Installation, Operation and Maintenance Manual

U-Match DC Inverter System *R-410A* Up To 16 SEER

Outdoor Unit - Cooling Only and Heat Pump

24,000 to 60,000 BTU/h - *60Hz*

Cooling Only
4TYK6524D1000AL
4TYK6536D1000AL
4TYK6548D1000AL
4TYK6560D1000AL

Heat Pump
4TXK6524D1000AL
4TXK6536D1000AL
4TXK6548D1000AL
4TXK6560D1000AL

MCC05

MCD05

MCX05

⚠SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, start- up, and servicing of heating, ventilating and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all caution indications in the literature and on the tags, stickers and labels that are attached to the equipment.

May 2017 **MS-SVN052E-EN**

Content

Warnings, Cautions and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury..
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants including industry replacements for CFCs and HCFCs such as saturated or unsaturated HFCs and HCFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required

Failure to follow code could result in death or serious injury. All field wiring must be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠ WARNING

Use of Refrigerant!

Failure to follow recommendations in the use of service equipment or components classified for the use of R410A refrigerant, could give way to equipment or component explosion under R410A pressures and as a result lead to death or serious injury or equipment damage. R410A refrigerant works at a higher pressure than R22 refrigerant. Employ only service equipment or components classified for use with this unit. In case of specific doubts related with the use of refrigerant, consult your local Trane representative.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical and chemical hazards, MUST follow precautions in this manual and on the tags, stickers and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (example; cut-resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS/SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

Identification

U-Match Inverter Unit (16 SEER) - R410A Refrigerant Voltage 220/230/1/60hz

Outdoor Unit - Cooling Only	
Model	**Capacity**
4TYK6524D1000AL	24 MBH - 16 SEER
4TYK6536D1000AL	36 MBH - 16 SEER
4TYK6548D1000AL	48 MBH - 16 SEER
4TYK6560D1000AL	60 MBH - 16 SEER

Outdoor Unit - Heat Pump	
Model	**Capacity**
4TXK6524D1000AL	24 MBH - 16 SEER
4TXK6536D1000AL	36 MBH - 16 SEER
4TXK6548D1000AL	48 MBH - 16 SEER
4TXK6560D1000AL	60 MBH - 16 SEER

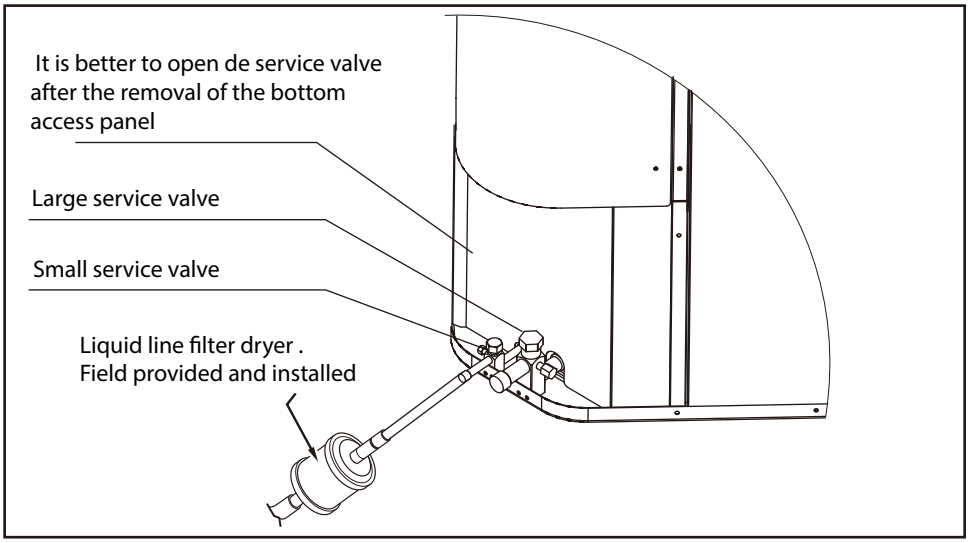
Inspection

Upon arrival, the unit should be inspected in search of shipping damages. If these are detected, they should be indicated on the delivery document presented by the transportation company. Present the transportation entity a written request for inspection of damages. If further information should be required, be sure to consult with your local distributor.

Requirements for installation/service of equipment using R410A refrigerant:

- Accessories such as pressure gauge, hoses, refrigerant containers and recovery system must be designed to handle POE or PVE oils.
- Manifold gauge classification should be 800 PSIG on the high side and 250 PSIG on the low side with 550 PSIG for restart on the low side.
- All hoses must be classified for 700 PSIG service pressure.
- Leak detectors must be designed to detect R-410A refrigerant.
- Recovery equipment (including containers for refrigerant recovery) must be designed specifically to handle R-410A refrigerant.
- **Do Not use a TXV for R-22**.
- Good refrigeration practice requires the installation of a field provided liquid line filter dryer. See **Figure 1.**

Figure 1. Filter Dryer Installation



Limitations

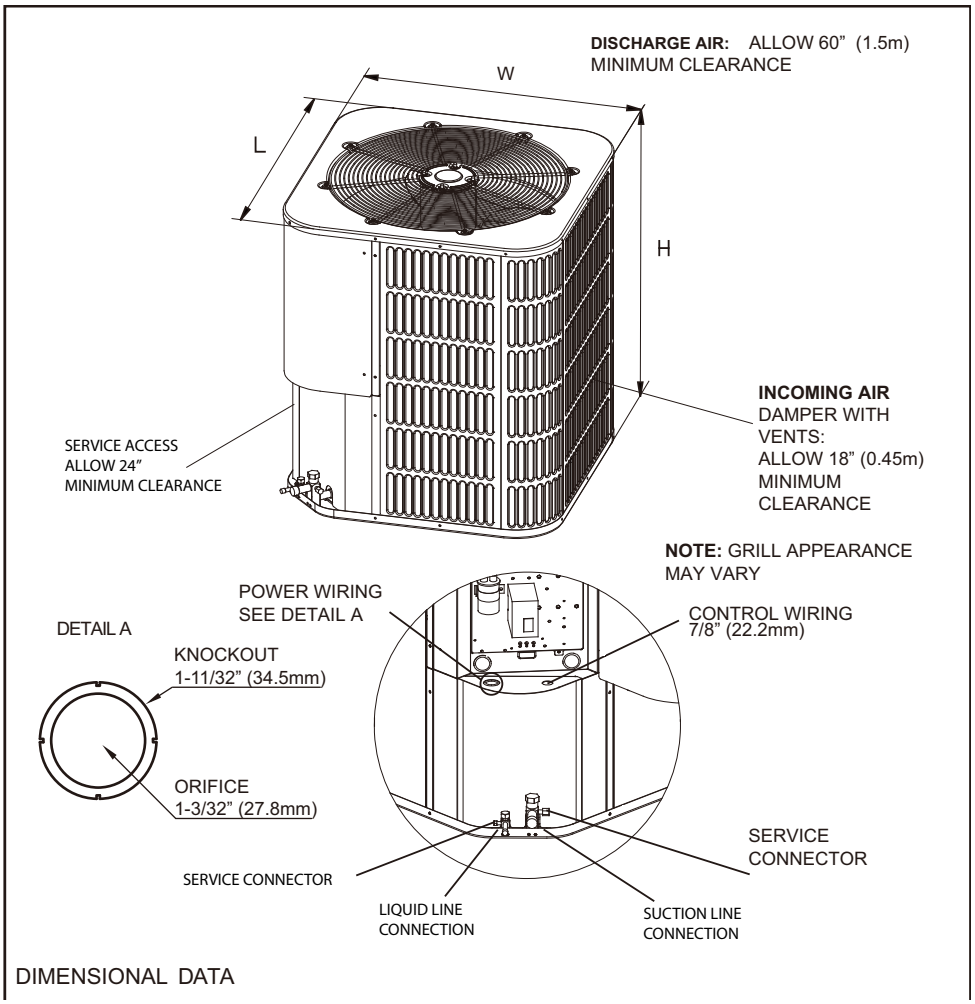
The unit should be installed in accordance with all national, state and local codes and in compliance with the following limitations:

1. All limitations shall be observed for the indoor unit as well as for the coil and appropriate accessories.
2. The outdoor unit shall not be installed with ductwork in the passage of air current. The outdoor fan is one of propeller type and is not designed to operate against any additional external static pressure.
3. Maximum and minimum operating conditions shall be observed in order to ascertain that the system offers maximum performance with minimum service.
4. This unit is not designed to operate with a low ambient kit. The control system shall not be modified to operate with any type of low ambient kit.
5. The maximum length of line allowed for this product is of 100 feet.

Outdoor units are designed to connect to an indoor coil with brazed connection lines. These units are shipped with factory charged refrigerant to be connected to a matched indoor coil and to 4.5m (15 ft) of field provided lines.

Indoor coils are provided with a thermostatic expansion valve or a calibrated expansion orifice. The size of the orifice and/or of refrigerant charge may require alterations in the case of some indoor-outdoor unit combinations, differences in lift or total lengths of line.

Figure 2. Dimensional Data



Model Size	Dimension (in)			Refrigerant Connection Service Valve Size	
	Height (in) (mm)	Width (in) (mm)		Liquid (in)	Suction (in)
24	24-15/16 (633)	29-1/8 (740)	29-1/8 (740)	3/8	3/4
36	24-15/16 (633)	29-1/8 (740)	29-1/8 (740)	3/8	3/4
48	33-3/16 (843)	29-1/8 (740)	29-1/8 (740)	3/8	7/8
60	33-3/16 (843)	29-1/8 (740)	29-1/8 (740)	3/8	7/8

Unit Installation

Location

Prior to the installation, select and verify the adaptability of the location for both indoor and outdoor units. Take into consideration all limitations and clearance requirements. The outdoor unit must comprise sufficient clearance for incoming air into the condenser, for discharge air, and for service access. See **Figure 2**.

Important: *In the case of multiple units installation, these must be spaced to contain a minimum separation of 36 inches (face-to-face coils).*

If the unit is to be installed on the roof with exposure to sun rays, or on a "blackened" surface, then the unit must be placed over a base with sufficient elevation that will prevent the accumulation of hot air being drawn into the outdoor unit.

Provide an appropriate structured support.

Installation on Outdoor Flat Surface

The unit may be installed on a solid flat surface which cannot shift or move in order to prevent stress over refrigerant lines or possible leaks. Clearances must be maintained as can be seen in **Figure 2.** Installation must be completely balanced.

Normal operation levels of noise may prove to be objectionable if the unit is installed directly below windows o close to bedrooms, studios, etc.

Important: *Outdoor unit must not be installed in areas where accumulation of mud or ice may cause personal injury or damages to the system.*

Place the unit high enough to avoid blocking the entry of air due to ice/snow or in areas that are prone to accumulate ice/snow. Isolate the unit away from drains to avoid mud slides/landslides of the foundation.

Installation on the Roof

When installing the unit on the roof, the structure should be able to support the total weight of the unit, including mounting frame, rails, etc., which must be used to minimize the transmission of sound or vibrations to the conditioned space.

Installation of the unit

1. Provide a mounting base on the selected installation area.
2. Remove all packaging material and inspect the unit in search of possible damages.
3. Compressor fastening nuts must remain tightened.
4. Place the unit on the provided mounting base.

The outdoor unit must be connected to the indoor coil with the provided copper refrigerant piping. The installation must employ only the approved sizes of pipes for system combinations. Refrigerant charge shown on the unit's nameplate refers to the lengths of standard size interconnecting liquid line up to 15 feet.

Note: *The use of a larger size of line from original specifications could cause problems of oil return. The use of a much smaller size of line could cause loss of capacity and other problems provoked by insufficient flow of refrigerant. Tilt the horizontal suction lines at least 1" every 20 feet towards the outdoor unit to aid in the appropriate return of oil.*

Mounting of the Unit

If the unit is to be installed on a roof surface or on a concrete base, observe the following guidelines:

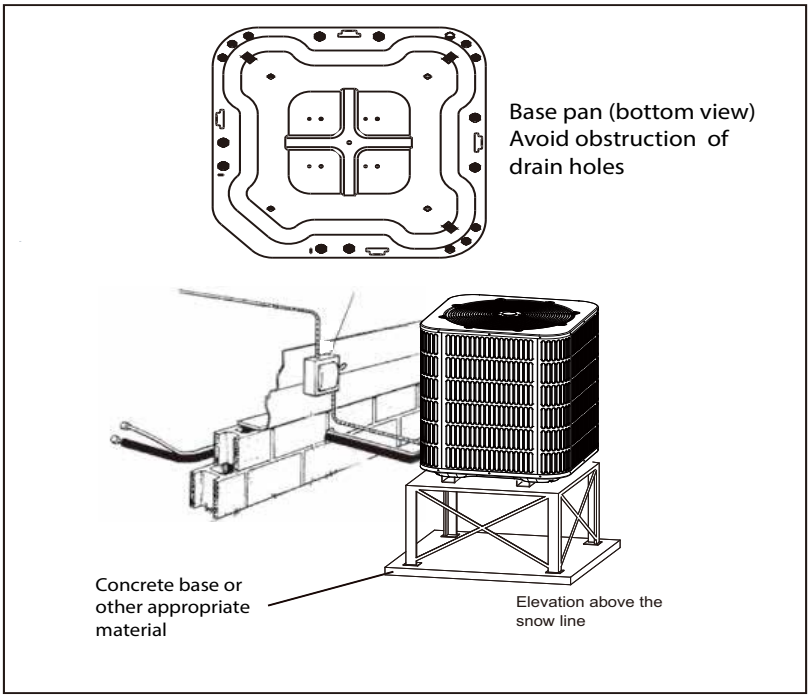
1. The provided base pan rises the heating pump 2" above the installation base.
2. If the unit is to be raised over the roof surface, use 4" x 4" boards (or equivalent) placed in a manner that may allow weight to be evenly distributed and to prevent the transmission of noise and vibrations. See **Figure 3.**

Note: *Avoid the blockage of drain openings as shown in* ***Figure 3.***

3. If the unit is to be raised to avoid seasonal snow/ice buildup, make sure the elevation support is sturdy enough to avoid unit's falling or tilting.

Note: *See* **Figure 4** *for proper unit setting guidelines.*

Figure 3. Recommended Rise Installation



Factory Recommendation for Mounting the Unit

1. Before installation, clean the mounting surface. ***Important =*** The cement base must comply with local codes and be thick enough to sustain the installation of fasteners.
2. Center and level the unit over the base or mounting surface.
3. Using the provided L-shaped bracket, mark the boring holes over the concrete and bore holes of at least 1/4" additional depth as compared to the bracket to be used. ***Important =*** Drill screws should not exceed 3/8" in length to avoid harming the coil.
4. Tighten brackets and drill screws following conventional practices for the installation of these supports. See **Figure 4.**

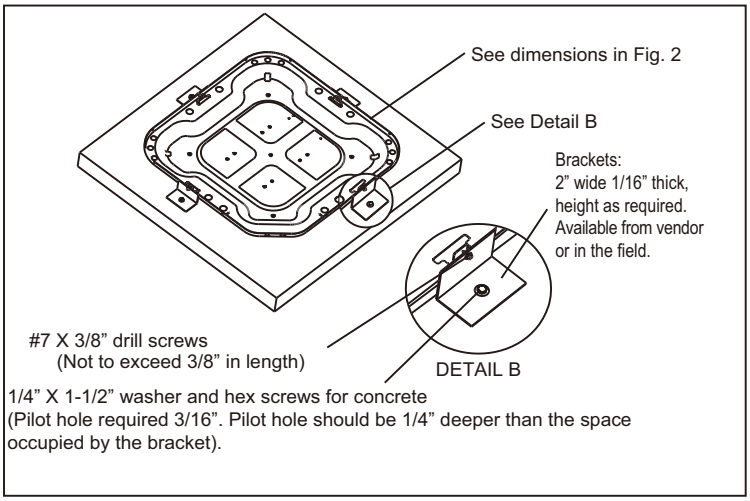
   Note: *Use one bracket at each side. For further stability, use 2 brackets at each side.*

   Note: *Do not over-tighten brackets in order to avoid weakening the concrete material.*

IMPORTANT NOTE:

These instructions are intended to provide a method of installation of the unit to the concrete base in order to establish a protective procedure in cases of strong winds. It is recommended to verify local codes for the application of methods and protocols for secure setting of the unit.

Figure 4. Preferred Method for Unit Setting



Cautions to be Observed During Installation of Refrigerant Lines

1. Install lines with the least amount of curves possible. Avoid damaging line couplings or line curves. Use clean and hard drawn copper tubing at points where it will not be necessary to apply multiple curves around obstructions. When it is necessary to use soft copper, it should be carefully applied avoiding sharp curves that may provoke any type of restriction.
2. Install lines avoiding any obstructions to the coil, to the air handling components o to the filter.
3. Take special care in the application of insulation to refrigerant lines in order to minimize the transmission of sound to the structure.
4. When applying insulation material to the suction line, refrigerant lines should be supported as illustrated in **Figure 5**. DO NOT allow any friction contact between metal piping.
5. Use PVC piping as conduit in all underground installations. See **Figure 6.** Underground lines should be kept as short as possible in order to minimize the accumulation of liquid refrigerant in the suction line during extended system shutdown periods.
6. In an effort to reduce vibrations and to retain some degree of flexibility, place a type of sealant material like permagum or similar around refrigerant lines that must be directed through walls.

Figure 5. Lines Support

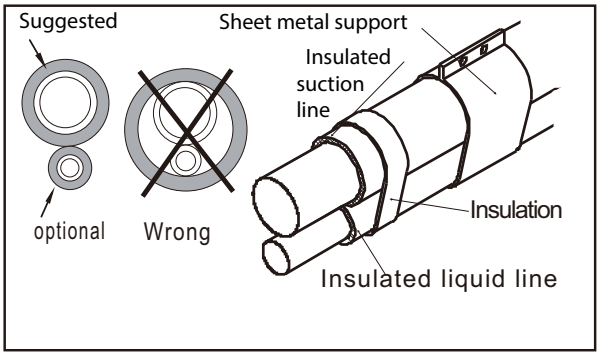


Figure 6. Underground Installation

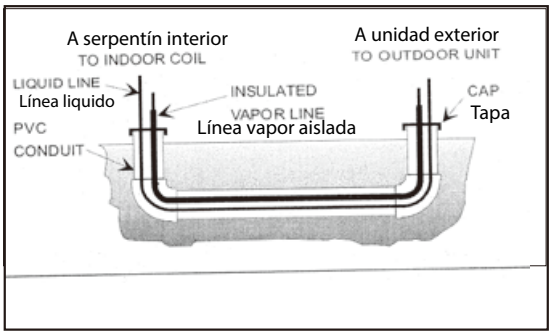
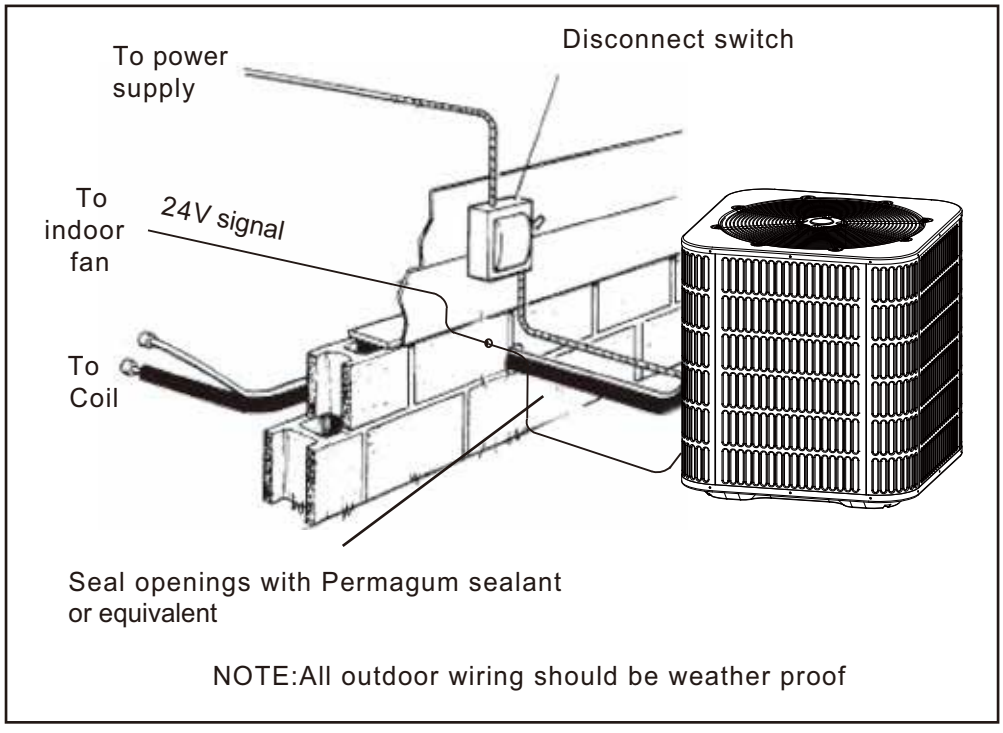


Figure 7. Typical Installation



Precautionary Measures During Line Brazing

All connections to indoor unit and to evaporator coil will be copper-to-copper. Brazing material should be done with the use of a copper-phosphorous alloy such as Silfos-5 or equivalent. DO NOT employ soft brazing alloy. Outdoor units contain service valves in both liquid and suction connections. Total system refrigerant charge is retained inside the outdoor unit during shipment and installation. Service valves are provided for evacuation and charging in accordance with these instructions.

The application of precautionary measures to ensure that system is clean and dry will aid in the avoidance of serious service problems.

¡CAUTION!

During line brazing always supply dry nitrogen through the lines due to the fact that temperature is sufficiently high to cause metal oxide of copper tubing, unless an inert atmosphere is provided. The flow of dry nitrogen must continue until the coupling/connection has cooled. Always use a pressure regulator and security valve to ascertain that only low pressure dry nitrogen is introduced into the line. Only a small amount of flow is required to move the air and prevent oxidation.

Precautionary Measures During Service Valve Brazing

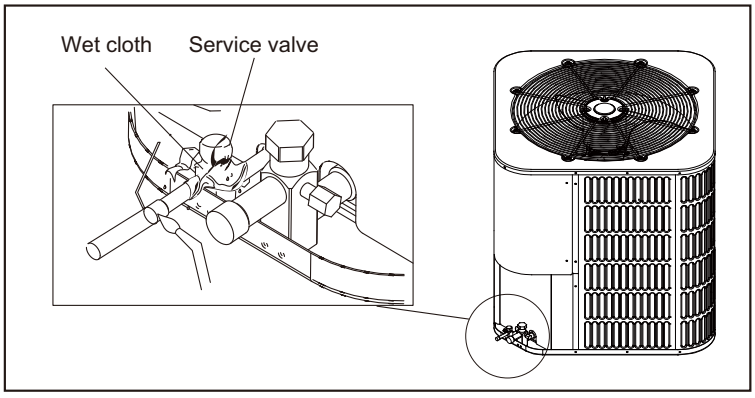
Precautionary measures should be adopted to prevent heat damage to the service valve.Wrap a wet cloth around the valve as shown in **Figure 8.** During brazing action, protect all painted surfaces and insulation; also, be sure to remove the Schraeder core to protect it against high temperature in the area due to the welding process. Once brazing has ended, wrap the coupling with a wet cloth.

In order to open the valve, it is necessary to remove the top of the plunger/piston and insert a hex wrench over the valve stem to turn it counterclockwise until the valve stem reaches the angled retention wall.

Connect refrigerant lines as follows;

1. Remove the Schraeder core taps from both service ports of liquid and suction lines' service valves on the outdoor unit. Connect low pressure nitrogen flow to the service port of the liquid line.

Figure 8. Protection against heat



2. Weld the liquid line to the liquid valve on the outdoor unit. Do not forget to wrap the body of the valve with a wet cloth. Continue to allow the flow of nitrogen.
3. Protect the suction valve with a wet cloth and braze the suction line connection to the outdoor unit. The flow of nitrogen should be leaving the system from the service port connection of the suction line. When this connection has cooled, remove the flow of nitrogen from the service port at the liquid coupling.

4. Replace the Schraeder core once more onto the liquid and suction valves.
5. Carry out leak tests on all refrigerant line connections, including tapered valves at the service port to ensure they are all leak-free. **DO NOT OVERTIGHTEN (between 40 and 60 in.lbs maximum).**
6. Purge suction line, evaporator, and liquid line at 350 microns or less. Consult Data Sheet to learn the appropriate sizing of liquid line.

Table 1. Recommended Size for Liquid and Suction Lines (in.)

Model	Líquid	Suction
24	3/8	7/8
36	3/8	7/8
48	3/8	7/8
60	3/8	7/8

7. Replace taps once more onto service ports. Do not remove tapered caps of service ports unless absolutely necessary for system service tasks.
8. Release the refrigerant charge inside the system. Open both liquid and suction valves; remove the plunger/piston cap and insert a hex wrench over the stem in order to turn it counterclockwise until said valve stem reaches the angled retention wall.
9. Replace the plunger/piston cap once more and tighten with your fingers; give it an additional 1-1/2 turn with your fingers. The cap should be placed in order to prevent leaking.

¡WARNING!

Never try to repair soldered connections while the system is under low pressure. Such action could provoke personal injuries. *Consult "System Charging" section to verify and register system charge values.*

Interconnecting Lines

Suction and Liquid Lines

Maintain all lines duly sealed until ready for interconnection tasks.

First, carry out connections on the indoor coil.

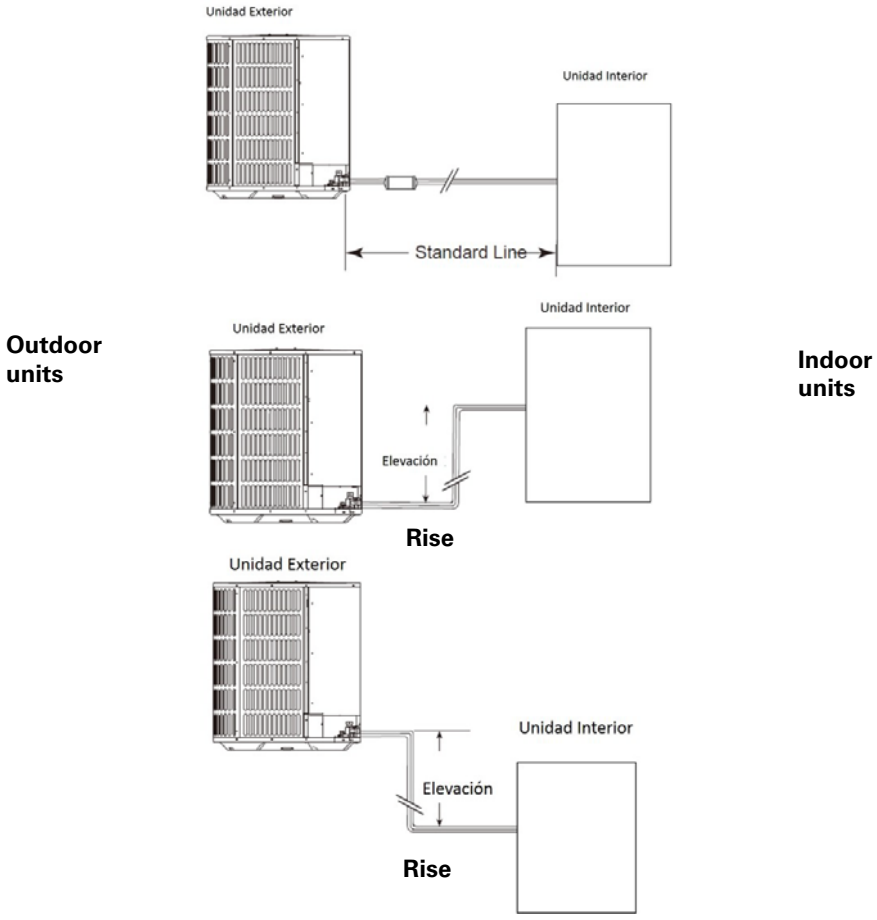
Consult line sizing information on **Table 2** and **Table 3** to verify the use of correct sizes and multipliers to determine the capacity for several diameter sizes of suction line and routing lengths. Losses due to exposure of lines under outdoor conditions are not included.

Factory refrigerant charge for outdoor unit is sufficient for 15 feet of standard size interconnecting liquid line.

Maximum Length for Lines

Maximum length for interconnecting lines is 160 feet.

Figure 9. Piping Length Diagram #1



Always use the shortest length possible with a minimum amount of curves.

Note: *Excessively long refrigerant lines produce capacity loss for the equipment.*

Vertical Rise

Keep the vertical rise at a minimum. See the following guides for unit installation.

1. DO NOT exceed vertical rise as indicated in **Table 3.**
2. It is recommended to use the smallest allowable size for liquid line in order to minimize system charge. This will maximize compressor reliability.

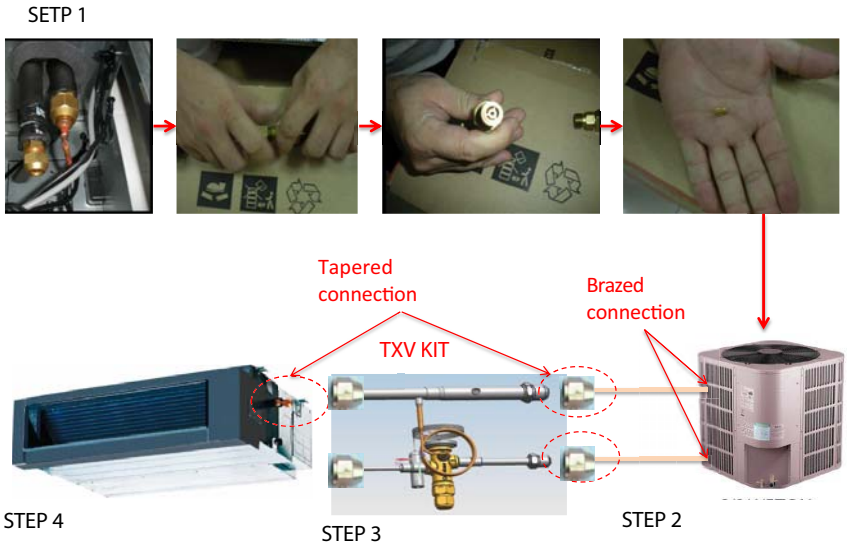
Table 3 may be used to define dimensions for horizontal runs.

Installation of TXV Valve

TXV Kit (thermostatic expansion valve) provided together with the equipment is for on-site mounting. Installation of this valve must be done with tapered threaded fitting.

Figure 10. Thermostatic Expansion Valve TXV

Figure 11. Steps for TXV Kit Installation



Step 1 - Remove the fixed expansion device (calibrated orifice) mounted on the indoor unit. See images.

Step 2 - Connect liquid line and gas line piping to the outdoor unit (brazed fitting).

Step 3 - Connect the thermostatic expansion valve TXV to the liquid line and gas line connections coming from the outdoor unit.

Step 4 - Connect the thermostatic expansion valve TXV to the liquid line and gas line piping of the indoor unit. Apply appropriate torque. Verify the absence of refrigerant leaks.

Evacuation

It is required to evacuate the system at 350 microns or less. If a leak is suspect, apply dry nitrogen to locate it. Repair the leak and repeat the leak test. To verify that the system reports no further leaks, close the valve that goes to the suction vacuum pump; this will isolate it and will allow you to sustain the system under a vacuum. Observe the gauge during several minutes. If reading indicates a stable and continuous increase, it will be indicative of a leak. If the gauge indicates an increase and after several minutes it stabilizes and remains constant, it will be indicative of a system free of leaks but still withholding humidity. This situation will require an additional evacuation in the event of a gauge reading above 350 microns.

Line Sizing

Table 2. Length/Dimension of Suction Line vs. Capacity Multiplier (R410A)

Model Size		2 Ton	3 Ton	4 Ton	5 Ton
Suction Line Connection Size		3/8″ Std.	3/8″ Std.	3/8″ Std.	3/8″ Std.
Suction Line routing (in feet)		5/8 Opt	5/8 Opt.	3/4 Opt.	3/4 Opt.
		3/4 Std.	3/4 Std.	7/8 Std.	7/8 Std.
25′	Optional	1.00	0.99	0.99	0.98
	Standard	1.00	1.00	1.00	1.00
50′	Optional	0.99	0.98	0.98	0.97
	Standard	0.99	0.99	0.99	0.99
100′	Optional	0.98	0.95	0.97	0.95
	Standard	0.99	0.98	0.98	0.97

Table 3. Dimension of Líquid Line (R410A)

Model Size	Line Connection Size (inch <O.D.)	Compressor Type	Connection Size and Line Size (inch O.D.)	Liquid Line Size Outdoor Unit Above or Below Indoor Coil			
				Total Length Equivalent - Feet			
				25	50	60	100
				Maximum Vertical Separation - Feet			
2 Ton	3/8″x	Rotating	3/4″x	25	50	45	40
			5/8″	25	50	45	40
3 Ton	3/8″x	Rotating	3/4″x	25	50	50	50
			5/8″	25	50	50	50
4 Ton	3/8″x	Rotating	7/8″x	25	50	50	40
			3/4″	25	50	50	40
5 Ton	3/8″x	Rotating	3/4″	25	50	50	40
			7/8″x	25	50	50	40
			1-1/8″	25	40	30	N/A

Note:

1. x Standard line size
2. N/A (application not recommended
3. Charge multiplier for additional interconnection of refrigerant line length: Líquid 3/8″ 0.6oz/ft

Electrical Connections

General Information and Grounding

Verify power supply to ensure compliance with data on the unit's identification label and wiring tags.

The installer shall supply power wiring, control wiring (low voltage), disconnect switches and overcurrent protection. All cable wiring should comply with specific requirements.

CAUTION!

All field wiring shall be of ONLY COPPER CONDUCTORS and in compliance with local, national and electrical security codes.This unit must be grounded with a separate cable and in accordance with local, national and electrical security codes.

Wiring diagram and wiring schematics can be found on the inside surface of the service access panel as well as in the present manual.

Power Wiring of Field Connections

1. Install properly sized and weather proof disconnect switch outdoors and close to the unit.
2. Remove retaining screws on the side of the corner panel. Slide corner panel downwards to remove it. See **Figure 12.**
3. Run power wiring from the disconnect switch to the unit
4. Direct cables from the disconnect point through the opening provided for power wiring and towards the interior of the unit's main control box.
5. Install properly sized time delay fuses or circuit breaker, and conduct power supply connections.
6. To save time, energize the crankcase heater (if equipped) through the reheating of compressor oil while the remaining the remaining installation steps continue to proceed.

Note: *When changing motor, first remove the top panel.*

Figure 12. Typical Field Wiring

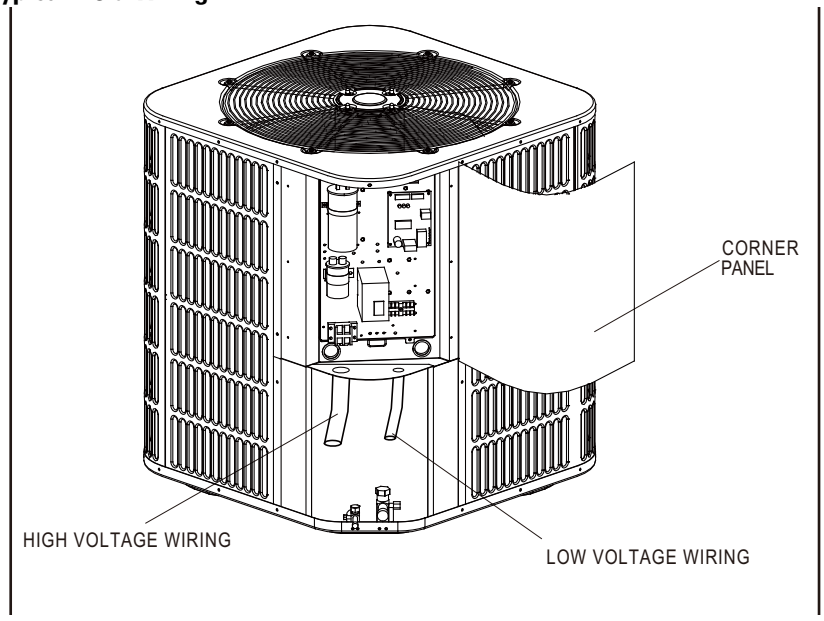
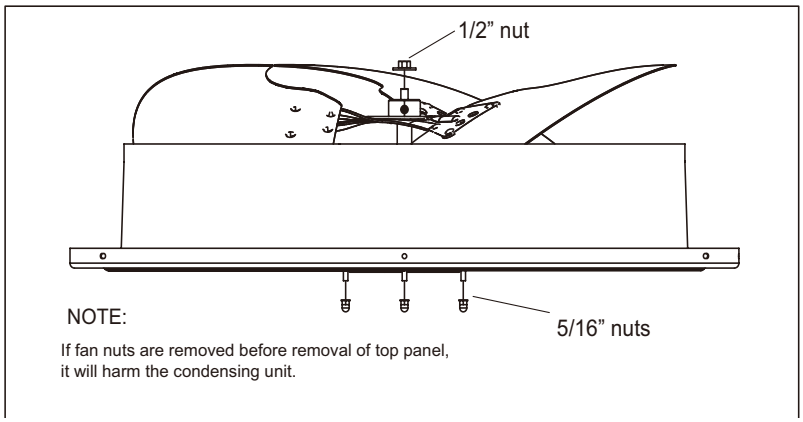


Figure 13. Removal of top panel and motor



When it is necessary to change the motor, follow the steps indicated below:

Step 1: Open the electrical panel; disconnect all power to the motor.

Important:

- ***Disconnect power supply to the unit. Failure to follow this recommendation could provoke severe burns and electrical shock.***

Step 2: Remove top panel (be careful with motor wiring)

Step 3: Place top panel on the floor**.**

Important:

- ***Take care NOT to allow fan blades to rest on or touch the floor or against any surface.***

Step 4: Remove fan motor with the removal of all 5/16” nuts from the panel.

Step 5: Remove fan blades from motor fan with the removal of 1/2” nut and place fan on the floor.

Step 6: Invert the removal process when ready to reinstall fan and motor.

Important:

- ***When connecting wiring to the motor, verify the direction of the motor.***

System Operation

Control Logic Description

The variable speed system adopts the same 24VAC control as conventional heat pumps.

Compressor speed is controlled according to coil pressures monitored by the pressure transducer. In order to ensure stable and appropriate capacity, compressor speed is modulated in accordance with evaporator pressure during the cooling mode, and in accordance with condensing pressure during the heating mode. Nominal pressure can be adjusted automatically at the SW4 switch to reach optimized compressor operational capacity, as well as to satisfy higher dehumidifying and capacity demands.

SW4

ON				
OFF	1	2	3	4

SW4-1	**Not Used**	
SW4-2	**Not Used**	
SW4-3	ON	Adaptive capacity output disable
	OFF	Adaptive capacity output enable
SW4-4	ON	Accelerated cooling/heating
	OFF	Normal cooling/heating

Sensor

T3 (Outdoor coil temperature) and T4 (indoor temperature heat pump only).

T5 (Compressor discharge temperature and Tf (IPM radiator temperature)

Pressure Transducer.

Sensor Description

T3 temperature sensor is used for:

- Protection during system operation (high/low coil temperature)
- Outdoor fan control (cooling)
- Defrost (heat pump only)
- Forecasting environment temperature (cooling only)

T4 sensor is required (heat pump only) for:

- Enabling system operation according to outdoor temperature
- Indicating one of the conditions for enabling defrost cycle
- Outdoor fan control (heating mode heat pump only)

T5 sensor is required for:

- Operational protection (high/low temperature)
- Control of outdoor electronic expansion valve (heat pump only)

Tf sensor is required for:

- Protection against module temperature (high temperature)

A pressure transducer (PT) is required for:

- Operating speed control
- Outdoor electronic expansion valve (heat pump only)
- High pressure protection (heating mode heat pump only)
- Low pressure protection (cooling mode)

Defrost Description (Heat Pump Only)

Defrost control (when ordered) measures coil temperature with the use of a sensor located on the heat pump coil. In order to measure outdoor ambient temperature, a second sensor is located on the outside of the outdoor coil.

Defrost cycle starts with the reading of various parameters, i.e., outdoor unit coil temperature (T3 temperature sensor), outdoor environment temperature (T4 temperature sensor), cummulative time of operation, coil temperature and high pressure (when high pressure is found to be lower than a specific value).

Defrost cycle starts under one of 3 conditions as follows:

1. When temperature differential (Delta T) between outdoor temperature (T4) and coil temperature (T3) reaches a duration of 5 minutes, that is:
   - T4 ≥ 39ºF, Delta T = 18ºF
   - T4 ≥ 30ºF, Delta T = 16ºF
   - T4 ≥ 19ºF, Delta T = 14ºF
   - When T4 < 19ºF, T3 < 9ºF
2. When minimum time of operation (MRT) based on outdoor temperature is for example:
   - MRT - 4 hour duration when: T4 < 23ºF
   - MRT - 2 hour duration when: 23ºF ≤ T4 < 42ºF
3. When saturation temperature descends below 82ºF during a period of 20 minutes.

Defrost cycle ends under the following conditions:

1. When outdoor coil temperature (T3) reaches 64ºF during a period of 1 minute or when defrost period exceeds 8 minutes.
2. The adjustment of SW5 switch offers various defrost cycle options depending upon geographical conditions and/or outdoor area conditions.

SW5

ON		
OFF	1	2

Defrost Options	SW5-1	SW5-2	Remarks
ON	Operating time is reduced by 10%	Defrost extended by 60 seconds	
OFF	Normal	Normal	Default
Remarks	Enter defrost	Cancel defrost	

Manual Defrost (Heat Pump Only)

1. Demand defrost can start when the system has been operating in heating mode during a period exceeding 8 minutes.
2. Press “Force” key during 6 seconds to initiate demand defrost.
3. Wait approximately 40 seconds to watch the initiation of the defrost cycle.
4. Once defrost cycle has started, the display will show “DF”.
5. Defrost test ends automatically and the display will show speed of operation.
6. If a second test is required, repeat Step 3 after 5 minutes has elapsed.

Compressor Crankcase Heater Description

The migration during the OFF cycle can result in a noisy startup. The use of a crankcase heater (CCH) minimizes refrigerant migration, reduces startup noise, and reduces the wearing out of bearings.

Crankcase heater must be located on the lower half of the compressor shell. Its purpose is to heat the compressor during the OFF cycle and avoid the return of refrigerant to the compressor.

At initial startup, or after extended periods of inactivity, the crankcase heater must be activated during a minimum of 12 hours prior to compressor operation, applying line tension to the system but with the controller in OFF mode.

Crankcase heater operation is initiated:

1. When the application of line tension for the first time and compressor discharge temperature is T5<104ºF.
2. During the defrost process.
3. When compressor stops operating during a period of 4 hours and outdoor temperature is T4<50ºF or T5<104ºF.

Crankcase heater operation ends:

1. When compressor discharge temperature is T5 ≥ 113ºF.
2. During heating mode and stops working during cooling mode.

Protection Functions

Outdoor coil protection function (T3)

- When T3 > 143.6ºF, compressor stops working
- When T3 > 129.2ºF, compressor starts working

Ambient temperature protection (T4)

- When 40ºF ≤ T4 < 120ºF, the unit is able to operate in the cooling mode
- When 5ºF ≤ T4 < 86ºF, the unit is able to operate in the heating mode
- When T4 < 6.8ºF, the heat pump provides the indoor unit with 24V, which in turn activates the electric heater (if installed)

Discharge temperature (DT) protection (T5)

- When DT > 239ºF during cooling mode, the compressor shuts down
- When DT < 194ºF during cooling mode, the compressor starts up again
- When DT > 221ºF during heating mode, the compressor starts up again

High pressure protection (HPS) (mechanical switch opening/closing pressure)

- When HPS is P > 580 PSIG, both the compressor and outdoor fan shut down
- When HPS is P < 435 PSIG, both the compressor and outdoor fan start up again

Low pressure protection (LP)

- When LP < 43.5 PSI during a period of 5 minutes in the cooling mode, both the compressor and outdoor fan shut down. After a 6 minute lapse, the system tries to start up again

Module (inverter) heating protection (TF)

- When TF > 176ºF, both the compressor and outdoor fan shut down
- When TF < 145ºF, both the compressor and outdoor fan start up again

Note: *In an effort to improve our products, we reserve the right to make changes without previous notice.*

Refrigerant Charge Review

Weigh-in Method (use of electronic scale)

Weigh-in method can be used the initial installation or anytime a system charge is being replaced. This method can also be used when power is not available at the site, or when operating conditions (indoor/outdoor temperature) are not in range to verify with the sub-cooling charging method.

A	B	C
Model	Factory charge	Charge multiplier for interconnecting refrigerant tube length
All models	(see data on nameplate)	Liquid 3/8” 0.6 oz/ft Liquido 5/16” 0.4 oz/ft

Note: *Factory charge in the outdoor unit is sufficient for 15 feet of standard size interconnecting liquid line.*

New installations - Calculation of additional charge for a line that is longer than 15 feet

1. Total line length (feet) = _____ (a)
2. Standard line (feet) = ____15_____ (b)
3. (a) less (b) = _____ (c)
4. Refrigerant multiplier = 0.6 or 0.4 oz/ft (d)
5. Additional refrigerant (c*d) = _____(e)*

*If the line is shorter than 15 feet, (e) = 0

Sealed system repairs - Charge calculation

1. Total line length (feet) = _____ (a)
2. Standard line (feet) = ____15_____ (b)
3. (a) less (b) = _____ (c)
4. Refrigerant multiplier = 0.6 or 0.4 oz/ft (d)
5. Additional refrigerant (c*d) = _____(e)*
6. Factory charge (unit nameplate) = _____(f)
7. Total system charge (e+f) =

*If the line is shorter than 15 feet, (e) = 0

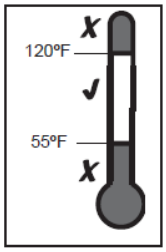
Note: *The only approved mode to validate the system charge during cooling mode, is employing the weigh-in charge. Outdoor temperature must be established to be between 55°F and 120°F with indoor temperature to be between 70°F and 80°F.*

Sub-cooling charge and refrigerant adjustment during cooling mode (above 55ºF outdoor temperature)

STEP 1 - Check the outdoor ambient temperatures.

Subcooling (in cooling mode) is the only recommended method of charging above 55ºF outdoor ambient temperatures.

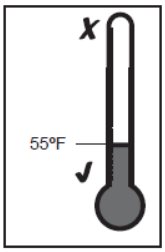
Outdoor Temperature Above 55ºF



Outdoor Temp1

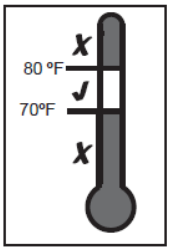
For outdoor ambient temperatures below 55ºF , use weigh-in charge method.
Note:It is important to return in the spring or summer to accurately charge the system in the cooling mode when outdoor ambient temperature is above 55ºF.

Outdoor Temperature Below 55ºF



Outdoor Temp2

For best results the indoor temperature should be kept between 70ºF to 80ºF.



Indoor Temp

STEP 2 - Ensure Sections 7, 8, 9, 10, and 13 have been completed.

STEP 3 - Stabilize the system.

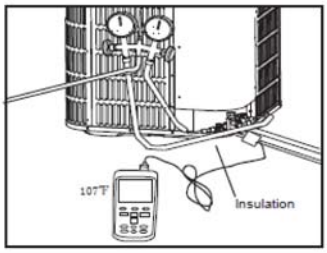
After starting the system in cooling mode, short press "FORCE"button, and " ⊢" symbol appears in 10 minutes, operate the system for a minimum of twenty (20) minutes.

Important:Whenever charge adjustment or expansion valve adjustment, if unit is running continuously, the system must be operated for a minimum of five (5) minutes, otherwise repeat step 3.

STEP 4 - Calculate superheat value on suction valves(According to form)

Measured Suction Line Temp. = _____ºF
Measured Suction Line Pressure = _____ PSIG
Calculate superheat value = _____ºF

Note:Make sure the superheat value of suction valve should be above 12ºF, if the value is lower than this, indoor TXV should be adjusted.If the temperature is higher than 18ºF, we suggest to adjust indoor TXV. Repeat the steps above.
(If to adjust TXV ,steps of adjustment are shown on separate sheet , and repeat this step.)

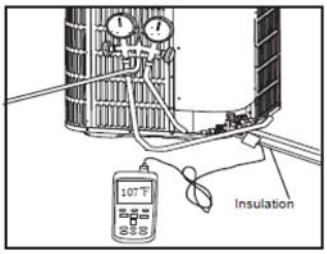


R-410A REFRIGERAN CHART								
SUCTION TEMP (℉)	FINAL SUPERHEAT(℉)							
	8	10	12	14	16	18	20	22
	SUCTION GAGE PRESSURE (PSI)							
40	101	97	93	89	86	82	78	75
42	105	101	97	93	89	86	82	78
44	110	105	101	97	93	89	86	82
46	114	110	105	101	97	93	89	86
48	118	114	110	105	101	97	93	89
50	123	118	114	110	105	101	97	93
52	128	123	118	114	110	105	101	97
54	133	128	123	118	114	110	105	101
56	138	133	128	123	118	114	110	105
58	143	138	133	128	123	118	114	110
60	148	143	138	133	128	123	118	114
62	153	148	143	138	133	128	123	118
64	159	153	148	143	138	133	128	123
66	164	159	153	148	143	138	133	128
68	170	164	159	153	148	143	138	133
70	176	170	164	159	153	148	143	138
72	182	176	170	164	159	153	148	143

STEP 5 - Calculate subcooling value on liquid valves(According to form)

Measured liquid Line Temp = _____ºF
Measured liquid Line Pressure = _____ PSIG
Calculate subcooling value = _____ºF

Note: If calculated subcooling value is lower than the design subcooling value, please add refrigerant. Repeat the steps above.



R-410A REFRIGERAN CHART								
SUCTION TEMP (℉)	FINALSUBCOOLING(℉)							
	6	7	8	9	10	11	12	13
	LIQUID GAGE PRESSURE (PSI)							
55	173	176	179	182	185	188	191	195
60	188	191	195	198	201	204	208	211
65	204	208	211	215	218	221	225	229
70	221	225	229	232	236	239	243	247
75	239	243	247	251	255	259	262	266
80	259	262	266	270	275	279	283	287
85	279	283	287	291	295	300	304	309
90	300	304	309	313	318	322	327	331
95	322	327	331	336	341	346	351	355
100	346	351	355	360	365	370	376	381
105	370	376	381	386	391	397	402	407
110	397	402	407	413	418	424	430	435
115	424	430	435	441	447	453	459	465
120	453	459	465	471	477	483	489	496
125	483	489	496	502	508	515	521	528

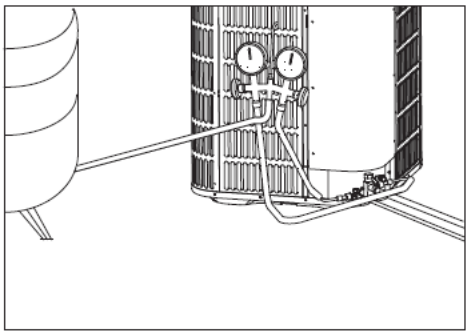
Model	24	36	48	60
Design subcooling	10ºF	10ºF	8ºF	7ºF

STEP 6 - Adjust refrigerant level to attain proper gage pressure.

Add refrigerant if the design subcooling is lower than the chart value.

1. Connect gages to refrigerant bottle and unit as illustrated.
2. Purge all hoses.
3. Open bottle.
4. Stop adding refrigerant when subcooling. matches the charging chart Final Subcooling value.

Recover refrigerant if the subcooling is higher than the chart value.



STEP 7 - Stabilize the system.

1. Wait 5 minutes for the system condition to stabilize between adjustments.

Note: When the subcooling match the chart, the system is properly charged.

2. Remove gages.
3. Replace service port caps to prevent leaks. Tighten finger tight plus an additional 1/6 turn.

STEP 8 - Record System Information for reference.

Record system pressures and temperatures after charging is complete.

Outdoor model number = _____

Measured Outdoor Ambient = _____ °F

Measured Indoor Ambient = _____ °F

Measured Liquid Line Temp = _____ °F

Measured Suction Line Temp = _____ °F

Liquid Gage Pressure = _____ PSIG

Suction Gage Pressure = _____ PSIG

Final Leak Test

After evacuating and charging the unit, use a halogen detector to detect any leaking. All piping must be verified in the evaporator, in the condenser and in the interconnecting lines. If a leak is detected, all refrigerant must be recovered before any intent of repair is carried out. The Clear Air Act forbids any emission of refrigerant to the atmosphere.

Manintenance

1. Prevent the accumulation of dirt in the indoor unit or in the outdoor coils and in any other parts of the air-conditioning system circuit. Cleaning methods should be exercised frequently to maintain the unit under a clean state. Use appropriate brushes, vacuum cleaners or other adequate accessories.
2. Outdoor fan motor is permanently lubricated and does not require periodic oiling.
3. Refer to heater and air handler instructions for filter and fan motor maintenance.
4. Carry out regular inspections of the indoor coil and drain pan to ensure appropriate operation.

CAUTION!

Under the law, the emission of refrigerant to the atmosphere is not allowed during unit servicing, repairing, maintenance or unit discarding. Once the unit is operating appropriately and once the proprietor has received proper instructions regarding the unit, obtain the corresponding approval from the proprietor of the equipment.

Wiring Diagrams

CAUTION!

These units must be wired and installed in compliance with all national, state and local security codes.

Figure 14. Outdoor Unit Wiring for A/C Systems (208/230V/1 Phase- 60Hz)

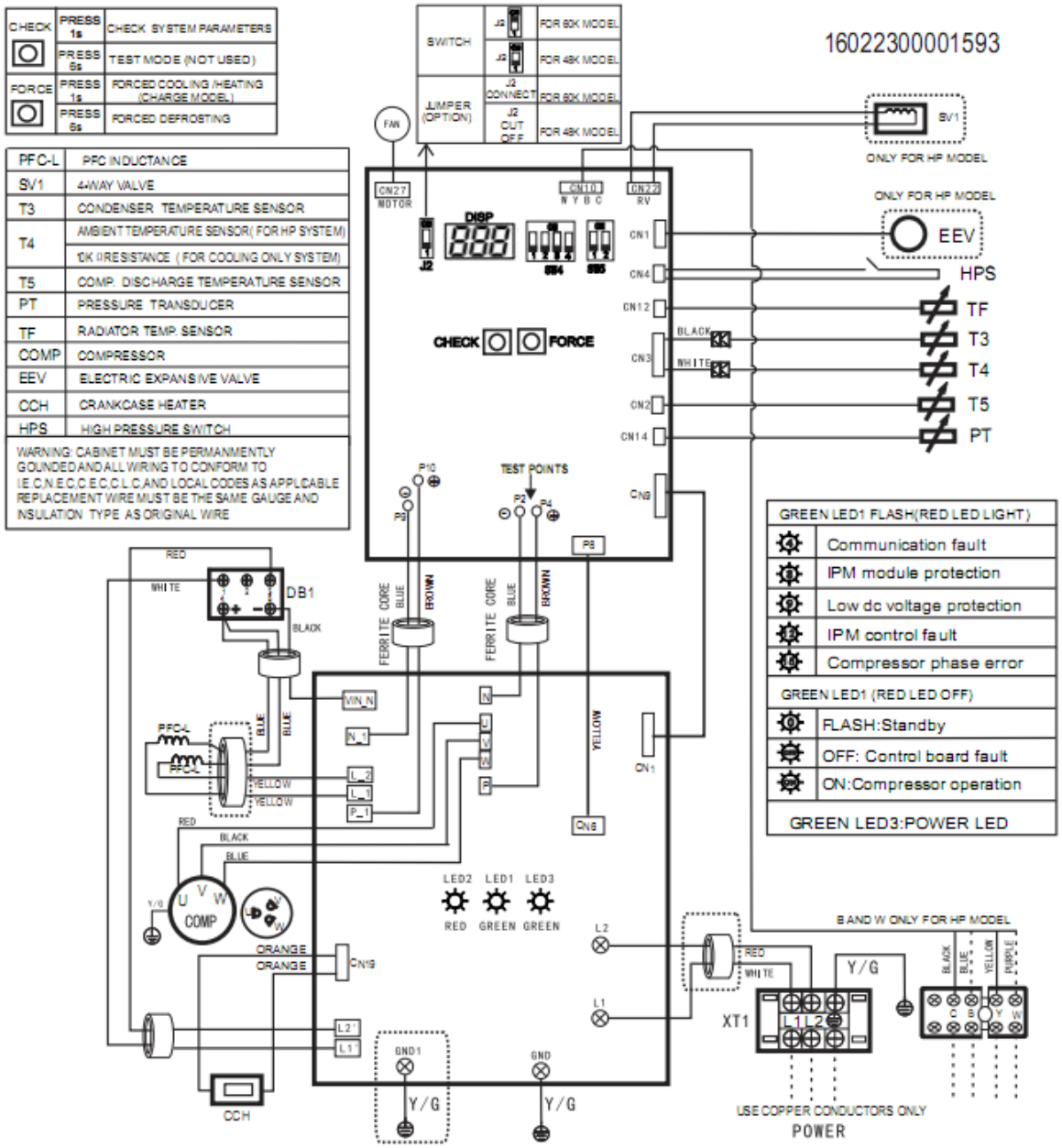


Figure 15. Control Wiring Diagram for A/C Systems

Post description

C1: Compressor
N1: Common 24 VAC
C: Common 24 VAC
Y: Compressor
Grounding

Figure 16. Control Wiring Diagram for Heat Pump Systems

Post description

C1: Compressor
N1: Common 24 VAC
V1: 4-way valve
F1: Outdoor fan signal
C: Common 24 VAC
B: 4-way valve
Y: Compressor
W: Aux. elec. resistor N/A
Grounding

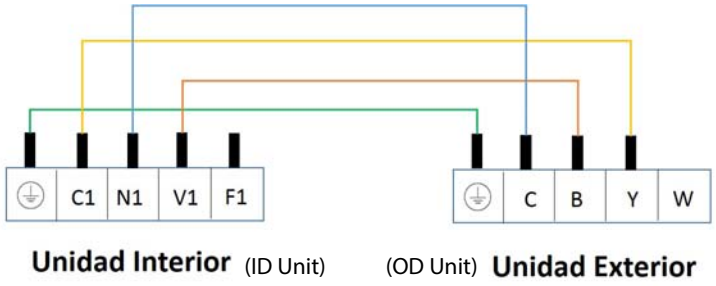


Table 4. Electrical Data

Model	Minimum Circuit Ampicity (A)	Maximum Circuit Protection (A)
24AC	17.7	30
36AC	24.2	40
48AC	31.9	50
60AC	36.5	60
24HP	17.7	30
36HP	24.2	40
48HP	31.9	50
60HP	36.5	60

AC: Air conditioning unit

HP: Heat Pump

Troubleshooting

Table 5. Troubleshooting

SYSTEM FAULTS		WHAT TO CHECK MODE	HIGH VOLTAGE POWER SUPPLY	I.D. CONTROL WIRING	COMPRESSOR CAPACITOR	O.D. FAN CAPACITOR	I.D. BLOWER CAPACITOR	CONTACTOR CONTACTS	LOW VOLTAGE WIRING	CONTROL TRANSFORMER	THERMOSTAT	CONTACTOR COIL	LOW VOLTAGE FUSE	STUCK COMPRESSOR	INEFFICIENT COMP.	REF. UNDERCHARGE	REF. OVERCHARGE	EXCESSIVE EVAP. LOAD	NONCONDENSABLES	RES. O.D. AIRFLOW	O.D. AIR RECIRCULATION	TXV STUCK OPEN	SUPERHEAT	RES. I.D. AIRFLOW	REF. CIR. RESTRICTIONS	SOV LEAKING	SOV COIL DEFECTIVE	CHECK VALVE LEAKING	LPC SENSOR DEF.	DEFROST CONTROL DEF.	T4 TEMP. SENSOR DEF.	T3 TEMP. SENSOR DEF.	HPC/HGS SENSOR DEF.
REFRIGERANT CIRCUIT																																
Head Pressure Too High	C																	P	P	S	P	S				S						
	H																	P	P	S					P	S						
Head Pressure Too Low	C															S	P						S	S		S		S		P		
	H															S	P						S	S		S	S	S	P			
Suction Pressure Too High	C															S		P	P					S			P		P			
	H															S								S			P					
Suction Pressure Too Low	C																P							S	P	S						
	H																P				S	S		S		S		S				
Liquid Refrig. Floodback (TXV)	C																					P							P			
	H																					P							P			
I.D. Coil Frosting	C																P				S	S										
	H																															
Compressor Runs Inadequate or No Cooling/Heating	C															S	P		S	S				S	P	S	S		S			
	H															S	P			S				S	P	S	S	S	S			
ELECTRICAL																																
Compressor & O.D. Fan Won't Start	C	P	P					S	S	P	S	P	P																			
	H	P	P						S	P	S		P																S	S	S	S	S
Compressor Will Not Start But O.D. Fan Runs	C		P		P									P																			
	H		P		P			S				P		P																S		S	
O.D. Fan Won't Start	C		P			P																										
	H		P			P																								S			
Compressor Hums But Won't Start	C				P			S						P																		
	H				P			S						P																			
I.D. Blower Won't Start	C	P	P	S			P		S	P	S		S																			
	H	P	P	S			P		S	P	S		S																			
DEFROST																																
Unit Won't Initiate Defrost	C																															
	H																										P			P		S	
Defrost Terminates on Time	C																															
	H																P													P		S	
Unit Icing Up	C																															
	H																P				S	S		S			P			P			

C- Cooling H - Heating P - Primary Causes S - Secondary Causes

Table 6. Fault Codes

CODE	FAULT DESCRIPTION
E4	Temperature sensor fault(T3 /T4/T5/TF)
E5	High/low voltage protection
E6	DC fan motor fault
Eb	System lockup, 2 times(E6),protection in 10 minutes
E7	Compressor discharge sensor(T5) is seated fault
E9	EEPROM fault
H0	Communication fault in main contrrol chip
H3	3 times (P3) protection in 120 minutes,system lockup
H4	3 times (P6) protection in 60 minutes,system lockup
H5	5 times (P2) protection in 100 minutes,system lockup
H6	3 times (P4) protection in 100 minutes,system lockup
H8	Pressure transducer(PT) short or open fault
Hb	High pressure(PT) protection in Heating
HH	2 times(PH) protection in 200 minutes,system lockup
P0	The module radiator temperature (TF)protection
P1	High pressure switch(HPS) protection
P2	Low pressure (PT) Protection
P3	Compressor over current protection
P4	High compressor discharge temperature(T5) protection
P5	High condensor coil temp. (T3) protection
P6	IPM module protection
P8	Hurricane protection of the DC fan motor
PH	Low discharge superheat protection
PC	Reversing valve fault protection
F1	High pressure switch(HPS) fault
F3	5 times (P5) protection in180 minutes,system lockup
F4	3 times(P0) protection in 120 minutes,system lockup
F5	5 times(Hb) protection in 180 minutes,system lockup
C3	Condensor coil sensor(T3) is seated fault in cooling
C4	3 times(C3) protection in 120 minutes,system lockup
C5	2 times(E7) protection in 180 minutes,system lockup
C6	2 times(PC) protection in 180 minutes,system lockup
CE	5 times (P1) protection in 150 minutes,system lockup
L0-L9	IPM module protection or frequent power on/off
⊢	Indication under charge model
L	Running indication under T3 limited condition
D	Running indication under T5 limited condition
P	Running indication under compressor ratio limited condition
F	Running indication under Tf limited condition
C	Running indication under current limited condition
U	Running indication under low voltage limited condition
H	Running indication under high pressure(PT) limited condition in heatin
A	Running indication under return oil model
dF	Running indication under defrost model

Operational and Verification Procedures

Parameter Point Check Table

Press “Check” button to see system available parameters. When pressing for the first time, the display will show you a sequence and at the end of 1 minute, the parameter value will appear. When pressing a second time, the following sequence appears.

For normal status display, the last 2 digits appear under the following conditions:

i. Unit is not in operation (delay mode); “outdoor ambient temperature”.

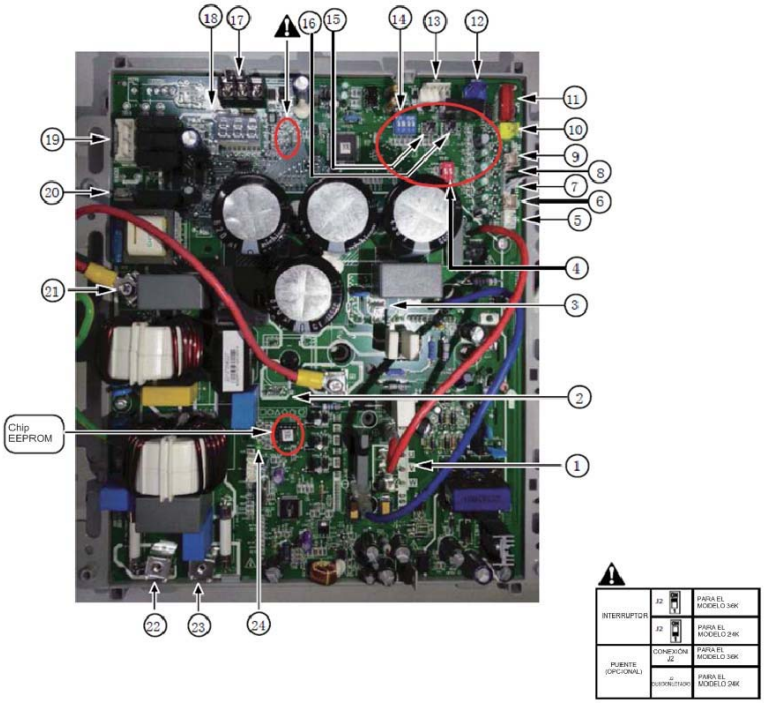
ii. Unit is in operation; “compressor frequency of operation” will be displayed.

After a 20 second delay under the same parameter, the display returns to its normal state.

If a system protection is active, the first digit indicates “status code”.

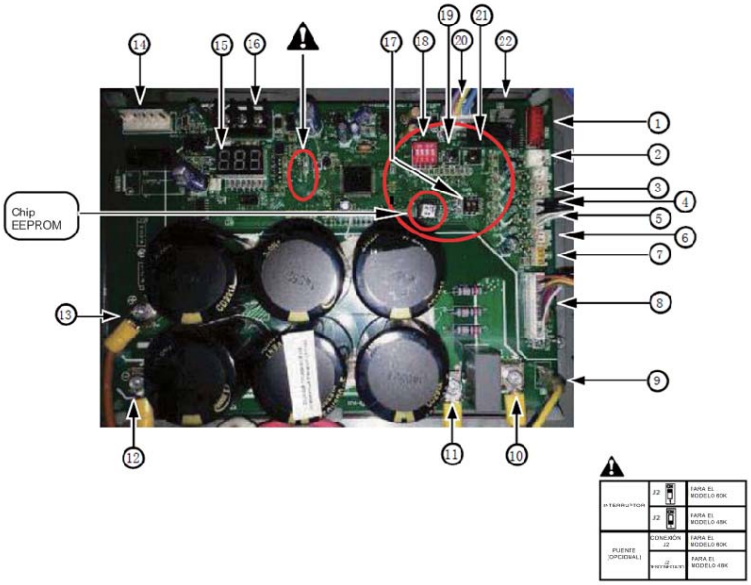
No.	Point check content	Example	Remark
0	Outdoor unit capacity	C3	Model+RT
1	Outdoor unit mode	2	0 standby, 2 cooling, 3 heating
2	Outdoor unit set compressor speed		
3	opening of EXV		Actual value
4	T3(outdoor coil temp.)		
5	T4 (outdoor ambient temp.)		
6	T5(compressor discharge temp.)		
7	Reserved		
8	Te (evaporating temp.)		
9	Tc (condensing temp.)		
10	Tf (module temp.)		
11	Pe (evaporating pressure)		Actual value MPa x10
12	Pc (evaporating pressure)		Actual value MPa x10
13	Compressor discharge superheat		
14	Reserved		
15	Reserved		
16	compressor current		
17	Reserved		
18	Fan speed		
19	Reserved		
20	Reserved		
21	Reserved		
22	Reserved		
23	The last time Fault code		
24	Software version		
25	Remark“--”		

For model 24/36k

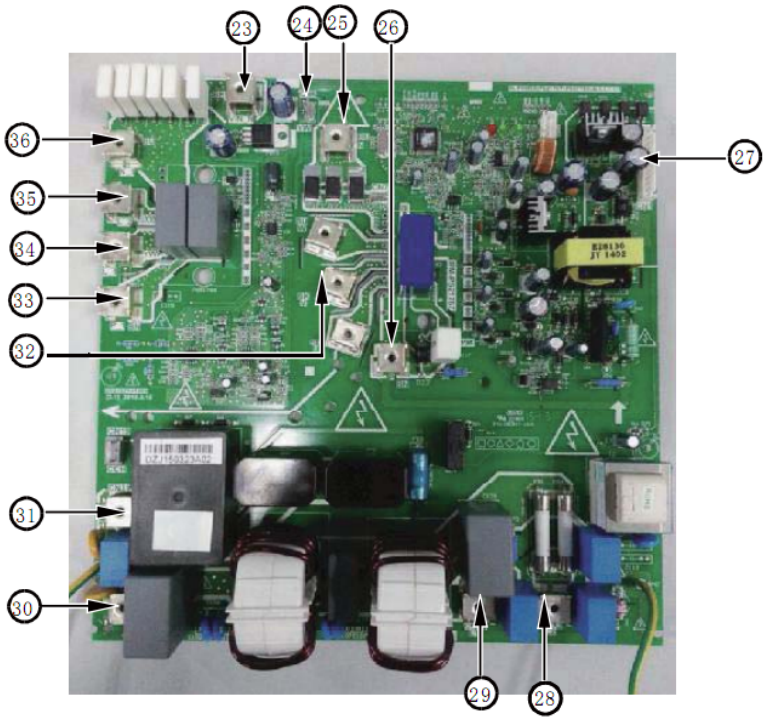


No.	Content	No.	Content
1	Compressor iring terminal	13	Temp. controller connecting port
2	Reactor w iring terminal(connect a reactor betw een 2 and 3)	14	Function dial code SW4
3	Reactor w iring terminal(connect a reactor betw een 2 and 3)	15	Spot check button
4	Defrosting function dial codeSW5	16	Forced operation button
5	Pressure transducer port	17	Reserved
6	Air discharge temp.sensor port	18	Nixie tube display
7	Outdoor temp.sensor port(HP only)	19	Fan control port
8	Condenser temp.sensor port	20	Crankcase heating zone control terminal
9	Radiator temp.sensor port	21	Short w ire
10	High pressure sw itch port	22	Pow er supply connecting terminal
11	EXV drive port(HP only)	23	Pow er supply connecting terminal
12	Reversing valve port	24	Indicator lamp

For model 48/60k and board



Board



No.	Content	No.	Content
1	EXV driving port (HP only)	19	Point check button
2	High pressure switch port	20	Temp. controller connection port
3	Radiator temp. sensor port	21	Forced operation button
4	Condenser temp. sensor port	22	4-way valve port (HP only)
5	Outdoor temp. sensor port (HP only)	23	Connect the cathode of the rectifier bridge
6	Air discharge temp. sensor port	24	DC motor driving source(15V-P2)
7	Pressure transducer	25	The voltage between 25 and 26 is 380Vdc (Compressor is running)
8	Connection wire port between main boards	26	The voltage between 25 and 26 is 380Vdc (Compressor is running)
9	DC motor driving source(15V-P2)	27	Connection wire port between main boards
10	The voltage between 10 and 11 is 380Vdc (Compressor is running)	28	AC power supply input port
11	The voltage between 10 and 11 is 380Vdc (Compressor is running)	29	AC power supply input port
12	The voltage between 12 and 13 is 380Vdc (Compressor is running)	30	AC power supply output port
13	The voltage between 12 and 13 is 380Vdc (Compressor is running)	31	AC power supply output port
14	DC motor control port	32	Compressor connection terminal
15	Nixie tube display	33	The voltage between 33 and 36 is 380Vdc (Compressor is running)
16	Reserved	34	Reactor L1 wiring terminal
17	Defrosting function dial code SW5	35	Reactor L2 wiring terminal
18	Function dial code SW4	36	The voltage between 33 and 36 is 380Vdc (Compressor is running)

Ingersoll Rand (NYSE:IR) advances the quality of life by creating comfortable, sustainable and efficient environments. Our people and our family of brands—including Club Car®, Ingersoll Rand®, Thermo King® and Trane®—work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. We are a global business committed to a world of sustainable progress and enduring results.

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