

**24APA
Performance™ Series Air Conditioner
with Puron® Refrigerant
Sizes 18 to 60
1 – 1/2 to 5 Nominal Tons**



Turn to the Experts.™

Installation Instructions



Performance
SERIES

A05176

Fig. 1 – 24APA

NOTE: Read the entire instruction manual before starting the installation.


TABLE OF CONTENTS

	PAGE
SAFETY CONSIDERATIONS	2
INSTALLATION RECOMMENDATIONS	2
INSTALLATION	3 - 9
Step 1 - Check Equipment & Jobsite	3
Step 2 - Install on Solid Pad	3
Step 3 - Clearance Requirements	3
Step 4 - Operating Ambient	3
Step 5 - Install TXV	3 - 4
Step 6 - Make Piping Connections	5 - 7
Step 7 - Make Electrical Connections	7 - 8
Step 8 - Compressor Crankcase Heater	8
Step 9 - Install Electrical Accessories	8
Step 10- Check OCT and OAT thermistor Attachment ..	8
Step 11 - Start-Up	8 - 9
Step 12 - Check Charge	9
GENERAL SEQUENCE OF OPERATION	9
AC DELUXE SYSTEM FUNCTIONS AND SEQUENCE OF OPERATION	9 - 10
TROUBLESHOOTING	11 - 12
FINAL CHECKS	13
CARE AND MAINTENANCE	13
PURON® REFRIGERANT QUICK REF. GUIDE	16

SAFETY CONSIDERATIONS

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 **would** 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.

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.



WARNING

UNIT OPERATION AND SAFETY HAZARD

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

Puron® refrigerant systems operate at higher pressures than standard R-22 systems. Do not use R-22 service equipment or components on Puron refrigerant equipment.

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, etc. where unit operation sound may disturb customer.
2. Ensure that vapor and liquid tube diameters are appropriate for unit capacity.
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. 2.)
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 which comes in direct contact with tubing. (See Fig. 2.)
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. 2.)
10. Isolate hanger straps from insulation by using metal sleeves bent to conform to shape of insulation.

NOTE: Avoid contact between tubing and structure

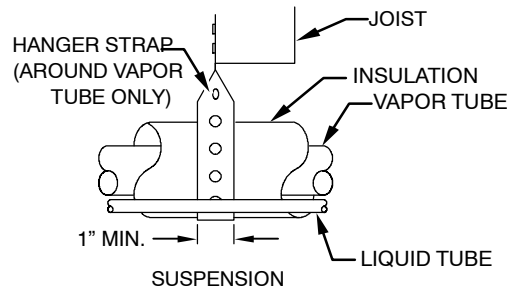
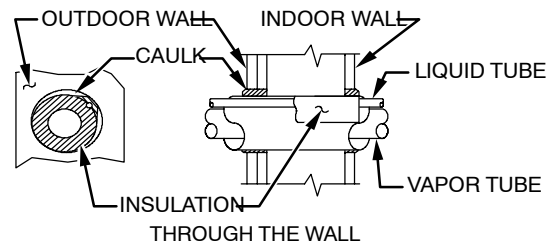


Fig. 2 – Connecting Tube Installation

A94026

Outdoor unit contains system refrigerant charge for operation with ARI rated indoor unit when connected by 15 ft. of field-supplied or factory accessory tubing. For proper unit operation, check refrigerant charge using charging information located on control box cover and/or in the Check Charge section of this instruction.

IMPORTANT: Maximum liquid-line size is 3/8-in. OD for all residential applications including long line.

IMPORTANT: Always install the factory-supplied liquid-line filter drier. Obtain replacement filter driers from your distributor or branch.

INSTALLATION

Specifications for this unit in residential new construction market require the outdoor unit, indoor unit, refrigerant tubing sets, metering device, and filter drier listed in presale literature. There can be no deviation. Consult the Application Guideline and Service Manual – Air Conditioners and Heat Pumps Using Puron® Refrigerant to obtain required unit changes for specific applications and for R-22 retrofit.

STEP 1 —Check Equipment and Job Site

Unpack Unit

Move to final location. Remove carton taking care not to damage unit.

Inspect Equipment

File claim with shipping company prior to installation if shipment is damaged or incomplete. Locate unit rating plate on unit corner panel. It contains information needed to properly install unit. Check rating plate to be sure unit matches job specifications.

STEP 2 —Install on a 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 unit base pan. Refer to unit mounting pattern in Fig. 3 to determine base pan size and knockout hole location.

For hurricane tie downs - contact your local distributor for details and PE (Professional Certification), if required by local authorities.

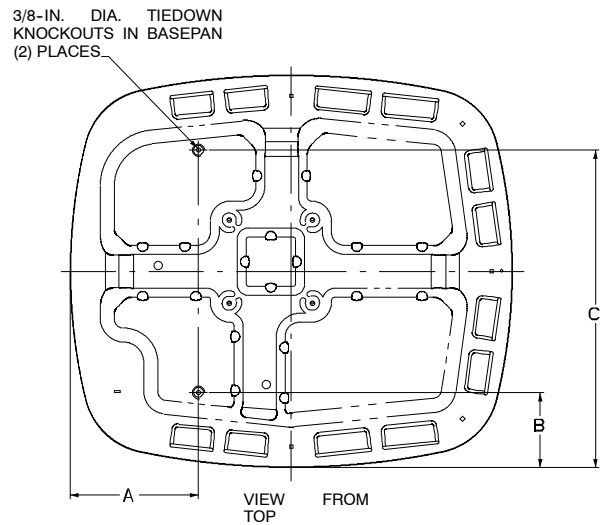
On rooftop applications, mount on level platform or frame. Place unit above a load-bearing wall and isolate unit and tubing set from structure. Arrange supporting members to adequately support unit and minimize transmission of vibration to building. Consult local codes governing rooftop applications.

Roof mounted units exposed to winds may require wind baffles. Consult the Application Guideline and Service Manual - Residential Split System Air Conditioners and Heat Pumps Using Puron® Refrigerant for wind baffle construction.

NOTE: Unit must be level to within $\pm 2^\circ$ ($\pm 3/8$ in./ft..) per compressor manufacturer specifications.

STEP 3 —Clearance Requirements

When installing, allow sufficient space for airflow clearance, wiring, refrigerant piping, and service. Allow 30-in. clearance to service end of unit and 48 in. above unit. For proper airflow, a 6-in. clearance on 1 side of unit and 12 in. on all remaining sides must be maintained. Maintain a distance of 24 in. between units. Position so water, snow, or ice from roof or eaves cannot fall directly on unit.



UNIT BASE PAN DIMENSIONS	TIEDOWN KNOCKOUT LOCATIONS		
	A	B	C
29-1/2 X 33	10-1/16	5-5/8	23-3/4
36-1/2 X 40	9-5/8	6-13/16	28-3/4

A05177

Fig. 3 – Tie-down Knockout Locations

On rooftop applications, locate unit at least 6 in. above roof surface.

STEP 4 —Operating Ambient

The minimum outdoor operating ambient in cooling mode is 55°F, and the maximum outdoor operating ambient in cooling mode is 125°F.

STEP 5 —Install TXV

NOTE: Applies to rated non-TXV and R-22 TXV indoor units only. If installing a rated and approved indoor coil without a factory installed TXV, remove and replace the fixed orifice or R-22 TXV expansion device with a hard shutoff Puron TXV.

The thermostatic expansion valve is specifically designed to operate with Puron refrigerant. Do not use an R-22 TXV. An existing R-22 TXV must be replaced with a factory-approved TXV specifically designed for Puron refrigerant. Refer to Product Data Sheet for the appropriate TXV kit number.

⚠

CAUTION

UNIT OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

All indoor coil units must be installed with a hard shut off Puron® TXV metering device.

IMPORTANT: The TXV should be mounted as close to the indoor coil as possible and in a vertical, upright position. Avoid mounting the inlet tube vertically down. Valve is more susceptible to malfunction due to debris if inlet tube is facing down. A factory-approved filter drier must be installed in the liquid line.

24APA

Installing TXV in Place of Piston in a Rated Indoor Coil (pre-2006)

1. Pump system down to 2 psig and recover refrigerant.
2. Remove hex nut from piston body. Use backup wrench on fan coils.
3. Remove and discard factory-installed piston. Be sure Teflon seal is in place.
4. Reinstall hex nut. Finger tighten nut plus 1/2 turn.

NOTE: If the piston is not removed from the body, TXV will not function properly.



CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Use a brazing shield and wrap TXV with wet cloth or use heat sink material

5. Install TXV on indoor coil liquid line. Sweat swivel adapter to inlet of indoor coil and attach to TXV outlet. Use backup wrench to avoid damage to tubing or valve. Sweat inlet of TXV, marked "IN" to liquid line. Avoid excessive heat which could damage valve.
6. Install vapor elbow with equalizer adapter to suction tube of line set and suction connection to indoor coil. Adapter has a 1/4-in. male connector for attaching equalizer tube.
7. Connect equalizer tube of TXV to 1/4-in. equalizer fitting on vapor line adapter.
8. Attach TXV bulb to horizontal section of suction line using clamps provided. Insulate bulb with field-supplied insulation tape. See Fig. 4 for correct positioning of sensing bulb.
9. Proceed with remainder of unit installation.

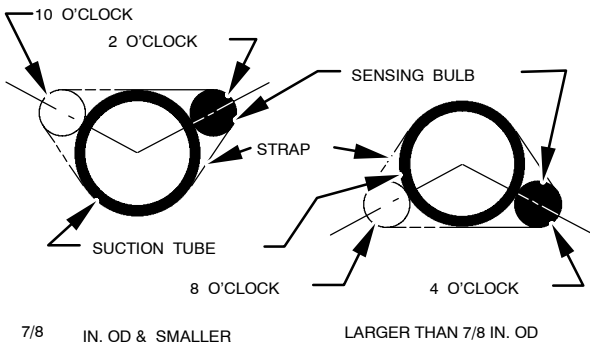


Fig. 4 – Position of Sensing Bulb

A81032

Replacing TXV on a Rated R-22 Indoor Coil (pre-2006)

1. Pump system down to 2 psig and recover refrigerant.
2. Remove coil access panel and fitting panel from front of cabinet.
3. Remove TXV support clamp using a 5/16-in. nut driver. Save the clamp.
4. Remove R-22 TXV using a backup wrench on flare connections to prevent damage to tubing.
5. Using wire cutters, cut equalizer tube off flush with vapor tube inside cabinet.
6. Remove bulb from vapor tube inside cabinet.
7. Braze equalizer stub-tube closed. Use protective barrier as necessary to prevent damage to drain pan.

IMPORTANT: Route the equalizer tube of Puron TXV through suction line connection opening in fitting panel prior to replacing fitting panel around tubing.

8. Install TXV with 3/8-in. copper tubing through small hole in service panel. Use wrench and backup wrench, to avoid damage to tubing or valve, to attach TXV to distributor.
9. Reinstall TXV support clamp (removed in item 3).
10. Attach TXV bulb to vapor tube inside cabinet, in same location as original was when removed, using supplied bulb clamps (nylon or copper). See Fig. 4 for correct positioning of sensing bulb.
11. Route equalizer tube through suction connection opening (large hole) in fitting panel and install fitting panel in place.
12. Sweat inlet of TXV, marked "IN" to liquid line. Avoid excessive heat which could damage valve.
13. Install vapor elbow with equalizer adapter to vapor line of line set and vapor connection to indoor coil. Adapter has a 1/4-in. male connector for attaching equalizer tube.
14. Connect equalizer tube of TXV to 1/4-in. equalizer fitting on vapor line adapter. Use backup wrench to prevent damage to equalizer fitting.
15. Proceed with remainder of unit installation.

STEP 6 —Make Piping Connections

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

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

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Use all service ports and open all flow-control devices, including solenoid valves.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

To prevent damage to unit or service valves observe the following:

- Use a brazing shield.
- Wrap service valves with wet cloth or use a heat sink material.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Do not leave system open to atmosphere any longer than minimum required for installation. POE oil in compressor is extremely susceptible to moisture absorption. Always keep ends of tubing sealed during installation.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

If ANY refrigerant tubing is buried, provide a 6 in. vertical rise at service valve. Refrigerant tubing lengths up to 36 in. may be buried without further special consideration. Do not bury lines longer than 36 in.

Outdoor units may be connected to indoor section using accessory tubing package or field-supplied refrigerant grade tubing of correct size and condition. Rated tubing diameters shown in Table 1 recommended up to 80 ft. See Product Data for acceptable alternate vapor diameters and associated capacity losses. For tubing requirements beyond 80 ft., substantial capacity and performance losses can occur. Following the recommendations in the Longline Guideline - Residential Split-System Air Conditioners and Heat Pumps Using Puron® Refrigerant will reduce these losses. Refer to Table 1 for field tubing diameters. Refer to Table 2 for accessory requirements.

There are no buried-line applications greater than 36 in.

If refrigerant tubes or indoor coil are exposed to atmosphere, they must be evacuated to 500 microns to eliminate contamination and moisture in the system.

Outdoor Unit Connected to Factory Approved Indoor Unit

Outdoor unit contains correct system refrigerant charge for operation with factory approved ARI rated indoor unit when connected by 15 ft. of field-supplied or factory-accessory tubing, and factory supplied filter drier. Check refrigerant charge for maximum efficiency.

24APA

Table 1—Refrigerant Connections and Recommended Liquid and Vapor Tube Diameters (In.)

UNIT SIZE	LIQUID		VAPOR (up to 80 ft. *)	
	Connection Diameter	Tube Diameter	Connection Diameter	Rated Tube Diameter
018, 024	3/8	3/8	5/8	5/8
030, 036	3/8	3/8	3/4	3/4
042, 048	3/8	3/8	7/8	7/8
060	3/8	3/8	7/8	1-1/8

Notes:

1. Tube diameters are for total equivalent lengths up to 80 ft..
2. Do not apply capillary tube or fixed orifice indoor coils to these units.

* For Tubing Set lengths between 80 and 200 ft. horizontal or 20 ft. vertical differential (250 ft. Total Equivalent Length), refer to the Longline Guideline – Air Conditioners and Heat Pumps using Puron refrigerant.

Table 2—Accessory Usage

Accessory	REQUIRED FOR LOW-AMBIENT APPLICATIONS (Below 55 °F)	REQUIRED FOR LONG LINE APPLICATIONS* (Over 80 Ft.)
Crankcase Heater	Yes	Yes
Evaporator Freeze Thermostat	Yes (For non-Infinity systems only)	No
Winter Start Control	Yes (For non-Infinity systems only)	No
Accumulator	No	No
Compressor Start Assist Capacitor and Relay	Yes	Yes
Low-ambient Pressure Switch	Yes (For non-Infinity system only)	No
Support Feet	Recommended	No
Liquid Line Solenoid Valve	No	See Long-Line Application Guideline
Ball Bearing Fan Motor	Standard	Standard

* For Tubing Set lengths between 80 and 200 ft. horizontal or 20 ft. vertical differential (250 ft. Total Equivalent Length), refer to the Longline Guideline – Air Conditioners and Heat Pumps using Puron® refrigerant.

Install Liquid Line Filter Drier Indoor

CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Installation of filter drier in liquid line is required.

CAUTION

UNIT DAMAGE HAZARD

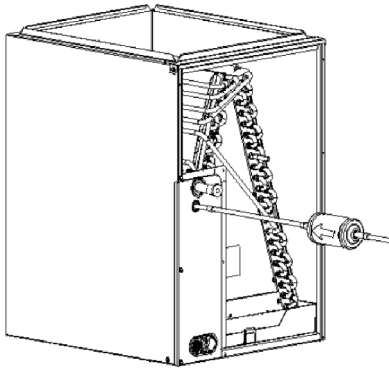
Failure to follow this caution may result in equipment damage or improper operation.

Filter drier must be wrapped in a heat-sinking material such as a wet cloth while brazing.

24APA

Refer to Fig. 5 and install filter drier as follows:

1. Braze 5-in. liquid tube to the indoor coil.
2. Wrap filter drier with damp cloth.
3. Braze filter drier to above 5" liquid tube. Flow arrow must point towards indoor coil.
4. Connect and braze liquid refrigerant tube to the filter drier.



A05178

Fig. 5 – Liquid Line Filter Drier

Refrigerant Tubing Connection Outdoor

Connect vapor tube to fitting on outdoor unit vapor service valves (see Table 1.) Connect and braze the 3/8" coupling (provided with the filter drier) to the liquid service valve and connect and braze the liquid tubing to the other end of this coupling. Use refrigerant grade tubing.

Sweat Connection

CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Service valves must be wrapped in a heat-sinking material such as a wet cloth.

Service valves are closed from factory and ready for brazing. After wrapping service valve with a wet cloth, braze sweat connections using industry accepted methods and materials. Consult local code requirements. Refrigerant tubing and indoor coil are now ready for leak testing. This check should include all field and factory joints.

Evacuate Refrigerant Tubing and Indoor Coil

CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

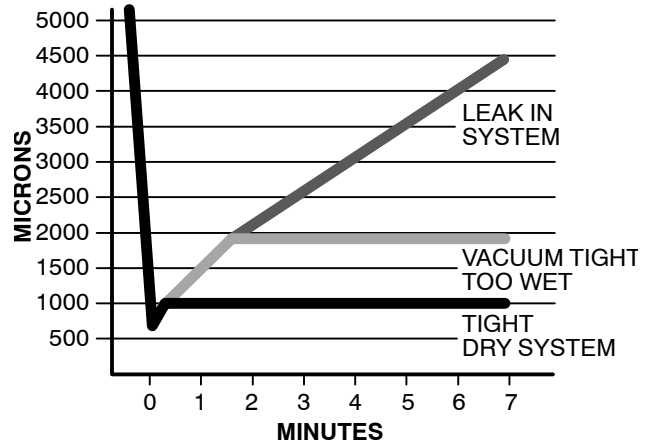
Never use the system compressor as a vacuum pump.

Refrigerant tubes and indoor coil should be evacuated using the recommended deep vacuum method of 500 microns. An alternate triple evacuation method may be used if the deep vacuum procedure is not followed.

IMPORTANT: Always break a vacuum with dry nitrogen.

Deep Vacuum Method

The deep vacuum method requires a vacuum pump capable of pulling a vacuum of 500 microns and a vacuum gage capable of accurately measuring this vacuum depth. The deep vacuum method is the most positive way of assuring a system is free of air and liquid water. (See Fig. 6)



A95424

Fig. 6 – Deep Vacuum Graph

Triple Evacuation Method

The triple evacuation method should be used when vacuum pump is only capable of pumping down to 28 in. of mercury vacuum and system does not contain any liquid water. Refer to Fig. 7 and proceed as follows:

1. Pump system down to 28 in. of mercury and allow pump to continue operating for an additional 15 minutes.
2. Close service valves and shut off vacuum pump.
3. Connect a nitrogen cylinder and regulator to system and open until system pressure is 2 psig.
4. Close service valve and allow system to stand for 1 hr. During this time, dry nitrogen will be able to diffuse throughout the system absorbing moisture.
5. Repeat this procedure as indicated in Fig. 7. System will then be free of any contaminants and water vapor.

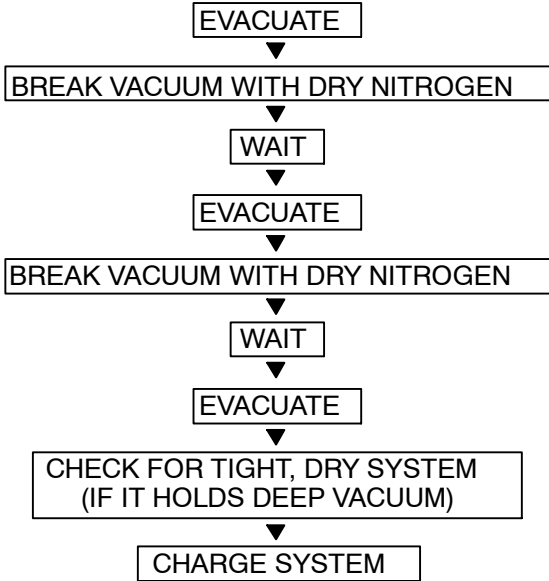


Fig. 7 – Triple Evacuation Method

A95425

Final Tubing Check

IMPORTANT: Check to be certain factory tubing on both indoor and outdoor unit has not shifted during shipment. Ensure tubes are not rubbing against each other or any sheet metal. Pay close attention to feeder tubes, making sure wire ties on feeder tubes are secure and tight.

STEP 7 —Make Electrical Connections

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

Do not supply power to unit with compressor terminal box cover removed.

Be sure field wiring complies with local and national fire, safety, and electrical codes, and voltage to system is within limits shown on unit rating plate. Contact local power company for correction of improper voltage. See unit rating plate for recommended circuit protection device.

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 may fluctuate above or below permissible limits.

NOTE: Use copper wire 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, per Section 440-14 of NEC.

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.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

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

The unit cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes.

Connect Ground and Power Wires

Connect ground wire to ground connection in control box for safety. Connect power wiring to contactor as shown in Fig. 8.

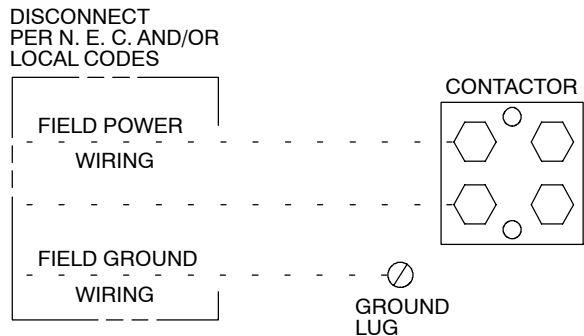


Fig. 8 – Line Power Connections

A91056

24APA

Connect Control Wiring

Route 24-v control wires through control wiring grommet and connect leads to control wiring. (See Fig. 13 & Fig. 14)

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, insulated wire to avoid excessive voltage drop.

All wiring must be NEC Class 1 and must be separated from incoming power leads.

Use furnace transformer, fan coil transformer, or accessory transformer for control power, 24-v/40-va minimum.

NOTE: Use of available 24-v accessories may exceed the minimum 40-va power requirement. Determine total transformer load and increase the transformer capacity or split the load with an accessory transformer as required.

Final Wiring Check

IMPORTANT: Check factory wiring and field wire connections to ensure terminations are secured properly. Check wire routing to ensure wires are not in contact with tubing, sheet metal, etc.

STEP 8 —Compressor Crankcase Heater

When equipped with a crankcase heater, furnish power to heater a minimum of 24 hr before starting unit. To furnish power to heater only, set thermostat to OFF and close electrical disconnect to outdoor unit.

A crankcase heater is required if refrigerant tubing is longer than 80 ft. Refer to the Longline Guideline Section - Residential Split-System Air Conditioners and Heat Pumps Using Puron® Refrigerant.

STEP 9 —Install Electrical Accessories

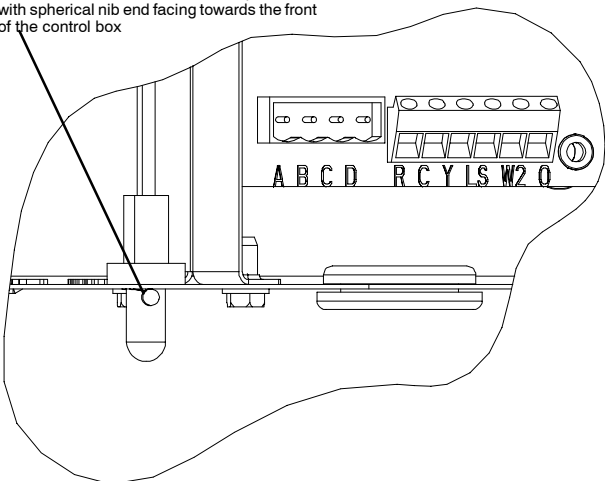
Refer to the individual instructions packaged with kits or accessories when installing.

STEP 10 —Check OAT Thermistor and OCT Thermistor Attachments

Outdoor Air Temperature (OAT) Thermistor is factory installed by inserting the nibs on either sides of the thermistor body through a keyhole in the bottom shelf of the control box and locking it in place by turning it 90 degrees, such that the spherical end of a nib faces the front of the control box.

Check to make sure the OAT is locked in place. See Fig. 9.

OAT Thermistor must be locked in place with spherical nib end facing towards the front of the control box

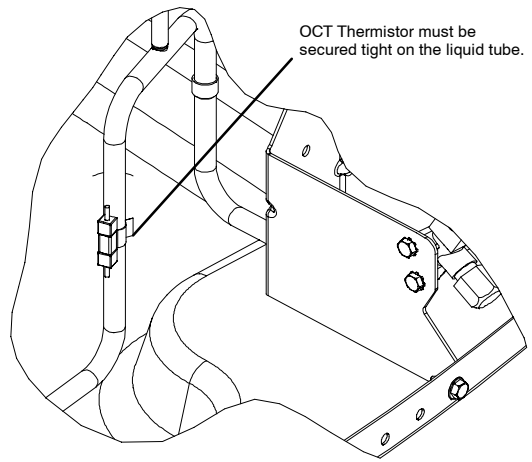


A05408

Fig. 9 – Outdoor Air Thermistor (OAT) Attachment

The Outdoor Coil Temperature (OCT) Thermistor is factory installed on the liquid tube between the coil assembly and the liquid service valve. See Fig. 10.

Check to make sure the thermistor is securely attached on the liquid tube with the clip as shown in Fig. 10.



A05409

Fig. 10 – Outdoor Coil Thermistor (OCT) Attachment

STEP 11 —Start-Up

CAUTION
<p>UNIT OPERATION AND SAFETY HAZARD</p> <p>Failure to follow this caution may result in minor personal injury, equipment damage or improper operation.</p> <p>To prevent compressor damage or personal injury, observe the following:</p> <ul style="list-style-type: none"> • Do not overcharge system with refrigerant. • Do not operate unit in a vacuum or at negative pressure. • Do not disable low pressure switch in scroll compressor applications. • Dome temperatures may be hot.

CAUTION
<p>PERSONAL INJURY HAZARD</p> <p>Failure to follow this caution may result in personal injury.</p> <p>Wear safety glasses, protective clothing, and gloves when handling refrigerant and observe the following:</p> <ul style="list-style-type: none"> • Front seating service valves are equipped with Schrader valves.

CAUTION
<p>ENVIRONMENTAL HAZARD</p> <p>Failure to follow this caution may result in environmental damage.</p> <p>Federal regulations require that you do not vent refrigerant to the atmosphere. Recover during system repair or final unit disposal.</p>

Follow these steps to properly start up the system:

1. After system is evacuated, fully open liquid and vapor service valves.
2. Unit is shipped with valve stem(s) front seated (closed) and caps installed. Replace stem caps after system is opened to refrigerant flow. Replace caps finger-tight and tighten with wrench an additional 1/12 turn.
3. Close electrical disconnects to energize system.
4. Set room thermostat at desired temperature. Be sure set point is below indoor ambient temperature.
5. Set room thermostat to COOL and fan control to ON or AUTO mode, as desired. Operate unit for 15 minutes. Check system refrigerant charge.

STEP 12 —Check Charge

Unit Charge

Factory charge and charging methods are shown on unit information plate. Charge Puron refrigerant units with cylinder in upright position and a commercial-type metering device in manifold hose. Charge refrigerant into suction line.

NOTE: If subcooling charging conditions are not favorable, charge must be weighed in accordance with unit rating plate, ± 0.6 oz./ft. of 3/8-in. liquid line above or below 15 ft., respectively. Favorable conditions fall within the ranges given on the charging chart on the outdoor unit plate.

NOTE: In longline applications, see Application Guideline for special charging requirements.

EXAMPLE:

To calculate additional charge required for a 25 ft. line set:
25 ft. - 15 ft. = 10 ft. X 0.6 oz./ft. = 6 oz. of additional charge.

Cooling Only Procedure

This system requires charging by the subcooling method.

1. Operate unit a minimum of 10 minutes before checking charge.
2. Measure liquid service valve pressure by attaching an accurate gage to service port.
3. Measure liquid line temperature by attaching an accurate thermistor type or electronic thermometer to liquid line near outdoor coil.
4. Refer to unit rating plate for required subcooling temperature.
5. Refer to Table 4. Find the point where required subcooling temperature intersects measured liquid service valve pressure.
6. To obtain required subcooling temperature at a specific liquid line pressure, add refrigerant if liquid line temperature is higher than indicated or reclaim refrigerant if temperature is lower. Allow a tolerance of $\pm 3^{\circ}\text{F}$.

**GENERAL SEQUENCE OF OPERATION
STANDARD THERMOSTAT**

Turn on power to indoor and outdoor units. Transformer is energized.

On a call for cooling, thermostat makes circuits R-Y and R-G. Circuit R-Y energizes contactor, starting outdoor fan motor and compressor circuit. R-G energizes indoor unit blower relay, starting indoor blower motor on high speed.

NOTE: To achieve the rated system performance, the indoor unit or the thermostat must be equipped with a time delay relay circuit.

When thermostat is satisfied, its contacts open, de-energizing contactor and blower relay. Compressor and motors stop. If indoor unit is equipped with a time-delay relay circuit, the indoor blower will run an additional 90 sec to increase system efficiency.

**AC DELUXE SYSTEM FUNCTIONS AND SEQUENCE
OF OPERATION**

The outdoor unit control system has special functions. The following is an overview of the control functions.

SEQUENCE OF OPERATION

Cooling Operation

This product utilizes either a standard indoor thermostat or Infinity communication User Interface. With a call for cooling, the outdoor fan and compressor are energized. When the cooling demand is satisfied, the compressor and fan will shut off.

NOTE: The outdoor fan motor will continue to operate for one minute after compressor shuts off, when the outdoor ambient is greater than or equal to 100 degrees F.

Communication and Status Function Lights

Green Communications (COMM) Light (Infinity Control only):

A green LED (COMM light) on the outdoor board indicates successful communication with the other system products. The green LED will remain OFF until communications is established. Once a valid command is received, the green LED will turn ON continuously. If no communication is received within 2 minutes, the LED will be turned OFF until the next valid communication.

Amber Status Light

An amber colored STATUS light is used to display the operation mode and fault codes as specified in the troubleshooting section. See Table 3 for codes and definitions.

NOTE: Only one fault code will be displayed on the outdoor unit control board (the most recent, with the highest priority).

Crankcase Heater Operation

The crankcase heater (when applicable) is energized during the off cycle below 65 degrees F.

Outdoor Fan motor Operation

The outdoor unit control energizes outdoor fan any time the compressor is operating. The outdoor fan remains energized for 15 minutes if a pressure switch or compressor thermal protector should open. Outdoor fan motor will continue to operate for one minute after the compressor shuts off when the outdoor ambient is greater than or equal to 100 degrees F.

Time Delays

The unit time delays include:

- Five minute time delay to start cooling operation when there is a call from the thermostat or user interface (there is no bypass of this feature in a non-communicating system, in a communicating system push the UI fan and up buttons simultaneously for approximately 10 seconds)
- Five minute compressor recycle delay on return from a brown out condition
- Two minute time delay to return to standby operation from last valid communications (with Infinity only)
- One minute time delay of outdoor fan at termination of cooling mode when outdoor ambient is greater than or equal to 100 deg F

Utility Interface

With Infinity Control

The input labeled UTIL is active only when a communicating Infinity Control is used. This input allows a power utility device to interrupt compressor operation during peak load periods. See figure below for wiring connections. When the utility sends a signal to shut the system down, the User Interface will display "CURTAILMENT ACTIVE".

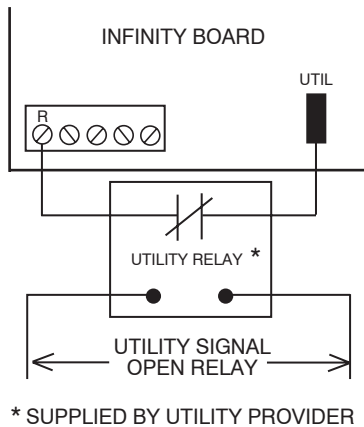


Fig. 11 – Utility Interface

A05410

With Non-Communicating Thermostats

When the utility curtailment interface is used with a non-communicating thermostat, the utility relay should be wired between R and Y.

Low Ambient Cooling

When this unit is operating below 55°F outdoor temperature, provisions must be made for low ambient operation.

Infinity Controlled low ambient cooling:

This unit is capable of low ambient cooling without a kit ONLY when using Infinity control. A low ambient kit is not required, and the outdoor fan motor does not need to be replaced for Infinity controlled low ambient operation. The Infinity Control provides an automatic evaporator coil freeze protection algorithm that eliminates the need for an evaporator freeze thermostat. Low ambient cooling must be enabled in the User Interface set up. Fan may not begin to cycle until about 40°F OAT. Fan will cycle based on coil and outdoor air temperature.

Infinity controlled low ambient mode operates as follows:

- Fan is OFF when outdoor coil temp is < (outdoor air temperature + 3 °F) or outdoor fan has been ON for 30 minutes. (Fan is turned off to allow refrigerant system to stabilize.)
- Fan is ON when outdoor coil temp > (outdoor air temperature + 25°F) or outdoor coil temp > 80°F or if outdoor fan has been OFF for 30 minutes. (Fan is turned on to allow refrigerant system to stabilize.)
- Low pressure switch is ignored for first 3 minutes during low ambient start up. After 3 minutes, if LPS trips, then outdoor fan motor is turned off for 10 minutes, with the compressor running. If LPS closes within 10 minutes then cooling continues with the outdoor fan cycling per the coil temperature routine listed above for the remainder of the cooling cycle. If the LPS does not close within 10 minutes, then the normal LPS trip response (shut down cooling operation and generate LPS trip error) will occur.

Standard Thermostat low ambient cooling mode:

A Low Ambient Pressure Switch kit, Evaporator Freeze Thermostat and Winter Start Control must be installed for low ambient operation in standard thermostat mode. The fan motor is a ball bearing type and does not need to be changed. A crankcase heater must be installed. See Product Data for part numbers on appropriate unit size and series units.

Major Components

Control Board

The AC control board controls the following functions:

- Compressor contactor operation
- Outdoor fan motor operation
- Compressor external protection
- Pressure switch monitoring
- Time Delays

Field Connections

When used with a standard thermostat, there are three field wires required to be connected to R, C and Y. The control receives 24vac low-voltage control system inputs through the R, C, and Y thermostat connections located at the bottom of the control board (see fig A) or the ABCD Infinity connector at the bottom of the control board.

Compressor Internal Relief

The compressor is protected by an internal pressure relief (IPR) which relieves discharge gas into the compressor shell when differential between suction and discharge pressure exceeds 550-625 psi. The compressor is also protected by an internal overload attached to motor windings.

TROUBLESHOOTING

SYSTEMS COMMUNICATION FAILURE

If communication between outdoor unit, control board, and indoor user interface control has failed, the control will flash the appropriate fault code. (See table 3) Check the wiring to the UI, indoor and outdoor units.

PRESSURE SWITCH PROTECTION

The outdoor unit is equipped with high- and low-pressure switches. If the control senses the opening of a high or low-pressure switch, it will de-energize the compressor contactor, keep the outdoor fan operating for 15 minutes and display the appropriate fault code. (See table 3)

After a 15 minute delay, if there is still a call for cooling, and the LPS or HPS is reset, the compressor contactor is energized. If the LPS or HPS has not closed after a 15 minute delay, the outdoor fan is turned off. If the open switch closes anytime after the 15-minute delay, then the unit will resume operation with a call for cooling.

If the LPS or HPS trips for five consecutive cycles, then unit operation is locked out for 4 hours and the appropriate fault code (See table 3) is displayed.

In the event of a high-pressure switch trip or high-pressure lockout, check the refrigerant charge, outdoor fan operation and outdoor coil for airflow restrictions.

In the event of a low-pressure switch trip or low-pressure lockout, check the refrigerant charge and indoor airflow.

CONTROL FAULT

If the outdoor unit control board has failed, the control will flash the appropriate fault code. (See table 3) The control board should be replaced.

24V BROWN OUT PROTECTION

If the control voltage is less than 15.5volts for at least 4 seconds, the compressor contactor and fan relay are de-energized. Compressor and fan operation are not allowed until control voltage is a minimum of 17.5volts. The control will flash the appropriate fault code. (See table 3) Verify the control voltage is in the allowable range of 18-30volts.

COMPRESSOR VOLTAGE SENSING

The input terminals labeled VR and VS on the control board (see Fig. 12) are used to detect compressor voltage status, and alert the user of potential problems. The control continuously monitors the high voltage on the run capacitor of the compressor motor. Voltage should be present any time the compressor contactor is energized, and voltage should not be present when the contactor is de-energized.

COMPRESSOR THERMAL CUTOUT OR LOSS OF 230V POWER

If the control senses the compressor voltage after start-up, and is then absent for 10 consecutive seconds while cooling demand exists, it will de-energize the compressor contactor, keep the outdoor fan operating for 15 minutes (if 230v power present) and display the appropriate fault code. (See table 3) Possible causes are compressor internal overload trip or loss of high voltage (230V) to compressor without loss of control voltage.

After a 15 minute delay, if there is still a call for cooling, the compressor contactor is energized. If the thermal protector has not re-set, the outdoor fan is turned off. If the call for cooling continues, the control will energize the compressor contactor every 15 minutes. If the thermal protector closes, (at the next 15 minute interval check), the unit will resume operation.

If the thermal cutout trips for three consecutive cycles, then unit operation is locked out for 4 hours and the appropriate fault code (See Table 3) is displayed.

CONTACTOR SHORTED DETECTION

If there is compressor voltage sensed when there is no demand for compressor operation, the contactor may be stuck closed. The control will flash the appropriate fault code. Check the contactor and control box wiring.

NO 230V AT COMPRESSOR

If the compressor voltage is not sensed when the compressor should be starting, the contactor may be stuck open or the unit disconnect or circuit breaker may be open. The control will flash the appropriate fault code. Check the contactor, unit disconnect or circuit breaker and control box wiring.

TEMPERATURE THERMISTORS

Thermistors are electronic devices which sense temperature. As the temperature increases, the resistance decreases. Thermistors are used to sense outdoor air (OAT) and coil temperature (OCT).

If the outdoor air or coil thermistor should fail, the control will flash the appropriate fault code. (See table 3)

IMPORTANT: The outdoor air thermistor and coil thermistor are factory mounted in the correct locations. Do not re-locate thermistor sensors.

THERMISTOR SENSOR COMPARISON

The control continuously monitors and compares the outdoor air temperature sensor and outdoor coil temperature sensor to ensure proper operating conditions. The comparison is, if the outdoor air sensor indicates $\geq 10^{\circ}\text{F}$ warmer than the coil sensor (or) the outdoor air sensor indicates $\geq 20^{\circ}\text{F}$ cooler than the coil sensor, the sensors are out of range.

If the sensors are out of range, the control will flash the appropriate fault code. (See Table 3)

The thermistor comparison is not performed during low ambient cooling.

FAILED THERMISTOR DEFAULT OPERATION

Factory defaults have been provided in the event of failure of outdoor air thermistor and/or coil thermistor.

If the OAT sensor should fail, low ambient cooling will not be allowed, and the one minute outdoor fan off delay will not occur.

If the OCT sensor should fail, low ambient cooling will not be allowed.

Thermistor Curve: The resistance vs. temperature chart shown in Figure 12 enables the technician to check the outdoor air and outdoor coil thermistors for proper resistance. Unplug the thermistor assembly from the circuit board and measure resistance across each thermistor. For example, if the outdoor temperature is 60°F , the resistance reading across the outdoor air thermistor should be around 16,000 Ohms.

STATUS CODES

Table 3 shows the status codes flashed by the amber status light. Most system problems can be diagnosed by reading the status code as flashed by the amber status light on the control board.

The codes are flashed by a series of short and long flashes of the status light. The short flashes indicate the first digit in the status code, followed by long flashes indicating the second digit of the error code. The short flash is 0.25 second ON and the long flash is 1.0 second ON. Time between flashes is 0.25 second. Time

between short flash and first long flash is 1.0 second. Time between code repeating is 2.5 seconds with LED OFF.

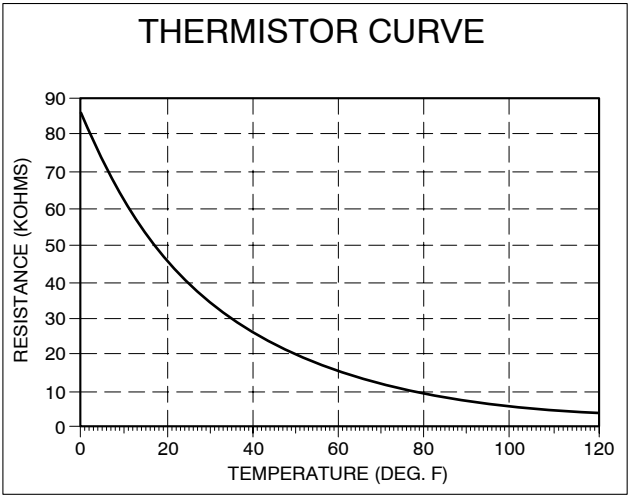
Count the number of short and long flashes to determine the appropriate flash code. Table 3 gives possible causes and actions related to each error.

Example: 3 short flashes followed by 2 long flashes indicates a 32 code. Table 3 shows this to be low pressure switch open.

Table 3— Status Codes

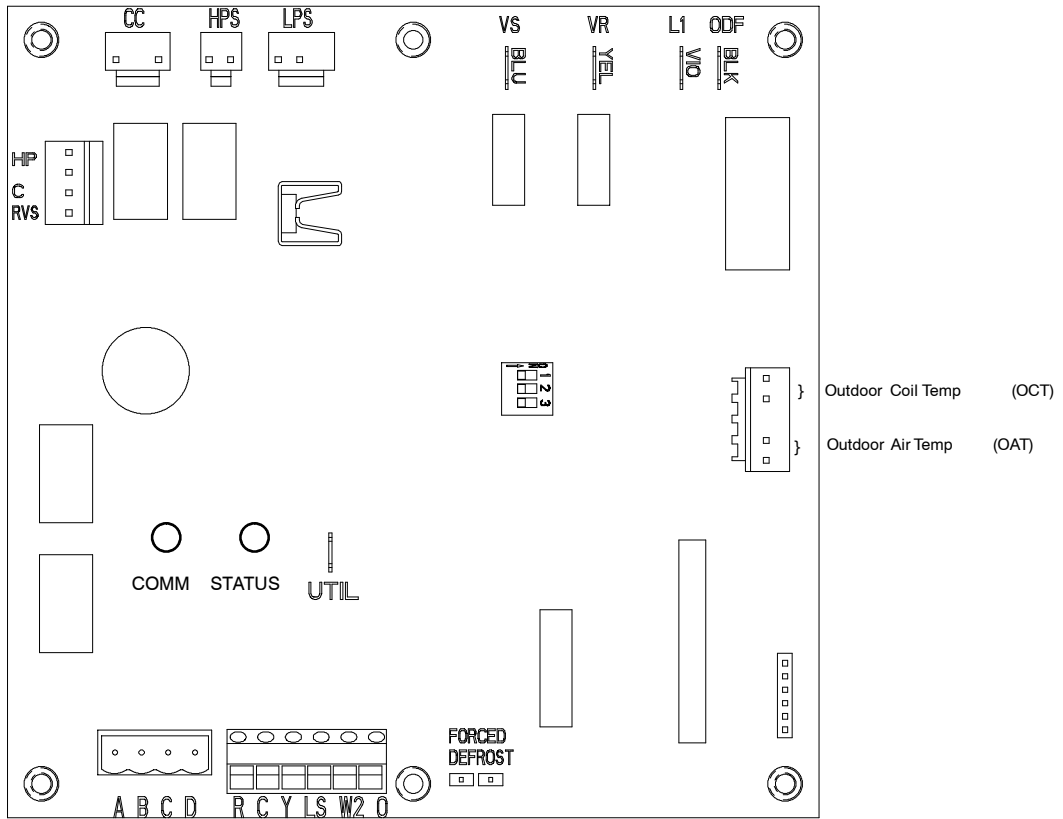
OPERATION	FAULT	AMBER LED FLASH CODE	Possible Cause and Action
Standby – no call for unit operation	None	On solid, no flash	Normal operation
Cooling Operation	None	1, pause	Normal operation
	System Communications Failure	16	Communication with user interface lost. Check wiring to UI, indoor and outdoor units
	High Pressure Switch Open	31	High pressure switch trip. Check refrigerant charge, outdoor fan operation and coils for airflow restrictions.
	Low Pressure Switch Open	32	Low pressure switch trip. Check refrigerant charge and indoor air flow
	Control Fault	45	Outdoor unit control board has failed. Control board needs to be replaced.
	Brown Out (24 v)	46	The control voltage is less than 15.5v for at least 4 seconds. Compressor and fan operation not allowed until control voltage is a minimum of 17.5v. Verify control voltage.
	Outdoor Air Temp Sensor Fault	53	Outdoor air sensor not reading or out of range. Ohm out sensor and check wiring
	Outdoor Coil Sensor Fault	55	Coil sensor not reading or out of range. Ohm out sensor and check wiring
	Thermistors out of range	56	Improper relationship between coil sensor and outdoor air sensor. Ohm out sensors and check wiring.
	Thermal Cutout	72	Compressor voltage sensed after start-up, then absent for 10 consecutive seconds while cooling demand exists. Possible causes are internal compressor overload trip or loss of high voltage to compressor without loss of control voltage.
	Contactors Shorted	73	Compressor voltage sensed when no demand for compressor operation exists. Contactor may be stuck closed or there is a wiring error.
	No 230V at Compressor	74	Compressor voltage not sensed when compressor should be starting. Disconnect may be open or contactor may be stuck open or there is a wiring error.
	Thermal Lockout	82	Thermal cutout occurs in three consecutive cycles. Unit operation locked out for 4 hours or until 24v power recycled.
	Low Pressure Lockout	83	Low pressure switch trip has occurred during 5 consecutive cycles. Unit operation locked out for 4 hours or until 24v power recycled.
	High Pressure Lockout	84	High pressure switch trip has occurred during 5 consecutive cycles. Unit operation locked out for 4 hours or until 24v power recycled.

24APA



A91431

Fig. 12 – Resistance vs Temperature Chart



A05411

Fig. 13 – Single-Stage Control Board

FINAL CHECKS

- IMPORTANT:** Before leaving job, be sure to do the following:
1. Ensure that all wiring is routed away from tubing and sheet metal edges to prevent rub-through or wire pinching.
 2. Ensure that all wiring and tubing is secure in unit before adding panels and covers. Securely fasten all panels and covers.
 3. Tighten service valve stem caps to 1/12-turn past finger tight.
 4. Leave Owner's Manual with owner. Explain system operation and periodic maintenance requirements outlined in manual.
 5. Fill out Dealer Installation Checklist and place in customer file.

CARE AND MAINTENANCE

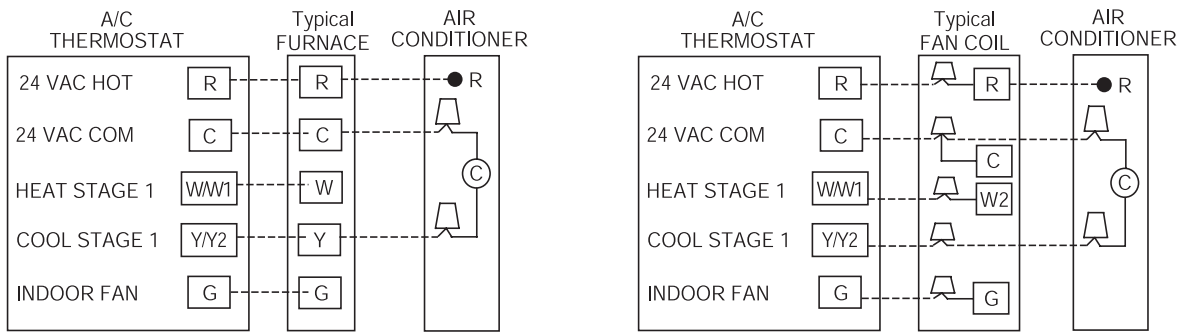
For continuing high performance and to minimize possible equipment failure, periodic maintenance must be performed on this equipment.

Frequency of maintenance may vary depending upon geographic areas, such as coastal applications. See Owner's Manual for information.

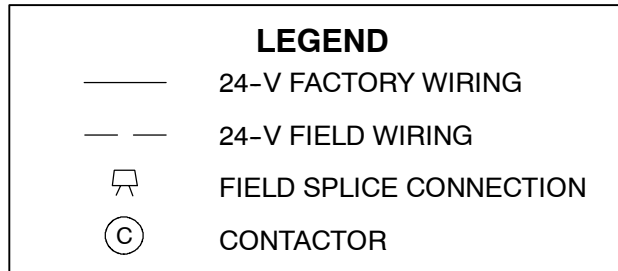
Table 4—Required Liquid—Line Temperature (°F)

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

24APA



A05379



A97368

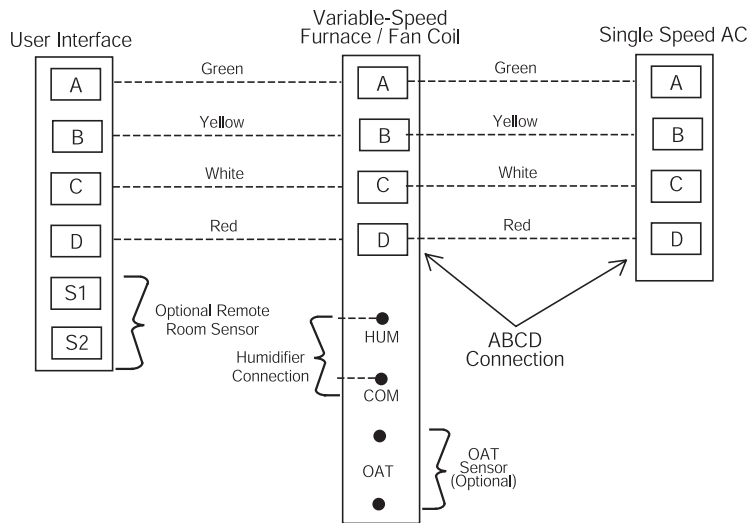
Fig. 14 – Generic 24V Circuit Connections
(See Thermostat Installation Instructions for Specific Unit combinations)

⚠ CAUTION

ELECTRICAL OPERATION HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

A minimum of three wire thermostat wiring is required for the system to operate.



A06087

Fig. 15 – Infinity Control Four-Wire Connection Wiring Diagrams
(See Thermostat Installation Instructions for specific unit combinations)

NOTE: Wiring must conform to NEC or local codes.

24APA

PURON® (R-410A) REFRIGERANT QUICK REFERENCE GUIDE

24APA

- Puron refrigerant operates at 50–70 percent higher pressures than R-22. Be sure that servicing equipment and replacement components are designed to operate with Puron refrigerant.
- Puron refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- Puron 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.
- Puron 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 Puron 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 or piston metering device, it must be changed to a hard shutoff Puron TXV.
- 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 Puron 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 hard shutoff Puron TXV metering device.