○	COMPONENT CONNECTION
—●—	JUNCTION
CAP	CAPACITOR
COMP	COMPRESSOR
CONT	CONTACTOR
GND	GROUND
HPS	HIGH PRESSURE SWITCH
LPS	LOW PRESSURE SWITCH
OFM	OUTDOOR FAN MOTOR
PRM	PHASE ROTATION MONITOR

NOTES

1. THE CONNECTION SEQUENCE DOESN'T REPRESENT THE PHYSICAL LAYOUT

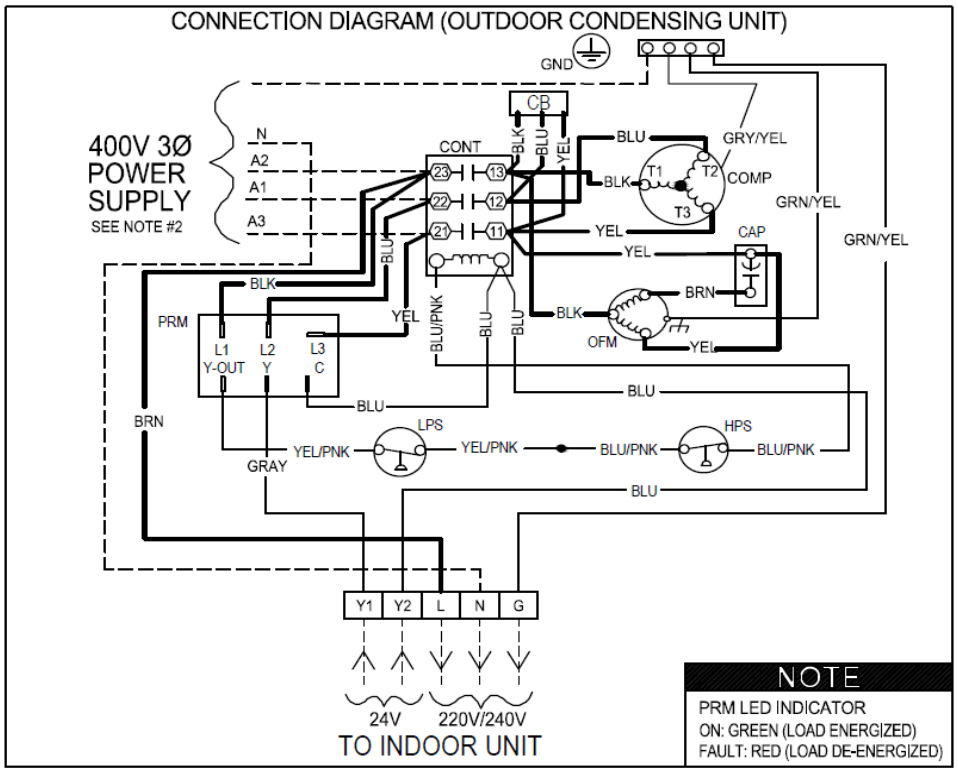
2. IT IS IMPERATIVE TO CONNECT 3ø FIELD POWER TO UNIT WITH CORRECT PHASING. WRONG PHASING WILL CAUSE REVERSE ROTATION OF COMPRESSOR WHICH WILL RESULT IN REDUCED CURRENT DRAW, ELEVATED NOISE LEVEL AND IMPROPER OPERATION. IF ROTATION IS REVERSED, SIMPLY INTERCHANGE ANY TWO OF THE THREE POWER CONNECTION ON FIELD SIDE.

3. USE "Y" TERMINALS FOR FIELD POWER SUPPLY WIRING.

ATTENTION: ANY WARRANTY IS DECLINED IN CASE OF FIELD CHANGES OF FACTORY WIRING AND SETTINGS.

Typical Wiring Schematic (Continued)

38CKP36-42-48-60 (400V/415V-3PH-50Hz) – Ducted With Capacitor Bank



-LEGEND-

———	FACTORY POWER WIRING
– – –	FIELD POWER WIRING
———	FACTORY CONTROL WIRING
- - - -	FIELD CONTROL WIRING
○	COMPONENT CONNECTION
—●—	JUNCTION
CAP	CAPACITOR
COMP	COMPRESSOR
CONT	CONTACTOR
GND	GROUND
HPS	HIGH PRESSURE SWITCH
LPS	LOW PRESSURE SWITCH
OFM	OUTDOOR FAN MOTOR
PRM	PHASE ROTATION MONITOR
CB	CAPACITOR BANK

NOTES

1. THE CONNECTION SEQUENCE DOESN'T REPRESENT THE PHYSICAL LAYOUT
2. IT IS IMPERATIVE TO CONNECT 3ø FIELD POWER TO UNIT WITH CORRECT PHASING. WRONG PHASING WILL CAUSE REVERSE ROTATION OF COMPRESSOR WHICH WILL RESULT IN REDUCED CURRENT DRAW, ELEVATED NOISE LEVEL AND IMPROPER OPERATION. IF ROTATION IS REVERSED, SIMPLY INTERCHANGE ANY TWO OF THE THREE POWER CONNECTION ON FIELD SIDE.
3. USE "Y" TERMINALS FOR FIELD POWER SUPPLY WIRING.

ATTENTION: ANY WARRANTY IS DECLINED IN CASE OF FIELD CHANGES OF FACTORY WIRING AND SETTINGS.

Installation

Un-Packing Instructions

1. Prepare unit for unpacking at site of final installation.
2. Remove two (2) pcs. Plastic straps.
3. Open carton flaps and remove top pad then lift carton box.
4. Remove unit from wood pallet and install according to installation procedures.

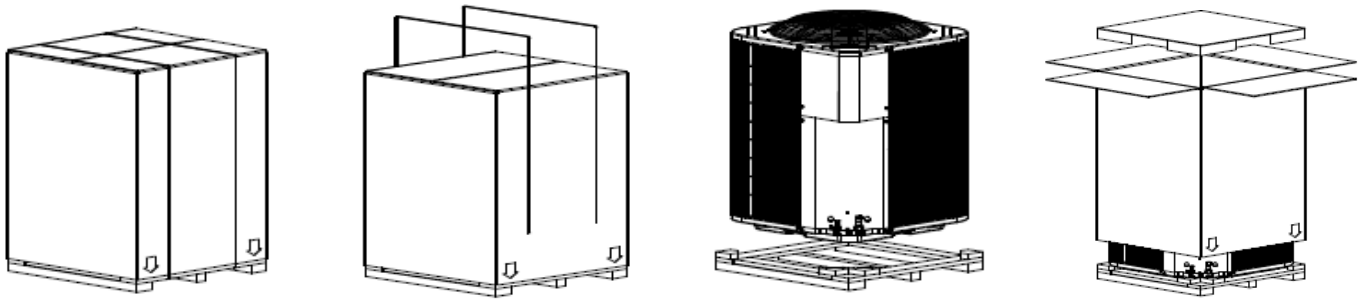


Fig.1 Un-packing Instructions

Packing Instructions

1. Place the unit on the wooden pallet.
2. Put the carton box from the top of the unit
3. Place the top pad on top of the unit.
4. Close the carton box and strap the unit.

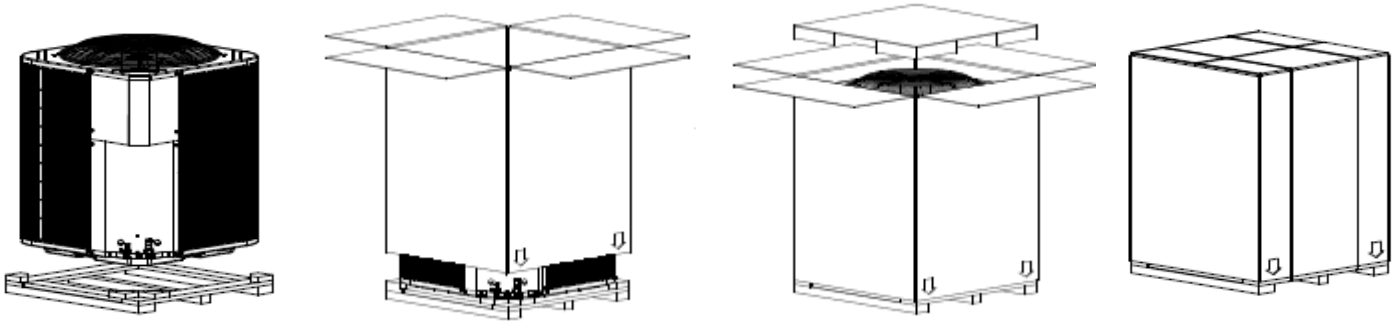


Fig.2 Packing Instructions

Installation Recommendations

NOTE: In some cases noise in the living area has been traced to gas pulsations from improper installation of equipment.

1. Locate unit away from windows, patios, decks, and so forth, where unit operation sound may disturb customer.
2. Insure that vapor and liquid tube diameters are appropriate to capacity of unit.
3. Run refrigerant tubes as directly as possible by avoiding unnecessary turns and bends.
4. Leave some slack between structure and unit to absorb vibration.
5. When passing refrigerant tubes through the wall, seal opening with RTV or other pliable silicon based caulk. (See Fig. 3.)
6. Avoid direct tubing contact with water pipes, duct work, floor joists, wall studs, floors, and walls.
7. Do not suspend refrigerant tubing from joists and studs with a rigid wire or strap that comes in direct contact with tubing. (See Fig. 3.)
8. Ensure that tubing insulation is pliable and completely surrounds vapor tube.
9. When necessary, use hanger straps which are 1 in. wide and conform to shape of tubing insulation. (See Fig. 3.)
10. Isolate hanger straps from insulation by using metal sleeves bent to conform to shape of insulation.

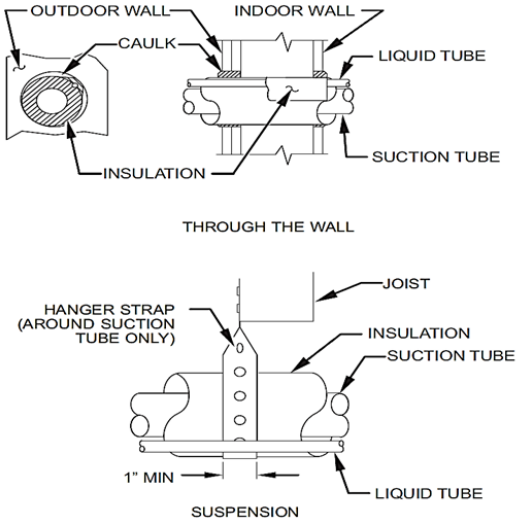


Fig. 3 Connecting Tubing Installation

Step 1 — Complete Pre-Installation Checks

Unpack Unit—Move unit to final location. Follow unpacking instructions as shown in manual, being careful not to damage service valves or grilles.

Inspect Shipment — File claim with shipping company if shipment is damaged or incomplete. Check unit nameplate to ensure unit matches job requirements. CONSIDER SYSTEM REQUIREMENTS — Consult local building codes and NEC for special installation requirements. Allow sufficient space for airflow clearance, wiring, refrigerant piping, and servicing unit. See Unit Dimensional Drawing. Unit can be mounted on a level pad directly on base legs or mounted on raised pads at support points.

Warning

ELECTRICAL SHOCK HAZARD

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

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

Step 2 — Rig and Mount Unit

Location — Check local codes for regulations concerning zoning, noise, platforms, and other issues.
Locate unit away from fresh air intakes, vents, or bedroom windows. Noise may carry into the openings and disturb people inside. Locate unit in a well drained area, or support unit high enough so that water runoff will not enter the unit. Locate unit away from areas where heat, lint, or exhaust fumes will be discharged onto unit (as from dryer vents). Locate unit away from recessed or confined areas where recirculation of discharge air may occur (refer to CLEARANCES section of this document). Roof-top installation is acceptable providing the roof will support the unit and provisions are made for water drainage and noise/vibration dampening.

Rigging — Keep unit upright. Lift unit using sling. Use cardboard or padding under sling, and spreader bars to prevent sling damage to unit. See Fig. 4 Install unit so coil does not face into prevailing winds, all panels must be in place when rigging.

Mounting on Ground — Mount unit on a solid, level concrete pad. Position unit so water from roof does not fall directly into unit. Accessory stacking kits can be used when units are to be stacked. If conditions or local codes require unit to be fastened to a pad, field- supplied tie down bolts should be used and fastened through slots provided in unit mounting feet. See Fig. 5, Fig. 6.

Mounting on Rooftop / Ground — Mount unit on level platform or frame at least 6 in. On roof surface, isolate unit and tubing from structure.

Install on solid, level mounting pad — If conditions or local codes require the unit be attached to pad, tie down bolts should be used and fastened through knockouts provided in the unit base pan. Refer to unit mounting pattern below to determine base pan size and knockout hole location. Arrange supporting members to adequately support unit and minimize transmission of vibration to building. Consult local codes governing rooftop applications.

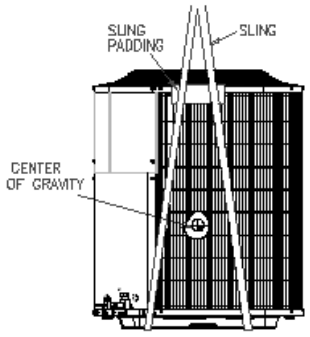


Fig – 4: Lifting Unit With Sling

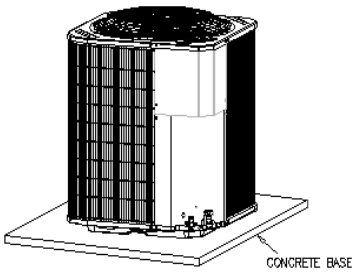


Fig – 5: Rooftop/Ground Mounting

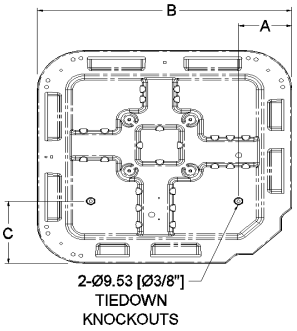


Fig – 6: Tie Down Knockouts

Base Pan Width x Dept (mm)	Tie Down Knockouts (mm)			Minimum Mounting Pad Dimensions (mm)
	A	**B**	**C**	
596.9 x 596.9	111.0	458.8	182.6	660 x 660
800.1 x 800.1	166.7	627.1	231.8	889 x 889

Tie Down Knockouts

Clearance requirements — When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping, and service. Allow 30 in. (762.0 mm) clearance to service end of unit and 48 in. (1219.2 mm) (above unit. For proper airflow, a 6-in. (152.4 mm) clearance on 1 side of unit and 12-in. (304.8 mm) on all remaining sides must be maintained. Maintain a distance of 24 in. (609.6 mm) between units or 18 in. (457.2 mm) if no overhang within 12 ft. (3.66 m). Position so water, snow, or ice from roof or eaves cannot fall directly on unit. On rooftop applications, locate unit at least 6 in. (152.4 mm) above roof surface.

Operating Ambient — The minimum outdoor operating ambient in cooling mode is 55°F (12.78°C), and the maximum outdoor operating ambient in cooling mode is 125°F (51.67°C).

Step 3—Complete Refrigerant Piping Connections

Caution

R-410A systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on R-410A equipment. No other refrigerant may be used in this system. Gage set, hoses, and recovery system must be designed to handle R-410A. If you are unsure consult the equipment manufacturer.

Outdoor units may be connected to indoor units using field-supplied tubing of refrigerant grade and condition. Do not use less than 10 ft. of interconnecting tubing. When more than 80 ft. of interconnecting tubing and more than 20 ft. of vertical lift is used, refer to Long Line Guideline Section.

Warning

Do not bury more than 36 in. of refrigerant pipe in the ground. If any section of pipe is buried, there must be a 6 in. vertical rise to the valve connections on the outdoor unit. If more than the recommended length is buried, refrigerant may migrate to the cooler, buried section during extended periods of system shutdown. This causes refrigerant slugging and could damage compressor at start-up.

If either refrigerant tubing or indoor coil is exposed to atmospheric conditions for longer than 5 minutes, it must be evacuated to 500 microns to eliminate contamination and moisture in the system.

Run refrigerant tubes as directly as possible, avoiding unnecessary turns and bends. Suspend refrigerant tubes so they do not damage insulation on vapor tube and do not transmit vibration to the structure. Also, when passing refrigerant tubes through the wall, seal opening so that vibration is not transmitted to structure. Leave some slack in refrigerant tubes between structure and outdoor unit to absorb vibration. Refer to separate indoor unit installation instructions for additional information.

Outdoor Unit Connected To Factory Approved Indoor Unit Outdoor — Unit contains correct system refrigerant charge for operation with indoor unit of same size when connected by 25 ft. (7m) of field supplied or factory accessory tubing. Check refrigerant charge for maximum efficiency.

Make Piping Sweat Connections — Remove plastic caps from liquid and suction service valves. Use refrigerant grade tubing. Service valves are closed from the factory and ready for brazing. After wrapping the service valve

with a wet cloth, the tubing set can be brazed to the service valve using either silver bearing or non-silver bearing brazing material. Consult local code requirements. Refrigerant tubing and indoor coil are ready for leak testing; this check should include all field and factory joints. NOTE: Unit is shipped with R-410A Holding factory charge indicated on nameplate. Pass nitrogen or other inert gas through piping while brazing to prevent formation of copper oxide.

Caution

To avoid damage while brazing, service valves should be wrapped in a heat sinking material such as a wet cloth. When Brazing tubing sets to service valves, a brazing shield must be used to prevent damage to the painted unit surface.

Step 4 — Make Electrical Connections

Warning

Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to the unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with NEC, ANSI/NFPA 70 (American National Standards Institute/National Fire Protection Association), and local electrical codes. Failure to follow this warning could result in the installer being liable for personal injury to others.

Caution

Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components. Such operation will invalidate any applicable Carrier warranty.

Power Wiring — Unit is factory-wired for voltage shown on nameplate. Provide adequate, fused disconnect switch within sight of unit, readily accessible but out of reach of children. Provision for locking the switch open (off) is advisable to prevent power from being turned on while unit is being serviced. Disconnect switch, fuses, and field wiring must be in compliance with NEC and applicable local codes. Use minimum 85 C wires for field power connection. Route power wires through opening in the unit side panel and connect in unit control box. Unit must be grounded

Route Ground And Power Wires — Remove access panel to gain access to unit wiring. Extend wires from disconnect through power wiring hole provided and into unit control box. See Electrical Data Table and unit label diagram for field-supplied wiring details.

Connect Ground And Power Wires — Connect ground wire to ground connection in control box for safety.

NOTE: Operation of unit on improper line voltage constitutes abuse and could affect unit reliability. See unit rating plate. Do not install unit in system where voltage or phase imbalance (3 phase) may fluctuate above or below permissible limits. Do not install unit in system where voltage may fluctuate above or below permissible limits. When making electrical connections, provide clearance at unit for refrigerant piping connections.

NOTE: Use copper wires only between disconnect switch and unit.

NOTE: Install branch circuit disconnect of adequate size per NEC to handle unit starting current. Locate disconnect within sight from and readily accessible from unit.

Connect Control Wiring — Route 24v control wires through control wiring and connect leads to control wiring. Use No. 18 AWG color coded, insulated (35°C minimum) wire. If thermostat is located more than 100 ft from unit, as measured along the control voltage wires, use No. 16 AWG color coded wire to avoid excessive voltage drop.

Warning

The unit cabinet must have an uninterrupted or unbroken ground. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes.

Warning

Before performing service or maintenance, be sure the indoor unit main power switch is off and indoor blower has completely stopped. Do not supply power to unit with compressor terminal box cover removed. Failure to do so may result in electrical shock or injury from rotating fan blades.

Compressor Crankcase Heater — A crankcase heater is required if refrigerant tubing is longer than 80 ft. (24.38 m). When equipped with a crankcase heater, energize heater a minimum of 24 hours before starting unit. To energize heater only, set thermostat to OFF mode and close electrical disconnect to outdoor unit.

Install Electrical Accessories — Refer to individual instructions packaged with kits or accessories when installing.

Start-Up

Preliminary Checks

1. Check that all the internal wiring connections are tight and that barriers, covers and panels are in place.
2. Make certain field electrical power source agrees with unit nameplate and rating.
3. Open all service valves.

Leak Test — Field piping and fan coil must be leak tested by pressure method described in Carrier Standard Service Techniques Manual, Chapter 1, Section 1-6.

Evacuate and Dehydrate— Field piping and fan coil must be evacuated and dehydrated by either of the methods described in Carrier Standard Service Techniques Manual, Chapter 1, Section 1-7.
Charge System — Release factory charge into system by opening (back seating) liquid and suction line service valves. Add charge amount as required for the total system. Refer to separate indoor unit installation instructions for the required total system charge when connected to the indoor unit.
Percentage decrease in capacity due to Maximum Line Lengths, Please refer to Long Line Guideline.

To Start Unit

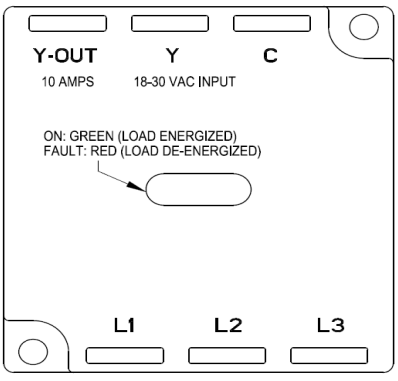
NOTE: Please use the Pre-startup and Startup included with the fan coil units for correct start-up procedures. Be sure that field disconnect is closed. Set room thermostat below ambient temperature. Operate unit for 15 minutes, then check system refrigerant charge.

Sequence Of Operation

Turn on power to indoor and outdoor units. Transformer is energized. On a call for cooling, thermostat makes circuits Y1-Y2 and L-N. Three phase models are equipped with a phase monitor to detect if the incoming power is correctly phased for compressor operation. If the phasing is correct, circuit Y1-Y2 energizes contactor, starting outdoor fan motor and compressor circuit. L-N energizes indoor unit blower relay, starting indoor blower motor on high speed.

NOTE: If the phasing is incorrect, the contactor will not be energized. To correct the phasing, interchange any two of the three power connections on the field side.

When thermostat is satisfied, its contacts open, de-energizing contactor and blower relay. Compressor and motors stop.



LED	Status
Green	Load Energized
Red	Load De-Energized

Caution

- 3-phase scroll compressors are rotation sensitive.
- A red LED on phase monitor indicates reverse rotation.
- This will not allow contactor to be energized.
- Disconnect power to unit and interchange 2 field wiring leads on unit contactor.

Fig. 7 Three Phase Monitor Control

Service

Warning

Before performing service or maintenance, be sure the indoor unit main power switch is off and indoor blower has completely stopped. Failure to do so may result in electrical shock or injury from rotating fan blades.

Caution

Do not leave system open to atmosphere. Product damage could occur. Compressor oil is highly susceptible to moisture absorption.

Caution

The compressor used in this product is specifically designed to operate with R-410A refrigerant and cannot be interchanged.

Outdoor Fan— A reinforced wire mount holds the outdoor fan assembly in place.

Compressor Pressure Relief Valve — Valve is located in compressor. Relief valve opens at a pressure differential of approximately 600 ± 50 psig between suction (low side) and discharge (high side) to allow pressure equalization.

Internal Current and Temperature Sensitive Overload — Control resets automatically when internal compressor motor temperature drops to a safe level (overloads may require up to 45 minutes to reset). When an internal overload is suspected of being open, check by using an ohmmeter or continuity tester. If necessary, refer to Carrier Standard Systems Techniques Manual, Chapter 2, for complete information.
Pump down Procedure — Service valves provide a convenient shut-off valve useful for certain refrigeration system repairs. System may be pumped down to make repairs on low side without losing complete refrigerant charge.

1. Attach pressure gage to suction service valve gage port.
2. Front seat the liquid line valve.
3. Start unit in cooling mode. Run until low-pressure switch opens at 54 psig (472Kpa). Do not allow compressor to pump to a vacuum.
4. Shut unit off and front seat suction valve.
5. Depressurize low side of unit and recover refrigerant following accepted practice.

Filter Drier – The filter drier is specifically designed to operate with R-410A, use only factory-authorized components. When removing a filter drier, use a tubing cutter to cut drier from system. **Do not unsweat a filter drier** from system. Heat from unsweating will release moisture and contaminants from drier into the system.

Caution

The 38C unit coils hold only the factory designated amount of refrigerant. Additional refrigerant may cause units to relieve pressure through compressor internal pressure relief valve (indicated by sudden rise of suction pressure) before suction pressure reaches 5 pisg. If this occurs, shut off immediately, then front seat the suction valve and remove and recover excess refrigerant following accepted practice.

Loss of Charge Pressure Switch — This switch, mounted on the suction line, has fixed non-adjustable settings. To check pressure switch, attach pressure gage to suction service valve gage port. Slowly close liquid shutoff valve and allow compressor to pump down. Do not allow compressor to pump down below 2 psig. Compressor should shut down when suction pressure drops to cutout pressure in Physical Data Table, and should restart when pressure builds up to cut-in pressure shown in Physical Data Table.

High Pressure Switch — This switch, mounted on the discharge line, has fixed non- adjustable settings & auto reset. To check pressure switch, attach pressure gauge to compressor discharge service port, block condenser coil, monitor pressure till compressor trips, remove blockage and observe at which pressure compressor restarts.

Caution

If the compressor does not trip at the cut-out pressure (630 psig), remove the blockage immediately and contact your local Carrier service center.

Service Valves — The service valves in the outdoor unit come from the factory front seated. This means the refrigerant charge is isolated from the line-set connection ports. To prevent damage to the valve, use a wet cloth or other acceptable heat sink material on the valve before brazing. The service valves must be back seated (turned counterclockwise until seated) before the service port caps can be removed and the hoses of the gage manifold connected. In this position, refrigerant has access from the through outdoor and indoor unit. The service valve cannot be field repaired; only a complete valve or valve stem seal and service port caps are available for replacement.

Maintenance

Caution

The compressor in this system uses a polyol ester (POE) oil Mobil EAL ARTIC 22CC. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oils can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Take all necessary precautions to avoid exposure of the oil to the atmosphere.

Warning

Before performing service or maintenance, be sure the indoor unit main power switch is off and indoor blower has completely stopped. Failure to do so may result in electrical shock or injury from rotating fan blades.

Lubrication Compressor — Compressor contains factory oil charges; replace oil when lost. Refer to Carrier Standard Service Techniques Manual, for oil recharging procedure.

Cleaning Coils — Coil should be washed out with water or blown out with compressed air. Note that the blow-thru design causes dirt and debris to build up on the inside of the coils. Clean coil annually or as required by location and outdoor air conditions. Inspect coil monthly and clean as required. Fins are NOT continuous through coil sections. Dirt and debris may pass through the first section, become trapped between the rows of fins, and restrict condenser airflow. Use a flashlight to determine if dirt or debris has collected between coil sections.

Clean coil as follows:
Turn off unit power. Use a garden hose or other suitable equipment to flush coil from the outside to remove dirt. Be sure to flush all dirt and debris from drain holes in the base of unit. Fan motors are waterproof.

Warning

Do not use harsh chemicals for cleaning coils, use only water, compressed air or Carrier approved coil cleaners.

Leak Detection — New installations should be checked for leaks prior to complete charging. If a system has lost all or most of its charge, system must be pressurized again to approximately 150 lb minimum. This can be done by adding refrigerant using normal charging procedures or by pressurizing system with nitrogen (less expensive than refrigerant). Nitrogen also leaks faster than R-410A. Nitrogen cannot, however, be detected by an electronic leak detector.

Warning

Due to the high pressure of nitrogen, it should never be used without a pressure regulator on the tank. Failure to follow this warning can cause a fire, personal injury, or death.

Assuming that a system is pressurized with either all refrigerant or a mixture of nitrogen and refrigerant, leaks in the system can be found with an electronic leak detector that is capable of detecting HFC refrigerant. If system has been operating for some time, make first check for a leak visually. Since refrigerant carries a small quantity of oil, traces of oil at any joint or connection is an indication that refrigerant is leaking at that point. A simple and inexpensive method of testing for leaks is to use soap bubbles. Any solution of water and soap may be used. Soap solution is applied to all joints and connections in system. A small pinhole leak is located by tracing bubbles in soap solution around leak. If the leak is very small, several minutes may pass before a bubble will form.

R-410A Refrigerant Charging — Refer to unit information plate for superheat charging procedure. **R-410A refrigerant cylinders contain a dip tube which allows liquid refrigerant to flow from cylinder in upright position**. Charge R-410A units with cylinder in upright position and a commercial type metering device in the manifold hose. Charge refrigerant into suction-line. For all approved combinations, system must be charged correctly for normal system operation and reliable operation of components. If system has lost all charge, weigh in charge using dial-a-charge designed for R-410A refrigerant or digital scale. System charge should be fine-tuned by using superheat method.

Caution

R410a refrigerant must be added to a system as a liquid since it is a blend. Adding liquid into suction service port using a flow metering device for throttling it in slowly to avoid slugging the compressor or diluting and washing out the compressor oil.

CHECK CHARGE

Factory charge amount is shown on unit rating plate.

Cooling Only Procedure

NOTE: If superheat or subcooling charging conditions are not favorable, charge must be weighed in accordance with unit rating plate ±0.6 oz/ft of 3/8-in. (56g/m of 9.5 mm) liquid line above or below 25 ft (7.6 m) respectively.

EXAMPLE:

Charging Formula:

[(Lineset oz/ft x total length) – (factory charge for lineset)] = charge adjustment

Example 1: System has 25ft of line set using existing 1/4“liquid line. What charge adjustment is required?

Formula: (.27 oz/ft x 25ft) – (13.5 oz) = -6.75 oz; (8.0 g/m x 7.6 m) – (382.7 g) = -321.9 g

Net result is to remove 6.75 oz of refrigerant from the system

Example 2: System has 45 ft of existing 5/16” liquid line. What is the charge adjustment?

Formula: (.40 oz/ft. x 45ft) – (13.5 oz.) = 9 oz; (11.8 g/m x 13.7m) – (382.7 g) = -221.0 g

Net result is to add 4.5 oz of refrigerant to the system

The following procedure is valid when indoor airflow is within ±21 percent of its rated CFM:

1. Operate unit a minimum of 10 minutes before checking charge.
2. Measure suction pressure by attaching an accurate gage to suction valve service port.
3. Measure suction temperature by attaching an accurate thermistor type or electronic thermometer to suction line near service valve.
4. Measure outdoor air dry bulb temperature with thermometer.
5. Measure indoor air (entering indoor coil) wet bulb temperature with a sling psychrometer.
6. Refer to “Super Heat Charging Table”. Find outdoor temperature and evaporator entering air web bulb temperature. At this intersection, note superheat.
7. Refer to “Required Suction Tube Temperature”. Find superheat temperature and suction pressure. At this intersection note suction line temperature.
8. If a unit has a higher suction line temperature than charted temperature, add refrigerant until charted temperature is reached.
9. If unit has a lower suction line temperature than charted temperature, reclaim refrigerant until charted temperature is reached.
10. When adding refrigerant, charge in liquid form into suction service port using a flow--restricting device.
11. If outdoor air temperature or pressure at suction valve changes, charge to new suction line temperature indicated on chart.

NOTE: If line length is beyond 80 ft (24.38 m) or greater than 20 ft (6.10 m) vertical separation, See Long Line Guideline for special charging requirements.

Superheat Charging Table

OUTDOOR TEMP (°C)	EVAPORATOR ENTERING AIR (°C WB)							
	10	11	12	13	14	15	16	17
13	5.0	6.7	7.8	9.4	11.1	11.9	12.8	14.4
16	3.9	5.6	6.7	8.3	10.0	10.8	11.7	13.3
18	–	3.3	5.6	7.2	8.9	9.7	10.6	11.7
21	–	–	3.9	5.6	7.2	8.1	8.9	10.6
24	–	–	–	3.3	5.0	5.8	6.7	8.3
27	–	–	–	–	2.8	3.6	4.4	6.7
29	–	–	–	–	–	–	–	4.4
32	–	–	–	–	–	–	–	2.8
35	–	–	–	–	–	–	–	–
38	–	–	–	–	–	–	–	–
41	–	–	–	–	–	–	–	–
43	–	–	–	–	–	–	–	–
46	–	–	–	–	–	–	–	–

OUTDOOR TEMP (°C)	EVAPORATOR ENTERING AIR (°C WB)						
	18	19	20	21	22	23	24
13	16.1	17.8	19.4	20.6	22.2	23.3	25.0
16	15.0	16.7	18.3	20.0	21.1	22.2	23.9
18	13.3	15.0	16.7	18.3	20.0	21.1	22.8
21	11.7	13.3	15.0	16.7	18.3	20.0	21.7
24	10.0	11.7	7.8	15.6	17.2	18.9	20.6
27	8.3	10.0	11.7	13.9	15.6	17.2	19.4
29	6.1	8.3	10.6	12.2	14.4	16.7	18.3
32	5.0	7.2	8.9	11.1	13.3	15.0	17.2
35	3.3	5.6	7.8	10.0	12.2	13.9	16.1
38	–	4.4	6.7	8.3	11.1	12.8	15.0
41	–	2.8	5.0	7.2	9.4	12.2	14.4
43	–	–	3.3	6.1	8.3	11.1	13.9
46	–	–	–	4.4	7.8	10.0	12.8

Where a dash (–) appears, do not attempt to charge system under these conditions, or refrigerant slugging may occur. Charge must be weighed in.

NOTE: Superheat ° C is at low-side service port.

Required Suction Tube Temperature (°C)

SUPERHEAT TEMP (°C)	SUCTION PRESSURE AT SERVICE PORT (KPA)								
	743	774	805	836	869	902	957	971	1005
0	1.7	2.8	3.9	5.0	6.1	7.2	8.3	9.4	10.6
1	2.8	3.9	5.0	6.1	7.2	8.3	9.4	10.6	11.7
2	3.9	5.0	6.1	7.2	8.3	9.4	10.6	11.7	12.8
3	5.0	6.1	7.2	8.3	9.4	10.6	11.7	12.8	13.9
4	6.1	7.2	8.3	9.4	10.6	11.7	12.8	13.9	15.0
6	7.2	8.3	9.4	10.6	11.7	12.8	13.9	15.0	16.1
7	8.3	9.4	10.6	11.7	12.8	13.9	15.0	16.1	17.2
8	9.4	10.6	11.7	12.8	13.9	15.0	16.1	17.2	18.3
9	10.6	11.7	12.8	13.9	15.0	16.1	17.2	18.3	19.4
10	11.7	12.8	13.9	15.0	16.1	17.2	18.3	19.4	20.6
11	12.8	13.9	15.0	16.1	17.2	18.3	19.4	20.6	21.7
12	13.9	15.0	16.1	17.2	18.3	19.4	20.6	21.7	22.8
13	15.0	16.1	17.2	18.3	19.4	20.6	21.7	22.8	23.9
14	16.1	17.2	18.3	19.4	20.6	21.7	22.8	23.9	25.0
15	16.7	17.8	18.9	20.0	21.1	22.2	23.3	24.4	25.6
16	17.2	18.3	19.4	20.6	21.7	22.8	23.9	25.0	26.1
17	18.3	19.4	20.6	21.7	22.8	23.9	25.0	26.1	27.2
18	19.4	20.6	21.7	22.8	23.9	25.0	26.1	27.2	28.3
19	20.6	21.7	22.8	23.9	25.0	26.1	27.2	28.3	29.4
20	21.7	22.8	23.9	25.0	26.1	27.2	28.3	29.4	30.6
21	22.8	23.9	25.0	26.1	27.2	28.3	29.4	30.6	31.7
22	23.9	25.0	26.1	27.2	28.3	29.4	30.6	31.7	32.8

Pressure vs. Temperature Chart R-410A

PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F	PSIG	°F
12	-37.7	114	37.8	216	74.3	318	100.2	420	120.7	522	137.6
14	-34.7	116	38.7	218	74.9	320	100.7	422	121.0	524	137.9
16	-32.0	118	39.5	220	75.5	322	101.1	424	121.4	526	138.3
18	-29.4	120	40.5	222	76.1	324	101.6	426	121.7	528	138.6
20	-36.9	122	41.3	224	76.7	326	102.0	428	122.1	530	138.9
22	-24.5	124	42.2	226	77.2	328	102.4	430	122.5	532	139.2
24	-22.2	126	43.0	228	77.8	330	102.9	432	122.8	534	139.5
26	-20.0	128	43.8	230	78.4	332	103.3	434	123.2	536	139.8
28	-17.9	130	44.7	232	78.9	334	103.7	436	123.5	538	140.1
30	-15.8	132	45.5	234	79.5	336	104.2	438	123.9	540	140.4
32	-13.8	134	46.3	236	80.0	338	104.6	440	124.2	544	141.0
34	-11.9	136	47.1	238	80.6	340	105.1	442	124.6	548	141.6
36	-10.1	138	47.9	240	81.1	342	105.4	444	124.9	552	142.1
38	-8.3	140	48.7	242	81.6	344	105.8	446	125.3	556	142.7
40	-6.5	142	49.5	244	82.2	346	106.3	448	125.6	560	143.3
42	-4.5	144	50.3	246	82.7	348	106.6	450	126.0	564	143.9
44	-3.2	146	51.1	248	83.3	350	107.1	452	126.3	568	144.5
46	-1.6	148	51.8	250	83.8	352	107.5	454	126.6	572	145.0
48	0.0	150	52.5	252	84.3	354	107.9	456	127.0	576	145.6
50	1.5	152	53.3	254	84.8	356	108.3	458	127.3	580	146.2
52	3.0	154	54.0	256	85.4	358	108.8	460	127.7	584	146.7
54	4.5	156	54.8	258	85.9	360	109.2	462	128.0	588	147.3
56	5.9	158	55.5	260	86.4	362	109.6	464	128.3	592	147.9
58	7.3	160	56.2	262	86.9	364	110.0	466	128.7	596	148.4
60	8.6	162	57.0	264	87.4	366	110.4	468	129.0	600	149.0
62	10.0	164	57.7	266	87.9	368	110.8	470	129.3	604	149.5
64	11.3	166	58.4	268	88.4	370	111.2	472	129.7	608	150.1
66	12.6	168	59.0	270	88.9	372	111.6	474	130.0	612	150.6
68	13.8	170	59.8	272	89.4	374	112.0	476	130.3	616	151.2
70	15.1	172	60.5	274	89.9	376	112.4	478	130.7	620	151.7
72	16.3	174	61.1	276	90.4	378	112.6	480	131.0	624	152.3
74	17.5	176	61.8	278	90.9	380	113.1	482	131.3	628	152.8
76	18.7	178	62.5	280	91.4	382	113.5	484	131.6	632	153.4
78	19.8	180	63.1	282	91.9	384	113.9	486	132.0	636	153.9
80	21.0	182	63.8	284	92.4	386	114.3	488	132.3	640	154.5
82	22.1	184	64.5	286	92.8	388	114.7	490	132.6	644	155.0
84	23.2	186	65.1	288	93.3	390	115.0	492	132.9	648	155.5
86	24.3	188	65.8	290	93.8	392	115.5	494	133.3	652	156.1
88	25.4	190	66.4	292	94.3	394	115.8	496	133.6	656	156.6
90	26.4	192	67.0	294	94.8	396	116.2	498	133.9	660	157.1
92	27.4	194	67.7	296	95.2	398	116.6	500	134.0	664	157.7
94	28.5	196	68.3	298	95.7	400	117.0	502	134.5	668	158.2
96	29.5	198	68.9	300	96.2	402	117.3	504	134.8	672	158.7
98	30.5	200	69.5	302	96.6	404	117.7	506	135.2	676	159.2
100	31.2	202	70.1	304	97.1	406	118.1	508	135.5	680	159.8
102	32.2	204	70.7	306	97.5	408	118.5	510	135.8	684	160.3
104	33.2	206	71.4	308	98.0	410	118.8	512	136.1	688	160.8
106	34.1	208	72.0	310	98.4	412	119.2	514	136.4	692	161.3
108	35.1	210	72.6	312	98.9	414	119.6	516	136.7	696	161.8
110	35.5	212	73.2	314	99.3	416	119.9	518	137.0		
112	36.9	214	73.8	316	99.7	418	120.3	520	137.3		

* Based on ALLIED SIGNAL Data.

Required Liquid Line Temperature

LIQUID PRESSURE AT SERVICE VALVE (PSIG)	REQUIRED SUBCOOLING TEMPERATURE (°F)					
	8	10	12	14	16	18
189	58	56	54	52	50	48
195	60	58	56	54	52	50
202	62	60	58	56	54	52
208	64	62	60	58	56	54
215	66	64	62	60	58	56
222	68	66	64	62	60	58
229	70	68	66	64	62	60
236	72	70	68	66	64	62
243	74	72	70	68	66	64
251	76	74	72	70	68	66
259	78	76	74	72	70	68
266	80	78	76	74	72	70
274	82	80	78	76	74	72
283	84	82	80	78	76	74
291	86	84	82	80	78	76
299	88	86	84	82	80	78
308	90	88	86	84	82	80
317	92	90	88	86	84	82
326	94	92	90	88	86	84
335	96	94	92	90	88	86
345	98	96	94	92	90	88
354	100	98	96	94	92	90
364	102	100	98	96	94	92
374	104	102	100	98	96	94
384	106	104	102	100	98	96
395	108	106	104	102	100	98
406	110	108	106	104	102	100
416	112	110	108	106	104	102
427	114	112	110	108	106	104
439	116	114	112	110	108	106
450	118	116	114	112	110	108
462	120	118	116	114	112	110
474	122	120	118	116	114	112
486	124	122	120	118	116	114
499	126	124	122	120	118	116
511	128	126	124	122	120	118

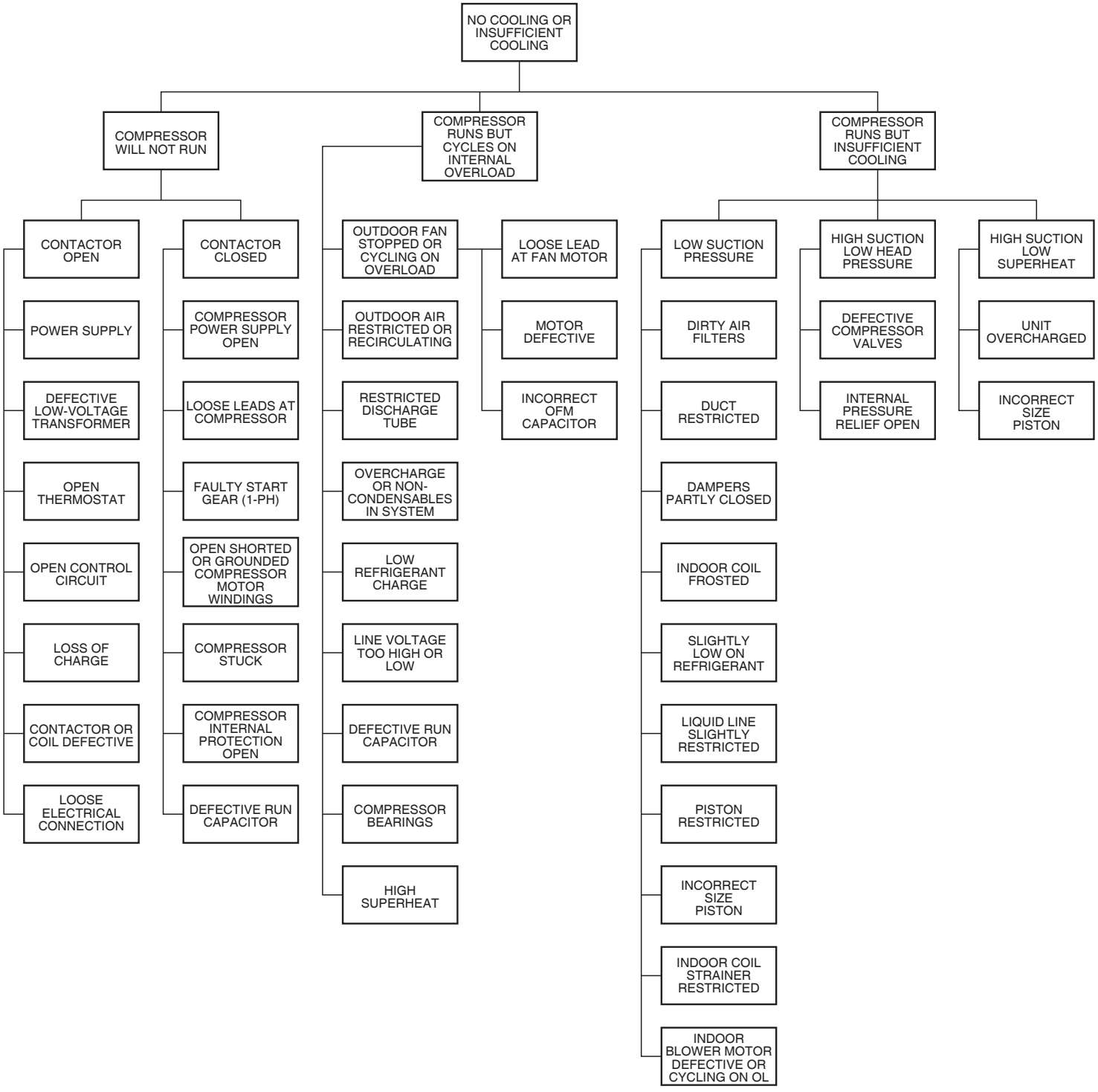
Subcooling Charging Table

ATTENTION INSTALLERS AND SERVICE TECHNICIANS!

R-410A Refrigerant Quick Reference Guide

- R-410A refrigerant operates at 50-70 percent higher pressures than R-22. Be sure that servicing equipment and replacement components are designed to operate with R-410A refrigerant.
- R-410A refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- R-410A refrigerant systems should be charged with liquid refrigerant. Use a commercial type metering device in the manifold hose when charging into suction line with compressor operating.
- Manifold sets should be 700 psig high side and 180 psig low side with 550 psig low-side retard.
- Use hoses with 700 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- R-410A refrigerant, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- Do not use liquid-line filter driers with rated working pressures less than 600 psig.
- Do not leave R-410A refrigerant suction line filter driers in line longer than 72 hours.
- Do not install a suction-line filter drier in liquid-line.
- POE oils absorb moisture rapidly. Do not expose oil to atmosphere.
- POE oils may cause damage to certain plastics and roofing materials.
- Wrap all filter driers and service valves with wet cloth when brazing.
- A factory-approved liquid-line filter drier is required on every unit.
- Do NOT use an R-22 TXV.
- If indoor unit is equipped with an R-22 TXV, it must be changed to a R-410A refrigerant TXV with 15 to 30% bleed.
- Never open system to atmosphere while it is under a vacuum.
- When system must be opened for service, recover refrigerant, evacuate then break vacuum with dry nitrogen and replace filter driers. Evacuate to 500 microns prior to recharging.
- Do not vent R-410A refrigerant into the atmosphere.
- Do not use capillary tube coils.
- Observe all **warnings**, **cautions**, and **bold** text.
- All indoor coils must be installed with a R-410A refrigerant TXV with 15 to 30% bleed metering device.
- COMPRESSOR CRANKCASE HEATER — An electric heater which mounts to base of compressor to keep lubricant warm during off cycles. Improves compressor lubrication on restart and minimizes chance of refrigerant slugging. May or may not include a thermostat control.

Air Conditioner Troubleshooting Chart



MANDATORY START-UP CHECK LIST AND RECORD

IMPORTANT!

This page is a mandatory checklist & record – the check to be executed and data to be recorded for future reference incase of failure.
A copy of this checklist data has to be submitted to carrier representative. Completion of this checklist is a must for any field claim, no field support will be provided for incomplete or blank checklists.

TEAR ALONG THE DOTTED LINE

Preliminary Information

Outdoor Model Number:	Outdoor Serial Number:
Indoor Model Number:	Indoor Serial Number:
Startup Date:	Technician Name:
Customer Name/Address:	Project Name:
Additional Accessories:	

Pre-Start-Up Checklist	Yes	No	NA
Outdoor Unit			
Is there any shipping damage?			
If the unit is damaged, Please specifiy where:			
Will this damage prevent the unit start-up?			
Check power supply to see if it matches the unit data plate?			
Has the ground wire been properly connected?			
Are the circuit protection matched with the unit size and installed properly?			
Are the power wire guage matched with the unit size and installed properly?			
Piping			
Are both refrigerant lines flushed / cleaned, connected to service valve sets and properly tightend?			
Are all the service valves open and backseated ?			
Are the Stem Valves Installed and snug?			
Have all the refrigerant connections and piping joints checked for leaks and vacuum test conducted to 500 micron?			
Indoor Fan Coil Unit Piping			
Check accurater device size is matched and installed in fan coil unit? (If Applicable)			
Are the refrigerant connections properly connected and have been checked for leakages?			
Is condensate line connected?			
Is the condensate line free from obstacle and drains freely?			
Controls			
Are control power lines connected to there control power terminal block?			
Are terminal snug in the housing?			
Are control power lines and control cables routed separately (Not in the same conduit and not in same multi-conductor cable?			
Are control wires connected to the same circuit as associated refrigerant lines?			
Check to make sure the subbase mounting to wall is secure? (Don't apply excessive force to mounting screw)			
Are fresh batteries installed in the fan coil remote controller?			
Does remote controller backlight illuminate when the button is pressed?			
Fan System			
Does fan rotate freely?			
Are air filters in place and clean?			
Indoor Power Supply			
Does the power supply match the fan coil unit data plate?			
Is ground wire connected?			
Start-Up Checklist	**Yes**	**No**	**NA**
Check Indoor Fan Operation Under Ceiling Fan Coil Units			
Select fan mode, then initiate test sequence. Does the fan motor start at low speed , then shift to medium then to high?			
Start System Operation at the Fan Coil Unit			
Select cooling mode and adjust set point, it must be below current room temperature then observe unit operation.			
Does compressor start (After Initial Time Delay) and Run?			
Does outdoor fan run properly?			

After atleast 15 minutes of running time, record all the information below:

Outdoor Unit	
Unit Amps(L1/L2/L3)	
Voltage (L1/L2/L3)	
Vapor Line Pressure	
Vapor Line Temp	
Liquid Line Temp	
Entering Outdoor Air Temp	
Leaving Outdoor Air Temp	

Fan Coil Unit	
Indoor Entering Air dB(Dry Bulb) Temp	
Indoor Leaving Air dB(Dry Bulb) Temp	
Indoor Entering Air wB(Wet Bulb) Temp	
Indoor Leaving Air wB(Wet Bulb) Temp	
Technician Name, Signature and Date:	

NOTES

Appendix

Long-Line Guideline.

(Single Stage Application For 38C Only)

A. Safety Considerations

Only trained service technicians familiar with standard service instructions and training materials should attempt installation, service, and repair of these units. Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory - authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements.

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

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

All equipment should be installed in accordance with accepted practices and unit Installation Instructions, and in compliance with all national and local codes. Power should be turned off when servicing or repairing electrical components. Extreme caution should be observed when troubleshooting electrical components with power on. Observe all warning notices posted on equipment and in instructions or manuals.

⚠ WARNING

EXPLOSION AND PERSONAL SAFETY HAZARD

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

Refrigeration systems contain refrigerant under pressure. Puron® refrigerant (R- 410A) systems operate at higher pressure than standard R- 22 systems. Use only service equipment and components rated for Puron® refrigerant. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operations, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

Refrigeration systems contain refrigerant under pressure. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operations, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

B. Definitions

This Guideline covers **all** residential split system air conditioner and heat pump products using Puron® refrigerant.

C. Introduction

An application is considered Long Line, when the refrigerant level in the system requires the use of accessories to maintain acceptable refrigerant management for systems reliability. See Table 1 for required accessories. Defining a system as long line depends on the liquid line diameter, actual length of the tubing, and vertical separation between the indoor and outdoor units.

For Air Conditioner systems, the chart below shows when an application is considered Long Line.

AC WITH PURON® REFRIGERANT LONG LINE DESCRIPTION ft (m)
Beyond these lengths, long line accessories are required

Liquid Line Size	Units On Same Level	Outdoor Below Indoor	Outdoor Above Indoor
1/4	No accessories needed within allowed lengths	No accessories needed within allowed lengths	175 (53.3)
5/16	120 (36.6)	50 (15.2) vertical or 120 (36.6) total	120 (36.6)
3/8	80 (24.4)	35 (10.7) vertical or 80 (24.4) total	80 (24.4)

For Heat Pump systems, the chart below shows when an application is considered Long Line.

HP WITH PURON® REFRIGERANT LONG LINE DESCRIPTION ft (m)
Beyond these lengths, long line accessories are required

Liquid Line Size	Units On Same Level	Outdoor Below Indoor	Outdoor Above Indoor
3/8	80 (24.4)	20 (6.1) vertical or 80 (24.4) total	80 (24.4)

Long line applications are clearly defined in this Guideline, and must be treated differently from standard systems. A long line system requires special consideration for the following reasons:

- Additional refrigerant charge
- Refrigerant migration control
- Oil return concerns
- Capacity losses
- Metering device adjustments

Longer line sets require additional refrigerant charge that must be managed throughout the entire range of possible ambient conditions. Off- cycle refrigerant migration that results in excess refrigerant in the compressor at start up, or condensed liquid refrigerant in the suction line at startup must be avoided for compressor reliability. Follow all accessory requirements in this Guideline to control off-cycle refrigerant migration (see Table 1).

Another concern is proper line set sizing and construction to control oil return to the compressor, and minimize capacity losses. In residential applications, proper suction line sizing is critical to achieve adequate oil return, and maintain expected system performance. Oil return in heating mode is different from cooling mode thus, in some cases; heat pumps have additional line set limitations from air conditioning units. Table 3 in this guideline can be used to properly size suction lines. Follow all suction line sizing recommendations to ensure system performance and adequate oil return for compressor lubrication.

The third concern is refrigerant metering. Elevation changes affect pressure drop in refrigerant lines. These effects must be considered when sizing liquid lines and orifice- metering devices. Since all current products utilize a TXV for cooling mode metering, piston sizing is only a concern for heat pump heating operation. Follow piston change recommendations in this Guideline for proper heat pump heating operation (see Tables 9 & 12).

Since the last revision of this guideline, testing has been done to determine limitations for the application of 1/4 and 5/16 inch liquid lines in cooling only systems. The limiting factor when sizing liquid lines is pressure drop. Equivalent length and vertical separation both contribute to the pressure drop in a liquid line. The liquid line sizing charts in this guideline have been developed based on a TXV metering device on the indoor coil. Staying within these guidelines and charging to a minimum of 10°F (5.6°C) subcooling will ensure a column of liquid is present at the TXV. There is no capacity of efficiency changes to the system performance when staying within these guidelines.

NOTE: When an application is "Long Line" the accessories shown in Table 1 are required. D.

General Limitations

Liquid Lines - AC Only

Liquid line diameters of 1/4" and 5/16" and 3/8" are allowed for cooling only systems and limitations are provided. Using smaller liquid lines affects the maximum allowable equivalent length and when the application qualifies as long line. Elevation changes between the indoor and outdoor units also affect allowable equivalent lengths. See tables 5, 7, and 10 to properly size liquid lines.

NOTE: Using 1/4 and 5/16" liquid lines within the limits provided, result in no capacity or efficiency changes to the system.

Liquid Lines - Heat Pump

Liquid line sizing for heat pumps is currently limited to 3/8". Future updates are planned to include alternate liquid line sizing for heat pump applications. Check HVAC Partners for updates.

Suction Lines

Use Table 3 to properly size suction lines. Acceptable suction line sizes are shown for each size and type system. Air conditioners and heat pumps have separate charts due to oil return needs for heat pumps in heating mode.

Table 1 – Long Line Accessory Requirements

ACCESSORY	OUTDOOR UNIT ABOVE		OUTDOOR UNIT BELOW		NO ELEVATION CHANGE	
	AC	HP	AC	HP	AC	HP
Liquid line solenoid (LLS) at outdoor	No	Yes KHALS0401LLS	No	Yes KHALS0401LLS	No	Yes KHALS0401LLS
TXV on indoor (Standard on all 13 SEER platform indoor coils and fan coils)	Yes	Yes	Yes	Yes	Yes	Yes
Crankcase heater (if not factory supplied)	Yes	Yes	Yes	Yes	Yes	Yes
Start capacitor and relay	Yes	Yes	Yes	Yes	Yes	Yes
Heating piston change	N/A	Yes see Table 12	N/A	Yes see Table 9	N/A	No
Inverted trap	N/A	N/A	Yes See Fig. 3	Yes See Fig. 3	N/A	N/A

⚠ CAUTION

COMPONENT FAILURE HAZARD

Failure to follow this caution may result in unit component failure.

For proper oil return and minimizing capacity losses, only use vapor line sizes listed in Tables 3.

E. Interconnecting Tubing and Fitting Losses

Choosing the proper tubing diameters is critical for reliable long line applications. For proper suction line sizing, see Table 3 the chart shows all acceptable suction line diameters and related performance data based on total equivalent length. See Tables 5, 7, and 10 for the allowable liquid tubing diameters for single- stage.

Refrigerant tubing must be measured both in terms of actual length and equivalent length. Use actual length for limitations and refrigerant charge calculation. The maximum liquid line length will vary depending on diameter and elevation change between indoor and outdoor units. Equivalent length takes into account pressure losses from both tubing length and losses due to fittings and accessories, such as elbows, liquid line solenoid and filter drier. Losses from fittings are expressed in equivalent length, meaning the length of straight tubing that would have the same pressure loss as the fitting. See Table 2 for equivalent lengths of commonly used fittings and accessories; maximum equivalent length allowed is up to See Table 5, 7, and 10 for maximum total equivalent length.

Calculate total equivalent length by adding linear (actual) length of the tubing required and the equivalent length of all elbows and accessories used. See Tables 3 to determine capacity loss of the system due to equivalent length losses and subtract them from the published system capacity for the particular outdoor/indoor unit combination. This data is found in the outdoor unit Product Data.

Example: A 4- ton system using 7/8 in. diameter line set has a total tubing length of 165 ft. The tubing configuration uses four standard 90° elbows and two 90° long- radius elbows. Checking Table 2, the total equivalent length is calculated as:

165 ft straight tubing + (four standard 90° elbows x 2 ft) + (two long- radius 90° elbows x 1.4 ft) = 165 ft. + 8 ft + 2.8 ft = 175.8 ft total equivalent length.

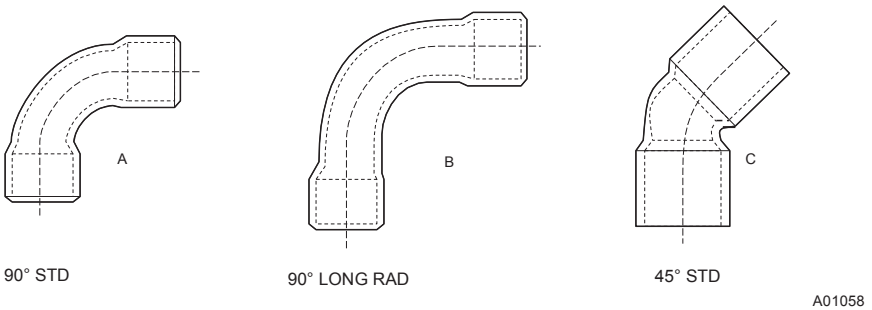


Fig. 1 – Tube Bend Losses

Table 2 – Fitting Losses in Equivalent Feet

Tube Size O.D. (In.)	Fitting– Reference Diagram in Fig. 1		
	90° Std (A)	90° Long–Rad (B)	45° Std (C)
1/2	1.2	0.8	0.6
5/8	1.6	1.0	0.8
3/4	1.8	1.2	0.9
7/8	2.0	1.4	1.0
1–1/8	2.6	1.7	1.3

Liquid Line Solenoid	12
Filter Drier	6

F. Metering Device — Long Line Cooling

In current equipment, all indoor units use a TXV with 15 to 30% bleed for metering in the cooling mode. This provides adequate refrigerant migration protection for all cooling applications.

G. Piston Sizing — Heat Pumps Only

An AccuRater™ (fixed orifice) is used for refrigerant metering in the heating mode. This fixed expansion device must be changed from the factory-supplied AccuRater™ based on indoor/outdoor vertical separation and system capacity. For horizontal applications up to 200 ft (61 m) linear length and 250 ft (76 m) total equivalent length, no heating piston change is necessary.

When sizing the heating piston for installations where the outdoor unit is below the indoor unit, use Table 9. When outdoor unit is located above indoor unit, use Table 12.

Example: The factory supplied AccuRater™ for a single-stage 3-ton heat pump is a number 57. A system is installed with 200 equivalent ft of line set. Approximately 60 ft (18.3 m) is horizontal and the outdoor unit is 140 ft (42.7 m) above the indoor unit. Table 9 shows the AccuRater™ piston change to be +6. The new piston size is 57 + 6 = 63. If a 63 is not produced, round up to the next larger available piston size.

On the same heat pump, if the outdoor unit was located 49 ft (14.9 m) below the indoor unit, Table 10 shows the piston change to be 57 - 2 = 55. If a 55 piston is not produced, round up to the next available size.

H. Liquid Line Solenoid — Long Line Heat Pump Heating

Since AccuRater™ do not provide off-cycle refrigerant migration protection in the heating mode, a liquid line solenoid is required for single-stage and two-stage heat pump long line applications. Bi-flow solenoid valves provide flow control protection only in the direction of the arrow molded into the valve. **The arrow must point toward the outdoor unit** for off-cycle refrigerant control in the heating mode. The arrow shows the direction of flow control. The solenoid should be installed within 2 ft. of the outdoor unit. The liquid line solenoid kit number for a heat pump is KHALS0401LLS.

NOTE: Equivalent length of the liquid line solenoid should be added to the total equivalent length of the tubing. See Table 2.

I. Charging Information

Use subcooling as the primary method for charging longline applications. Outdoor units are pre-charged for 15 ft (4.6 m) of 3/8 liquid line. When using different length diameter liquid lines, charge adjustments are required. See Table 4 for charge adjustments required. The charge adjustment will depend on the liquid line diameter used. See unit installation instructions for proper charging procedure.

For all long line applications, pressure drop and subcooling loss become a concern. In these applications, a **minimum of 10°F (5.6°C) of subcooling** is required for all liquid line diameters to ensure no refrigerant flashing occurs before the TXV metering device. Systems should be charged to 10°_ subcooling or the rating plate subcooling, whichever is greater.

The amount of factory-charge can be found on the unit rating plate or in the Product Data literature. Long line applications do not require additional oil charge.

VAPOR LINE SIZING AND COOLING CAPACITY LOSS

Acceptable vapor line diameters provide adequate oil return to the compressor while avoiding excessive capacity loss. The suction line diameter shown in Table 3 is acceptable for AC and HP systems with Puron refrigerant:

Table 3 - Vapor Line Sizing and Cooling Capacity Losses — Puron® Refrigerant 1-Stage Air Conditioner Applications

Unit Nominal Size (Btuh)	Maximum Liquid Line Diameters (In. OD)	Vapor Line Diameters (In. OD)	Cooling Capacity Loss (%) Total Equivalent Line Length ft. (m)								
			26 – 50 (7.9 – 15.2)	51 – 80 (15.5 – 24.4)	81 – 100 (24.7 – 30.5)	101 – 125 (30.8 – 38.1)	126 – 150 (38.4 – 45.7)	151 – 175 (46.0 – 53.3)	176 – 200 (53.6 – 61.0)	201 – 225 (61.3 – 68.6)	226 – 250 (68.9 – 76.2)
18000 1 Stage AC with Puron	3/8	1/2	1	2	3	5	6	7	8	9	11
		5/8	0	1	1	1	2	2	2	3	3
		3/4	0	0	0	0	1	1	1	1	1
24000 1 Stage AC with Puron	3/8	5/8	0	1	2	2	3	3	4	5	5
		3/4	0	0	1	1	1	1	1	2	2
		7/8	0	0	0	0	0	1	1	1	1
30000 1 Stage AC with Puron	3/8	5/8	1	2	3	3	4	5	6	7	8
		3/4	0	0	1	1	1	2	2	2	3
		7/8	0	0	0	0	1	1	1	1	1
36000 1 Stage AC with Puron	3/8	5/8	1	2	4	5	6	8	9	10	12
		3/4	0	1	1	2	2	3	3	4	4
		7/8	0	0	0	1	1	1	1	2	2
42000 1 Stage AC with Puron	3/8	3/4	0	1	2	2	3	4	4	5	6
		7/8	0	0	1	1	1	2	2	2	3
		1 1/8	0	0	0	0	0	0	0	0	0
48000 1 Stage AC with Puron	3/8	3/4	0	1	2	3	4	5	5	6	7
		7/8	0	0	1	1	2	2	2	3	3
		1 1/8	0	0	0	0	0	0	0	1	1
60000 1 Stage AC with Puron	3/8	3/4	1	2	4	5	6	7	9	10	11
		7/8	0	1	2	2	3	4	4	5	5
		1 1/8	0	0	0	1	1	1	1	1	1

Applications in this area may be long line and may have height restrictions.

Table 4 - Refrigerant Charge Adjustments

Liquid Line Size	Puron Charge (oz/ft)
3/8	0.60 (Factory charge for lineset = 13.5 oz (382.7)
5/16	0.40
1/4	0.27

Units are factory charged for 25 ft (7.6 m) of 3/8" liquid line. The factory charge for 3/8" lineset 9 oz (266.2 g). When using other length or diameter liquid lines, charge adjustments are required per the chart above.

Charging Formula:

[(Lineset oz/ft x total length) – (factory charge for lineset)] = charge adjustment

Example 1: System has 25ft of line set using existing 1/4"liquid line. What charge adjustment is required?
Formula: (.27 oz/ft x 25ft) – (13.5 oz) = -6.75 oz; (8.0 g/m x 7.6 m) – (382.7 g) = -321.9 g
Net result is to remove 6.75 oz of refrigerant from the system

Example 2: System has 45 ft of existing 5/16" liquid line. What is the charge adjustment?
Formula: (.40 oz/ft. x 45ft) – (13.5 oz.) = 9 oz; (11.8 g/m x 13.7m) – (382.7 g) = -221.0 g
Net result is to add 4.5 oz of refrigerant to the system

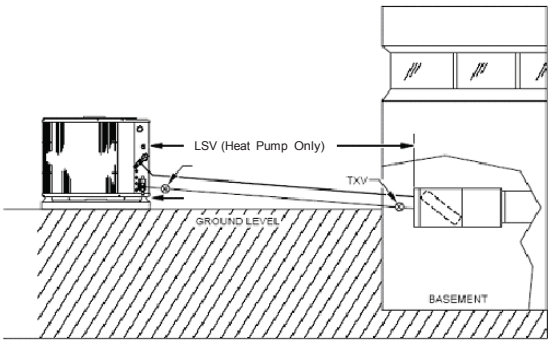


Fig. 2 – Equal– Level Outdoor/Indoor Unit

- A TXV with 15 to 30% bleed must be installed at indoor unit when application qualifies as long line. See Table 6.
- Hard Start Kit (start capacitor and relay) must be installed on outdoor unit when application qualifies as long line. See Table 6.
- A crankcase heater must be installed on compressor when the application qualifies as long line. See Table 6.
- Vapor line should slope towards indoor unit.
- Maximum actual liquid line is up to **100** (61 m). See Table 5.
- Maximum total equivalent length is up to **120** (76.2 m). See Table 5.
- Heat pump only – Bi- flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Heat pump only – Outdoor AccuRater™ adjustment not required
- Use vapor line per Tables 3.
- Use liquid lines per Table 5.

Table 5 – Maximum Total Equivalent Length
Equal Level or Outdoor Unit Below Indoor

Size	System Type	Liquid Line Diameter w/ TXV	Maximum Total Equivalent Length**: Outdoor unit BELOW Indoor Vertical Separation ft (m)								
			0 – 5 (0 – 1.5)	6 – 10 (1.8 – 3.0)	11 – 20 (3.4 – 6.1)	21 – 30 (6.4 – 9.1)	31 – 40 (9.4 – 12.2)	41 – 50 (12.5 – 15.2)	51 – 60 (15.5 – 18.3)	61 – 70 (18.6 – 21.3)	71 – 80 (21.6 – 24.4)
18000	AC Only	1/4	150*	150*	125	100	100	75	– –	– –	– –
	AC Only	5/16	150*	150*	150*	150*	150*	150*	150*	150*	150
	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	150*	150*
24000	AC Only	1/4	75	75	75	50	50	– –	– –	– –	– –
	AC Only	5/16	150*	150*	150*	150*	150*	150*	150*	125	100
	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	150*	150*
30000	AC Only	1/4	30	– –	– –	– –	– –	– –	– –	– –	– –
	AC Only	5/16	150*	125*	100	150	125	100	75	– –	– –
	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	150*	150*
36000	AC Only	5/16	150*	150*	150*	100	100	100	75	– –	– –
	AC/HP	3//8	150*	150*	150*	150*	150*	150*	150*	150*	150*
48000	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	150*	– –
60000	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	– –	– –

*** Maximum actual length not to exceed 100 ft**

**** Total equivalent length accounts for losses due to elbows or fitting. See the Table 2 for details.**

– – = outside acceptable range

Table 6 – AC / HP with Puron® Refrigerant Long Line Description ft (m)
Beyond these lengths, long line accessories are required

	AC Liquid Line Size	Units On Same Level
AC	1/4	No accessories needed within allowed lengths
	5/16	120 (36.6)
	3/8	80 (24.4)

	HP Liquid Line Size	Units On Same Level
HP	3/8	80 (24.4)

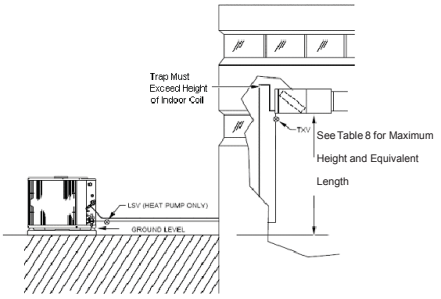


Fig. 3 – Outdoor Unit Below Indoor Unit

- Unit must be charged to 10° subcooling or nameplate subcooling, whichever is greater.
- A TXV with 15 to 30% bleed must be installed at indoor unit when application qualifies as long line. See Table 8.
- A crankcase heater must be installed on compressor when the application qualifies as long line. See Table 8.
- Hard Start Kit (start capacitor and relay) must be installed in outdoor unit when the application qualifies as long line. See Table 8.
- An inverted vapor- line trap must be installed at indoor unit. The top peak of trap must be greater than height of indoor coil.
- Maximum actual liquid line length is up to See Table 7 for maximum total equivalent length.
- Heat pump only – Bi- flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Heat pump only – Adjust outdoor piston per Table 9.
- Use vapor line per Tables 3.
- Use liquid lines per Table 7.

Table 7 - Maximum Total Equivalent Length**
Outdoor Unit Below Indoor Unit

Size	System Type	Liquid Line Diameter w/ TXV	Maximum Total Equivalent Length{: Outdoor unit BELOW Indoor Vertical Separation ft (m)								
			0 – 5 (0 – 1.5)	6 – 10 (1.8 – 3.0)	11 – 20 (3.4 – 6.1)	21 – 30 (6.4 – 9.1)	31 – 40 (9.4 – 12.2)	41 – 50 (12.5 – 15.2)	51 – 60 (15.5 – 18.3)	61 – 70 (18.6 – 21.3)	71 – 80 (21.6 – 24.4)
18000	AC Only	1/4	150	150	125	100	100	75	– –	– –	– –
	AC Only	5/16	150*	150*	150*	150*	150*	150*	150*	150*	150*
	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	150*	150*
24000	AC Only	1/4	75	75	75	50	50	– –	– –	– –	– –
	AC Only	5/16	150*	150*	150*	150*	150*	150*	150*	125	100
	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	150*	150*
30000	AC Only	1/4	30	– –	– –	– –	– –	– –	– –	– –	– –
	AC Only	5/16	150*	150*	150*	150*	125	100	75	– –	– –
	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	150*	150*
36000	AC Only	5/16	150*	150*	150*	100	100	100	75	– –	– –
	AC/HP	3//8	150*	150*	150*	150*	150*	150*	150*	150*	150*
48000	AC/HP	3/8	150*	150*	150*	150*	150*	150*	150*	150*	– –
60000	AC/HP	3/8	150*	150*	150*	150*	150*	150*	110	– –	– –

*** Maximum actual length not to exceed 100ft**

**** Total equivalent length accounts for losses due to elbows or fitting. See the Table 2 for details.**

– – = outside acceptable range

Table 8 - AC / HP with Puron® Refrigerant Long Line Description ft (m)
Beyond these lengths, long line accessories are required

	AC Liquid Line Size	Outdoor Below Indoor
AC	1/4	No accessories needed within allowed lengths
	5/16	50 (15.2) vertical or 120 (36.6) total
	3/8	35 (10.7) vertical or 80 (24.4) total

	HP Liquid Line Size	Outdoor Below Indoor
HP	3/8	20 (6.1) vertical or 80 (24.4) total

Table 9 - Puron® Refrigerant Heat Pump Outdoor Piston Change – Outdoor Unit BELOW Indoor Unit

Btuh	Vertical Separation ft (m) – Outdoor BELOW Indoor Unit)						
	0 – 19 (0 – 5.8)	20 – 29 (6.1 – 8.8)	30 – 39 (9.1 – 11.9)	40 – 49 (12.2 – 14.9)	50 – 59 (15.2 – 18.0)	60 – 69 (18.3 – 21.0)	70 – 80 (21.3 – 24.4)
18,000	0	–1	–1	–2	–2	–2	–2
24,000	0	–1	–1	–2	–2	–3	–3
30,000	0	–1	–1	–2	–2	–3	–3
36,000	0	–1	–2	–2	–2	–3	–3
42,000	0	–1	–2	–2	–3	–3	–4
48,000	0	–1	–2	–2	–3	–3	—
60,000	0	–1	–2	–3	–3	—	—

NOTE: (—) Indicates vertical separation exceeds allowable limits.

Example 1: On a 4 ton system the outdoor unit is 60 ft (18.3 m) below the indoor unit. This is acceptable only if the total equivalent length is 230 ft (70.1 m) or less. The heating piston must be re–sized –3.

Example 2: On a 3–ton system the outdoor unit is 80 ft (24.4 m) below the indoor unit. This is acceptable up to 250 ft (76.2 m) total equivalent length. The heating piston must be re–sized –3.

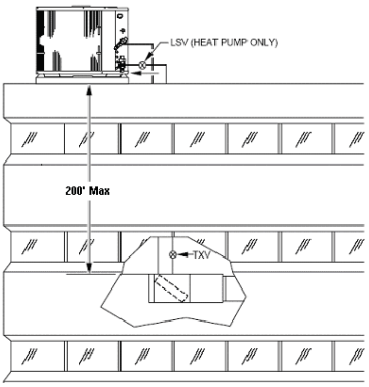


Fig. 4 – Outdoor Unit Above Indoor Unit

- A TXV with 15 to 30% bleed must be installed at indoor unit when the application qualifies as long line. See Table 11.
- A crankcase heater must be installed on compressor when the application qualifies as long line. See Table 11.
- Hard Start Kit (start capacitor and relay) must be installed in outdoor unit when the application qualifies as long line. See Table 11.
- Heat pump only – Heating piston must be changed as shown in Table 12.
- Maximum actual liquid line length is up to 200 ft (61 m). See Table 10.
- Maximum total equivalent length is up to 250 ft (61 m). See Table 10.
- Heat pump only – Bi- flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Use vapor line sizes per Tables 3.
- Use liquid lines per Table 10.
- Vapor line traps are not required.

Table 10 - Puron Refrigerant Maximum Total Equivalent Length Outdoor Unit ABOVE Indoor Unit

Size	System Type	Liquid Line Diameter	Vertical Separation ft (m) Outdoor unit ABOVE indoor unit				
			25 (7.6)	26 – 50 (7.9 – 15.2)	51 – 75 (15.5 – 22.9)	76 – 100 (23.2 – 30.5)	101 – 125 (30.8 – 38.1)
18000	AC Only	1/4	150*	150*	150*	150*	150*
	AC Only	5/16	150*	150*	150*	150*	150*
	AC/HP	3/8	150*	150*	150*	150*	150*
24000	AC Only	1/4	100	125	150*	150*	150*
	AC Only	5/16	150*	150*	150*	150*	150*
	AC/HP	3/8	150*	150*	150*	150*	150*
30000	AC Only	1/4	30	– –	– –	– –	– –
	AC Only	5/16	150*	150*	150*	150*	150*
	AC/HP	3/8	150*	150*	150*	150*	150*
36000	AC Only	5/16	150*	150*	150*	150*	150*
	AC/HP	3/8	150*	150*	150*	150*	150*
48000	AC/HP	3/8	150*	150*	150*	150*	150*
60000	AC/HP	3/8	150*	150*	150*	150*	150*

*Maximum Actual Length Not to Exceed 200ft (61 m)

Table 11 - AC / HP with Puron® Refrigerant Long Line Description ft (m)

Beyond these lengths, long line accessories are required

	AC Liquid Line Size	Outdoor Above Indoor
AC	1/4	175 (53.3)
	5/16	120 (36.6)
	3/8	80 (24.4)

	AC Liquid Line Size	Outdoor Above Indoor
HP	3/8	80 (24.4)

Table 12 - Heat Pump Outdoor Piston Change - Outdoor Unit ABOVE Indoor Unit

Btuh	Vertical Separation ft (m) – Outdoor Above Indoor Unit							
	20 – 25 (6.1 – 7.6)	26 – 50 (7.9 – 15.2)	51 – 75 (15.5 – 22.9)	76 – 100 (23.2 – 30.5)	101 – 125 (30.8 – 38.1)	126 – 150 (38.4 – 45.7)	151 – 175 (46.0 – 53.3)	176 – 200 (53.6 – 61.0)
18,000	+1	+1	+2	+3	+3	+4	+5	+6
24,000	+1	+1	+2	+3	+4	+5	+6	+7
30,000	+1	+2	+2	+4	+5	+6	+8	+9
36,000	+1	+2	+2	+4	+5	+6	+8	+9
42,000	+1	+2	+3	+4	+5	+7	+8	+10
48,000	+1	+2	+3	+4	+5	+7	+9	+10
60,000	+1	+2	+3	+5	+6	+8	+10	+12

J. General Requirements (Check List)

All Long Line Applications

- TXV with 15 to 30% bleed must be installed at indoor unit.
- Hard Start Kit (start capacitor and relay) must be installed on outdoor unit.
- Crankcase heater must be installed on compressor.
- Use liquid line per Tables 5, 7, and 10.
- Use only vapor line sizes listed in Tables 3.
- Adjust charge per Table 4.
- Charge system to 10° subcooling or rating plate subcooling, whichever is greater.

Heat Pumps Only

- Bi- flow liquid line solenoid must be installed within 2 ft (0.61 m)of outdoor unit with arrow pointing towards outdoor unit.

Equal- level Outdoor/Indoor unit

- Outdoor unit and indoor unit must be within +/- 20 ft (6.1 m) vertical separation.
- Vapor line should slope towards indoor unit.

Heat Pumps Only

- No outdoor AccuRater™ adjustment required with less than 20 ft (6.1 m) vertical separation.

Outdoor unit BELOW indoor unit

- See Tables 6, 8, and 11 for longline thresholds.
- An inverted vapor- line trap must be installed at indoor unit. The top peak of trap must be greater than height of indoor coil. See Fig. 3.
- Vertical separation and line set equivalent length must not exceed requirements listed in Tables 5, 7, or 10.

Heat Pumps Only

- Adjust outdoor AccuRater™ per Table 9.

Outdoor unit ABOVE indoor unit

- Maximum vertical separation is 200 ft (61 m)
- Maximum actual line length is 200 ft (61 m)
- Maximum total equivalent length is 250 ft (76.2 m). See Table 10.
- Vapor line traps are not required.

Heat Pumps Only

- Adjust outdoor AccuRater™ per Table 12.

Table 13 - Common AccuRater™ – Piston Sizes Available through RCD
(Part numbers are all EA52PHxxx. The last 3 digits represent size.)

EA52PH032	063	093
035	065	096
037	067	098
038	068	101
040	070	104
042	073	106
043	076	109
046	078	110
049	080	113
052	082	116
055	084	120
057	086	125
059	088	128
061	090	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