⚠WARNING:

RECOGNIZE THIS SYMBOL AS AN INDICATION OF IMPORTANT SAFETY INFORMATION

⚠WARNING

THESE INSTRUCTIONS ARE INTENDED AS AN AID TO QUALIFIED, LICENSED SERVICE PERSONNEL FOR PROPER INSTALLATION, ADJUSTMENT, AND OPERATION OF THIS UNIT. READ THESE INSTRUCTIONS THOROUGHLY BEFORE ATTEMPTING INSTALLATION OR OPERATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN IMPROPER INSTALLATION, ADJUSTMENT, SERVICE, OR MAINTENANCE POSSIBLY RESULTING IN FIRE, ELECTRICAL SHOCK, PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH.

Do not destroy this manual. Please read carefully and keep in a safe place for future reference by a serviceman.

[ ] indicates metric conversions.

92-104921-07-11 (/) Printed in USA

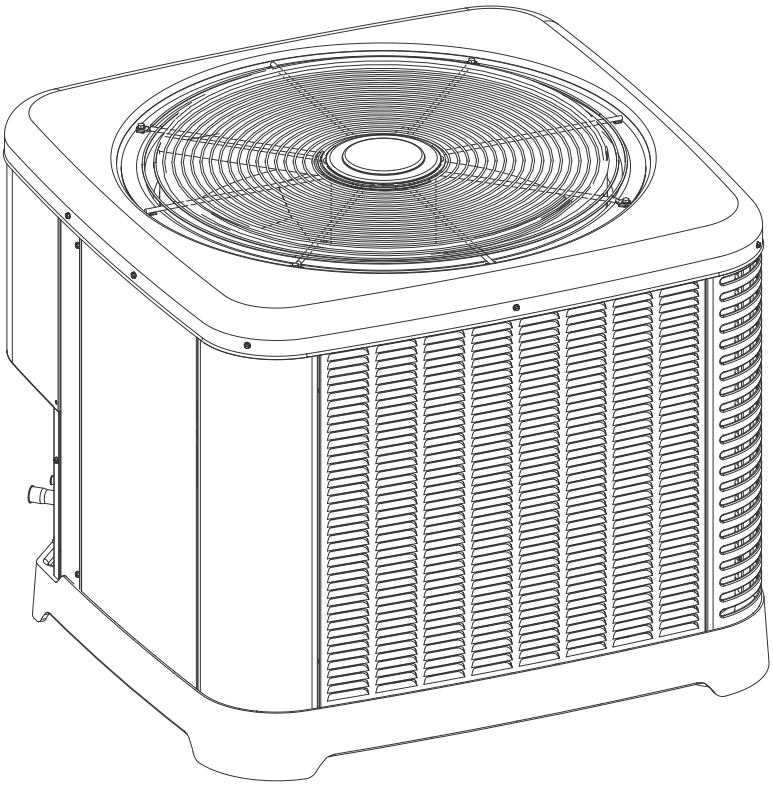
AIR COOLED CONDENSING UNITS

INSTALLATION INSTRUCTIONS

(-)A17 MODEL SERIES - 17 SEER

EQUIPPED WITH ECONET™ COMMUNICATIONS

FEATURING INDUSTRY STANDARD R410-A REFRIGERANT



ISO 9001:2008
Certificate Number: 30164

Contents

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1.0 IMPORTANT SAFETY INFORMATION

⚠WARNINGS:

- These instructions are intended as an aid to qualified, licensed service personnel for proper installation, adjustment, and operation of this unit. Read these instructions thoroughly before attempting installation or operation. **Failure to follow these instructions may result in improper installation, adjustment, service, or maintenance possibly resulting in fire, electrical shock, property damage, personal injury, or death.**
- **The unit must be permanently grounded. Failure to do so can cause electrical shock resulting in severe personal injury or death.**
- **Turn off electric power at the fuse box or service panel before making any electrical connections.**
- **Complete the ground connection before making line voltage connections. Failure to do so can result in electrical shock, severe personal injury, or death.**
- **Disconnect all power to unit before starting maintenance. Failure to do so can cause electrical shock resulting in severe personal injury or death.**
- **Never assume the unit is properly wired and/or grounded. Always test the unit cabinet with a noncontact voltage detector available at most electrical supply houses or home centers before removing access panels or coming into contact with the unit cabinet.**
- **DO NOT use oxygen to purge lines or pressurize system for leak test. Oxygen reacts violently with oil, which can cause an explosion resulting in severe personal injury or death.**
- The top of the scroll compressor shell is hot. Touching the compressor top may result in serious personal injury.
- The manufacturer's warranty does not cover any damage or defect to the unit caused by the attachment or use of any components, accessories, or devices (other than those authorized by the manufacturer) into, onto, or in conjunction with the heat pump. **You should be aware that the use of unauthorized components, accessories, or devices may adversely affect the operation of the heat pump and may also endanger life and property.** The manufacturer disclaims any responsibility for such loss or injury resulting from the use of such unauthorized components, accessories, or devices.

⚠CAUTIONS:

- R-410A systems operate at approximately 60% higher pressures (1.6 times) than R-22 systems. Do not use R-22 service equipment or components on R-410A equipment. Use appropriate care when using this refrigerant. Failure to exercise care may result in equipment damage or personal injury.
- Only match this outdoor unit with a matched indoor coil or air handler approved for use with this outdoor unit per the unit manufacturer's specification sheet. The use of unmatched coils or air handler will likely result in a charge imbalance between the cooling and heating modes which can cause unsatisfactory operation including a high-pressure switch lockout condition.
- Only use indoor coils approved for use on R-410A systems. An R-22 coil will have a TXV or fixed expansion device that is not designed to operate properly in an R-410A system and will result in serious operational issues. The R-22 coil could also contain a significant amount of mineral oil which is incompatible with the POE oil used in R-410A systems and could result in reliability issues with the compressor and expansion devices.
- When the indoor coil or air handler is installed over a finished ceiling and/or living area, it is required that an auxiliary overflow pan be constructed and installed under the entire indoor unit. Failure to do so can result in property damage.
- UNIT MAY START SUDDENLY AND WITHOUT WARNING. The 7 segment LED on the Outdoor Control will flash c or C when a call for unit operation is present, but the unit is in temporary lockout. The variable speed outdoor control will attempt to start unit after the anti-short cycle time expires or when a high or low pressure control automatically resets.

2.0 GENERAL INFORMATION

⚠WARNING:

Improper installation, or installation not made in accordance with these instructions, can result in unsatisfactory operation and/or dangerous conditions and can cause the related warranty not to apply.

2.1 Introduction

The (-)A17 series condensing units are specifically designed to operate with matching communicating EcoNet™ enabled air-handlers, gas furnaces, and Control Center. A conventional 24VAC 2-stage thermostat can be used, but many features and benefits are lost, so this is only recommended for emergency situations when there are issues with the EcoNet™ communications and the system must be made operational until the communication issues are resolved.

This installation instruction manual contains complete instructions for installation and setup using the EcoNet™ or conventional 24VAC controls. Please refer to the manufacturer's specification sheets for complete performance data, thermostat, and accessory listings.

The information contained in this manual has been prepared to assist in the proper installation, operation, and maintenance of the air conditioning system.

Read this manual and any instructions packaged with separate equipment required to make up the system prior to installation. Homeowner should retain this manual for future reference.

2.2 Agency Performance Audit Testing Notice

For purposes of verifying or testing efficiency ratings, the test procedure in Title 10 APPENDIX M to Subpart B of Part 430 (Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps) and the clarifying provisions provided in the AHRI Operations Manual 210/240 that were applicable at the date of manufacture should be used for test set up and performance.

Should this unit be selected for performance audit testing, follow the instructions included in the Appendix (Section 12.1) of this manual.

2.3 Importance of Quality Installation

A quality installation is critical to assure safety, reliability, comfort, and customer satisfaction. Strict adherence to applicable codes, the information in this installation manual, the outdoor unit installation manual, and the thermostat installation manual are key to a quality installation. Read the entire instruction manuals before starting the installation.

IMPORTANT: This product has been designed and manufactured to meet certified AHRI capacity and efficiency ratings with the appropriate outdoor units. However, proper refrigerant charge, proper airflow, and refrigerant line sizing are critical to achieve optimum capacity and efficiency and to assure reliable operation. Installation of this product should follow the manufacturer's refrigerant charging and airflow instructions located in this installation manual and the charging chart label affixed to the outdoor unit. Failure to confirm proper charge and airflow may reduce energy efficiency and shorten equipment life.

The equipment has been evaluated in accordance with the Code of Federal Regulations, Chapter XX, Part 3280.

Install the unit in accordance with applicable national, state, and local codes. Latest editions are available from: "National Fire Protection Association, Inc., Batterymarch Park, Quincy, MA 02269." These publications are:

• ANSI/NFPA No. 70-(Latest Edition) National Electrical Code.

• NFPA90A Installation of Air Conditioning and Ventilating Systems.

• NFPA90B Installation of warm air heating and air conditioning systems.

Install the unit in such a way as to allow necessary access to the coil/filter rack and blower/control compartment.

2.4 System Sizing and Selection

Before specifying any air-conditioning equipment, a survey of the structure, a heat gain calculation must be made. A heat gain calculation involves identifying all surfaces and openings that allow heat to enter the building and determines the amount of heat needed to be removed. A heat gain calculation also calculates the extra heat load caused by sunlight and by humidity removal.

2.0 GENERAL INFORMATION

These factors must be considered before selecting an air conditioning system. The Air Conditioning Contractors of America (ACCA) Manual J method of load calculation is one recognized procedure for determining the cooling load.

After the proper equipment combination has been selected, satisfying both sensible and latent requirements, the system must be properly installed. Only then can the system provide the comfort it was designed to provide.

There are several factors that installers must consider.

- Outdoor unit location
- Indoor unit blower speed and airflow
- Proper equipment evacuation
- Supply and return air duct design and sizing
- Refrigerant charge
- System air balancing
- Diffuser and return air grille location and sizing

IMPORTANT: Excessive use of elbows in the refrigerant line set can produce excessive pressure drop. Follow industry best practices for installation. Installation and commissioning of this equipment is to be performed by trained and qualified HVAC professionals. For technical assistance, contact your Distributor Service Coordinator.

2.5 Importance of Proper Indoor/Outdoor Match-Ups

To assure many years of reliable operation and optimum customer comfort and to assure the outdoor unit warranty remains valid, an air-handler model or indoor coil/furnace combination should be selected that is properly matched to the outdoor unit. The recommended approach is to select an air-handler or indoor coil and gas furnace that has an AHRI match with the outdoor unit. Refer to the AHRI directory at www.ahridirectory.org to confirm the air-handler and outdoor unit are a certified combination in the AHRI Directory.

2.6 Checking Product Received

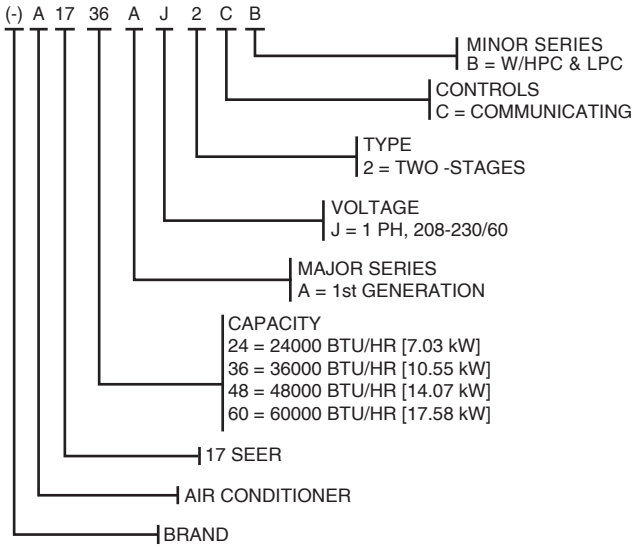
Upon receiving unit, inspect it for any shipping damage. Claims for damage, either apparent or concealed, should be filed immediately with the shipping company. Check model number, electrical characteristics, and accessories to determine if they are correct. Check system components (indoor coil, outdoor unit, air handler/furnace, etc.) to make sure they are properly matched.

2.7 Compressor Break-In Notice

Prior to performance audit testing, system must be operated for 20 hours at 115°F [46.1°C] outdoor ambient temperature with 80°F [26.7°C] dry bulb / 75°F [23.9°C] wet bulb indoor ambient temperature to break the compressor in.

3.0 UNIT SPECIFICATIONS

3.1 Model Number Nomenclature and Available Models



AVAILABLE MODELS
(-)A1724AJ2CB
(-)A1736AJ2CB
(-)A1748AJ2CB
(-)A1760AJ2CB

3.0 UNIT SPECIFICATIONS

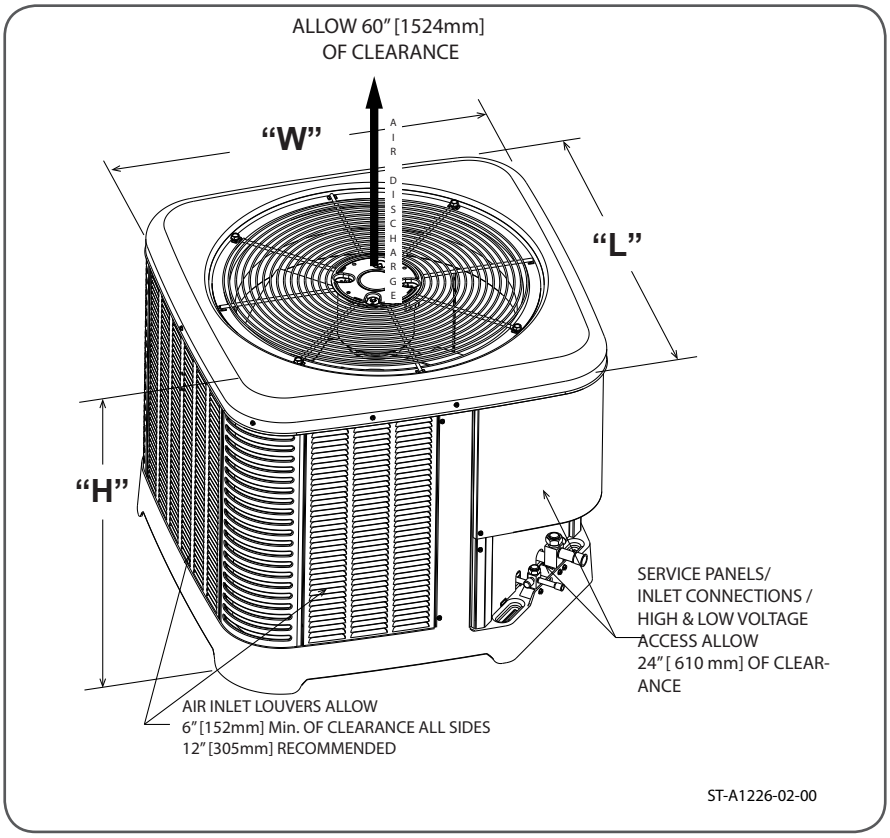
3.2 Electrical and Physical Data

(-)A17

Model Number	ELECTRICAL									PHYSICAL					
	Voltage	Phase	Freq	Compressor		Fan Motor Full Load Amperes (FLA)	Minimum Circuit Ampacity Amperes	Fuse or HACR Circuit Breaker		Outdoor Coil			Refrig. Per Circuit (oz.) [g]	Weight	
				Rated Load Amperes (RLA)	Locked Rotor Amperes (LRA)			Maximum Amperes	Minimum Amperes	Face Area Sq. Ft. [m^2]	No. Rows	CFM [L/s]		Net Lbs. [kg]	Shipping Lbs [kg]
(-)A1724AJ2CB	208-230	1	60	11.7/11.7	58.3	1.40	16/16	25/25	20/20	19.76 [1.84]	1	5133 [2423]	128 [3629]	160 [72.6]	167 [75.7]
(-)A1736AJ2CB	208-230	1	60	15.3/15.3	83.0	1.20	21/21	35/35	25/25	22.23 [2.07]	1	3540 [1671]	144 [4082]	180 [81.6]	187 [84.8]
(-)A1748AJ2CB	208-230	1	60	21.2/21.2	104.0	5.30	32/32	50/50	40/40	32.30 [3.00]	1	4251 [2006]	204 [5783]	231 [104.8]	238 [108.0]
(-)A1760AJ2CB	208-230	1	60	28.8/28.8	152.9	5.30	42/42	60/60	50/50	32.30 [3.00]	1	5133 [2423]	223 [6322]	241 [109.3]	248 [112.5]

DIMENSIONS

(-)A17	24	36	48	60
Height “H” inches [mm]	35 [889]	39 [991]	51 [1295]	51 [1295]
Length “L” inches [mm]	33.75 [857]	33.75 [857]	33.75 [857]	33.75 [857]
Width “W” inches [mm	33.75 [857]	33.75 [857]	33.75 [857]	33.75 [857]



4.1 Tools and Refrigerant

4.1.1 Tools Required for Installing and Servicing R-410A Models

Manifold Sets:

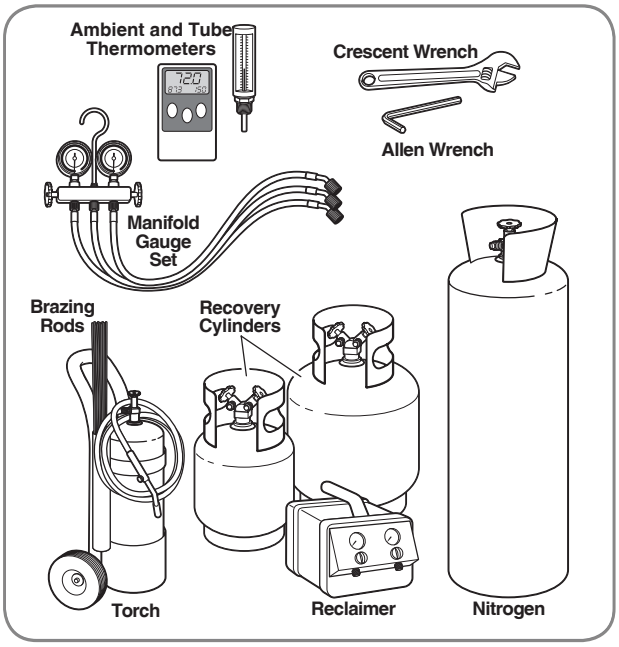
– Up to 800 PSIG [5,516 kPa] High-Side
– Up to 250 PSIG [1,724 kPa] Low-Side
– 550 PSIG [3,792 kPa] Low-Side Retard

Manifold Hoses:

– Service Pressure Rating of 800 PSIG [5,516 kPa]

Recovery Cylinders:

– 400 PSIG [2,758 kPa] Pressure Rating
– Dept. of Transportation 4BA400 or BW400



⚠CAUTION: R-410A systems operate at higher pressures than R-22 systems. **DO NOT** use R-22 service equipment or components on R-410A equipment.

4.1.2 Specifications of R-410A

Application: R-410A is not a drop-in replacement for R-22 . Equipment designs must accommodate its higher pressures. It cannot be retrofitted into R-22 equipment.

Physical Properties: R-410A has an atmospheric boiling point of -62.9°F [-52.7°C] and its saturation pressure at 77°F [25°C] is 224.5 psig [1,548 kPa].

Composition: R-410A is a near-azeotropic mixture of 50% by weight difluoromethane (HFC-32) and 50% by weight pentafluoroethane (HFC-125).

Pressure: The pressure of R-410A is approximately 60% (1.6 times) greater than R-22. Recovery and recycle equipment, pumps, hoses, and the like must have design pressure ratings appropriate for R-410A. *Manifold sets need to range up to 800 psig [5,516 kPa] high-side and 250 psig [1,724 kPa] low-side with a 550 [3,792 kPa] psig low-side retard Hoses need to have a service pressure rating of 800 psig [5,516 kPa]. Recovery cylinders need to have a 400 [2,758 kPa] psig service pressure rating, DOT 4BA400 or DOT BW400.*

Combustibility: At pressures above 1 atmosphere, a mixture of R-410A and air can become combustible. **R-410A and air should never be mixed in tanks or supply lines or be allowed to accumulate in storage tanks. Leak checking should never be done with a mixture of R-410A and air.** Leak-checking can be performed safely with nitrogen or a mixture of R-410A and nitrogen.

4.1.3 Quick-Reference Guide for R-410A

- R-410A refrigerant operates at approximately 60% higher pressure (1.6 times) than R-22. Ensure that servicing equipment is designed to operate with R-410A.
- R-410A refrigerant cylinders are light rose in color.
- R-410A, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from POE oil used in R-410A systems.
- R-410A systems are to be charged with liquid refrigerants. Prior to March 1999, R-410A refrigerant cylinders had a dip tube. These cylinders should be kept upright for equipment charging. Post-March 1999 cylinders do not have a dip tube and should be inverted to ensure liquid charging of the equipment.
- **DO NOT** install a suction line filter drier in the liquid line.
- A factory-approved liquid line filter drier is shipped with every unit and must be installed in the liquid line at the time of installation. Only manufacturer-approved liquid line filter driers should be used. Filter driers must have a working pressure rating of at least 600 psig [4,137 kPa]. The filter drier will only have adequate moisture-holding capacity if the system is properly evacuated.
- Desiccant (drying agent) must be compatible for POE oils and R-410A refrigerant.

4.0 INSTALLATION

4.2 Choosing a Location

4.2.1 Allowable Clearances

12” to side intake louvers
24” to service access panels
60” vertical for fan discharge

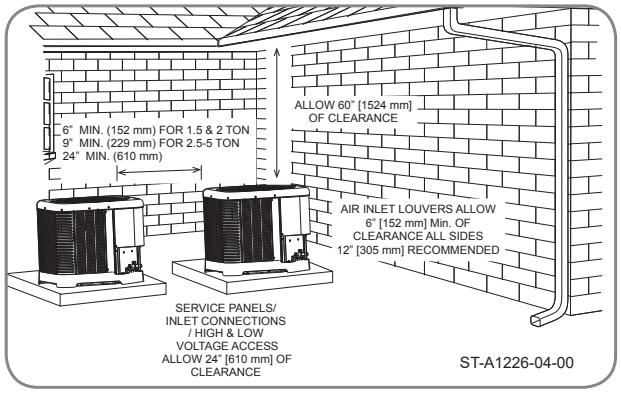
If space limitations exist, the following clearances will have minimal impact to capacity and efficiency and are permitted:

Single-Unit Applications: Minimum of 6” to side intake louvers. **DO NOT** reduce the 60” [152.4 cm] for fan discharge or the 24” [61.0 cm] service clearances.

Multiple-Unit Applications: For units positioned next to each other, a minimum of 6” [15.2 cm] clearance between units is recommended for 2 ton models and 9” [22.9 cm] for 3 ton to 5 ton models. **DO NOT** reduce the 60” [152.4 cm] for fan discharge or the 24” [61.0 cm] service clearances.

IMPORTANT: Consult local and national building codes and ordinances for special installation requirements. Following location information will provide longer life and simplified servicing of the outdoor unit.

NOTICE: These units must be installed outdoors. No ductwork can be attached, or other modifications made, to the discharge grille. Modifications will affect performance or operation.



4.2.2 Operational Issues Related to Unit Location

IMPORTANT: Locate the unit in a manner that will not prevent, impair, or compromise the performance of other equipment installed in proximity to the unit. Maintain all required minimum distances to gas and electric meters, dryer vents, and exhaust and inlet openings. In the absence of national codes or manufacturers’ recommendations, local code recommendations and requirements will take precedence.

- Refrigerant piping and wiring should be properly sized and kept as short as possible to avoid capacity losses and increased operating costs.
- Locate the unit where water runoff will not create a problem with the equipment. Position the unit away from the drip edge of the roof whenever possible. Units are weatherized, but can be affected by the following:
- Water pouring into the unit from the junction of roof-lines, without protective guttering. Large volumes of water entering the unit while in operation can impact fan blade or motor life.
- Closely follow the clearance recommendations in section 4.2.1.
  - 24” [61.0 cm] to the service panel access
  - 60” [152.4 cm] above the fan discharge (unit top) to prevent recirculation
  - 6” [15.2 cm] to the coil grille air inlets with 12” [30.5 cm] minimum recommended

4.2 Choosing a Location (cont.)

4.2.3 Corrosive Environment

The metal parts of this unit may be subject to rust or deterioration if exposed to a corrosive environment. This oxidation could shorten the equipment's useful life.

Corrosive elements include, but are not limited to, salt spray, fog or mist in seacoast areas, sulphur or chlorine from lawn watering systems, and various chemical contaminants from industries such as paper mills and petroleum refineries.

If the unit is to be installed in an area where contaminants are likely to be a problem, special attention should be given to the equipment location and exposure.

Avoid having lawn sprinkler heads spray directly on the unit cabinet.

In coastal areas, locate the unit on the side of the building away from the waterfront.

Shielding provided by a fence or shrubs may give some protection, but cannot violate minimum airflow and service access clearances.

⚠WARNING: Disconnect all power to unit before starting maintenance. Failure to do so can cause electrical shock resulting in severe personal injury or death.

Regular maintenance will reduce the buildup of contaminants and help to protect the unit's finish.

- Frequent washing of the cabinet, fan blade, and coil with fresh water will remove most of the salt or other contaminants that build up on the unit.
- Regular cleaning and waxing of the cabinet with a good automobile polish will provide some protection.
- A good liquid cleaner may be used several times a year to remove matter that will not wash off with water.

4.2.4 Customer Satisfaction Issues

- The outdoor unit should be located away from the living, sleeping, and recreational spaces of the owner and those spaces on adjoining property.
- To prevent noise transmission, the mounting pad for the outdoor unit should not be connected to the structure and should be located a sufficient distance above grade to prevent ground water from entering the unit.

4.3 Unit Mounting

4.3.1 Unit Mounting Methods

The outdoor unit may be mounted in a number of ways. The most common method is on the ground mounted on a concrete or pre-fabricated pad. It can also be mounted on a ground or roof mounted metal frame, wooden frame, or 4" x 4" wooden stringers. It is extremely important to properly secure the unit to the pad or frame so it does not shift during high winds, seismic events, or other outside forces to eliminate the possibility of a safety hazard or physical damage to the unit. Local codes in regions subject to frequent hurricanes and seismic events will dictate specific mounting requirements and must be followed.

4.3.2 High Wind and Seismic Tie-Down Methods

The manufacturer-approved/recommended method is a guide to securing equipment for wind and seismic loads. Other methods might provide the same result, but the manufacturer method is the only one endorsed by the manufacturer for securing equipment where wind or earthquake damage can occur. Additional information is available in the PTS (Product Technical Support) section of the manufacturer's Web sites MyRheem.com, or MyRuud.com and can be found as a listing under each outdoor model. If you do not have access to this site, your distributor can offer assistance.

4.0 INSTALLATION

4.3.3 Elevating Unit

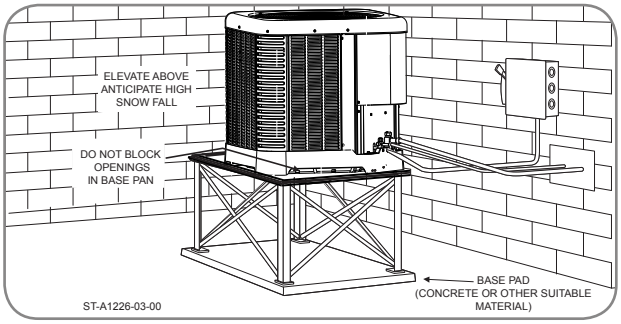
⚠WARNING: Secure an elevated unit and its elevating stand in order to prevent tipping. Failure to do so may result in severe personal injury or death.

If elevating the unit, either on a flat roof or on a slab, observe the following guidelines.

- If elevating a unit on a flat roof, use 4" x 4" [10.2 cm x 10.2 cm] or equivalent stringers positioned to distribute unit weight evenly and prevent noise and vibration.

NOTICE: **DO NOT** block drain openings on bottom of unit.

- If unit must be elevated, secure unit and elevating stand such that unit and/or stand will not tip over or fall off. Keep in mind that someone may try to climb on unit.



4.4 Refrigerant Line Set Selection

4.4.1 Replacing Existing Systems

To prevent failure of a new unit, the existing line set must be correctly sized for the new unit and must be cleaned or replaced. Care must be taken so the expansion device is not plugged. For new and replacement units, a liquid line filter drier must be installed and the line set must be properly sized. Test the oil for acid. If it tests positive for acid, a suction line filter drier is mandatory.

IMPORTANT: When replacing an R-22 unit with an R-410A unit, either replace the line set or ensure that residual mineral oil is drained from existing lines including oil trapped in low spots

4.4.2 Line Set Length and Fitting Losses

Refrigerant tubing is measured in terms of actual length and equivalent length. Actual length is used for refrigerant charge applications. Equivalent length takes into account pressure losses from tubing length, fittings, vertical separation, accessories, and filter driers. The table below references commonly used equivalent lengths.

Table 1

Equivalent Length for Fittings (ft) [m]							
Line Size (in) [mm]	90° Short Radius Elbow	90° Long Radius Elbow	45° Elbow	Solenoid Valve	Check Valve	Site Glass	Filter Drier
3/8 [9.53]	1.3 [0.40]	0.8 [0.24]	0.3 [0.09]	6 [1.83]	4 [1.22]	0.4 [0.12]	6 [1.83]
1/2 [12.71]	1.4 [0.43]	0.9 [0.27]	0.4 [0.12]	9 [2.74]	5 [1.52]	0.6 [0.18]	6 [1.83]
5/8 [15.88]	1.5 [0.46]	1 [0.30]	0.5 [0.15]	12 [3.66]	6 [1.83]	0.8 [0.24]	6 [1.83]
3/4 [19.05]	1.9 [0.58]	1.3 [0.40]	0.6 [0.18]	14 [4.27]	7 [2.13]	0.9 [0.27]	6 [1.83]
7/8 [22.23]	2.3 [0.70]	1.5 [0.46]	0.7 [0.21]	15 [4.57]	8 [2.44]	1 [0.30]	6 [1.83]
1-1/8 [28.58]	2.7 [0.82]	1.8 [0.55]	0.9 [0.27]	22 [6.71]	12 [3.66]	1.5 [0.46]	6 [1.83]

4.4.3 Liquid Line Selection

The purpose of the liquid line is to transport warm sub-cooled liquid refrigerant between the outdoor unit to the indoor unit. It is important not to allow the refrigerant to flash into superheated vapor prior to entering the expansion device of the indoor coil or outdoor unit. Flashing of refrigerant can occur for the following reasons:

- Low refrigerant charge.
- Improperly selected liquid line size.
- Absorption of heat prior to expansion device.
- Excessive vertical separation between the outdoor unit and indoor coil.
- Restricted liquid linear filter drier.
- Kinked liquid line.

The total pressure drop allowed for the liquid line is 50 PSI [345 kPa]. The procedure for selecting the proper liquid line is as follows:

- Measure the total amount of vertical separation between the outdoor unit and indoor coil.
- Measure the total indoor length of liquid line required.
- Add all of the equivalent lengths associated with any fittings or accessories using Table 1.
- Add the linear length to the total fitting equivalent length. This will equal your total equivalent line length.
- Reference Table 2 to verify the calculated equivalent length is acceptable with the required vertical separation and diameter of liquid line.

Example: A 3-ton unit is installed 25’ below the indoor unit, requires 75’ of 1/2” diameter liquid line, 3/4” suction line, 4 90° LR elbows, and a filter drier.

- Fitting Equivalent Length (ft.) = (4 × .9’) + 6’ = 9.6’
- Total Equivalent Length (ft.) = 75’ + 9.6’ = 84.6’

This application is acceptable because the 25’ vertical rise is less than the maximum rise of 50’ for this application. This application is also considered to have a lone line set since 75’ exceeds the limit of 0 feet.

Unit Size	Allowable Liquid Line Size	Allowable Suction Line Size	Use Long Line Guidelines for Linear Line Lengths Greater Than Shown Below (Feet)	Outdoor Unit ABOVE or BELOW Indoor Unit Equivalent Length (Feet)					
				<25	26-50	51-75	76-100	101-125	126-150
				Maximum Vertical Separation (Outdoor Unit Below Indoor Unit)* / Capacity Multiplier					
3 Ton	5/16”	5/8”	20	25 / 0.99	50 / 0.97	50 / 0.95	50 / 0.93	36 / 0.91	NR
	3/8”	5/8”	15	25 / 0.99	50 / 0.97	50 / 0.95	50 / 0.93	50 / 0.91	NR
	5/16”	3/4”	20	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	36 / 0.97	18 / 0.96
	3/8”	3/4”	15	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96
	1/2”	3/4”	0	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96

(Excerpt from Table 2A)

4.4.4 Suction Line Selection

The purpose of the suction line is to return superheated vapor to the condensing unit from the indoor coil. Proper suction line sizing is important because it plays an important role in returning oil to the compressor to prevent potential damage to the bearings, valves, and scroll sets. Also, an improperly sized suction line can dramatically reduce capacity and performance of the system. The procedure for selecting the proper suction line is as follows:

- Determine the total linear length of suction line required.
- Add all of the equivalent lengths associated with any fittings or accessories using Table 1.
- Add the linear length and total fitting equivalent length. This will equal your total equivalent line length.
- Reference Table 2 to verify that the calculated equivalent length falls within the compatibility region of the chart.
- Verify capacity loss is acceptable for the application.

4.0 INSTALLATION

Table 2A: Refrigerant Line Sizing Chart (English Units)

17 SEER 2-Stage Air-Conditioners									
Unit Size	**Allowable Liquid Line Size**	**Allowable Vapor Line Size**	**Use Long Line Guidelines for Linear Line Lengths Greater Than Shown Below**	**Outdoor Unit ABOVE or BELOW Indoor Unit**					
				Equivalent Length (Feet)					
				< 25	26-50	51-75	76-100	101-125	126-150
				Maximum Vertical Rise (Outdoor Unit Below Indoor Unit) * / Capacity Multiplier					
2.0 Ton **** SEE NOTE 3**	1/4"	5/8"	n/a	25 / 0.99	50 / 0.98	31 / 0.97	3 / 0.97	NR	NR
	5/16"	5/8"	73	25 / 0.99	50 / 0.98	50 / 0.97	50 / 0.97	50 / 0.96	50 / 0.95
	3/8"	5/8"	48	25 / 0.99	50 / 0.98	50 / 0.97	50 / 0.97	50 / 0.96	50 / 0.95
	1/4"	3/4" *	n/a	25 / 1.00	50 / 1.00	31 / 0.99	3 / 0.99	NR	NR
	5/16"	3/4" *	73	25 / 1.00	50 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.98
	3/8"	3/4" *	48	25 / 1.00	50 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.98
3 Ton	5/16"	5/8"	20	25 / 0.99	50 / 0.97	50 / 0.95	50 / 0.93	34 / 0.91	NR
	3/8"	5/8"	15	25 / 0.99	50 / 0.97	50 / 0.95	50 / 0.93	50 / 0.91	NR
	5/16"	3/4"	20	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	34 / 0.97	18 / 0.96
	3/8"	3/4"	15	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96
	1/2"	3/4"	0	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.97	50 / 0.96
4 Ton	3/8"	3/4"	0	25 / 0.99	50 / 0.98	50 / 0.97	50 / 0.95	50 / 0.94	50 / 0.93
	1/2"	3/4"	0	25 / 0.99	50 / 0.98	50 / 0.97	50 / 0.95	50 / 0.94	50 / 0.93
	3/8"	7/8"	0	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.98	50 / 0.97
	1/2"	7/8"	0	25 / 1.00	50 / 0.99	50 / 0.99	50 / 0.98	50 / 0.98	50 / 0.97
5 Ton	3/8"	3/4"	0	25 / 0.99	50 / 0.97	50 / 0.95	50 / 0.93	50 / 0.91	NR
	1/2"	3/4"	0	25 / 0.99	50 / 0.97	50 / 0.95	50 / 0.93	50 / 0.91	NR
	3/8"	7/8"	0	25 / 1.00	50 / 0.99	50 / 0.98	50 / 0.98	50 / 0.97	39 / 0.96
	1/2"	7/8"	0	25 / 1.00	50 / 0.99	50 / 0.98	50 / 0.98	50 / 0.97	50 / 0.96

Notes:

1) Do not exceed 150 ft linear line length.
2) *Do not exceed 50 ft vertical separation between indoor and outdoor units if the outdoor unit is above the indoor unit.
3) ** 3/4" vapor line should only be used for 2 ton systems if outdoor unit is below or at same level as indoor unit to assure proper oil return.
4) Always use the smallest liquid line allowable to minimize refrigerant charge.
5) Applications shaded in light gray indicate capacity multipliers between 0.90 and 0.96 which are not recommended, but are allowed.
6) Applications shaded in dark gray are not recommended due to excessive liquid or suction pressure drop.

Table 2B: Refrigerant Line Sizing Chart (Metric Units)

17 SEER 2-Stage Air-Conditioners									
Unit Size	**Allowable Liquid Line Size mm [in.]**	**Allowable Vapor Line Size mm [in.]**	**Use Long Line Guidelines for Linear Line Lengths Greater Than Shown Below**	**Outdoor Unit ABOVE or BELOW Indoor Unit Equivalent Length (Meters)**					
				< 8	8-15	16-23	24-30	31-38	39-46
				Maximum Vertical Rise (Outdoor Unit Below Indoor Unit) * / Capacity Multiplier					
7.0 KW [2.0 Ton] **SEE NOTE 3	6.35 [1/4]	15.88 [5/8]	n/a	8 / 0.99	15 / 0.98	9 / 0.97	1 / 0.97	NR	NR
	7.94 [5/16]	15.88 [5/8]	22	8 / 0.99	15 / 0.98	15 / 0.97	15 / 0.97	15 / 0.96	15 / 0.95
	9.53 [3/8]	15.88 [5/8]	15	8 / 0.99	15 / 0.99	15 / 0.97	15 / 0.97	15 / 0.96	15 / 0.95
	6.35 [1/4]	19.05 [3/4] *	n/a	8 / 1.00	15 / 0.99	9 / 0.99	1 / 0.99	NR	NR
	7.94 [5/16]	19.05 [3/4] *	22	8 / 1.00	15 / 0.99	15 / 0.99	15 / 0.99	15 / 0.98	15 / 0.98
	9.53 [3/8]	19.05 [3/4] *	15	8 / 1.00	15 / 0.99	15 / 0.99	15 / 0.99	15 / 0.98	15 / 0.98
10.6 KW [3 Ton]	7.94 [5/16]	15.88 [5/8]	6	8 / 0.99	15 / 0.97	15 / 0.95	15 / 0.93	10 / 0.91	NR
	9.53 [3/8]	15.88 [5/8]	5	8 / 0.99	15 / 0.97	15 / 0.95	15 / 0.93	15 / 0.91	NR
	7.94 [5/16]	19.05 [3/4]	6	8 / 1.00	15 / 0.99	15 / 0.99	15 / 0.98	10 / 0.97	5 / 0.96
	9.53 [3/8]	19.05 [3/4]	5	8 / 1.00	15 / 0.99	15 / 0.99	15 / 0.98	15 / 0.97	15 / 0.96
	12.7 [1/2]	19.05 [3/4]	0	8 / 1.00	15 / 0.99	15 / 0.99	15 / 0.98	15 / 0.97	15 / 0.96
14.1 KW [4 Ton]	9.53 [3/8]	19.05 [3/4]	0	8 / 0.99	15 / 0.98	15 / 0.97	15 / 0.95	15 / 0.94	15 / 0.93
	12.7 [1/2]	19.05 [3/4]	0	8 / 0.99	15 / 0.98	15 / 0.97	15 / 0.95	15 / 0.94	15 / 0.93
	9.53 [3/8]	22.23 [7/8]	0	8 / 1.00	15 / 0.99	15 / 0.99	15 / 0.98	15 / 0.98	15 / 0.97
	12.7 [1/2]	22.23 [7/8]	0	8 / 1.00	15 / 0.99	15 / 0.99	15 / 0.98	15 / 0.98	15 / 0.97
17.6 KW [5 Ton]	9.53 [3/8]	19.05 [3/4]	0	8 / 0.99	15 / 0.97	15 / 0.95	15 / 0.93	15 / 0.91	NR
	12.7 [1/2]	19.05 [3/4]	0	8 / 0.99	15 / 0.97	15 / 0.95	15 / 0.93	15 / 0.91	NR
	9.53 [3/8]	22.23 [7/8]	0	8 / 1.00	15 / 0.99	15 / 0.98	15 / 0.98	15 / 0.97	12 / 0.96
	12.7 [1/2]	22.23 [7/8]	0	8 / 1.00	15 / 0.99	15 / 0.98	15 / 0.98	15 /0.97	15 / 0.96

Notes:

1) Do not exceed 46 meters linear line length.
2) *Do not exceed 15 meters vertical separation between indoor and outdoor units if the indoor unit is above the indoor unit.
3) ** 19.05mm [3/4 in.] vapor line should only be used for 2 ton systems if outdoor unit is below or at same level as indoor unit to assure proper oil return.
4) Always use the smallest liquid line allowable to minimize refrigerant charge.
5) Applications shaded in light gray indicate capacity multipliers between 0.90 and 0.96 which are not recommended, but are allowed.
6) Applications shaded in dark gray are not recommended due to excessive liquid or suction pressure drop.

4.0 INSTALLATION

4.4 Refrigerant Line Set Selection (cont.)

4.4.5 Long Line Set Considerations

Long line set applications are defined as applications that require accessories or alternate construction methods. The following are things that should be considered when selecting and installing a long line set:

- Additional refrigerant charge
- Fitting losses and maximum equivalent length considerations
- Refrigerant migration during the off cycle
- Oil return to the compressor
- Capacity losses
- System oil level adjustment

4.4.5.1 Determining if Long Line Set Length Requirements Apply

Table 2 is used to determine if the application is considered to have a long line set. A column is provided that shows the linear line length where long line length requirements apply.

4.4.5.2 Oil Return to Compressor

Small amounts of compressor crankcase oil is picked up and carried out of the compressor by the moving refrigerant and is circulated through the system along with the refrigerant before it returns to the compressor crankcase. It is critical to the life of the compressor for the oil to be able to return to the compressor to maintain an adequate level of oil in the compressor crankcase. Oversized suction lines result in inadequate refrigerant velocities to carry the oil along with the refrigerant and will cause the oil to accumulate in the low spots in the vapor line instead of being returned to the compressor crankcase. This is especially true for long line lengths. Only use the suction line sizes listed in Table 2 to assure proper oil return. Do not oversize the suction line.

4.4.5.3 Refrigerant Migration During Off Cycle

Long line set applications can require a considerable amount of additional refrigerant. This additional refrigerant needs to be managed throughout the entire ambient operating envelope that the system will go through during its life cycle. Off-Cycle migration is where excess refrigerant condenses and migrates to the coldest and/or lowest part of the system. Excessive build-up of refrigerant at the compressor will result in poor reliability and noisy operation during startup. Long line applications require an EXV or TXV on both the indoor coil and outdoor unit and a crankcase heater. (See Section 7.4 and 9.3 for crankcase heater information.)

4.4.5.4 Maximum Liquid Pressure Drop

The total liquid line pressure drop must not exceed 50 psig [345 kPa] to assure a solid column of liquid at the metering device and stable control of superheat. Be sure to account for vertical separation, elbows, filter driers, solenoid valves, sight glasses, and check valves when calculating liquid line pressure drop.

4.4.5.5 Liquid Line Refrigerant Flashing

Excessive pressure drop and heat gain in long liquid lines can result in the refrigerant flashing into a vapor before it reaches the metering device which will dramatically reduce the capacity and efficiency of the system. For this reason, the liquid line must be sized properly using the table in Table 2 and must be insulated in unconditioned spaces.

4.4 Refrigerant Line Set Selection (cont.)

4.4.5.6 Compressor Oil Level Adjustment for Long Line Set Applications

Additional oil may need to be added for long line set applications. (Ref. Table 2). Below is the equation for the oil level adjustment. The compressor name plate oil charge for the different outdoor units is shown in the table to the right.

Oil to be Added = [(Charge Adjustment + OD Unit Name Plate Charge (oz.)) × (0.022) – [(0.10) × (Compressor Name Plate Oil Charge (oz.))]

Example: An application requires 125 ft. of line set with a liquid line diameter of 3/8", Charge Adjustment = 52.4 oz., Name Plate Charge = 107 oz., Name Plate Oil Charge = 25 oz., Oil to be Added = ((52.4 oz. +107 oz.) × .022) – (.10 × 25 oz.) = 1.0 oz.

Model Number	Compressor	Name Plate Oil Charge oz [ml]	Factory Installed CCH
(-)A1724	ZPS20K5E-PFV-130	25 [739]	N
(-)A1736	ZPS30K5E-PFV-130	25 [739]	Y
(-)A1748	ZPS40K5E-PFV-130	42 [1242]	Y
(-)A1760	ZPS49K5E-PFV-130	42 [1242]	Y

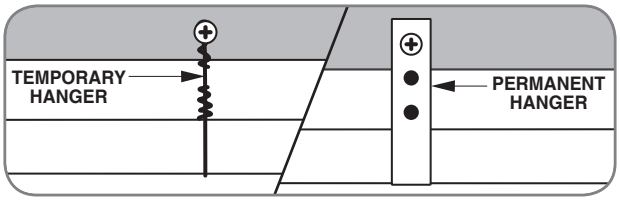
4.4.5.7 Capacity Losses

Long line lengths can result in a reduction in capacity due to vapor line pressure drop and heat gain or loss. Refer to Table 2 for capacity loss multipliers for various vapor line diameters and lengths. Only use vapor lines listed in Table 2 to assure proper oil return. This table does not account for any capacity loss due to heat gain or loss from the environment. It is extremely important not to oversize the vapor line to minimize capacity loss at the expense of proper oil return. If the table shows an "NR" for a particular vapor line diameter and length, capacity loss will be excessive. The full length of the vapor line must be insulated to minimize heat gain or loss.

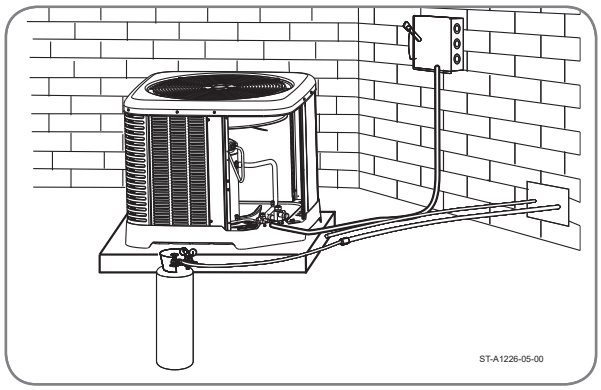
4.0 INSTALLATION

4.5 Line Set Installation

- If tubing is to be run underground, it must be run in a sealed watertight chase.
- Use care in routing tubing and **DO NOT** kink or twist. Use a good quality tubing bender on the suction line to prevent kinking.



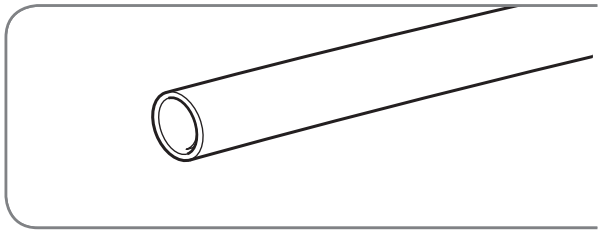
- Route the tubing using temporary hangers; then straighten the tubing and install permanent hangers. The tubing must be adequately supported.
- Blow out the liquid and suction lines with dry nitrogen before connecting to the outdoor unit and indoor coil to remove debris that can plug the expansion device.



4.5.1 Important Tubing Installation Practices

Observe the following when installing correctly sized type “L” refrigerant tubing between the outdoor unit and indoor coil:

- Check Table 2 for the correct suction line size and liquid line size.
- **If a portion of the liquid line passes through a very hot area where liquid refrigerant can be heated to form vapor, insulating the liquid line is required.**
- Use clean, dehydrated, sealed refrigeration-grade tubing.
- Always keep tubing sealed until tubing is in place and connections are to be made.
- A high-quality biflow filter drier is included with all R-410A heat pump units and must be installed in the liquid line upon unit installation.
- When replacing an R-22 system with an R-410A system and the line set is not replaced, blow out the lines with dry nitrogen to remove as much of the remaining mineral oil as possible. Check for low spots where oil may be trapped and take measures to drain the oil from those areas.

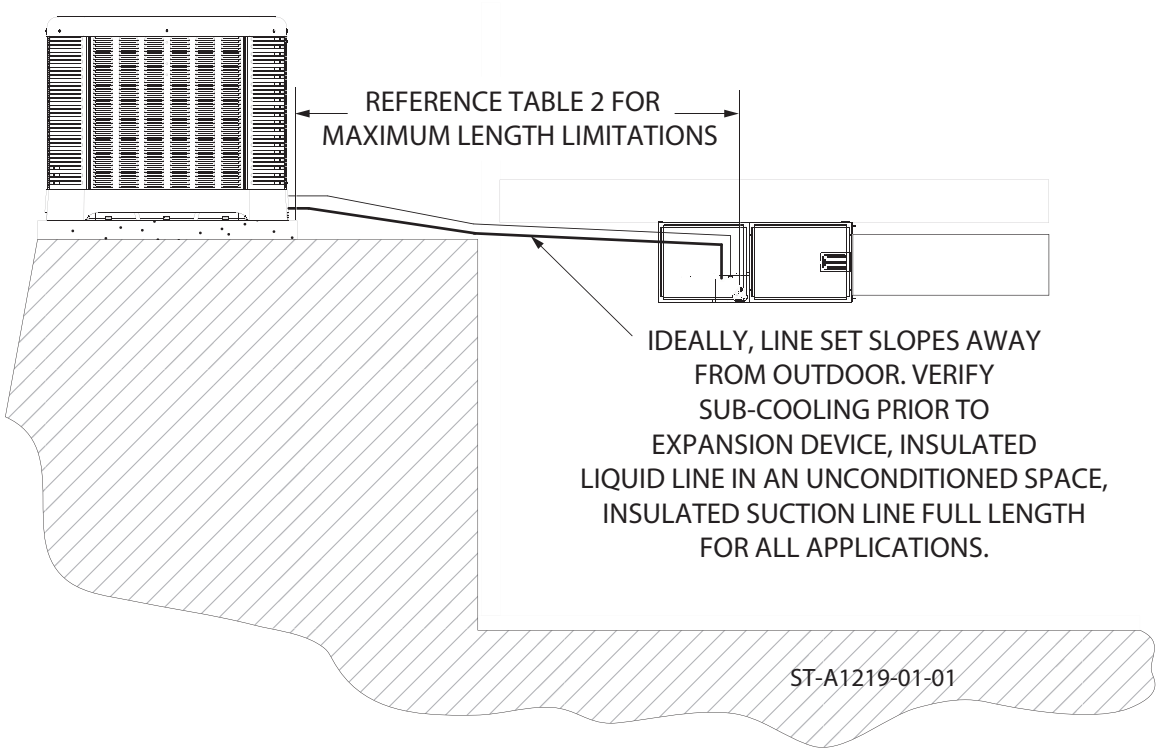


- If tubing has been cut, debur the ends while holding the tubing in a position to prevent chips from falling into tubing. Burrs such as those caused by tubing cutters can affect performance dramatically, particularly on small diameter liquid lines.
- For best operation, keep tubing run as short as possible with a minimum number of elbows or bends
- Locations where the tubing will be exposed to mechanical damage should be avoided. If it is necessary to use such locations, the copper tubing should be protected by a housing to prevent damage.

4.5 Line Set Installation (cont.)

4.5.2 Relative Location of Indoor and Outdoor Units

4.5.2.1 Indoor and Outdoor Unit Near Same Level



For applications that are considered to have a long line set with the outdoor unit and indoor unit near the same level the following is required:

- EXV or TXV on the indoor coil
- Start components may be required depending upon quality of voltage (consistantly <200vac at outdoor unit)
- Crankcase heater (Some models have factory installed CCH's. Refer to tables in Section 4.4.5.6.)
- Insulated liquid line in unconditioned space only.
- Insulated suction line full length.
- Suction line should slope toward the indoor unit
- Follow the proper line sizing, maximum linear and equivalent lengths, charging requirements, and oil level adjustments spelled out in this manual.
- Verify at least 5°F [2.8°C] liquid sub-cooling at the indoor unit prior to expansion device in the cooling mode.

4.0 INSTALLATION

4.5 Line Set Installation (cont.)

4.5.2.2 Outdoor Unit Below Indoor Unit

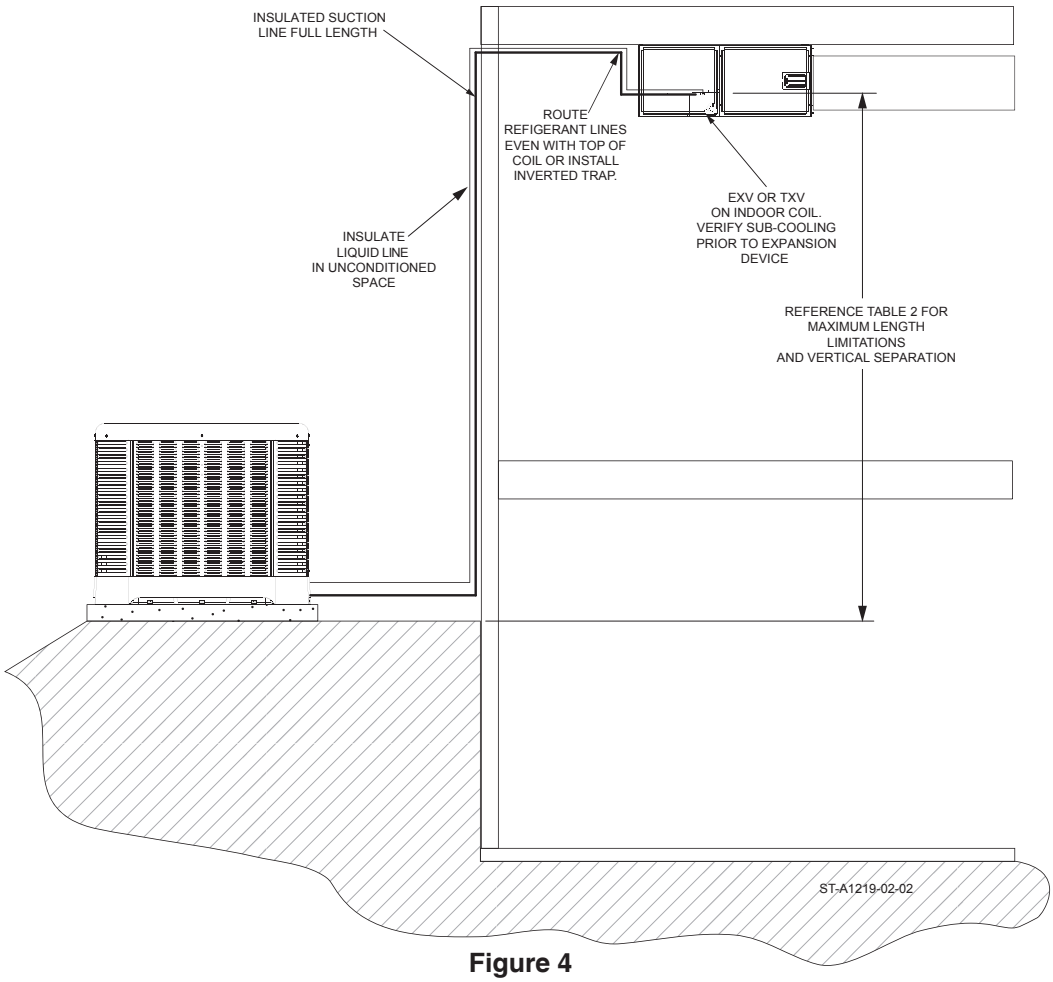


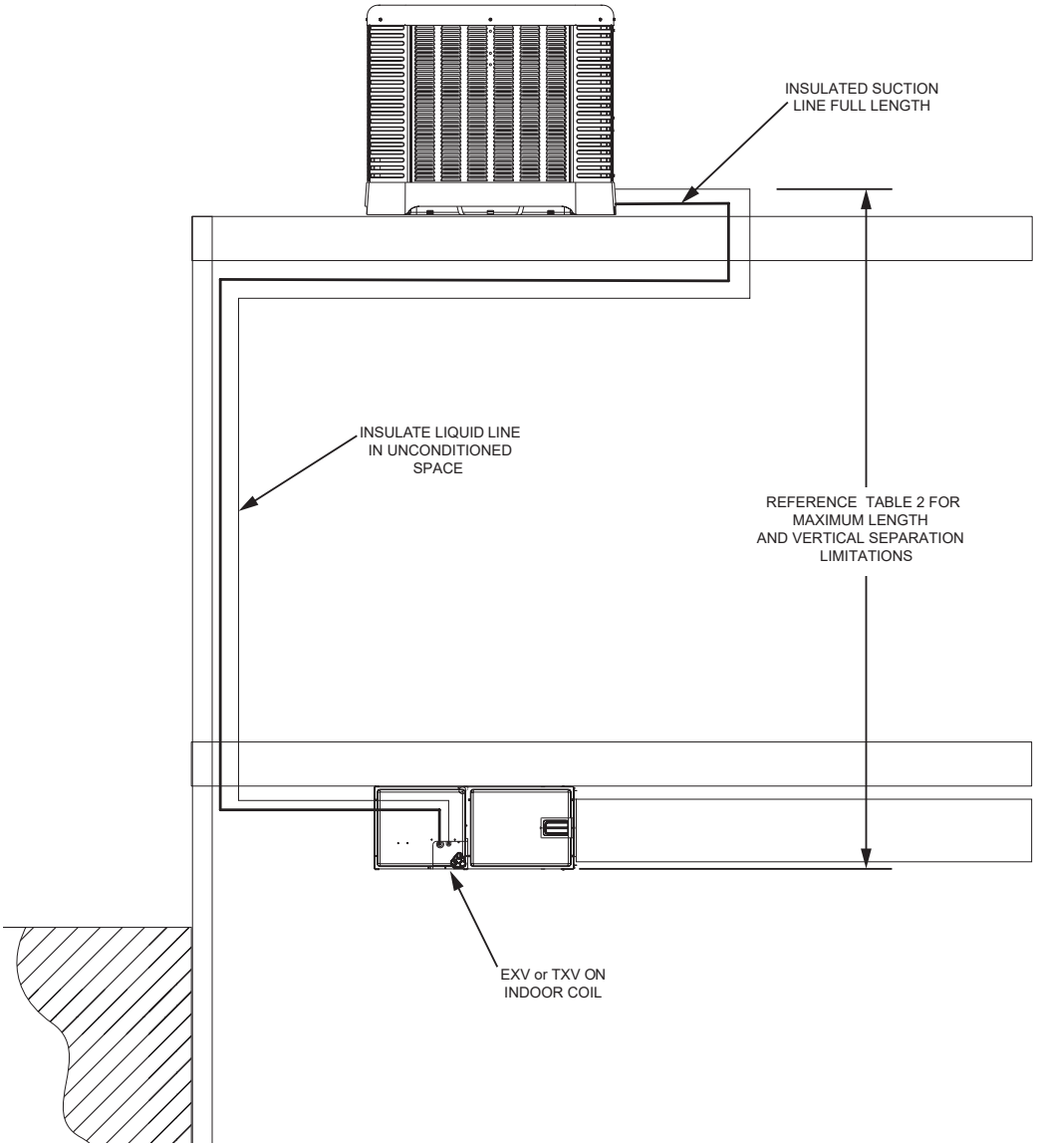
Figure 4

For applications that are considered to have a long line set with the outdoor unit below the indoor unit the following is required:

- EXV or TXV on the indoor coil.
- Crankcase heater (Some models have factory installed CCH's. Refer to tables in Section 4.4.5.6.)
- Start components may be required depending upon quality of voltage (consistantly <200vac at outdoor unit)
- Refrigerant lines should be routed even with the top of the indoor coil or an inverted trap is to be applied (refer to Figure 4).
- Insulated liquid line in unconditioned space only.
- Insulated suction line full length.
- Follow the proper line sizing, maximum linear and equivalent lengths, charging requirements, and oil level adjustments spelled out in this manual.
- Verify at least 5°F [2.8°C] liquid sub-cooling at the indoor unit prior to expansion device.

4.5 Line Set Installation (cont.)

4.5.2.3 Outdoor Unit Above Indoor Unit



For applications that are considered to have a long line set with the outdoor unit above the indoor unit the following is required:

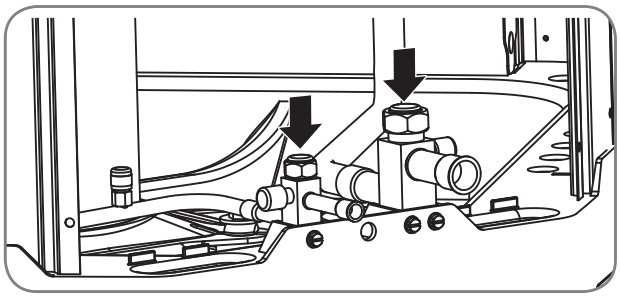
- EXV or TXV on the indoor coil.
- Crankcase heater (Some models have factory installed CCH's. Refer to tables in Section 4.4.5.6.)
- Start components maybe required depending upon quality of voltage (consistantly <200 vac at outdoor unit)
- Insulated liquid line in unconditioned space only.
- Insulated suction line full length.
- Follow the proper line sizing, maximum linear and equivalent lengths, charging requirements, and oil level adjustments spelled out in this manual.

4.0 INSTALLATION

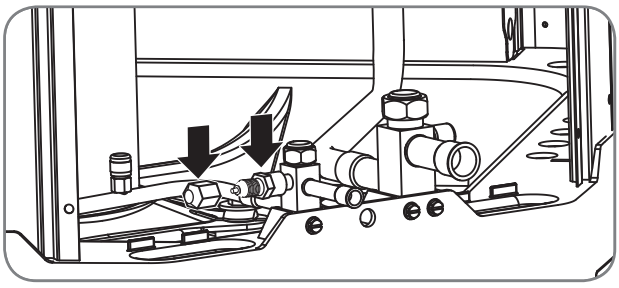
4.5.3 Tubing Connections

Indoor coils have only a holding charge of dry nitrogen. Keep all tube ends sealed until connections are to be made.

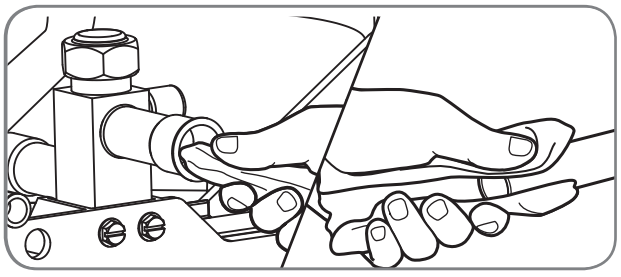
- Use type “L” copper refrigeration tubing. Braze the connections with the following alloys:
  – copper to copper, 5% silver minimum
  – copper to steel or brass, 15% silver minimum



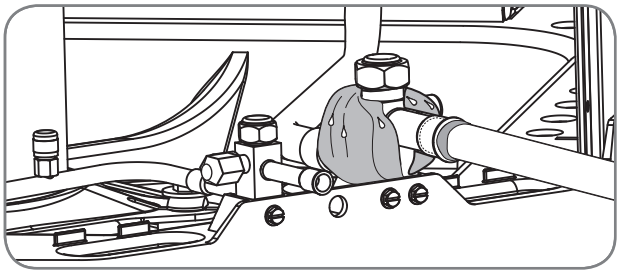
- Be certain both refrigerant shutoff valves at the outdoor unit are closed.



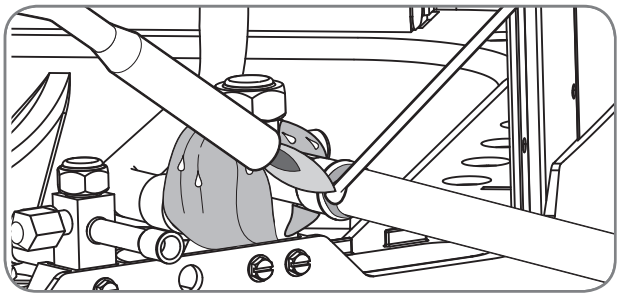
- Remove the caps and Schrader cores from the pressure ports to protect seals from heat damage. Both the Schrader valves and the service valves have seals that may be damaged by excessive heat.



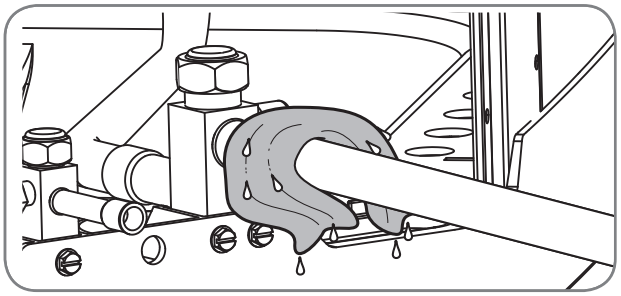
- Clean the inside of the fittings and outside of the tubing with a clean, dry cloth before soldering. Clean out debris, chips, dirt, etc., that enters tubing or service valve connections.



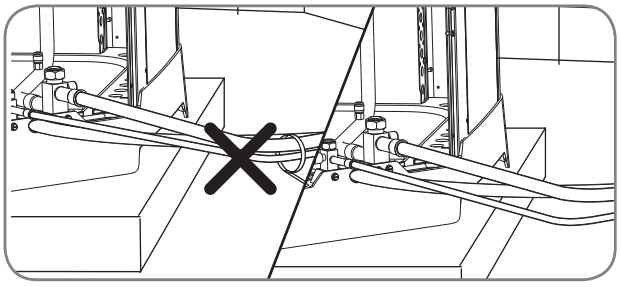
- Wrap valves with a wet rag or thermal barrier compound before applying heat.



- Braze the tubing between the outdoor unit and indoor coil. Flow dry nitrogen into a pressure port and through the tubing while brazing, but **DO NOT** allow pressure inside tubing which can result in leaks. Once the system is full of nitrogen, the nitrogen regulator should be turned off to avoid pressuring the system.



- After brazing, use an appropriate heatsink material to cool the joint.
- Reinstall the Schrader cores into both pressure ports.



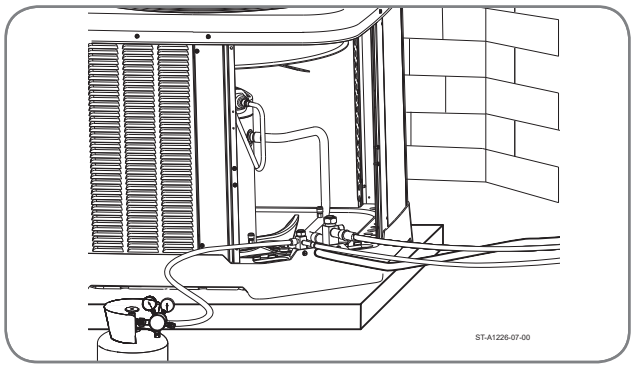
- **DO NOT** allow the bare suction line and liquid line to be in contact with each other. This causes an undesirable heat transfer resulting in capacity loss and increased power consumption.

4.6 Initial Leak testing

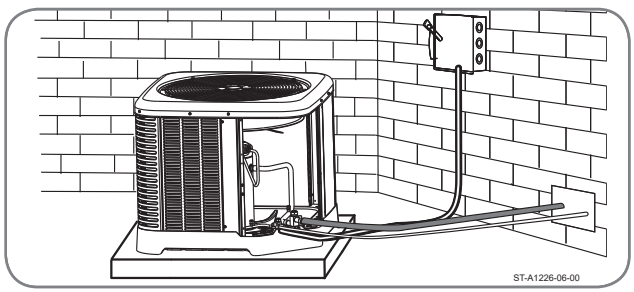
Indoor coils have only a holding charge of dry nitrogen. Keep all tube ends sealed until connections are to be made.

⚠WARNING: DO NOT use oxygen to purge lines or pressurize system for leak test. Oxygen reacts violently with oil, which can cause an explosion resulting in severe personal injury or death.

The 2-stage condensing units must be matched to indoor coils or air-handlers that are equipped with an EXV or TXV. During shipment, vibration has been found to move the EXV stem valve to a near closed position despite being set to a fully open position in the factory. Prior to leak testing, it is recommended to apply power to the indoor unit if the indoor coil has an EXV, making sure there is no call for operation by disconnecting the EcoNet™ control center or thermostat. By doing this, the controls will immediately close the EXV followed immediately by opening it to the wide open position, permitting free flow of nitrogen through the system during the brazing process.



- Pressurize line set and coil through service fittings with dry nitrogen to 150 PSIG (maximum). Close nitrogen tank valve, let system sit for at least 15 minutes, and check to see if the pressure has dropped. If the pressure has dropped, check for leaks at the line set braze joints with soap bubbles and repair leak as necessary. Repeat pressure test. If line set and coil hold pressure, proceed with line set and coil evacuation (see Sections 4.7 and 4.8 for evacuation and final leak testing).



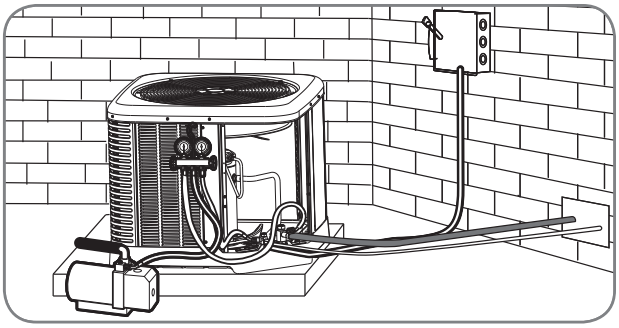
- The suction line must be insulated for its entire length to prevent dripping (sweating) and prevent performance losses. Closed-cell foam insulation such as Armaflex and Rubatex® are satisfactory insulations for this purpose. Use 1/2” [12.7 mm] minimum insulation thickness. Additional insulation may be required for long runs. The liquid line must be insulated in any unconditioned space when long line sets are used and anytime the liquid line is run through an attic due to hot temperatures that occur there.

4.7 Evacuation

Evacuation is one of the most important parts of the entire installation and service procedure. The life and efficiency of the equipment is dependent upon the thoroughness exercised by the serviceman when evacuating air and moisture from the system.

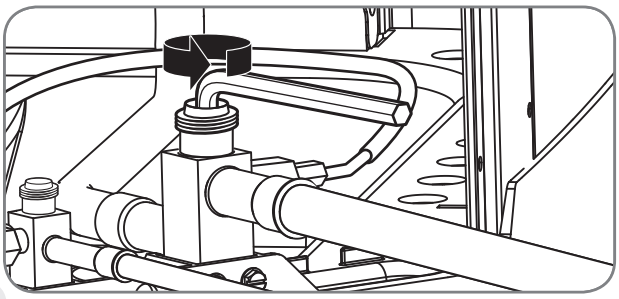
Air or nitrogen in the system increases condensing temperature and pressure, resulting in increased power consumption, erratic operation, and reduced capacity.

Moisture chemically reacts with the refrigerant and oil to form corrosive acid which attacks the compressor motor windings and internal parts and which can result in compressor failure.

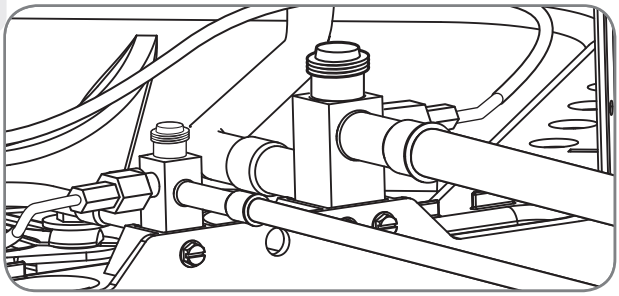


- After the system has been leak-checked and proven sealed, connect the vacuum pump and evacuate system to 500 microns and hold 500 microns or less for at least 15 minutes. The vacuum pump must be connected to both the high and low sides of the system by connecting to the two pressure ports. Use the largest size connections available since restrictive service connections may lead to false readings because of pressure drop through the fittings.

4.0 INSTALLATION



- After adequate evacuation, open both service valves by removing both brass service valve caps with an adjustable wrench. Insert a 3/16” [5 mm] or 5/16” [8 mm] hex wrench into the stem and turn counterclockwise until the wrench stops.



- If not already connected from evacuation process, gauges must be connected at this point to check and adjust charge.

IMPORTANT: Compressors (especially scroll type) should never be used to evacuate the air conditioning system because internal electrical arcing in near vacuum conditions may result in a damaged or failed compressor. Never run a scroll compressor while the system is in a vacuum or compressor failure will occur.

4.8 Final Leak Testing

After the unit has been properly evacuated and service valves opened, a halogen leak detector should be used to detect leaks in the system. All joints and piping within the outdoor unit, evaporator, and interconnecting tubing should be checked for leaks. If a leak is detected, the refrigerant should be recovered before repairing the leak. The Clean Air Act prohibits releasing refrigerant into the atmosphere.

4.9 Control Wiring

⚠WARNING: Turn off electrical power at the fuse box or service panel before making any electrical connections. Also, the ground connection must be completed before making line voltage connections. Failure to do so can result in electrical shock, severe personal injury, or death.

4.9.1EcoNet™ Communications

The EcoNet™enabled (-)A17 Series condensing units are specifically designed to be matched with and EcoNet™enabled air-handler or gas furnace and the EcoNet™Control Center. While they are also designed to be controlled by a conventional 24VAC 2-stage thermostat, many features and benefits are lost.

4.9.2 EcoNet™ Control Center or Thermostat Installation

The EcoNet™ Control Center or thermostat should be mounted 4 to 5 feet above the floor on an inside wall of the living room or a hallway that has good air circulation from the other rooms being controlled by the Control Center or thermostat. It is essential that there be free air circulation at the location of the same average temperature as other rooms being controlled. Movement of air should not be obstructed by furniture, doors, draperies, etc. The Control Center or thermostat should not be mounted where it will be affected by drafts, hot or cold water pipes or air ducts in walls, radiant heat from fireplace, lamps, the sun, T.V. or an outside wall. See instructions packaged with Control Center or thermostat for detailed mounting and installation instructions.

4.9.3 EcoNet™ Communication Wiring Connections

The four 18 AWG low-voltage control wires must be installed from the EcoNet™ Control Center to the indoor unit and from the indoor unit to the outdoor unit.

The wire length between the Control Center and indoor unit should not be greater than 100 feet [30.5 m]. The wire length between the indoor unit and outdoor unit should not be greater than 125 feet [38.1 m].

Running low-voltage wires in conduit with line voltage power wires is not recommended. Low-voltage wiring must be connected to the low voltage pigtails below the control box.

An EcoNet™ communicating system consists of these matched components:

- EcoNet™ communicating outdoor unit.
- EcoNet™ communicating air handler or EcoNet™ communicating furnace.
- EcoNet™ Control Center.

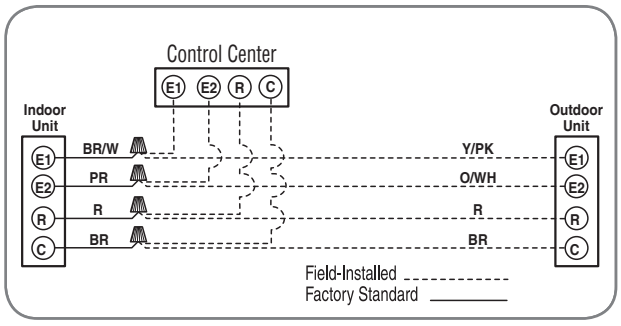
4.9 Control Wiring (cont.)

IMPORTANT: The EcoNet™ control system requires continuous 18 AWG thermostat wire. **DO NOT use phone cord to connect indoor and outdoor units. This will damage the controls.**

The EcoNet™ control system requires four (4) control wires for unit operation:

- R 24 VAC
- C 24 VAC common
- Data wire E1 Communications
- Data wire E2 Communications

The EcoNet™ enabled air handler or furnace is equipped with a 24-volt, 40 or 50 VA transformer for proper system operation. See the wiring diagram below for low voltage wiring connections.



These wires need to be connected to each device (Control Center, indoor air handler or furnace, and outdoor unit).
Once all devices are connected, apply the line voltage to the indoor and outdoor units.
When all devices are powered, the EcoNet™ Control Center should detect the indoor and outdoor units within 45 seconds.
Once the system is powered and all components are communicating with each other, the airflow settings will be automatically configured in the air-handler or furnace.
All adjustments for indoor airflow are made at the EcoNet™ Control Center from this point for variable speed air-handlers and furnaces. Air-flow adjustment on (-)H2T air-handlers must be made by moving the low voltage leads on the motor terminal block. Items that can be changed are for variable speed air-handlers and furnace (except (-)H2T air-handlers) airflow trim adjustment, on-demand dehumidification, cooling and heating airflow and electric heat airflow. The Control Center also has a wide range of fault and history information. To access any of the control center menus press the settings, status, or service icons at the bottom of the touch screen. Refer to the air handler or furnace installation manual and the EcoNet™ Control Center installation manual for further details on setting up the system and available adjustment options.

4.9.4 Conventional 24VAC Thermostat Control Wiring Connections

The (-)A17 series condensing units allow the installer to use conventional 24 VAC control wiring and a conventional 2-stage thermostat.

IMPORTANT: The preferred method for unit installation and operation is by the EcoNet™ Communicating System which allows access to the fault history of the system. This diagnostic information is not available at the thermostat when the (-)A17 unit is using a conventional thermostat.

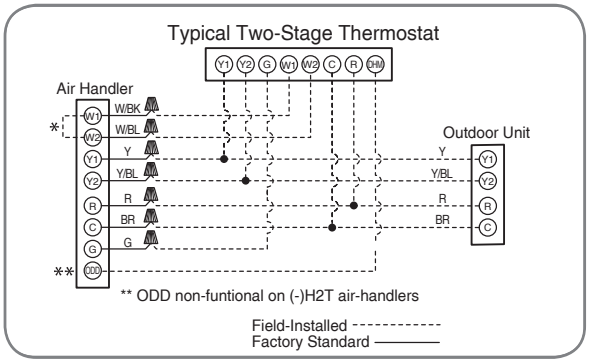
Thermostat control wiring requires a minimum of six (4) wires for proper unit operation:

R - 24 VAC
C - 24 VAC common
Y1 - First-stage cooling operation
Y2 - Second-stage cooling operation

The following figures show the typical control wiring diagram with (-)A17 condensing unit using a conventional 24VAC 2-stage thermostat. The cooling airflow level will need to be adjusted for homeowner comfort once the system is operational. Use DIP switches on the air-handler or furnace control board to adjust indoor air-flow. Speed changes on (-)H2T air-handlers must be made on the motor terminal block.

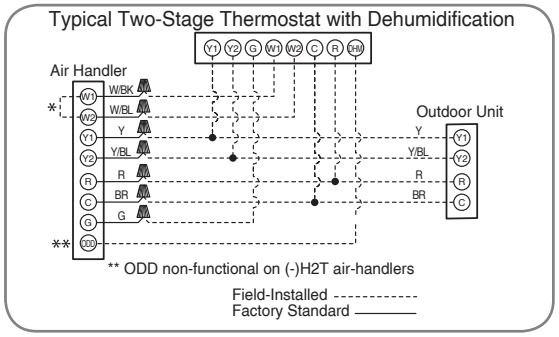
WIRE COLOR CODE		
BK - BLACK	**GR - GREY**	**W - WHITE**
BR - BROWN	**O - ORANGE**	**Y - YELLOW**
BL - BLUE	**PR - PURPLE**	
G - GREEN	**R - RED**	

TYPICAL 2-STAGE THERMOSTAT: (-)A17 AIR CONDITIONER WITH ELECTRIC HEAT USING A TWO-STAGE THERMOSTAT WITH DEHUMIDIFICATION

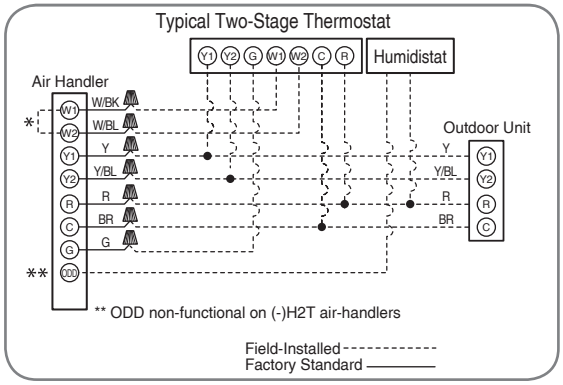


4.9 Control Wiring (cont.)

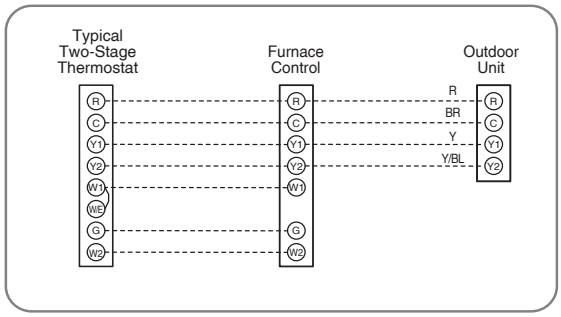
TYPICAL 2-STAGE THERMOSTAT: AIR CONDITIONER WITH ELECTRIC HEAT



TYPICAL 2-STAGE THERMOSTAT: AIR CONDITIONER WITH ELECTRIC HEAT USING A HUMIDISTAT FOR DEHUMIDIFICATION



TYPICAL 2-STAGE THERMOSTAT: AIR CONDITIONER AND FURNACE



Field wiring must comply with the National Electric Code (C.E.C. in Canada) and any applicable local code.

4.10 Power Wiring

4.10 Power Wiring

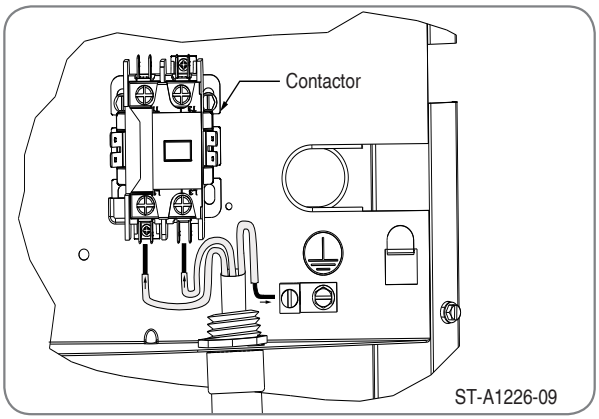
It is important that proper electrical power from a commercial utility is available at the outdoor unit contactor. Voltage ranges for operation are shown below.

VOLTAGE RANGES (60 HZ)

Nameplate Voltage	Operating Voltage Range at Maximum Load Design Conditions for Compressors Copeland
208/230 (1 Phase)	187 - 253

Install a branch circuit disconnect within sight of the unit and of adequate size to handle the minimum circuit capacity (see Section 3.2).

Power wiring must be run in a rain-tight conduit. Conduit must be attached to the hole in the bottom of the control box as shown below.



Connect power wiring to line-voltage lugs on the contactor located in the outdoor unit electrical box. (See wiring diagram attached to unit access panel and above illustration.)

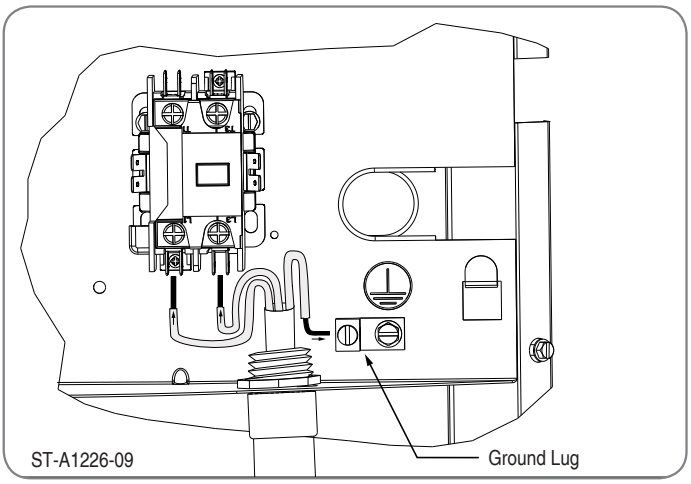
Check all electrical connections, including factory wiring within the unit and make sure all connections are tight.

DO NOT connect aluminum field wire to the contactor terminals.

4.11 Grounding

⚠WARNING: The unit must be permanently grounded. Failure to do so can cause electrical shock resulting in severe personal injury or death.

A grounding lug is provided near the line-voltage power entrance for a ground wire as shown in the above illustration.



5.0 SYSTEM START-UP AND REFRIGERANT CHARGING

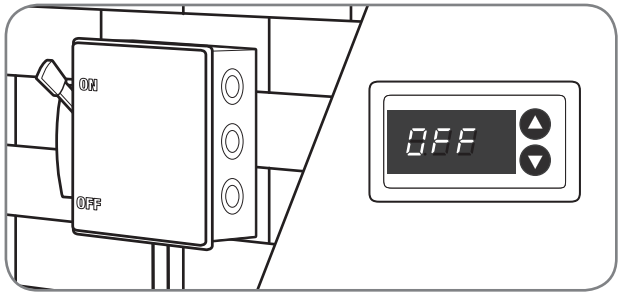
5.1 System Start-Up Overview

Once the system hardware and wiring has been properly installed, the next step is to start the system up, verify indoor air-flow, and adjust the refrigerant charge. To assure optimum comfort, efficiency, and reliability, it is extremely important to follow the procedures in this section to assure the indoor air-flow and refrigerant charge are correct.

5.2 Initial Power-Up and EcoNet™ Communication Verification

After all installation steps have been completed, apply electrical power to the indoor and outdoor units. The EcoNet™ Control Center or thermostat should be switched to the off position initially. Within 45 seconds of power being applied, the EcoNet™ Control Center should detect the indoor and outdoor units. A “0” for Standby Mode will be displayed on the 2-stage Outdoor Control (TSODC).

If the unit is equipped with a crankcase heater, it is recommended to wait at least 12 hours after electrical power is applied to the outdoor unit before starting the compressor to assure any liquid refrigerant inside the compressor has been driven out by the crankcase heater.



5.3 EcoNet™ Control Center Set-Up

Follow the set-up instructions included with the EcoNet™ Control Center prior to starting system. Cooling dehumidification (if applicable) must be disabled for indoor air-flow verification and refrigerant charging. The indoor air-flow trim adjustment (if applicable) should be set to 0% for indoor air-flow verification, but should be adjusted prior to refrigerant charging should the application require an adjustment to the indoor air-flow.

5.4 Initial System Start-Up

Set the EcoNet™ Control Center or 2-stage thermostat several degrees below the room temperature to assure the system will operate at 100% capacity (2nd stage) during indoor air-flow verification and refrigerant charging. Except for applications using an (-)H2T air-handler, check to make sure “On-Demand Dehumidification” is disabled in the EcoNet™ Control Center or the humidity setting is set at maximum humidity in the case of a dehumidifying 24VAC thermostat.

5.0 SYSTEM START-UP AND REFRIGERANT CHARGING

5.5 Indoor Air-Flow Verification

Correct indoor air-flow and proper supply air distribution is critical to system comfort, efficiency and reliability. Excessive indoor air-flow results in elevated humidity levels and excessive air noise. Low indoor air-flow reduces system capacity and can result in coil icing and compressor failure. Correct indoor air-flow must be verified before the refrigerant charge level is finalized.

Confirm the indoor air-flow is at the desired level when the system is operating at maximum capacity (2nd stage). Make the necessary adjustments at the indoor unit if necessary to achieve the desired air-flow level. If the displayed air-flow level on the EcoNet™ Control Center (not applicable for applications with (-)H2T air-handlers) is not reasonably close to the desired indoor air-flow, confirm cooling dehumidification is disabled, the indoor air-flow trim adjustment (not applicable for (-)H2T air-handlers) is set to the desired level (0%, +10% or -10%), and verify the model numbers of the indoor and outdoor units are an approved combination by the manufacturer before making further adjustments.

IMPORTANT: The indoor air-flow for EcoNet™ enabled (-)H2T air-handlers must be manually set by selecting the correct speed taps on the motor terminal block even for applications using the EcoNet™ Control Center. Refer to the (-)H2T installation manual for the procedure for selecting the correct speed tap for the specific application and the procedure for verifying the air-flow level. The indoor air-flow must also be manually selected using dip-switches on the control board of (-)HMV air-handlers and (-)802V, (-)96V, (-)97V, and (-)98V gas furnaces if a conventional 24VAC thermostat is used. The approximate indoor air-flow will be displayed in 100 CFM increments by a flashing LED on the (-)HMV air-handler or furnace control board while the blower is operating (one flash per 100 CFM). Refer to the (-)HMV air-handler or gas furnace installation manual for the location and appropriate dip switch settings.

When the (-)A17 condensing units are matched to EcoNet™ enabled (-)HMV air-handlers or (-)802V, (-)96V, (-)97V, and (-)98V gas furnaces and are controlled by the EcoNet™ Control Center, the indoor air-flow is automatically set to the proper level based on the model data stored in the Two-Stage Outdoor Control (TSODC) memory card. When the indoor blower is operating, the EcoNet™ Control Center will display the indoor CFM in the air-handler or furnace portion of the Status Menu.

5.6 Refrigerant Charging

The refrigerant charge for all systems should be checked against the Charging Chart located inside the access panel cover.

⚠WARNING: The top of the scroll compressor shell is hot. Touching the compressor top may result in serious personal injury.

⚠CAUTION: R-410A pressures are approximately 60% higher (1.6 times) than R-22 pressures. Use appropriate care when using this refrigerant. Failure to exercise care may result in equipment damage or personal injury. Charge for all systems should be checked against the Charging Chart inside the access panel cover.

IMPORTANT: **DO NOT** operate the compressor without charge in the system. Addition of R-410A will raise high-side pressures (liquid and discharge).

NOTICE: System maintenance is to be performed by a qualified and certified technician.

The following method is used for charging the system. All steps listed should be performed to ensure proper charge has been set. For measuring pressures, the service valve ports on the liquid service valve (small valve) and the suction service valve (large valve) are to be used.

The optimum refrigerant charge for any outdoor unit matched with an indoor coil/air handler is affected by the application. Refer to the charging chart inside the access panel cover on the unit and choose the appropriate column for the specific application being installed or serviced. New installations utilizing either an RCF indoor coil installed on a gas furnace or an (-)HMV series air handler in the down flow or horizontal right-hand discharge may require removal of some refrigerant since the factory charge could result in an overcharge condition.

5.0 SYSTEM START-UP AND REFRIGERANT CHARGING

5.6.1 Measurement Device Set-Up

1. With an R-410A gauge set, attach the high-pressure hose to the access fitting on the liquid line (small) service valve at the OD unit.
2. Attach the low-pressure hose to the access fitting on the suction line service valve (large valve) at the outdoor unit.
3. Attach a temperature probe within 6” [15.2 cm] of the outside of the unit on the copper liquid line (small line). For more accurate measurements, clean the copper line prior to measurement and use a calibrated clamp on temperature probe or an insulated surface thermocouple.

5.6.2 Preliminary Charging by Weight

NOTICE: Adjust the system charge by weight for the linear length of the refrigerant line set.

For a new installation, evacuation of interconnecting tubing and indoor coil is adequate; otherwise, evacuate the entire system. Use the factory charge shown in “Electrical and Physical Data” in Section 3.2 of these instructions or on the unit data plate. Note that the charge value includes charge required for 15 ft. [4.6 m] of standard-size liquid line without a filter drier.

Calculate actual charge required with the actual installed liquid line size and length using:

1/4” [6.4 mm] O.D. = .3 oz./ft. [28.3 g/m]

5/16” [7.9 mm] O.D. = .4 oz./ft. [37.7 g/m]

3/8” [9.5 mm] O.D. = .6 oz./ft. [56.7 g/m]

1/2” [12.7 mm] O.D. = 1.2 oz./ft. [113.3 g/m]

Add 6 oz. for field-installed filter drier.

Charge Adjustment = (Line Set (oz./ft.) x Total Length) – Factory Charge for Line Set

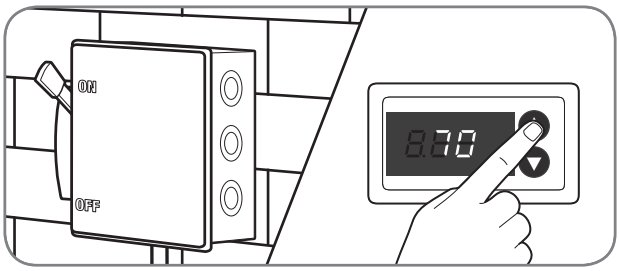
Example: A three ton heat pump unit with factory installed 3/8” liquid service valve requires 75 ft. of line set with a liquid line diameter of 1/2”.

Factory Charge for Line Set = 15 ft. × .6 oz. = 9 oz.

Charge Adjustment = (1.2 oz. × 75 ft.) – 9 oz. =+ 81 oz.

With an accurate scale (+/– 1 oz. [28.3 g]) or volumetric charging device, adjust the refrigerant charge based on the actual line set length. If the entire system has been evacuated, add the total calculated charge.

IMPORTANT: Charging by weight is not always accurate since the application can affect the optimum refrigerant charge. Charging by weight is considered a starting point ONLY. Always check the charge by using the Charging Chart and adjust as necessary. CHARGING BY LIQUID SUBCOOLING PER THE SYSTEM CHARGING CHART MUST BE USED FOR FINAL CHARGE ADJUSTMENT.



IMPORTANT: R-410A is a blending refrigerant of R-32 and R-125 (50/50). These two refrigerants have different saturation curves and therefore change state at different pressures and temperatures. If charge is added to the system in the vapor state, it is possible to have a disproportionate amount of each part of the R-410A blend which will cause unstable and inefficient operation. Therefore, it is critical to add R-410A in the liquid form only!

5.6.3 Preliminary Charging by Pressure (Optional)

1. Following airflow verification and charge weigh-in, run the unit for a minimum of 15 minutes on 2nd stage prior to noting pressures and temperatures.

IMPORTANT: Indoor conditions as measured at the indoor coil must be within 2°F [1.1°C] of comfort conditions per the homeowner’s preference.

NOTICE: If the indoor temperature is above or below this range, run the system to bring the temperature down or run the electric heat/furnace to bring the temperature up to within this range.

2. Note the Outdoor Dry Bulb Temperature, ODDB° = _____°F [_____°C]. Unit charging is recommended under the following outdoor conditions ONLY:

   55°F [12.8°C] outdoor dry bulb and above

3. Locate and note the design pressures. The correct liquid and vapor pressures are found at the intersection of the installed system and the outdoor ambient temperature on the Charging Chart located inside the access panel cover.
   Liquid Pressure: = _____psig; Vapor Pressure = _____psig

5.0 SYSTEM START-UP AND REFRIGERANT CHARGING

NOTICE: The refrigerant pressures provided are for preliminary charge check ONLY. These pressure values are typical, but may vary due to application. Evaporator load will cause pressures to deviate. The values listed are for the correct matched indoor coil ONLY!

4. If the measured liquid pressure is below the listed requirement for the given outdoor and indoor conditions, add charge. If the measured liquid pressure is above the listed requirement for the given outdoor and indoor conditions, remove charge.

5.6.4 Final Charging by Liquid Subcooling

1. After preliminary charging by weight or pressures, find the design subcooling value. The correct subcooling value is found at the intersection of the installed system and the outdoor ambient temperature on the Charging Chart located inside the access panel cover.
   SC° from Charging Chart = _____°F [_____°C].

IMPORTANT: Indoor conditions as measured at the indoor coil are required to be within 2ºF (1.1ºC) of comfort conditions as preferred by the homeowner and must have operated for at least 15 minutes on 2nd stage prior to final charge adjustment. Unit charging is recommended under the following outdoor conditions ONLY:

55°F [12.8°C] outdoor dry bulb and above

NOTICE: If the indoor temperature is above or below the recommended range, run the system to bring the temperature down or run the electric heat/furnace to bring the temperature up.

2. Note the measured Liquid Pressure, Liq Press = _____psig, as measured from the liquid (small) service valve. Use the Temperature Pressure Chart below to note the corresponding saturation temperature for R-410A at the measured liquid pressure. Liquid Saturation Temperature, SAT°= _____°F [_____°C].

3. Note the liquid line temperature, Liq° = _____°F [_____°C], as measured from a temperature probe located within 6” [15.2 cm] outside of the unit on the copper liquid line (small line). It is recommended to use a calibrated clamp-on temperature probe or an insulated surface thermocouple.

4. Subtract the liquid line temperature from the saturation temperature to calculate subcooling.

SAT°_____°F [_____°C] - Liq°_____°F [_____°C] =

SC°_____°F [_____°C]

5. Adjust charge to obtain the specified subcooling value. If the measured subcooling level is below the listed requirement for the given outdoor temperature, add charge. If the measured subcooling level is above the listed requirement for the given outdoor temperature, remove charge.

5.6.5 R-410A Temperature Pressure Chart

SATURATION TEMP (Deg. F) [Deg. C]	R-410A PSIG	SATURATION TEMP (Deg. F) [Deg. C]	R-410A PSIG	SATURATION TEMP (Deg. F) [Deg. C]	R-410A PSIG	SATURATION TEMP (Deg. F) [Deg. C]	R-410A PSIG
-150 [-101]	-	-30 [-34]	17.9	35 [2]	107.5	100 [38]	317.4
-140 [-96]	-	-25 [-32]	22.0	40 [4]	118.5	105 [41]	340.6
-130 [-90]	-	-20 [-29]	26.4	45 [7]	130.2	110 [43]	365.1
-120 [-84]	-	-15 [-26]	31.3	50 [10]	142.7	115 [46]	390.9
-110 [-79]	-	-10 [-23]	36.5	55 [13]	156.0	120 [49]	418.0
-100 [-73]	-	-5 [-21]	42.2	60 [16]	170.1	125 [52]	446.5
-90 [-68]	-	0 [-28]	48.4	65 [18]	185.1	130 [54]	476.5
-80 [-62]	-	5 [-15]	55.1	70 [21]	201.0	135 [57]	508.0
-70 [-57]	-	10 [-12]	62.4	75 [24]	217.8	140 [60]	541.2
-60 [-51]	0.4	15 [-9]	70.2	80 [27]	235.6	145 [63]	576.0
-50 [-46]	5.1	20 [-7]	78.5	85 [29]	254.5	150 [66]	612.8
-40 [-40]	10.9	25 [-4]	87.5	90 [32]	274.3		
-35 [-37]	14.2	30 [-1]	97.2	95 [35]	295.3		

5.7 Completing Installation

- Disconnect the hoses from the pressure ports Replace the pressure port caps and tighten adequately to seal caps. **DO NOT overtighten.**
- Replace the service valve top caps finger-tight and then tighten with a wrench to adequately seal caps. **DO NOT overtighten.**
- Replace control box cover and service panel and install screws to secure panels.
- Restore power to unit at disconnect if required.
- Exit Charging Mode and configure EcoNet™ Control Center or thermostat per the thermostat installation instructions and set to desired mode and temperature.

6.0 SEQUENCE OF OPERATION

6.1 Cooling Mode

When the EcoNet™ Control Center or 2-stage conventional 24VAC thermostat calls for the 1st stage of cooling, the outdoor fan motor is energized and the 1st stage of the compressor and indoor blower motor are energized. The system then provides cooling and dehumidification for the conditioned space. If the Control Center or thermostat calls for the 2nd stage of cooling, the compressor shifts to the 2nd stage of capacity and the indoor blower motor speeds up to the 2nd stage of air-flow. The system will cycle between the 1st and 2nd stages as directed by the Control Center or thermostat. When the call for cooling has ended or the thermostat is switched to the OFF position, the compressor and outdoor fan motor are de-energized, but the indoor blower motor continues to operate for 30 – 45 seconds to extract the residual cooling capacity in the cold indoor coil before it stops.

6.2 On-Demand Cooling Dehumidification

The EcoNet™ Control Center can be configured for On-Demand Dehumidification for applications with an EcoNet™ enabled air-handler or gas furnace with a variable speed ECM motor. The On-Demand Dehumidification feature is not available on the (-)H2T air-handlers. On-Demand Dehumidification allows the system to automatically increase the level of dehumidification in the cooling mode by decreasing the indoor air-flow by 15% when the indoor relative humidity measured at the EcoNetTM Control Center rises above the set-point. Once the relative humidity drop to the set-point, the indoor air-flow level returns to normal.

7.0 COMPONENTS & CONTROLS

7.1 Compressor

Copeland Ultratech 2-stage scroll compressors are used in all (-)A17 condensing units. The 2nd capacity stage is activated by a DC signal that energizes an internal solenoid which shifts the compressor to full capacity. The 24VAC Y2 signal from the thermostat is rectified to DC current by the 2-Stage Outdoor Control (TSODC), providing the DC output to the low voltage terminals on the compressor.

7.2 Compressor/Fan Motor Capacitor

3 ton models utilize a dual capacitor for the compressor and PSC outdoor fan motor. 2, 4, and 5 ton models utilize a single capacitor since they have ECM outdoor fan motors that do not require a capacitor.

7.3 Compressor Contactor

All models utilize a single-pole contactor to control the compressor.

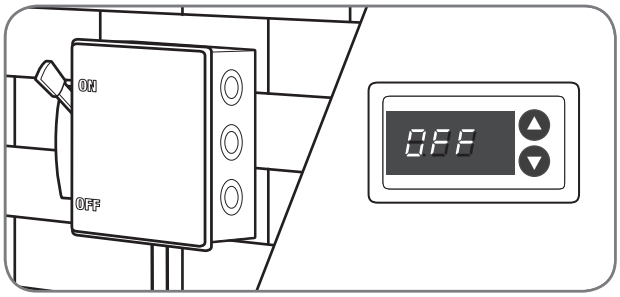
7.4 Compressor Crackcase Heat (CCH)

While scroll compressor usually do not require crankcase heaters, there are instances when a heater should be added. Refrigerant migration during the off cycle can result in a noisy start up.
Add a crankcase heater to minimize any start up noise or bearing “wash out”

NOTE: A crankcase heater should be installed if:

- They system charges exceeds the values listed in the adjacent tables,

They system is subject to low voltage variations or



- When a low ambient control is used for system operation below 55°F.

All heaters are located on the lower half of the compressor shell. Its purpose is to drive refrigerant from the compressor shell during long off cucles, thus preventig damage to the compressor during start-up.
At initial start-up or after extended shutdown periods, make sure the heater is energized for at least 12 hours before the compressor is started.
(Disconnect sweitch is on and wall thermostat is off.)

Model Number	Compressor Model Number	Charge Limit Without Crankcase Heat
(-)A1724AJ*	ZPS20K5E-PFV-130	9.6 lbs.
(-)A1736AJ*	ZPS30K5E-PFV-130	9.6 lbs.*
(-)A1748AJ*	ZPS40K5E-PFV-130	12 lbs.*
(-)A1760AJ*	ZPS49K5E-PFV-130	12 lbs.*

*Crankcase Heater Factory Installed

7.5 EcoNet™ 2-Stage Outdoor Control

All models are equipped with a EcoNet™ enabled 2-Stage Outdoor Control (TSODC) that interfaces with the inverter, EcoNet™ Control Center, and EcoNet™ enabled air-handler or gas furnace using the EcoNet™ serial communication protocol. The TSODC provides connections for various sensors, controls, and outdoor fan motor. It also has a dual 7-segment LED for displaying status and fault codes. Buttons are provided for navigating the control menu and to initiate and terminate various test modes. A plug-in memory card provides model specific information (model data) necessary for proper unit operation and parameters for the correct indoor air-flow.

7.5.1 TSODC Features and Connections (See Fig 1)

- Displays status and diagnostic codes (see Status and Diagnostic Description)
- Displays diagnostic/fault recall (see section 10.1)

⚠CAUTION: UNIT MAY START SUDDENLY AND WITHOUT WARNING.
Solid red light indicates a thermostat call for unit operation is present at the TSODC control. TSODC control will attempt to start unit after short cycle timer expires or when in Active Protection mode will attempt to restart unit prior to Lockout mode.

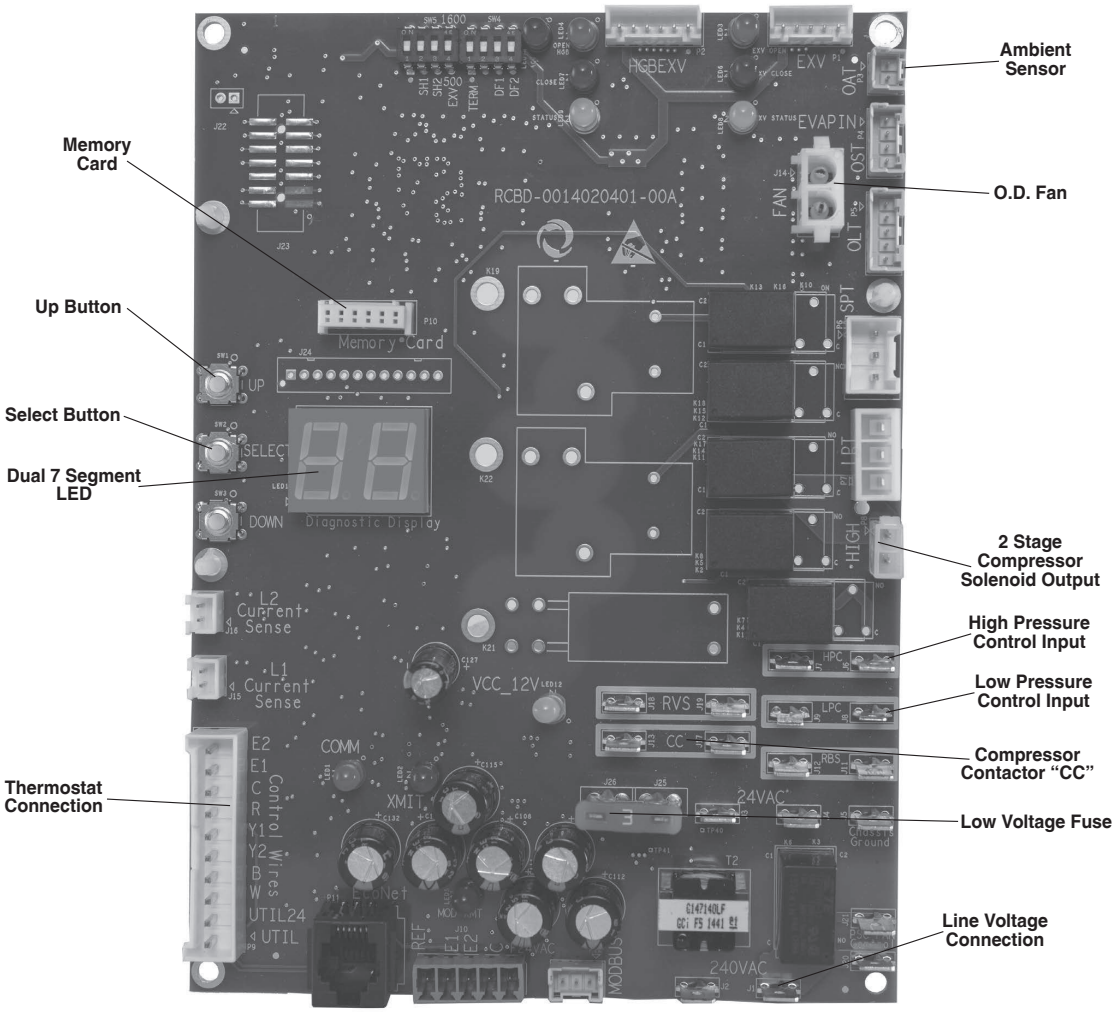
Line Voltage Connector

- Line voltage is connected to control board at terminals 208/230 VAC

Thermostat Connector (P9)

- R-24VAC from the indoor unit 24VAC transformer (40 VA minimum)

Figure 1. EcoNet™ 2-Stage Outdoor Control



7.5 EcoNet™ 2-Stage Outdoor Control (TSODC) (cont.)

- C- 24VAC Common from the indoor unit 24VAC transformer
- E- 1 Data: System Communications Line 1
- E- 2 Data: System Communications Line 2

Low Volt Fuse

- If required replace with 3 A automotive ATC style blade fuse

Low Pressure Control (LPC Input)

- Low-pressure control is factory installed
- Low-pressure control is an automatic resetting device

High Pressure Control (LPC Input)

- High-pressure control is factory installed
- High-pressure control is an automatic resetting device

Ambient Temperature Sensor (included with all applications)

- Included with all applications

Up and Select Buttons

- Up and Select buttons used to enter Test and Fault Recall Mode

Memory Card

- The memory card stores all unit information.
- The unit information is called model data.
- The shared data is all the information needed for proper unit operation.

7.5.2 Overview of TSODC Operation

Installation Verification

- 24V AC power must be present at the R and C terminals on the control board for it to operate
- Line voltage must be present at the control for the compressor and the outdoor fan to operate.
- The 7 segment LED displays a “0” for standby mode. Standby mode indicates line voltage and 24VAC are present at the control and there is not a command for unit operation from the EcoNet™ Control Center or Thermostat.

Zero (0) displayed
The unit is in standby

Command for Compressor Operation

- The control has an on/off fan delay of one (1) second for each stage of cooling.
- The control ignores the low pressure control for the first 90 seconds of compressor operation.
- The dual 7-segment LED displays five (5) operational status codes.

1) First Stage Cooling Operation

When the control received a command for first stage cooling operation, a low case “c” is displayed on the dual 7-segment LEDs.

Low case “c” indicates first stage cooling operation

2) Second Stage Cooling Operation

When the control received a command for second stage cooling operation, a upper case “C” is displayed on the dual 7-segment LEDs.

Upper case “C” indicates second stage cooling operation

5-minute Anti-Short Cycle Timer

- The control has a built in 5-minute time delay between cooling cycles to protect the compressor against short cycling. The 7-segment LED will flash “c” or “C” while the short cycle timer is active and a command for unit operation is received.

Flashing low case c
A command for first stage cooling has been received

Flashing upper case C
A command for second stage cooling has been received

- The 5-minutes time delay can be bypassed when a command for compressor operation is present by pressing the UP button. The compressor will begin operation and the 7-segment LED will stop flashing.

7.0 COMPONENTS & CONTROLS

7.5 EcoNet™ 2-Stage Outdoor Control (TSODC) (cont.)

30 Second Minimum Run Time

- The control has a built in minimum unit run time. If a command for compressor operation is received and the command is removed within 30 seconds, the compressor will continue to operate until the 30 second minimum run time has been satisfied. The 7-segment LED will flash “c” or “C” while the minimum run time is active.

1 Second Compressor/Fan Delay

- The control starts/stops the outdoor fan motor one (1) second after the start/stop of the compressor upon a command for compressor operation to minimize current inrush and/or voltage drop.

7.5.3 Control Board Replacement

Each control board in the EcoNet™ Communication Network needs information specific to the unit the control is installed in. This information is called model data because it is model specific information required for the communication network to operate properly for the specific model installed. The data for a unit contains information that allows the unit to operate correctly. When a control board requires replacement, it is important that the replacement board gets the model data from the old control. The primary way the replacement control gets this information is by the memory card that should be installed on the old control. Remove the memory card from the old control, replace the control, and reinstall the memory card on the new control. The memory card from a different unit should never be used.

NOTE: See links to training and service manuals at MyRheem.com or MyRuud.com, or contact the wholesale distributor selling this unit.

7.6 High and Low Pressure Controls

HPC and LPC are factory installed on (-)A17**AJ2CB. These controls keep the compressor from operating in pressure ranges which can cause damage to the compressor. Both controls are in the low-voltage control circuit.

The high-pressure control (HPC) is an automatic reset type which opens near 610 PSIG [4206 kPa] and closes near 420 PSIG [2896 kPa].

The low-pressure control (LPC) is an automatic reset which opens near 50 PSIG [345 kPa] and closes near 95 PSIG [655 kPa].

⚠CAUTION: The compressor has an internal overload protector. Under some conditions, it can take up to 2 hours for this overload to reset. Make sure overload has had time to reset before condemning the compressor.

7.0 COMPONENTS & CONTROLS

7.7 Outdoor Ambient Temperature Sensor

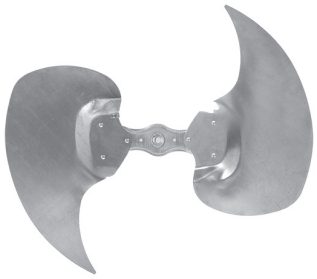
The outdoor ambient temperature is sensed by a thermistor located directly underneath the control box where it is shielded from direct sunlight. The thermistor leads plug into the connector marked OAT on the 2-Stage Outdoor Control (TSODC).The outdoor ambient temperature is utilized by the TSODC and EcoNet™ Control Center for several control functions and is displayed on the EcoNet™ Control Center.

7.8 Outdoor Fan Blade

All models are equipped with a swept fan blade design that provides improved efficiency and quieter operation than conventional fan blade designs.

7.9 Outdoor Fan Motor

2, 4, and 5 ton models feature single speed ECM outdoor fan motors that operates at a speed determined by a PWM signal from the 2-stage outdoor control. The specific speed for each model is programmed into the outdoor control memory card at the factory. A standard single-speed PSC motor is used on 3 ton model.



8.0 ACTIVE COMPRESSOR PROTECTION

- If the EcoNet™ 2-Stage Outdoor Control detects an operating condition that could be harmful to the compressor, it will shut the compressor off to protect it and will lock the compressor out if the harmful condition persists. This feature is referred to as Active Compressor Protection.
- Harmful operating conditions for the compressor include low suction pressure, high discharge pressure, high compressor current level, and low line voltage conditions.
- Fault codes are displayed on the dual 7-segment display located on the outdoor unit control. Faults are also displayed on the EcoNet™ Control Center if one is being used to control the system.

IMPORTANT: The prefered method of unit installation is with the EcoNet™ communication system. The EcoNet™ communication system allows access to the fault history of the system. This diagnostic information is not available at the thermostat when a conventional 24VAC thermostat is used.

- When the condition causing the lock-out condition is resolved, the control can be manually reset to restart the system.
- To reduce nuisance lock-outs, the control will not lock the compressor out until the same fault occurs 3 times during a call for operation.
- A list of fault codes is provided in Section 10.2 of the Diagnostics Section of this manual which includes those for Active Compressor Protection.
- If the dual 7-segment LED's on the control are displaying an alternating fault code and the letter "L", the compressor has been locked out due to the fault and requires a manual reset for the system to restart.
- **Exiting Active Protection Compressor Lock-Out**
  There are 2 options for resetting the control after an active compressor protection lock-out.
  1. Cycle 24VAC to the control by removing the wires connected to the R or C terminals on the control or cycling the power to the indoor air-handler or furnace.
  2. Push the TEST button down with an insulated probe for 1 second and release.

WARNING: The control will attempt to start the unit immediately when the TEST button is pushed and released.

9.0 ACCESSORIES

⚠WARNING: Turn off electric power at the fuse box or service panel before making any electrical connections while installing accessories. Failure to do so can result in electrical shock, severe personal injury, or death.

⚠CAUTION:
SINGLE POLE COMPRESSOR CONTACTOR (CC):
Single pole contactors are used on all single-phase units. Caution must be exercised when servicing as only one leg of the power supply is broken with the contactor.

9.1 Low Ambient Kit (Part. No. RXAD-A08)

This component senses compressor head pressure and shuts the outdoor fan off when the head pressure drops to approximately 250 PSIG [1724 kPa]. This allows the unit to build a sufficient head pressure at lower outdoor ambient (down to 0ºF [-18ºC]) in order to maintain system balance and obtain improved capacity. Low ambient control should be used on all equipment operated below 70ºF [21ºC] ambient.

9.2 Hard Start Kit (Part. No. SK-A1)

Start components are not usually required with the scroll compressor used in (-)A17 condensing units, but are available for special cases and where starts components are desirable to reduce light dimming. Also, see the interconnecting tubing section of this manual to see if the application requires start components.

9.3 Compressor Crankcase Heater

2 Ton Models:
44-17402-44 (without outdoor temperature thermostat) or
44-101884-08 (with outdoor temperature thermostat)

Note: 3 - 5 ton models have factory installed crankcase heaters

9.4 Compressor Sound Enclosure

2 & 3 Ton Models:
68-23427-26
4 & 5 Ton Models:
68-25217-10

10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.1 Test and Fault Recall Modes

10.1.1 Test Mode (Test Button on the TSODC)

- Enter TEST mode by pressing the UP button with an insulated probe for five (5) seconds and release.
- The TEST mode causes the following:
  1) Resets the TSODC from any active protection lockout mode.
  2) Reset the 4-minute anti-short cycle timer.
  3) Energizes the unit without a command for unit operation.
- If the 4-minute anti-short cycle timer or 30 second minimum run time is active (a flashing "c" or "C" is displayed on the dual 7-segment LEDs) and a command for unit operation is present, TEST mode causes:
  1) A "c" to display momentarily on the dual 7-segment display.
  2) The compressor will start and the outdoor fan will operate.
  3) The display will change to a steady "c" or "C" to show the current command for unit operation.

NOTE: If a command for unit operation is present at the end of TEST mode will cause the unit to continue to operate.

- If no command for unit operation is present, TEST mode causes the following:
  1) A steady "c" appears on the dual 7-segments LEDs.
  2) The compressor will start.
  3) The compressor will turn off after 5-seconds.

  NOTE: Entering TEST mode without a command for unit operation will cause the compressor to run 5-seconds.

10.1.2 Fault Recall Mode

- Enter **FAULT RECALL** mode by pressing the **UP** and **SELECT** buttons at the same time with insulated probes for five (5) seconds and release.
- FC is displayed for fault history. Press **SELECT** to show most recent fault. Continue to press **UP** to show other alarms.
- Each fault is displayed with the most recent fault displayed first.
- A maximum of six individual faults can be stored.
- A "0" will be displayed with no faults are stored.
- The TSODC will automatically exit the **FAULT RECALL** mode after displaying stored faults.

IMPORTANT: The preferred method of unit installation is with the EcoNet™ communication system. The EcoNet™ communication system allows access to the fault history of the system. This diagnostic information is not available at the thermostat when a conventional 24VAC thermostat is used.

10.1.3 Clearing Fault History (UP and SELECT Buttons)

- Clear FAULT HISTORY by pressing both UP and SELECT button for five (5) seconds with insulated probes and release.
- The top and bottom segments of the dual 7-segment LED flash to indicate the history has been cleared.

NOTE: The memory card for the system has specific model data for this system. For the system data fault D1, reference the label on the memory card.

10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.2 Status and Diagnostic Codes

Descriptions of the EcoNet™ 2-Stage Control diagnostic codes are provided below:

Dual 7-Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause - Trouble-shooting Information
	0 - Standby No command for unit operation	Normal Operation
	c - First Stage Cooling Unit has received a command for first stage cooling	Normal Operation
 **FLASHING**	c - Anti-short cycle timer (3 minutes) or Minimum run timer (30 seconds) active	• The unit as received a command for first stage cooling during and active anti-short cycle timer or minimum run timer. • Wait until unit timer has expired or press the TEST button to defeat short cycle delay.
	C - Second Stage Cooling Unit has received a command for second stage cooling	Normal Operation
 **FLASHING**	C - Anti-short cycle timer (3 minutes) or minimum run timer (30 seconds) active	• The unit as received a command for second stage cooling during and active anti-short cycle timer or minimum run timer. • Wait until unit timer has expired or press the TEST button to defeat short cycle delay.
	4 - Compressor Locked Rotor The Outdoor Control series high compressor current due to locked rotor condition	• Check for miswired, failed or wrong capacitor • Check for broken wires, loose connections, or miswired compressor • Check compressor windings for continuity • Check for seized compressor
 **FLASHING**	4L - Active Protection Locked Rotor Lockout	• Check for miswired, failed or wrong capacitor • Check for broken wires, loose connections, or miswired compressor • Check compressor windings for continuity • Check for seized compressor
	5 - Protector Trip A command for compressor operation is present but no current is measured to the compressor	• Motor protector open • Line voltage disconnected

10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.2 Status and Diagnostic Codes (cont.)

Descriptions of the EcoNet™ 2-Stage Control diagnostic codes are provided below:

Dual 7-Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause - Trouble-shooting Information
	5L - Active Protection Protector Trip The Outdoor Control has had a protector trip for longer than 4 hours or has tripped 3 times during a call for cooling.	• Check for damaged, miswired, or wrong run capacitor • Check for broken wires, loose connectors, or miswired compressor • Check compressor windings for continuity • Check for open compressor internal protector
	6 - Compressor Open Start Circuit The Outdoor Control detects current in the Run circuit but not in the Start circuit of the compressor	• Check for damaged, miswired, or wrong run capacitor • Check for broken wires, loose connectors, or miswired compressor • Check compressor windings for continuity
	6L - Active Protection Compressor Open Start Circuit Lockout The Outdoor Control detects loss of current in the Run circuit three (3) times in one cooling call	• Check for damaged, miswired, or wrong run capacitor • Check for broken wires, loose connectors, or miswired compressor • Check compressor windings for continuity • Check for compressor locked rotor
 **FLASHING**	9 - Active Protection - Line Voltage Brown Out	The Outdoor Control has sensed line voltage has dropped below 175V and has shut the compressor off for 5 minutes. If line voltage is above 187V after 5 minutes, the compressor is allowed to start.
	21 - Low Pressure Control Open The Outdoor Control detects the LPC is open. Note: The low pressure control is ignored for the first 90 seconds of compressor operation	• Units has low refrigerant charge • Indoor coil is frozen (cooling mode) • Dirty indoor coil or filter (cooling mode) • Indoor blower is not running (cooling mode) • Outdoor coil is frozen (heating mode) • Expansion valve is not operating correctly
 **FLASHING**	21L - Active Protection Low Pressure Lockout	LPC has opened 3 times in the same call for cooling operation, the Outdoor Control has locked out the compressor to protect it. Outdoor Control alternately flashes L and 21

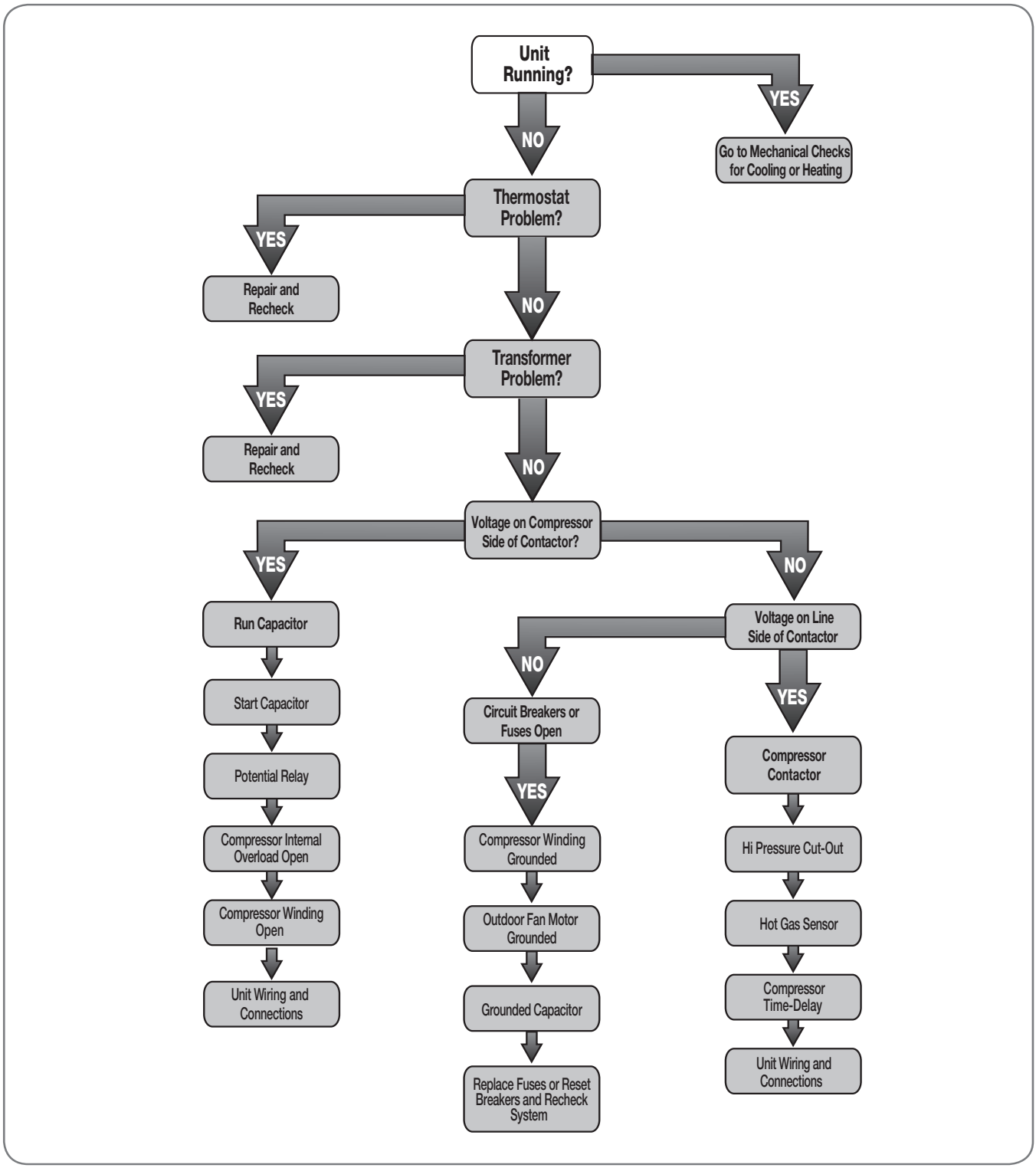
10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.2 Status and Diagnostic Codes

Descriptions of the EcoNet™ 2-Stage Control diagnostic codes are provided below:

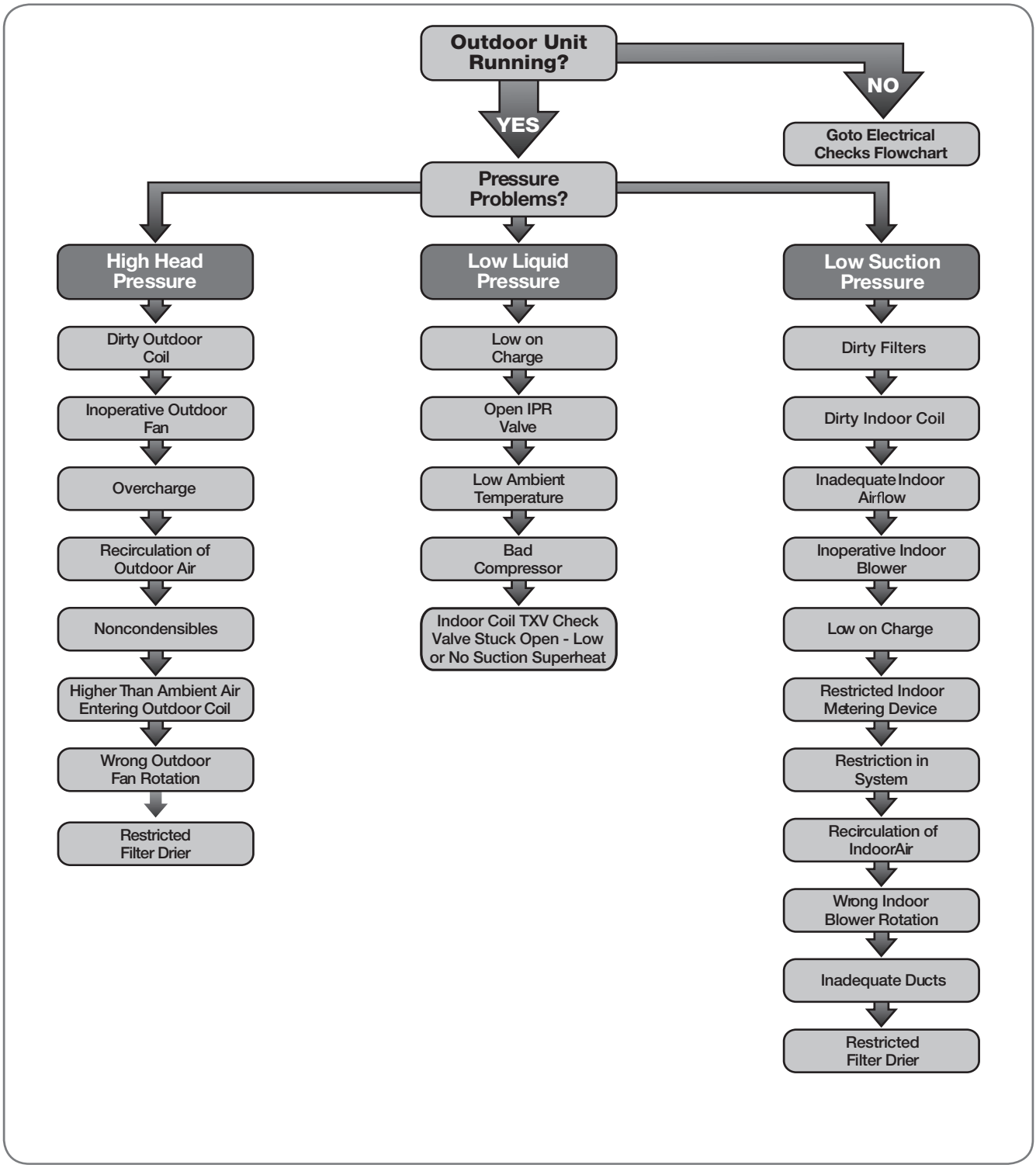
Dual 7-Segment LEDs Display Code	Diagnostic Description	Status/Possible Cause - Trouble-shooting Information
	29 - High Pressure Control Open The Outdoor Control detects the HPC is open	• Outdoor coil is dirty (cooling mode) • Outdoor fan is not running (cooling mode) • Dirty indoor coil or filter (heating mode) • Indoor blower is not running (heating mode) • Liquid line restriction • Excessive refrigerant charge
 **FLASHING**	29L - Active Protection High Pressure Control Trip	HPC has opened 3 times in the same cooling operation, the Outdoor Control has locked out the compressor to protect it. Outdoor Control alternately flashes L and 29
	48 - Open Run Circuit or No Compressor Current	• Check to ensure power to compressor is correct • Check capacitor
	49 - Compressor Current with No Call For Cooling	• Check for welded contactor contacts • Check for shorted wires
	84 - Outdoor Ambient Temperature Fault The sensor detects an abnormally low or high outdoor ambient temperature	• Check unit placement - If the outdoor units is in a high temperature area, wait until the ambient temperature drops and check sensor reading. • Replace the sensor • Check if sensor is installed correctly on Outdoor Control
	93 - Internal Control Fault The control is not functioning properly	• Check Outdoor Control for proper system operation • Replace Outdoor Control
	d1 - No Shared Data	• Replace memory card with correct system information.

10.3 Electrical Checks Flowchart



10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.4 Cooling Mechanical Checks Flowchart



10.5 Checking Temperature Sensors

TEMPERATURE SENSORS:

The outdoor temperature sensor/thermistor uses a scale of 10,000 Ohms at 77ºF (25ºC). This means, a sensor exposed to 77ºF will show a resistance of 10,000 Ohms +/- 1%. As the temperature decreases, the resistance increases. Alternatively, as the temperature increases, the resistance decreases.

Measurements will be made with the sensor disconnected from the control board. Again, comparing the results must be done against a calibrated tester.

A glass of water, mixed completely with ice chips and given several minutes to settle should measure 32 to 32.4ºF.

Apply resistance measurements to the chart found below and compare to the control.

32º will have a resistance +/- 1% of 32,650 Ohms.

In the event Celsius is being used, the Fahrenheit temperature will need to be converted.

*ºC = (ºF - 32) * 5 / 9*

Example using 82ºF

*ºC = (82 - 32) * 5 / 9*

*ºC = (50) * 5 / 9*

ºC = 250 / 9

ºC = 27.8

Temp F°	Ohms	Temp F°	Ohms	Temp F°	Ohms	Temp F°	Ohms
0	85,378	33	31,738	66	13,138	99	5,961
1	82,710	34	30,855	67	12,811	100	5,827
2	80,135	35	30,000	68	12,493	101	5,697
3	77,649	36	29,171	69	12,184	102	5,570
4	75,249	37	28,376	70	11,883	103	5,446
5	72,931	38	27,589	71	11,591	104	5,326
6	70,693	39	26,834	72	11,307	105	5,208
7	68,531	40	26,103	73	11,031	106	5,094
8	66,442	41	25,394	74	10,762	107	4,982
9	64,475	42	24,706	75	10,501	108	4,873
10	62,475	43	24,039	76	10,247	109	4,767
11	60,592	44	23,393	77	10,000	110	4,663
12	58,771	45	22,766	78	9,760	111	4,562
13	57,012	46	22,158	79	9,526	112	4,464
14	55,311	47	21,568	80	9,298	113	4,368
15	53,667	48	20,996	81	9,077	114	4,274
16	52,077	49	20,441	82	8,862	115	4,183
17	50,540	50	19,902	83	8,651	116	4,094
18	49,054	51	19,379	84	8,448	117	4,007
19	47,616	52	18,872	85	8,250	118	3,922
20	46,225	53	18,379	86	8,056	119	3,839
21	44,880	54	17,902	87	7,868	120	3,758
22	43,578	55	17,438	88	7,685	121	3,679
23	42,318	56	16,987	89	7,507	122	3,602
24	41,099	57	16,550	90	7,333	123	3,527
25	39,920	58	16,125	91	7,164	124	3,453
26	38,778	59	15,713	92	7,000	125	3,382
27	37,672	60	15,312	93	6,839	126	3,312
28	36,602	61	14,923	94	6,683	127	3,243
29	35,566	62	14,545	95	6,531	128	3,177
30	34,563	63	14,178	96	6,383	129	3,112
31	33,591	64	13,822	97	6,238	130	3,048
32	32,650	65	13,475	98	6,098		

10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.6 General Troubleshooting Guide

⚠WARNING: Disconnect all power to unit before servicing. Contactor may break only one side. Failure to shut off power can cause electrical shock resulting in personal injury or death.

SYMPTOM	POSSIBLE CAUSE	REMEDY
Unit will not run	• Power off or loose electrical connection • Thermostat out of calibration - set too high • Defective control board • Blown fuses/tripped breaker • Transformer defective • High-pressure control lock-out • Low-pressure control lock-out • Miswiring of communications (communication light on continuously)	• Check for correct voltage at line voltage connections in condensing unit. • Reset • Check control board diagnostic codes • Replace fuses/reset breaker • Check wiring. Replace transformer • Reset by cycling power to unit. Also see high head and low suction pressure remedies. • Check for refrigerant leaks. • Check communication wiring.
Outdoor fan runs, compressor doesn't	• Run or start capacitor defective • Contactor defective • Loose connection • Compressor stuck, grounded or open motor winding, open internal overload. • Low-voltage condition	• Replace • Replace • Check for the correct voltage at compressor. Check and tighten all connections. • Wait at least 3 hours for overload to reset. If still open, replace the compressor. • Add start kit components.
Insufficient cooling	• Improperly sized unit • Improper indoor airflow • Incorrect refrigerant charge • Air, noncondensibles, or moisture in system • Bad ID EXV or TXV	• Recalculate load • Check. Should be approximately 400 CFM per ton • Charge per procedure attached to unit service panel • Recover refrigerant. Evacuate and recharge. Add filter drier • Replace EXV or TXV
Compressor short cycle	• Incorrect voltage • Defective overload protector • Refrigerant undercharge or undercharge (HPC or LPC cycling)	• At compressor terminals, voltage must be 10% of nameplate marking when unit is operating. • Replace. Check for correct voltage • Add refrigerant
Registers sweat	• Low indoor airflow	• Increase speed of blower or reduce restriction. • Replace air filter.
High head, low suction pressure	• Restriction in liquid line, expansion device, or filter drier • Bad EXV or TXV	• Remove or replace defective component. • Verify thermistor and pressure transducer connection and operation • Replace EXV or TXV
High head, high or normal suction pressure - Cooling mode	• Dirty outdoor coil • Refrigerant overcharge • Outdoor fan not running • Air or noncondensibles in system	• Clean coil • Correct system charge • Repair or replace • Recover refrigerant. Evacuate and recharge
Low head, high suction pressure	• EXV in bypass mode or TXV Check valve stuck open • Bad compressor	• Verify thermistor and pressure transducer connection and operation • Replace EXV or TXV • Replace compressor
Low suction, cool compressor, iced indoor coil	• Low indoor airflow • Operating below 65oF outdoors • Moisture in system • Restricted indoor coil circuit	• Increase speed of blower or reduce restriction. Replace air filter • Add Low Ambient Kit • Recover refrigerant. Evacuate and recharge. Add filter drier • Repair or replace indoor coil
High suction pressure	• Excessive load • Defective compressor	• Recheck load calculation • Replace
Fluctuating head and suction pressure	• EXV or TXV hunting • Air or noncondensibles in system	• Check thermistor to suction line connection • Check air distribution on coil • Check suction thermistor and pressure transducer and operation • Recover refrigerant. Evacuate and recharge. • Remove and confirm EXV movement. Clean EXV inside with nitrogen to remove any debris then reinstall
Gurgle or pulsing noise at expansion device or liquid line	• Air or noncondensibles in system • Undercharged System	• Recover refrigerant. Evacuate and recharge • Adjust charge per charging chart

10.7 Service Analyzer Chart (cont.)

COMPRESSOR OVERHEATING		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK/REMEDY**
High superheat (greater than 15ºF [8.3ºC] at coil)	Low charge	Check system charge
	Verify suction thermistor operation	Replace thermistor
	Verify pressure transducer operation input and output voltage	Replace transducer and/or harness and/or control board
	Faulty metering device (EXV or TXV)	Foreign matter stopping flow. Clean EXV or TXV inside with nitrogen
	High internal load	Hot air (attic) entering return
		Heat source on; miswired or faulty control
	Restriction in liquid line	Drier plugged
		Line kinked
	Low head pressure	Low charge
		Operating in low ambient temperatures
	Suction or liquid line subjected to high heat source	Hot attic / insulate liquid line and suction line
		Hot water line / isolate from suction or liquid line
Low line voltage	Loose wire connection	Check wiring
	Power company problem	Report problem
	Undersized wire feeding unit	Correct and complete diagnosis
High line voltage	Power company problem	Report problem
High head pressure	Overcharge	Check system charge
	Dirty outdoor coil	Clean coil
	Faulty or wrong size outdoor fan motor	Replace fan motor. Check capacitor
	Faulty fan blade or wrong rotation	Replace fan blade
		Replace with correct rotation motor
	Recirculation of air	Correct installation
	Additional heat source	Check for dryer vent near unit
		Check for recirculation from other equipment
	Noncondensibles	Recover refrigerant. Evacuate and recharge system
	Equipment not matched	Correct mismatch
Short cycling or compressor	Cycling or faulty pressure control	Check pressure and address cause of high or low pressure. Replace pressure control if faulty
	Loose wiring	Check unit wiring
	Thermostat	Located in supply air stream
		Differential setting too close
		Customer misuse
	EXV or TXV restricted	Internal foreign matter. Clean with nitrogen
		Pressure transducer failure
		Suction thermistor or sensing bulb failure
		EXV control failure
		EXV coil failure
		Distributor tube/tubes restricted
		TXV equalizer tube plugged

10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.7 Service Analyzer Chart (cont.)

COMPRESSOR OVERHEATING (Cont.)		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK OR REMEDIES**
Short cycling of compressor (cont.)	Distributor tube	Restricted with foreign matter
		Kinked
		I.D. reduced from previous compressor failure
	Low charge	Check system charge
	Low evaporator airflow	Dirty coil
		Dirty filter
		Duct too small or restricted
	Faulty run capacitor	Replace capacitor
	Faulty internal overload	Replace compressor
Faulty compressor	Fast equalization/Low pressure difference	Replace compressor and examine system to locate reason
ELECTRICAL		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK OR REMEDIES**
Voltage present on load side of compressor contactor and compressor won't run	Compressor starts components	Check start capacitor
		Check potential relay
	Run capacitor	Check with ohmmeter
	Internal overload	Allow time to rest
	Compressor windings	Check for correct ohms
Voltage present on line side of compressor contactor only	Thermostat	Check for control voltage to contactor coil
	Compressor control circuit	High-pressure switch
		Low-pressure switch
		Ambient thermostat
		Solid-state protection control or internal thermal sensor
		Compressor timed off/on control or interlock
No voltage on line side of compressor contactor	Blown fuses or tripped circuit breaker	Check for short in wiring or unit
	Improper wiring	Recheck wiring diagram
Improper voltage	High voltage	Wrong unit
		Power supply problem
	Low voltage	Wrong unit
		Power supply problem
		Wiring undersized
		Loose connections
FLOODED STARTS		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK OR REMEDIES**
Liquid in the compressor shell	Faulty or missing crankcase heater	Replace crankcase heater
Too much liquid in system	Incorrect piping	Check piping guidelines
	Overcharge	Check and adjust charge

10.7 Service Analyzer Chart (cont.)

CONTAMINATION		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK/REMEDY**
Moisture	Poor evacuation on installation or during service	In each case, the cure is the same. Recover refrigerant. Add filter drier, evacuate and recharge
High head pressure	Noncondensibles air	
Unusual head and suction readings	Wrong refrigerant or mixed refrigerants	
Foreign matter - copper filings	Copper tubing cuttings	
Copper oxide	Dirty copper piping or nitrogen not used when brazing	
Welding scale	Nitrogen not used during brazing	
Soldering flux	Adding flux before seating copper partway	
Excess soft solder	Wrong solder material	
LOSS OF LUBRICATION		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK/REMEDY**
Compressor failures	Line tubing too large	Reduce pipe size to improve oil return
Low suction pressure	Low charge	Check system charge
	Refrigerant leaks	Repair and recharge
Cold, noisy compressor - Slugging	Dilution of oil with refrigerant	Observe piping guidelines
Noisy compressor	Migration	Check crankcase heater
Cold, sweating compressor	Flooding	Check system charge
Low load	Reduced airflow	Dirty filter
		Dirty coil
		Wrong duct size
		Restricted duct
	Thermostat setting	Advise customer
Short cycling of compressor	Cycling or faulty high or low-pressure control	Check pressures and address cause of any abnormal pressure. Replace control if faulty
	Loose wiring	Check all control wires
	Thermostat	In supply air stream, out of calibration
		Customer misuse
SLUGGING		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK/REMEDY**
On start-up	Incorrect piping	Review pipe size guidelines
TXV hunting when running	Fault TXV	Replace TXV

10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.7 Service Analyzer Chart (cont.)

FLOODING		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK OR REMEDIES**
Poor system control using an EXV	Bad pressure reading	Check pressure transducer wiring. Replace bad transducer or wire harness
	Suction thermistor in wrong location	Relocate thermistor
	Bad suction thermistor	Replace thermistor
	Improper superheat setting (less than 5ºF [2.8ºC])	Adjust EXV SH setpoint dipswitches and validate valve operation
ELECTRONIC EXPANSION VALVES		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK OR REMEDIES**
High superheat, Low suction pressure (superheat over 15ºF [8.3ºC])	Moisture freezing and blocking EXV	Recover charge, install filter-drier, evacuates system, recharge
	Dirt or foreign material blocking EXV	Recover charge, install filter-drier, evacuates system, recharge
	Low refrigerant charge	Correct the charge
	Vapor bubbles in liquid line	Remove restriction in liquid line. Correct the refrigerant charge
		Remove noncondensible gases
		Size liquid line correctly
	Undersized EXV	Replace with correct EXV
	Incorrect sensing suction line temperature	Verify suction thermistor resistance is correct and properly attached and insulated to the suction line
	Suction thermistor incorrectly calibrated	Replace suction thermistor assembly
	Suction pressure measured incorrectly	After verifying lack of connectivity, replace the pressure transducer or harness
		If harness has a short, replace harness If gauge pressure measurement and the converted voltage reading at the control are different replace the control
	EXV is stuck	Remove EXV from the system and purge with nitrogen, replace filter drier and recharge
		If EXV will not open, validate EXV wiring harness and rotor resistance between the black wire and the other 4 wires
		If none of the above rectifies the issue, replace EXV and filter drier and recharge
	EXV control board on air-handler control board	Verify 5Vdc to pressure transducer is present. If not, replace EXV control board on air-handler control board
	High superheat adjustment	Charge the superheat offset dip switches to lower superheat

10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.7 Service Analyzer Chart (cont.)

ELECTRONIC EXPANSION VALVES		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK OR REMEDIES**
EXV feeds too much refrigerant, with low superheat, with low superheat and higher than normal suction pressure	EXV control dc circuit failed	Verify 5Vdc to pressure transducer is present, if not, replace EXV controller
	High superheat adjustment	Change the superheat offset dip switches to increase superheat
	Moisture causing valve to stick open	Recover refrigerant, replace filter-drier, evacuate system and recharge
	Dirt or foreign material causing valve to stick open	Recover refrigerant, replace filter-drier, remove EXV and purge with nitrogen, evacuate system and recharge
		If EXV is completely clogged, use the EXV control to open the EXV, and purge with nitrogen, replace filter drier, and recharge
	Oversized EXV	Install correct EXV
	Incorrect suction thermistor location	Install suction thermistor with the provided stainless steel strap and an additional zip tie between the 10:00 and 2:00 position on suction line, and insulate
	Low superheat adjustment	Change the superheat offset dip switches to increase superheat
	Incorrect sensing suction line temperature	Verify suction thermistor resistance is correct and properly attached and insulated to the suction line
	Suction thermistor incorrectly calibrated	Replace suction thermistor assembly
	Suction pressure measured incorrectly	After verifying lack of connectivity, replace the pressure transducer or harness
		If harness has a short, replace harness
		If gauge pressure measurement and the converted voltage readings at the control are different replace pressure transducer
		If gauge pressure measurement and the converted voltage readings at the control are the same, replace the control
Compressor flood back upon start-up	Refrigerant drained from flooded evaporator	Install trap riser to the top of the elevator coil
	Inoperable crankcase heater or crankcase heater needed	Replace or add crankcase heater
	Any of the causes listed under symptoms of electrical problem in section 10.3	Any of the solutions listed under solutions of electrical problems in section 10.3
Superheat is low to normal with low suction pressure	Unequal evaporator circuit loading	Ensure airflow is equally distributed through evaporator
		Check for blocked distributor tubes
	Low load or airflow entering evaporator coil	Ensure blower is moving proper air-flow
		Remove/correct any airflow restriction

10.0 DIAGNOSTICS AND TROUBLESHOOTING

10.7 Service Analyzer Chart (cont.)

FLOODING		
SYMPTOM	**POSSIBLE CAUSE**	**CHECK OR REMEDIES**
Superheat and suction pressure fluctuate (EXV is hunting)	Oversized EXV	Install correct EXV
	Unequal refrigerant flow through evaporator circuit	Ensure suction line thermistor is in correct location in a clean section of copper pipe
	Moisture freezing and partially blocking EXV	Recover refrigerant, change filter-drier, evacuate system and recharge
TXV does not regulate at all	External equalizer line not connected or line plugged	Connect equalizer line in proper location, or remove any blockage
	Sensing bulb lost its operating charge	Replace TXV
	Valve body damaged during soldering or by improper installation	Replace the TXV

10.8 Troubleshooting Tips

COOLING MODE TROUBLESHOOTING TIPS					
SYSTEM PROBLEM	**INDICATORS**				
	DISCHARGE PRESSURE	**SUCTION PRESSURE**	**SUPERHEAT Normal: 5°-15°F [2.8°-8.3°C]**	**SUBCOOLING Normal: See Charging Chart**	**COMPRESSOR AMPS**
Overcharge	High	High	Low	High	High
Undercharge	Low	Low	High	Low	Low
Liquid Restriction (Filter Drier)	Low	Low	High	High	Low
Low Indoor Airflow	Low	Low	Low	Low	Low
Dirty Outdoor Coil	High	High	Low	Low	High
Low Outdoor Ambient Temperature	Low	Low	High	High	Low
Inefficient Compressor	Low	High	High	High	Low
Indoor TXV Sensing Bulb Charge Lost or Bad Thermistor	Low	Low	High	High	Low
Poorly Insulated Indoor TXV Sensing Bulb or Thermistor. Bad Thermistor.	High	High	Low	Low	High

11.0 OUTDOOR UNIT MAINTENANCE

11.1 Outdoor Coil Cleaning

The outdoor fan draws air across the coil during operation which results in contaminants collecting on and between the aluminum fins. These contaminants restrict the air-flow through the coil resulting in reduced capacity and efficiency and increases the temperature of the components that can reduce their life. Therefore, it is recommended that the outdoor coil be cleaned at least annually by a qualified service technician using a non-corrosive coil cleaner and low pressure water hose sprayer. Care must be taken not to damage or flatten out the fins by spraying the fins from an angle. Washing from the top of the coil down from the inside out is the most effective method of cleaning the coil. The exterior louver panels and unit top are easily removable to facilitate the coil cleaning task.

⚠ **WARNING:** Disconnect electrical power to the unit before removing the top panel or any electrical panel as the fan motor could start at any time and live electrical connections will be exposed.

11.2 Cabinet Cleaning and Care

Annual cleaning of the exterior cabinet is recommended using a mild detergent, water, and cloth/sponge to remove dust, mold, and potentially corrosive contaminants that have collected on the cabinet. It is also recommended to apply a good quality automotive wax to the painted metal cabinet parts annually to protect the finish and to restore the gloss of the paint. **DO NOT** apply wax to the plastic parts.

11.3 Motor Lubrication

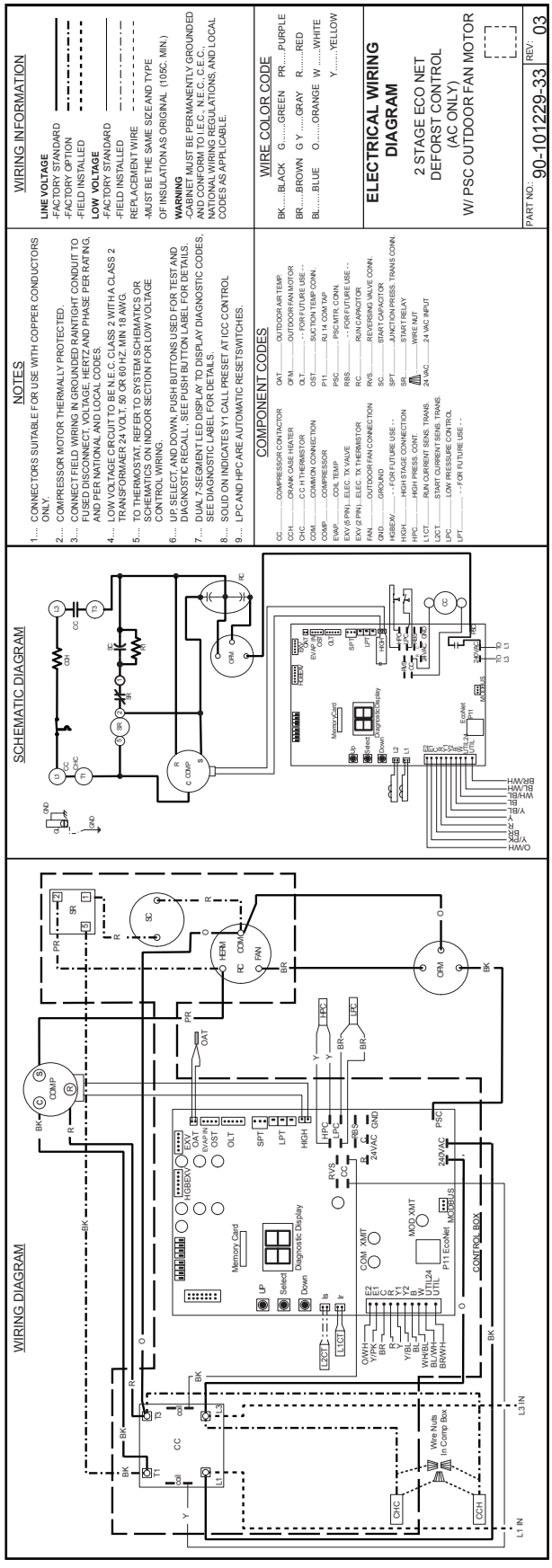
The ball bearings in the outdoor motor are pre-lubricated by the motor manufacturer and do not have oiling ports. The motor will run for an indefinite period of time without additional lubrication.

11.4 Replacement Parts

Any replacement part used to replace parts originally supplied on equipment must be the same as or an approved alternate to the original part supplied. The manufacturer will not be responsible for replacement parts not designed to physically fit or operate within the design parameters the original parts were selected for.

12.0 WIRING DIAGRAM

12.1: 2, 4 and 5 Ton Models - ECM Fan Motor



Wiring Diagram

12.0 WIRING DIAGRAM

12.2: 3 Ton Models - PSC Fan Motor