LENNOX
Service Literature

INSTALLATION AND SERVICE PROCEDURE

XP21

Corp. 1031-L7
Revised August 2018

Dave Lennox *Signature*® Collection XP21 Series Units

iComfort®
So simple. So smart. So comfortable.

NOTICE

A thermostat is not included and must be ordered separately.

- A Lennox communicating thermostat must be used in communicating applications.
- In non-communicating applications, the Lennox ComfortSense® 7500 thermostat may be used, as well as other non-communicating thermostats.

In all cases, setup is critical to ensure proper system operation.

Field wiring examples for non-communicating applications begin on page 72.

See the thermostat ***Quick Start Guide*** for communicating and partial communicating field wiring connections.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can cause personal injury, loss of life, or damage to property.

Installation and service must be performed by a licensed professional installer (or equivalent) or a service agency.

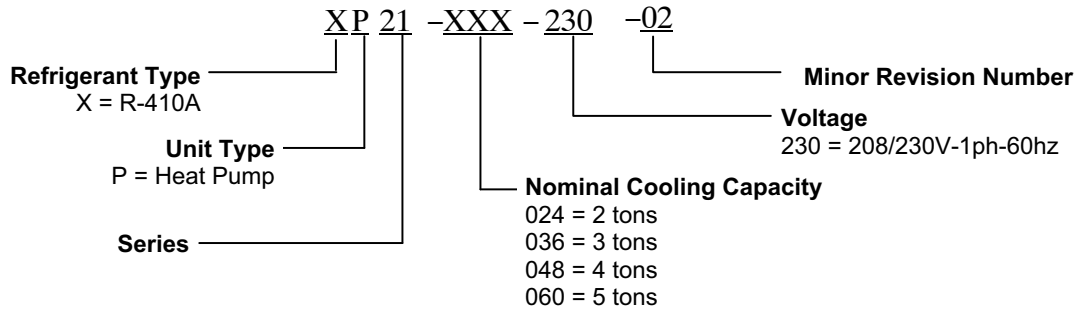
⚠ IMPORTANT

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFCs, HCFCs AND HFCs) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration may be levied for noncompliance.

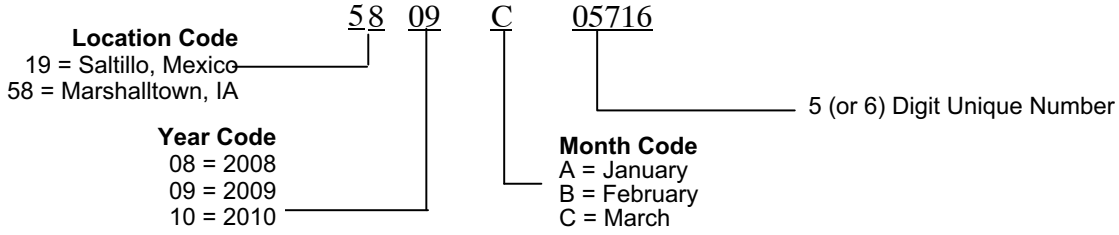
TABLE OF CONTENTS

I. OVERVIEW

Model Number identification



Typical Serial Number Identification



Specifications

Model Number	Unit		Outdoor Fan	
	Sound Rating Number (dB)[1]	Factory Refrigerant Charge[2]	Number of Blades	Diameter - inches.
XP21-024-230-01, -02, -03, -04, -05	67	11 lbs. 0 oz.	5	26.1
XP21-024-230-06	67	10 lbs. 10 oz.	5	26.1

Model Number	Unit		Outdoor Fan	
	Sound Rating Number (dB)[1]	Factory Refrigerant Charge[2]	Number of Blades	Diameter - inches.
XP21-036-230-01, -02, -03, -04	72	11 lbs. 0 oz.	5	26.1
XP21-036-230-05	72	10 lbs. 10 oz.	5	26.1

Model Number	Sound Rating Number (dB)[1]	Factory Refrigerant Charge[2]	Number of Blades	Diameter - inches.
XP21-048-230-01, -02, -03	73	14 lbs. 0 oz.	5	26.1
XP21-048-230-04	73	13 lbs. 0 oz.	5	26.1
XP21-048-230-05	73	12 lbs. 10 oz.	5	26.1

Model Number	Sound Rating Number (dB)[1]	Factory Refrigerant Charge[2]	Number of Blades	Diameter - inches.
XP21-060-230-01, -02, -03	73	14 lbs. 4 oz.	5	26.1
XP21-060-230-04	73	13 lbs. 2 oz.	5	26.1
XP21-060-230-05	73	12 lbs. 12 oz.	5	26.1

[1] Tested according to AHRI Standard 270-2008 test conditions.

[2] Refrigerant charge sufficient for 15 feet length of refrigerant lines.

Electrical Data

208/230V-60 Hz-1 Ph

Model Number	Unit		Compressor		Condenser Fan			
	Maximum Over-current Protection (amps)[1]	Minimum Circuity Ampacity[2]	Rated Load Amps (RLA)	Locked Rotor Amps (LRA)	Motor HP	Nominal RPM 1-Stage	Nominal RPM 2-Stage	Full Load Amps (FLA)
XP21-024-230-01, -02, -03, -04, -05	25	14.9	10.3	51.0	1/3	430	500	2.0
XP21-024-230-05, -06	25	16.6	11.7	58.0	1/3	430	500	2.0

208/230V-60 Hz-1 Ph

Model Number	Unit		Compressor		Condenser Fan			
	Maximum Over-current Protection (amps)[1]	Minimum Circuity Ampacity[2]	Rated Load Amps (RLA)	Locked Rotor Amps (LRA)	Motor HP	Nominal RPM 1-Stage	Nominal RPM 2-Stage	Full Load Amps (FLA)
XP21-036-230-01, -02, -03	35	22.9	16.7	82.0	1/3	525	600	2.0
XP21-036-230-04, -05	35	21.1	15.3	83.0	1/3	525	600	2.0

208/230V-60 Hz-1 Ph

Model Number	Unit		Compressor		Condenser Fan			
	Maximum Over-current Protection (amps)[1]	Minimum Circuity Ampacity[2]	Rated Load Amps (RLA)	Locked Rotor Amps (LRA)	Motor HP	Nominal RPM 1-Stage	Nominal RPM 2-Stage	Full Load Amps (FLA)
XP21-048-230-01, -02, -03	45	28.5	21.2	96.0	1/3	600	675	2.0
XP21-048-230-04, -05	45	28.5	21.2	104.0	1/3	600	675	2.0

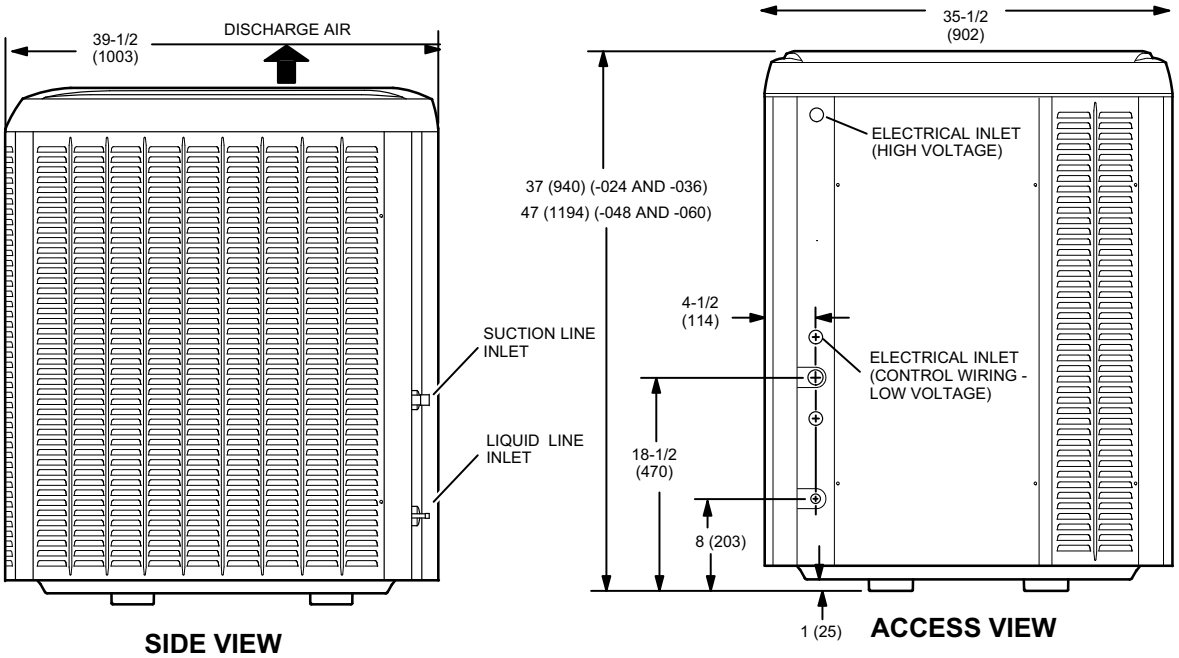
208/230V-60 Hz-1 Ph

Model Number	Unit		Compressor		Condenser Fan			
	Maximum Over-current Protection (amps)[1]	Minimum Circuity Ampacity[2]	Rated Load Amps (RLA)	Locked Rotor Amps (LRA)	Motor HP	Nominal RPM 1-Stage	Nominal RPM 2-Stage	Full Load Amps (FLA)
XP21-060-230-01	50	34.1	25.7	118.0	1/3	625	700	2.0
XP21-060-230-02, -03	50	30.9	23.1	118.0	1/3	625	700	2.0
XP21-060-230-04, -05	60	38.0	28.8	153.0	1/3	625	700	2.0

[1] HACR type circuit breaker or fuse.

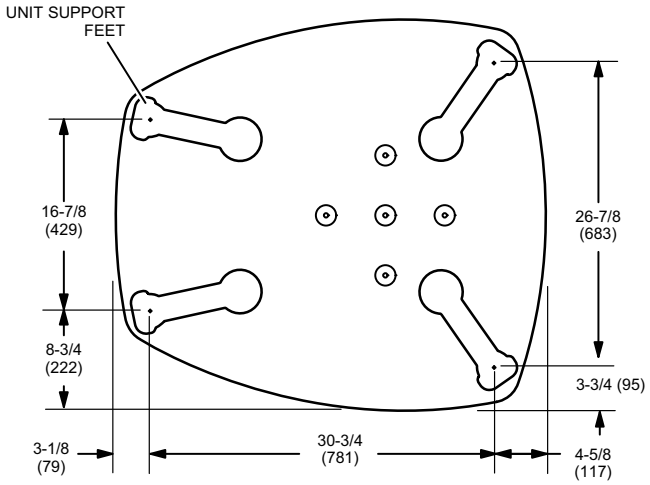
[2] Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

Unit Dimensions -- Inches (mm)



SIDE VIEW

ACCESS VIEW



BASE WITH ELONGATED LEGS

Typical Unit Parts Arrangement

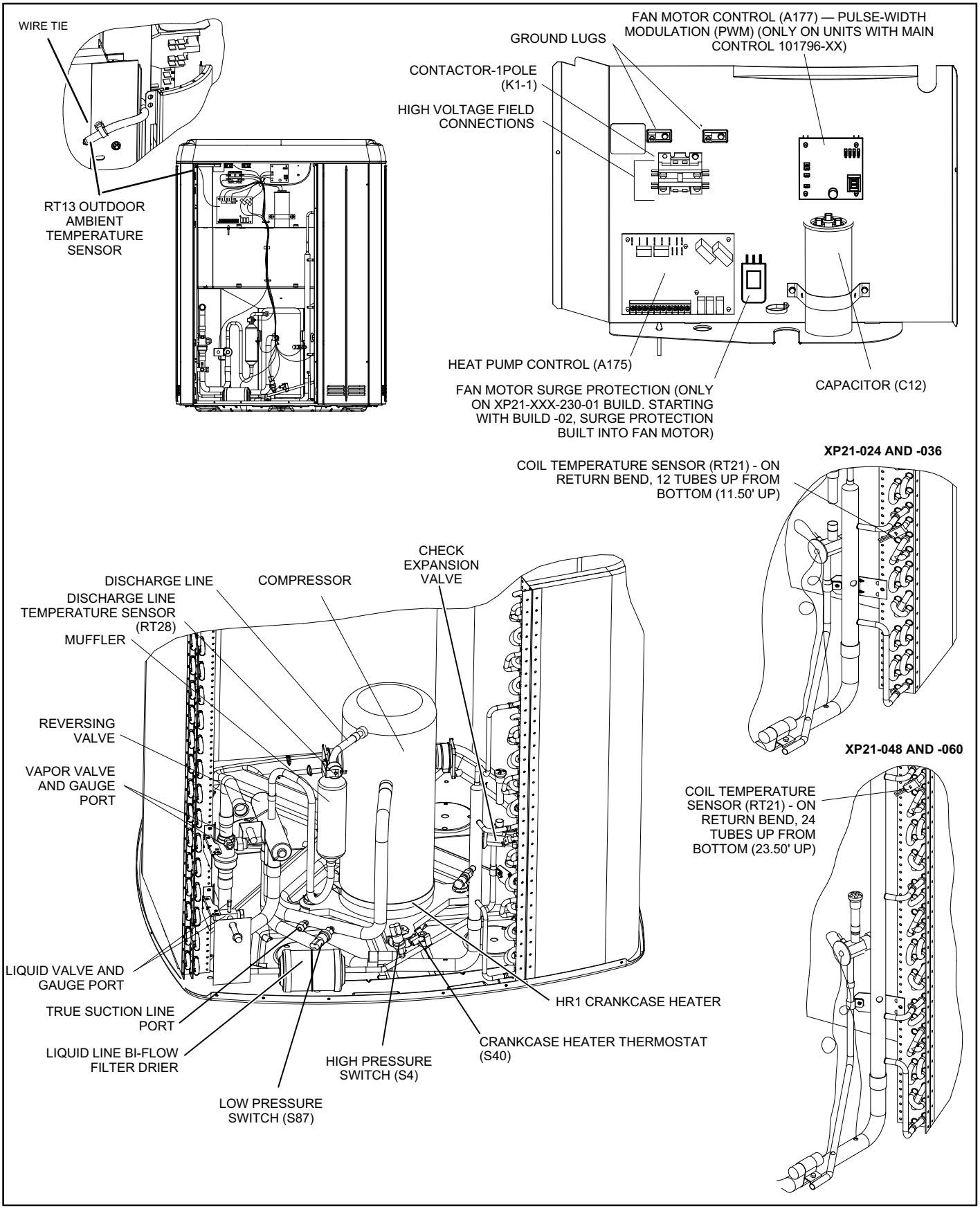


Figure 1. Plumbing, Switches and Sensor Components

⚠ IMPORTANT

This unit must be matched with an indoor coil as specified in Lennox' Product Specification bulletin. Coils previously charged with HCFC-22 must be flushed.

⚠ CAUTION

As with any mechanical equipment, contact with sharp sheet metal edges can result in personal injury. Take care while handling this equipment and wear gloves and protective clothing.

⚠ WARNING

Electric Shock Hazard. Can cause injury or death. Unit must be grounded in accordance with national and local codes.

Line voltage is present at all components when unit is not in operation on units with single-pole contactors. Disconnect all remote electric power supplies before opening access panel. Unit may have multiple power supplies.

Operating Gauge Set

These instructions are intended as a general guide and do not supersede local codes in any way. Consult authorities who have jurisdiction before installation.

TORQUE REQUIREMENTS

When servicing or repairing HVAC components, ensure the fasteners are appropriately tightened. Table 1 lists torque values for fasteners.

⚠ IMPORTANT

Only use Allen wrenches of sufficient hardness (50Rc - Rockwell Harness Scale minimum). Fully insert the wrench into the valve stem recess.

Service valve stems are factory-torqued (from 9 ft-lbs for small valves, to 25 ft-lbs for large valves) to prevent refrigerant loss during shipping and handling. Using an Allen wrench rated at less than 50Rc risks rounding or breaking off the wrench, or stripping the valve stem recess.

See the Lennox Service and Application Notes #C-08-1 for further details and information.

⚠ IMPORTANT

To prevent stripping of the various caps used, the appropriately sized wrench should be used and fitted snugly over the cap before tightening.

Table 1. Torque Requirements

Parts	Recommended Torque	
Service valve cap	8 ft.- lb.	11 NM
Sheet metal screws	16 in.- lb.	2 NM
Machine screws #10	28 in.- lb.	3 NM
Compressor bolts	90 in.- lb.	10 NM
Gauge port seal cap	8 ft.- lb.	11 NM

USING MANIFOLD GAUGE SET

When checking the system charge, only use a manifold gauge set that features low loss anti-blow back fittings.

Manifold gauge set used with HFC-410A refrigerant systems must be capable of handling the higher system operating pressures. The gauges should be rated for use with pressures of 0 - 800 psig on the high side and a low side of 30” vacuum to 250 psig with dampened speed to 500 psi. Gauge hoses must be rated for use at or up to 800 psig of pressure with a 4000 psig burst rating.

OPERATING SERVICE VALVES

The liquid and vapor line service valves are used for removing refrigerant, flushing, leak testing, evacuating, checking charge and charging.

Each valve is equipped with a service port which has a factory-installed valve stem. Figure 2 provides information on how to access and operating both angle and ball service valves.

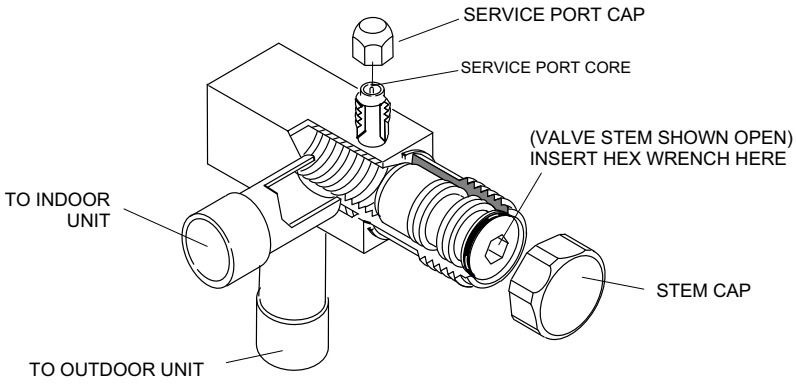
General

The XP21 is a high efficiency residential split-system heat pump unit, which features a two-stage scroll compressor and HFC-410A refrigerant. Units are available in 2, 3, 4 and 5-ton sizes. The series is designed for use with an expansion valve only (approved for use with HFC-410A) in the indoor unit.

SERVICE VALVES ANGLE AND BALL

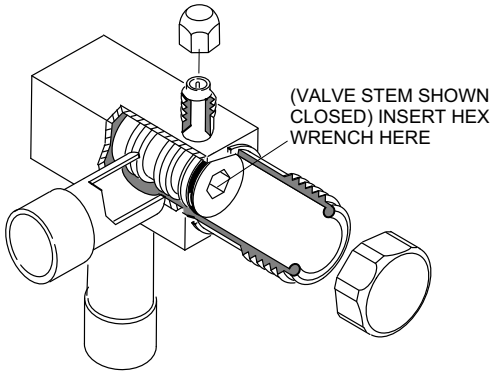
Operating Angle Type Service Valve:

1. Remove stem cap with an appropriately sized wrench.
2. Use a service wrench with a hex-head extension (3/16" for liquid line valve sizes and 5/16" for vapor line valve sizes) to back the stem out counterclockwise as far as it will go.



ANGLE-TYPE SERVICE VALVE (BACK-SEATED OPENED)

When service valve is **OPEN**, the service port is open to linE set, indoor and outdoor unit.

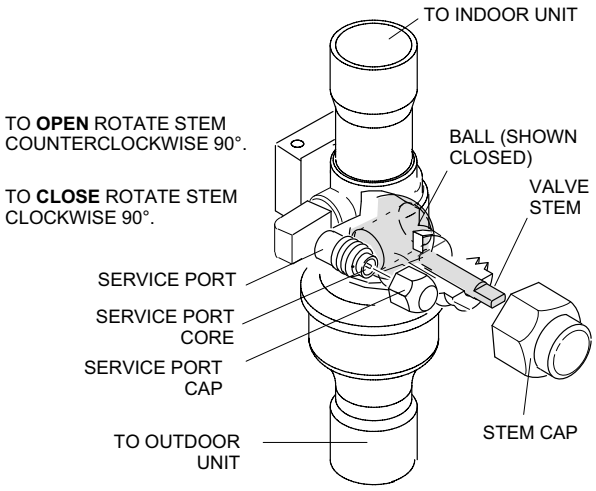


ANGLE-TYPE SERVICE VALVE (FRONT-SEATED CLOSED)

WHEN SERVICE VALVE IS **CLOSED**, THE SERVICE PORT IS OPEN TO THE LINE SET AND INDOOR UNIT.

Operating Ball Type Service Valve:

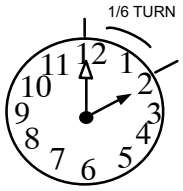
1. Remove stem cap with an appropriately sized wrench.
2. Use an appropriately sized wrenched to open. To open valve, rotate stem counterclockwise 90°. To close, rotate stem clockwise 90°.



To Access Service Port:

A service port cap protects the service port core from contamination and serves as the primary leak seal.

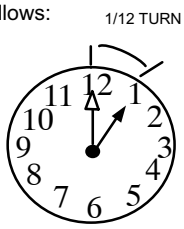
1. Remove service port cap with an appropriately sized wrench.
2. Connect gauge set to service port.
3. When testing is completed, replace service port cap and tighten as follows:
   - With torque wrench: Finger tighten and torque cap per table 1.
   - Without torque wrench: Finger tighten and use an appropriately sized wrench to turn an additional 1/6 turn clockwise.



Reinstall Stem Cap:

Stem cap protects the valve stem from damage and serves as the primary seal. Replace the stem cap and tighten as follows:

- With Torque Wrench: Finger tighten and then torque cap per table 1.
- Without Torque Wrench: Finger tighten and use an appropriately sized wrench to turn an additional 1/12 turn clockwise.



NOTE — A label with specific torque requirements may be affixed to the stem cap. If the label is present, use the specified torque.

Figure 2. Angle and Ball Service Valves

101796-XX Jumpers, Loop and Terminals

HEAT PUMP CONTROL — TWO STAGE

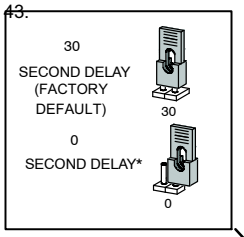
TABLE 2 ON PAGE 9 PROVIDES ADDITIONAL INFORMATION CONCERNING JUMPERS, LINKS, AND CONNECTIONS FOR THE HEAT PUMP CONTROL.

THE OUTDOOR CONTROL PART NUMBER IDENTIFICATION IS LOCATED HERE.

E37

COMPRESSOR SHIFT DELAY

NOTE — ON OUTDOOR CONTROL PART NUMBERS 101796-04 AND LATER FAN CYCLING IS ON WHEN JUMPER IS SET TO 0 SECOND DELAY. FOR MORE INFORMATION ON THE FAN CYCLING FEATURE SEE PAGE 43.



DS11 and DS14
LED ALERT CODES

E33
USED FOR CONFIGURING CONTROL OR CLEARING LOCKOUTS (SEE FIGURE 9 FOR DESCRIPTION OF VARIOUS FUNCTIONS)

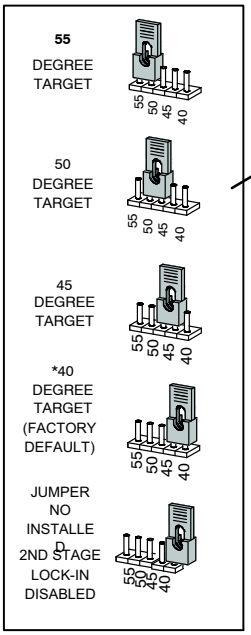
DS13 and DS15
LED ALERT CODES

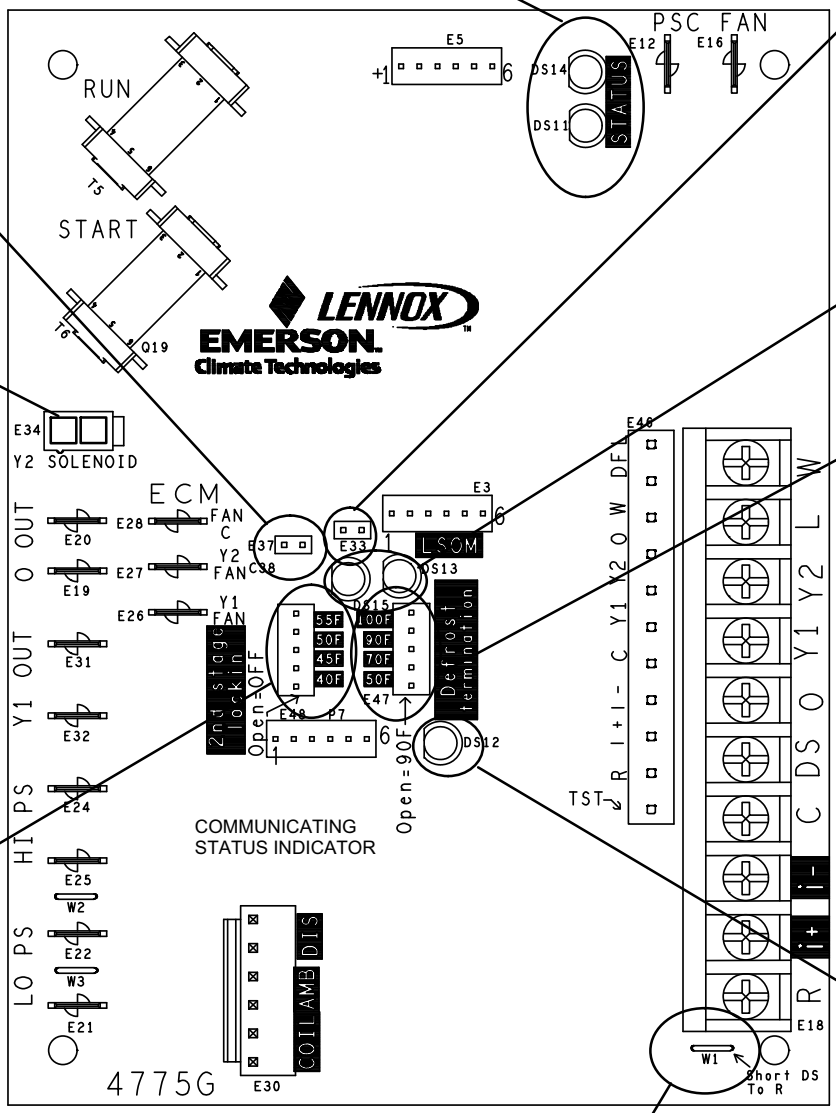
E34
Y2 SOLENOID COIL (SEE TABLE 2 FOR FURTHER DETAILS)

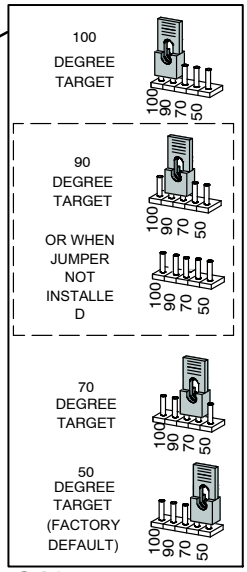
E47
DEFROST TERMINATION TEMPERATURE

E48
SECOND-STAGE LOCK-IN TEMPERATURE

NOTE — SETTING IS ONLY AVAILABLE ON OUTDOOR CONTROL PART NUMBERS 101796-01 THROUGH -03







DS12
INDICATES RS-BUS DATA COMMUNICATION IS ACTIVE. (COMMUNICATION MODE ONLY)

Figure 3. Jumpers, Loop and Links (Outdoor Control Part Number - 101796-XX)

Table 2. 101796-xx Jumpers, Loop and Terminal Descriptions

Control ID	Label	Description
E12	PSC Fan	240 VAC output connection for outdoor fan.
E16	PSC Fan	240 VAC input connection for outdoor fan.
E18	W	24VAC output for defrost auxiliary heat output.
	L	Thermostat service light connection.
	Y2	24VAC thermostat input/output for second stage operation of the unit.
	Y1	24VAC thermostat input for first stage operation of the unit.
	O	24VAC thermostat input for reversing valve operation
	DS	Humiditrol Input
	C	24VAC system common
	i-	Input/Output - RSBus data low. Used in communicating mode only with compatible indoor thermostat.
	i+	Input/Output - RSBus data high. Used in communicating mode only with compatible indoor thermostat.
	R	24VAC system power input
E19 and E20	O OUT	24 VAC output connection for reversing valve.
E21 and E22	LO-PS	Connection for low-pressure switch (2.4 milliamps @ 18VAC)
E31 and E32	Y1 OUT	24 VAC common output, switched for enabling compressor contactor.
E24 and E25	HS-PS	Connection for high-pressure switch.
E26	FAN 1	First Stage and second stage basic and precision dehumidification ECM fan motor 24VDC output connection 1.
E27	FAN 2	Second stage basic and precision dehumidification ECM fan motor 24VDC output connection 2.
E28	FAN C	ECM common connection for ECM fan.
E30	Six position square pin header. P4 provides connections for the temperature sensors.	
	DIS (YELLOW) PINS 5 and 6	DIS 5 — Discharge line temperature sensor supply. DIS 6 — Discharge line temperature sensor return. Range is 35ºF to 310ºF. Sensor is clipped on a 1/2” copper tube.
	AMB (BLACK) Pins 3 and 4	AMB 3 — Outdoor ambient temperature sensor supply. AMB 4 — Outdoor ambient temperature return. Range is 40ºF to +140ºF
	COIL (BROWN) Pins 1 and 2	COIL 1 — Outdoor coil temperature sensor supply. COIL 2 — Outdoor coil temperature sensor return Range is 40ºF to 140ºF. Sensor is clipped on a 5/16” copper return bend.
E33	Field Test	This jumper allows service personnel to defeat the timed off control, initiate or terminate a defrost and field programming of unit capacity feature and clears lockouts.
E34	Y2 Solenoid	Keyed plug header used for second-stage compressor output. Sequence for Y2 solenoid coil operations: • Five (5) second delay after Y2 is ON. • Two (2) seconds full 24VDC. • Pulsing voltage to keep solenoid engage
E37	Comp Shift Delay	The heat pump control has a field-selectable function to reduce occasional sounds that may occur while the unit is cycling in and out of the defrost mode. When a jumper is installed on the DELAY pins (E37), the compressor will be cycled off for 30 seconds going in and out of the defrost mode. Units are shipped with jumper installed on DELAY pins. If no jumper is installed, the 30 second compressor shift delay is not active. **On outdoor control part number 101796-04 and later, removing jumper also enables the fan cycling option.**
E47	50* 70 90 100	Seven position square pin header. E47 provides selection of the defrost terminate temperature based on the position of the selection jumper. The defrost termination temperature is measured by the RT21 coil temperature sensor. The jumper termination pin is factory set at 50°F (10°C). If the temperature jumper is not installed, the default termination temperature is 90°F (32°C).
E48	55 50 45 40 *	**(This option is only available on outdoor control part numbers 101796-01 through -03)** Five position square pin header. If the first-stage compressor output is active in heating mode and the outdoor ambient temperature is below the selected compressor lock-in temperature, the second-stage compressor solenoid outputs will be energized without the Y2 input. If the jumper is not present on E48, the default lock-in temperature of 40ºF will be used.

W1	Short DS To R	Cut for Humiditrol (EDA) application. This sets the outdoor fan speed to predefined speed. See table 9 for set speed based on unit capacity size. Use only in two-stage units.
* Factory default setting		

101796-XX System Status, Fault and Lockout LED Codes

LED codes are displayed via various LEDs located on the heat pump control (A175). See figure 3 for location of heat pump control LEDs.

DS11 AND DS14 — SYSTEM STATUS, FAULT AND LOCKOUT LED CODES

DS11 (Green) and DS14 (Red) LEDs indicate non-communicating mode diagnostics conditions that are listed in table 3.

These LEDs display the most common fault conditions in the system. When an abnormal condition is detected, this function communicates the specific condition through LED alert codes. The function is capable of detecting both mechanical and electrical system problems.

DS15 AND DS13 — COMPRESSOR FAULT AND LOCKOUT LED CODES

DS15 (yellow) and DS13 (red) LEDs indicate non-communicating mode diagnostics conditions that are listed in table 3.

These LEDs display fault conditions in system cooling or heating modes, dehumidification mode, anti-short cycle lockout, high and low pressures, discharge line temperature, outdoor temperature, and discharge sensor failures.

⚠ IMPORTANT

DS15 and DS13 compressor LED fault and lockout codes do not provide safety protection. The is a monitoring function only and cannot control or shut down other devices.

RESETTING FAULT AND LOCKOUT LED CODES

All LED fault and lockout codes can be reset manually or automatically.

1. **Manual Reset**

   Manual reset can be achieve by one of the following methods:

   - Disconnecting **R** wire from the heat pump control's **R** terminal.
   - Turning the indoor unit off an on again

   After power up, existing code will display for 60 seconds and then clear.

2. **Automatic Reset**

   After a fault or lockout is detected, the heat pump control continues to monitor the compressor and outdoor unit. When/if conditions return to normal, the fault or lockout LED code is turned off automatically.

Table 3. 101796-XX System Status, Fault and Lockout LED Codes and Related iComfort™ Thermostat Alert Codes (Outdoor Unit Codes Only)

System fault and lockout LED (DS11 / DS14) alarm codes takes precedence over system status LED codes (cooling, heating stages or defrost/dehumidification). Only the latest active LED fault or lockout alarm code if present will be displayed. If no fault or lockout codes are active, then system status LEDs are routinely displayed. See notes 1 and 2 in table below for duration of fast / slow flashes and pause.

Heat Pump Control LEDs		iComfort™ Thermostat Display	Condition	Possible Cause(s)	Solution
DS11 Green	DS14 Red				
SYSTEM STATUS					
Off	Off	Not applicable	Power problem	1. No power (24V) to heat pump control terminal's R and C or heat pump control failure. 2. Heat pump control failure.	[1] Check control transformer power (24V). [2] If power is available to control and LED(s) do not light, replace the heat pump control.
Simultaneous slow flash		Not applicable	Normal operation	Unit operating normally or in standby mode.	
Alternating slow flash		Not applicable	5-minute anti-short cycle delay	Initial power up, safety trip, end of room thermostat demand.	None required (Jumper FIELD TEST (E33) pins to override)
On	On	Not applicable	Heat pump control failure	Indicates that heat pump control has an internal component failure. Cycle 24 volt power to heat pump control. If code does not clear, replace the heat pump control.	

System fault and lockout LED (DS11 / DS14) alarm codes takes precedence over system status LED codes (cooling, heating stages or defrost/dehumidification). Only the latest active LED fault or lockout alarm code if present will be displayed. If no fault or lockout codes are active, then system status LEDs are routinely displayed. See notes 1 and 2 in table below for duration of fast / slow flashes and pause.

Heat Pump Control LEDs		iComfort™ Thermostat Display	Condition	Possible Cause(s)	Solution
DS11 Green	DS14 Red				
Off	1 fast flash then pause	Not applicable	First-stage compressor heating	These are codes that show status of operation whether the system is operating in either in first or second stage heating or cooling operation, defrost or in the dehumidification modes.	
Off	2 fast flashes then pause	Not applicable	Second-stage compressor heating		
On	2 fast flashes then pause	Not applicable	Defrost		
1 fast flash then pause	Off	Not applicable	First-stage compressor cooling		
2 fast flashes then pause	Off	Not applicable	Second-stage compressor cooling		
2 fast flashes then pause	On	Not applicable	Dehumidification mode		
ALERT STATUS					
None		Moderate Alert Code 105	Device communication failure	Equipment is unable to communicate. Indicates numerous message errors. In most cases errors are related to electrical noise. Make sure high voltage power is separated from RSBus. Check for mis-wired and/or loose connections between the stat, indoor unit and outdoor unit. Check for a high voltage source of noise close to the system. Fault clears after communication is restored.	
None		Moderate Alert Code 120	Unresponsive device	Usually caused by delay in outdoor unit responding to indoor unit poling. Recycle power. Check all wiring connections. Cleared after unresponsive device responds to any inquiry.	
None		Critical Alert Code 124	Active subnet controller missing for 180 seconds	Equipment lost communication with the thermostat. Check four wiring connections, ohm wires and cycle power at the thermostat. Alert stops all services and waits for heartbeat message from thermostat (subnet controller). Cleared after valid thermostat (subnet controller) message is received.	
None		Critical Alert Code 125	Hardware Failure	Hardware problem on the control. Cycle power on control. Replace if problem prevents service and is persistent. Cleared 300 seconds after fault recovered.	
None		Moderate / Critical Alert Code 126	Internal control communication failure	Internal communication on heat pump control. Alert will clear 300 seconds after fault has recovered.	
None		Critical Alert Code 131	Corrupted control parameters	Reconfigure the system. Replace control if heating or cooling is not available. Only applicable in the communicating mode, not in start up. Exit from Commissioning and Execute 'Set Factory Default mode'. Control will still operate on default parameter settings.	
Simultaneous fast flashes		Moderate / Critical Alert Code 180	Ambient sensor problem	If sensor detects an open, shorted or out-of-temperature range. heat pump control will revert to time/temperature defrost operation. System will still heat or cool.	
None		Moderate Alert Code 409	Low 24VAC. Secondary voltage is low.	Secondary voltage is below 18VAC. After 10 minutes, operation is discontinued. Clears the code after voltage is higher than 20 VAC for 2 seconds or after power reset.	
Off	Slow flash	Moderate Alert Code 410	Low pressure fault	Unit pressures below the lower limit. System is shut down. Clears after pressure switch closes.	

System fault and lockout LED (DS11 / DS14) alarm codes takes precedence over system status LED codes (cooling, heating stages or defrost/dehumidification). Only the latest active LED fault or lockout alarm code if present will be displayed. If no fault or lockout codes are active, then system status LEDs are routinely displayed. See notes 1 and 2 in table below for duration of fast / slow flashes and pause.

Heat Pump Control LEDs		iComfort™ Thermostat Display	Condition	Possible Cause(s)	Solution
DS11 Green	DS14 Red				
Off	On	Critical Alert Code 411	Low pressure switch lockout	Open low pressure switch error count reached 5 strikes. Check system charge using approach and subcooling temperatures. Reset by putting outdoor unit control in test mode or resetting low voltage power.	
Slow flash	Off	Moderate Alert Code 412	High pressure fault	Unit pressure is above the upper limit. System is shut down. Check system operating pressures and compare to unit charging charts. Clears when pressure switch closes.	
On	Off	Critical Alert Code 413	High pressure switch lockout	Open high pressure switch error count reached 5 strikes. Check system charge using approach and subcooling temperatures. Check outdoor fan operation. Check for dirt or debris blocking air flow to outdoor unit. Reset by putting outdoor unit control in test mode or resetting low voltage power.	
Slow flash	On	Moderate Alert Code 414	High Discharge line temperature fault	Discharge line temperature is > 279ºF. Check system operating pressures and compare to unit charging charts in installation manual. Clears after discharge temperature is < 225ºF.	
Fast flash	On	Critical Alert Code 415	High Discharge Line Temperature Strikes Lockout	Discharge line high temperature error count reached 5 strikes. Check system charge using approach and subcooling temperatures. Reset by putting outdoor board in test mode or resetting low voltage power.	
Fast flash	On	Critical Alert Code 416	Outdoor Coil Sensor Faulty	Sensor being detected open or shorted, or temperature is out of sensor range. Outdoor unit control will not perform demand or time/temperature defrost operation. (System will still heat or cool.) Clears when outdoor unit control detects proper sensor readings.	
Off	Fast flash	Moderate / Critical Alert Code 417	Discharge sensor fault	Outdoor unit control detects open or shorted sensor, or temperature that is out of sensor range. Critical Alert after 10 minutes. Reset by replacing sensor. This fault is detected by allowing the unit to run for 90 seconds before checking sensor resistance. If the sensor resistance is not within range after 90 seconds, the board will count one fault. After 5 faults, the board will lock out. Check for proper sensor reading and attachment to line. Replace if out-of-spec.	
3 fast flashes then pause	Off	Moderate / Critical Alert Code 418	W output hardware fault	When auxiliary heat output is detected as active. Fault in the heat pump control. Replace heat pump control. See figure 37 for further details.	
3 fast flashes then pause	On	Moderate / Critical Alert Code 419	W output hardware fault lockout	If heat pump control recognizes five output hardware fault events during a single cooling demand, the heat pump control will initiate a lockout. See figure 37 for further details.	
Off	3 fast flashes then pause	Critical Alert Code 421	W external miswire fault	When auxiliary heat output is detected as active after compressor has been de-energized. See figure 37 for further details.	
Simultaneous fast flashes then pause		None	Second-stage heat lock-in	If the unit is in non-communicating mode and it goes to second stage due to ambient temperature being below second stage lock-in setting (E48).	
Fast simultaneous flashing of DS11, DS13, DS14 and DS15			OEM mode	Factory test mode.	

1. Pause duration is two (2) seconds.
2. Fast flash duration is 1/2 second. Slow flash duration is one (1) second.

Table 4. 101796-XX Compressor Fault and Alarm LED Codes and Related iComfort™ Thermostat Alert Codes

NOTE — See notes 1 and 2 in table below for duration of fast / slow flashes and pause.

Heat Pump Control LEDs		iComfort™ Thermostat Display	Condition	Possible Cause(s)	Solution	Clearing Status
DS15 Yellow	DS13 Red					
Off	On	Moderate/ Critical[3] Alert Code 400	Compressor internal overload trip	Thermostat demand signal Y1 is present, but compressor not running	[1] Compressor protector is open. • Check for high head pressure • Check compressor supply voltage [2] Outdoor unit power disconnect is open. [3] Compressor circuit breaker or fuse(s) is open. [4] Broken wire or connector is not making contact. [5] Low or high pressure switch open if present in the system. [6] Compressor contactor has failed to close.	Clears the error after current is sensed in the run and start winding for two seconds, service removed or power reset.
1 flash then pause	Off	Critical Alert Code 401 on outdoor controls 101796-01 through -04. Moderate Alert Code 401 on 101796-04 and later	Long run time.	Compressor is running extremely long run cycles.	[1] Low refrigerant charge. [2] Evaporator blower is not running. • Check blower relay coil and contacts • Check blower motor capacitor • Check blower motor for failure or blockage • Check evaporator blower wiring and connectors • Check indoor blower control • Check thermostat wiring for open circuit [3] Evaporator coil is frozen. • Check for low suction pressure • Check for excessively low thermostat setting • Check evaporator airflow (coil blockages or return air filter) • Check ductwork or registers for blockage. [4] Faulty metering device. • Check TXV bulb installation (size, location and contact) • Check if TXV/fixed orifice is stuck closed or defective [5] Condenser coil is dirty. [6] Liquid line restriction (filter drier blocked if present). [7] Thermostat is malfunctioning. • Check thermostat sub-base or wiring for short circuit • Check thermostat installation (location and level)	Clears the error after 30 consecutive normal run cycles, or after power reset.
2 flashes then pause	Off	Critical Alert Code 402	System pressure trip	Indicates the compressor protector is open or missing supply power to the compressor.	[1] High head pressure. • Check high pressure switch if present in system • Check if system is overcharged with refrigerant • Check for non-condensable in system [2] Condenser coil poor air circulation (dirty, blocked, damaged). [3] Condenser fan is not running. • Check fan capacitor • Check fan wiring and connectors • Check fan motor for failure or blockage [4] Return air duct has substantial leakage.	Clears after four consecutive normal compressor run cycles, or after power reset.
3 flashes then pause	Off	Moderate Alert Code 403	Short cycling	Compressor is running less than three minutes.	[1] Thermostat demand signal is intermittent. [2] Time delay relay or heat pump control is defective. [3] If high pressure switch is present, see flash code 2 information.	Clears after four consecutive normal compressor run cycles, or after power reset.

Heat Pump Control LEDs		iComfort™ Thermostat Display	Condition	Possible Cause(s)	Solution	Clearing Status
DS15 Yellow	DS13 Red					
4 flashes then pause	Off	Critical Alert Code 404	Locked rotor	Compressor has a locked out due to run capacitor short, bearings are seized, excessive liquid refrigerant.	[1] Run capacitor has failed. [2] Low line voltage (contact utility if voltage at disconnect is low). • Check wiring connections [3] Excessive liquid refrigerant in the compressor. [4] Compressor bearings are seized.	Clears after power reset or four normal compressor cycles.
5 flashes then pause	Off	Critical Alert Code 405	Open circuit	Compressor has an open circuit due to power disconnection, fuse is open or other similar conditions.	[1] Outdoor unit power disconnect is open. [2] Unit circuit breaker or fuse(s) is open. [3] Unit contactor has failed to close. • Check compressor contactor wiring and connectors • Check for compressor contactor failure (burned, pitted or open) • Check wiring and connectors between supply and compressor • Check for low pilot voltage at compressor contactor coil [4] High pressure switch is open and requires manual reset. [5] Open circuit in compressor supply wiring or connections. [6] Unusually long compressor protector reset time due to extreme ambient temperature. [7] Compressor windings are damaged. • Check compressor motor winding resistance	Clears after one normal compressor run cycle or power reset.
6 flashes then pause	Off	Critical Alert Code 406	Open start circuit	Current not sensed by Start transformer.	[1] Run capacitor has failed. [2] Open circuit in compressor start wiring or connections. • Check wiring and connectors between supply and the compressor **S** terminal [3] Compressor start winding is damaged. • Check compressor motor winding resistance	Clears when amperage is detected in RUN and START sensors, or after power reset.
7 flashes then pause	Off	Critical Alert Code 407	Open run circuit	Current not sensed by run transformer.	[1] Open circuit in compressor start wiring or connections. • Check wiring and connectors between supply and the compressor **R** terminal [2] Compressor start winding is damaged. • Check compressor motor winding resistance	Clears when amperage is detected in RUN and START sensors, or after power reset.
8 flashes then pause	Off	Critical Alert Code 408	Welded contactor	Compressor always runs	[1] Compressor contactor failed to open. [2] Thermostat demand signal not connected to module.	Clears after one normal compressor run cycle or after power reset.
9 flashes then pause	Off	Moderate/ Critical Alert[3] Code 409	Secondary low voltage	24VAC is below 18VAC.	[1] Control circuit transformer is overloaded. [2] Low line voltage (contact utility if voltage at disconnect is low). • Check wiring connections	Clears after voltage is higher than 20VAC for two seconds, or after power reset.
Fast simultaneous flashing of DS11, DS13, DS14 and DS15			OEM Mode	Factory test mode.		

1. Pause duration is two (2) seconds.
2. Fast flash duration is 1/2 second. Slow flash duration is one (1) second.
3. Initially a moderate status is displayed and is escalated to critical if alarm exists for more than 10 minutes.

101796-XX Component Field Configuration and Troubleshooting

FAN MOTOR CONTROL (A177)

This section provides procedures for testing the fan control.

FAN MOTOR CONTROL LED CODES, JUMPER SETTINGS AND SEQUENCE OF OPERATION

During start up, the LED:

1. Display error conditions (see table 7), if present
2. If no errors are detected, then the LED code indicating stage operation (see table 8) will display the applicable code and then a long pause.
3. The fan motor speed / revolutions per minute (RPM) indicator is displayed next (see table 9).
4. After the RPM indicator is displayed, there is a short pause. The sequence repeats if a thermostat demand is still present. See figure 4 for LED sequence. See table 8 for description of flash and pause durations.

FAN MOTOR CONTROL TROUBLESHOOTING

Use the following subsections to verify and test the fan motor control (A177).

Verifying Jumper Settings (J2)

The unit is shipped from the factory with the default fan motor speed setting (in RPMs) required for each specific model. Use table 9 to verify that jumpers are set correctly for the specific size unit.

Verifying LED Status Codes

During start up, the fan motor control LED will display any error conditions. If error conditions exist then no other codes will display. If no error conditions are present, then the stage status and and RPM indicator are displayed. Two-stage units have various fan motor speed operations available (see table 9).

Verifying Correct DC Output Voltage (J2)

The following three methods can be used to determine whether the fan motor (B4) is operating at the correct RPMs based on unit size.

1. Use the information provided in table 9 to verify that all four jumper terminals are set correctly for the specific unit.
2. Verify that the fan motor speed / RPM indicator is displaying the correct flash sequence for the specific unit (see table table 9).
3. Test DC voltage output on the fan motor control's J2 terminals (see figure 5) while under full load. The actual voltage tested should match the voltage listed in table 9 for the specific unit.
4. If no voltage is detected at the **J2** terminals, verify there is a Y1 demand at the thermostat.

If there is a demand, proceed to the next section for further testing.

VERIFYING CORRECT INPUT VOLTAGE (ECM/Y1, ECM/Y2, ECM C AND EXT ECM/R)

Use a voltmeter to check voltages on the following fan motor control inputs, using either table 5. Voltage will only be present during a thermostat demand. See figure 6 for test example.

If correct voltages are detected at the applicable inputs during a demand, and no voltage is present at the J2 terminals, then the fan motor control (A177) should be replaced.

Table 5. Fan Motor Control Voltage Inputs

Input	Thermostat Demand	Voltage Present
ECM/Y1 and ECM C (Low Stage)	YES	Between 24VDC and 32 VDC
	NO	NONE
ECM/Y1 - ECM/Y2 and ECM C (High Stage)	YES	Between 24VDC and 32 VDC at each input
	NO	NONE at each input
ECM/Y2 and ECM C (EDA Operation)	YES	Between 24VDC and 32 VDC
	NO	NONE
EXT ECM/R and ECM C	YES	24VAC
	NO	NONE

Table 6. Fan Motor Control Flash and Pause Durations

Flash or Pause State	Duration
Flash Flash	Three flashes per second
Slow Flash	One flash per second
Short Pause	Two seconds of OFF time.
Long Pause	Five seconds of OFF time.

Table 7. Fan Motor Control Error/Fault LED Codes

Unit Status	Motor Control LED	Possible Cause
Mismatched RPM	Fast Flash with no pause	Internal feedback, PWM does not match target.
CRC Failure	Constant ON.	Microcontroller CRC failure.

Table 8. Fan Motor Control Stage Operation LED Indicator Codes

Unit Status	Unit Status	Motor Control LED
Two Stage Operation	**Low Stage — ECM1/Y1 ONLY**	One slow flash, then short pause.
	High Stage — ECM1/Y1 and ECM2/Y2	Two slow flash, then short pause.
	EDA Operation — ECM2/Y2 ONLY	Three slow flash, then short pause.

Table 9. Multi-Stage — Fan Motor Control RPM Jumper Settings, LED RPM Indicator and P2 DC Voltage Outputs

Application	CFM Profile Pin Select				Low Stage — ECM1/Y1 Only			High Stage — ECM1/Y1 and ECM2/Y2			EDA Operation — ECM2/Y2 Only		
	4	3	2	1	RPM	LED Code	DC Volt	RPM	LED Code	DC Volt	RPM	LED Code	DC Volt
XP21-024	ON	ON	OFF	ON	425	6	13.6	500	7	16.0	200	3	6.3
XP21-036	ON	OFF	ON	ON	525	7	16.8	600	8	19.2	225	3	7.0
XP21-048	ON	OFF	OFF	ON	600	8	19.2	675	9	21.6	225	3	7.0
XP21-060	ON	OFF	OFF	OFF	625	8	20.0	700	10	22.5	225	3	7.0

** LED Code indicates Fan Motor Control LED flash sequence. For example, LED Code 9 indicates 9 slow flashes and pause.*

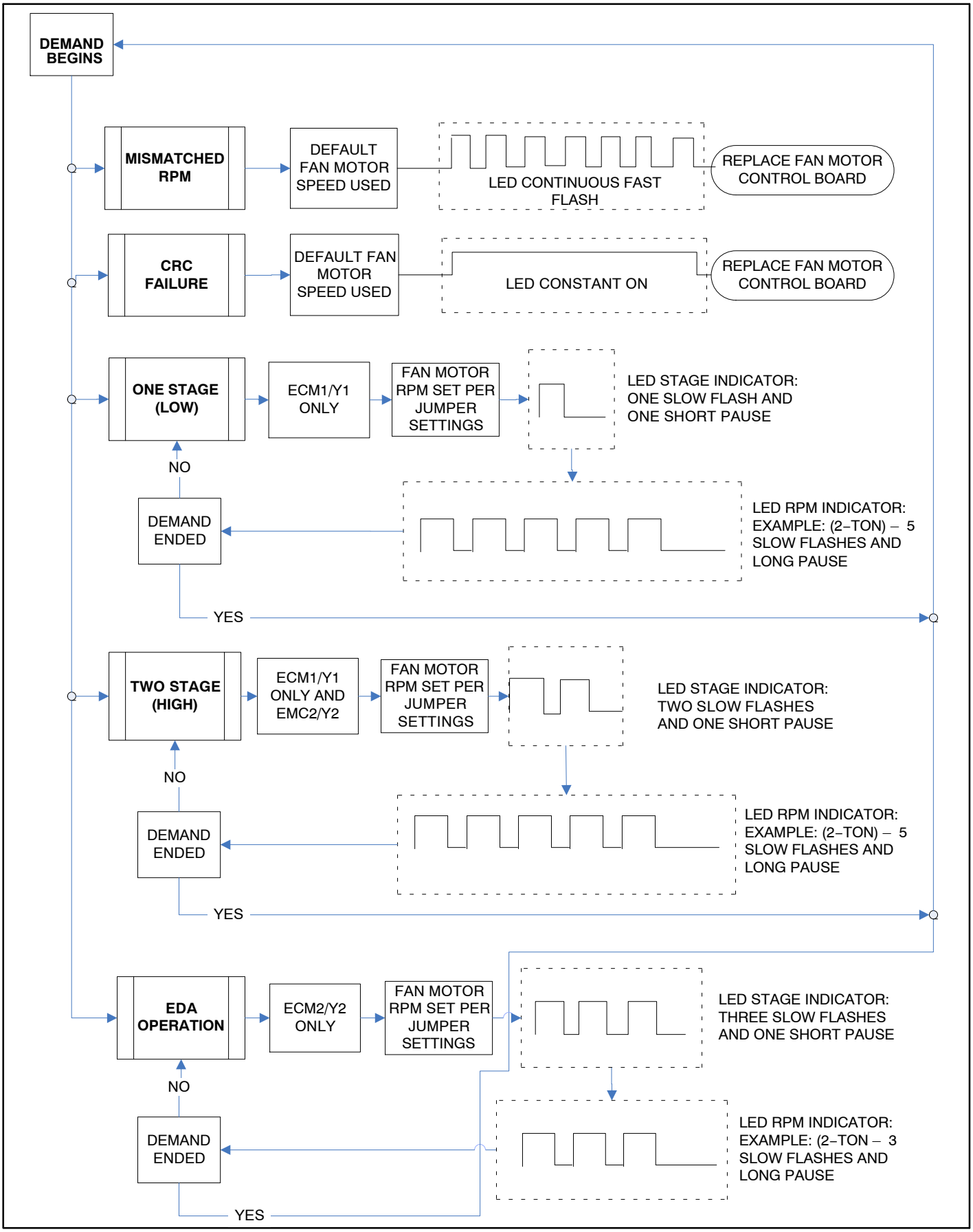


Figure 4. Fan Motor Control (A177) One/Two Stage and EDA LED Sequence of Operation

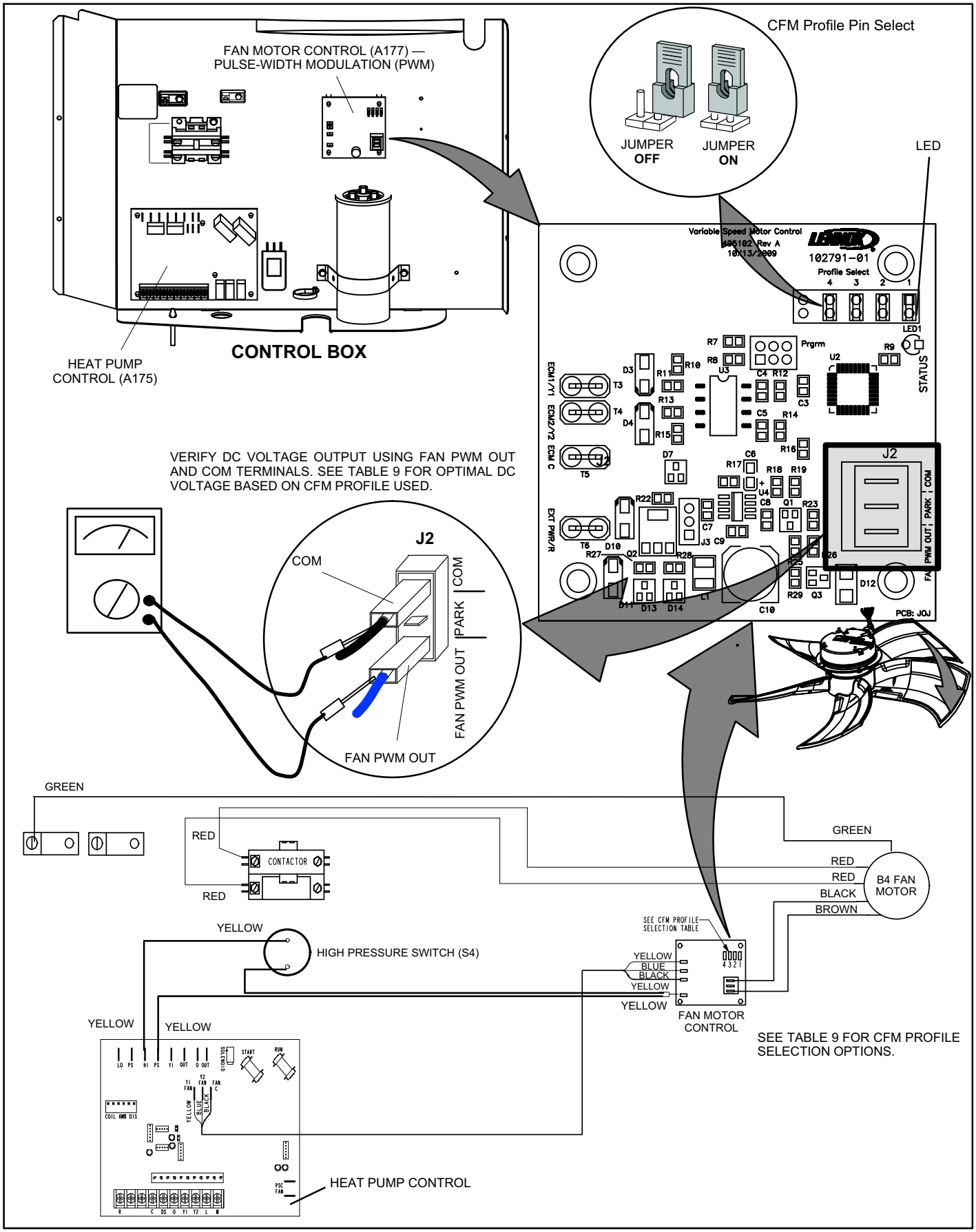


Figure 5. Fan Motor Control, Wiring, Jumper Settings, Testing and LED Location

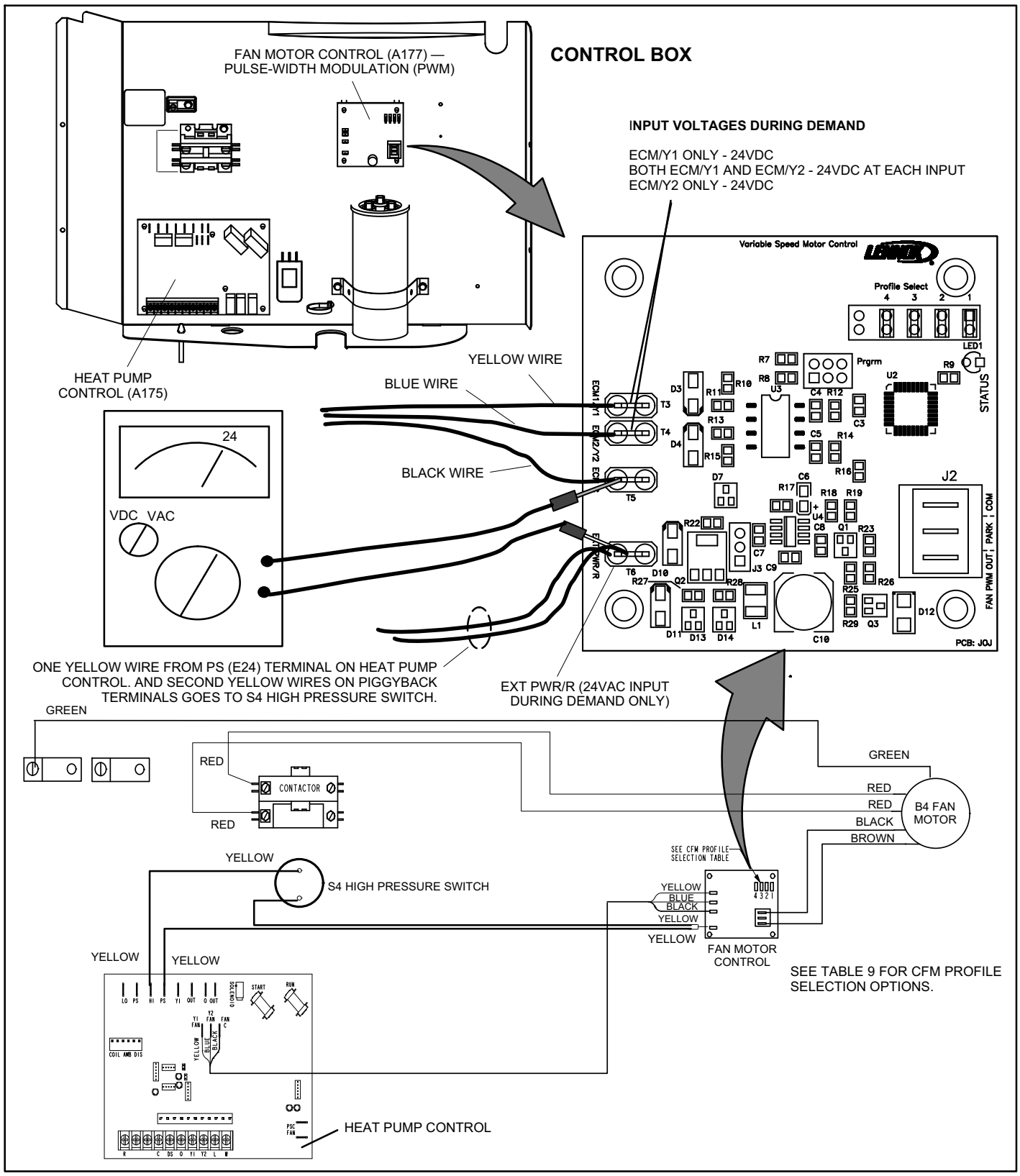


Figure 6. Testing for External Power to Fan Motor Control (A177)

Fan Motor Test Procedure

A simple test can be used to test the fan motor operation. A fully charged 9V battery will be required for this procedure.

FAN MOTOR (B4) TEST

This is a test that will verify that the motor does operate.

1. Verify main (240 volt) power if **OFF** to unit.
2. Remove both wires (brown and black) from the J2 terminal on the fan motor control (A177).
3. Room thermostat should be in **OFF** position (unit in idle mode - no heating or cooling demands)
4. Turn main power (240 volt) **ON** to unit.
5. Connect 9 Volt battery to fan motor plugs as noted in picture below.
6. Fan motor should run at a reduced fan speed.
7. If fan motor does not run, then replace fan motor assembly.

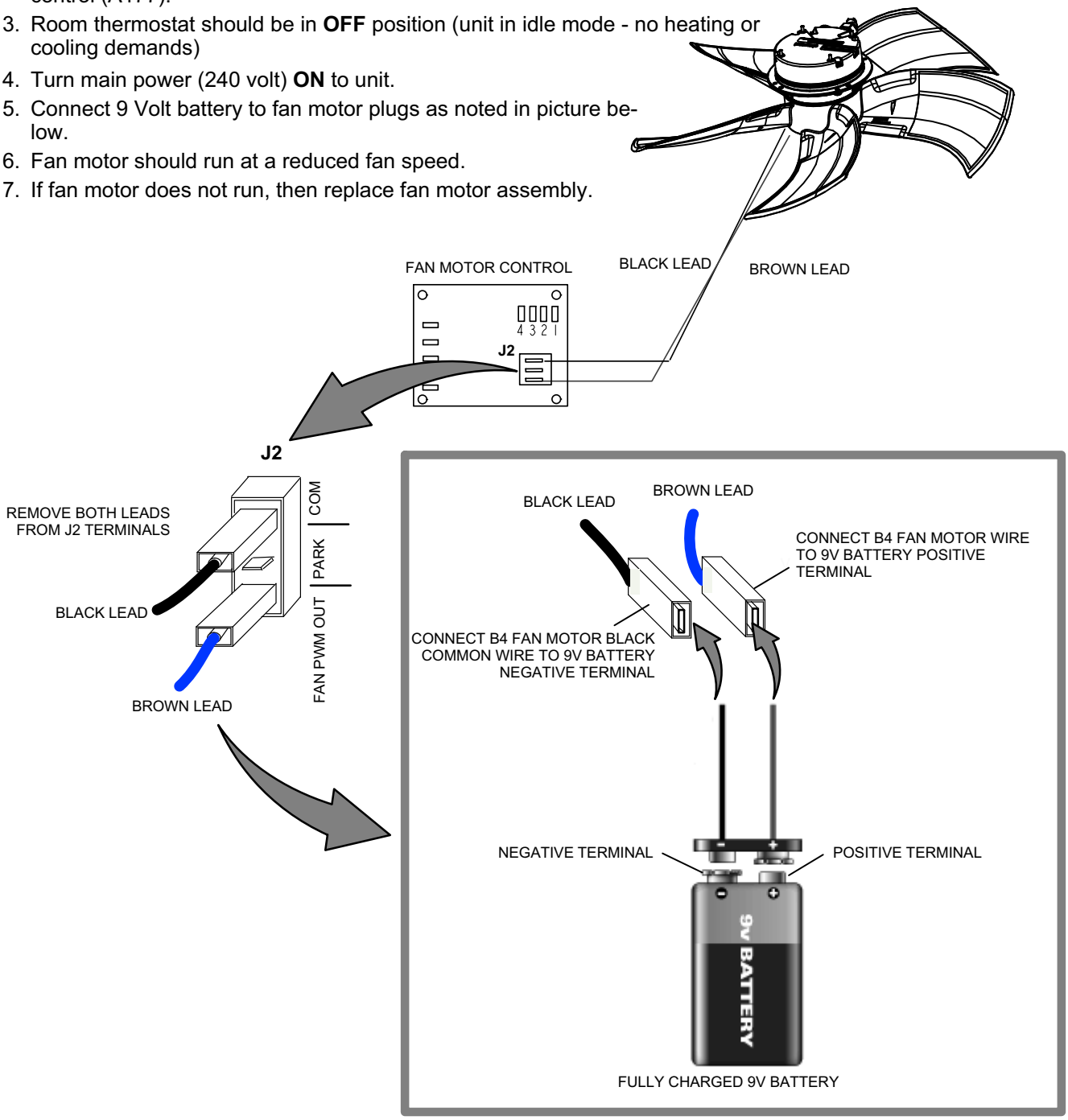


Figure 7. B4 Fan Motor Test

101796-XX UNIT NOMINAL CAPACITY CODE CONFIGURATION

In a communicating system, if the room thermostat is indicating either a error code 313, *indoor and outdoor unit capacity mismatch* error code, or error code 34, *must program unit capacity for outdoor unit*. Use the procedure provided in figure 8 to set the unit nominal capacity code.

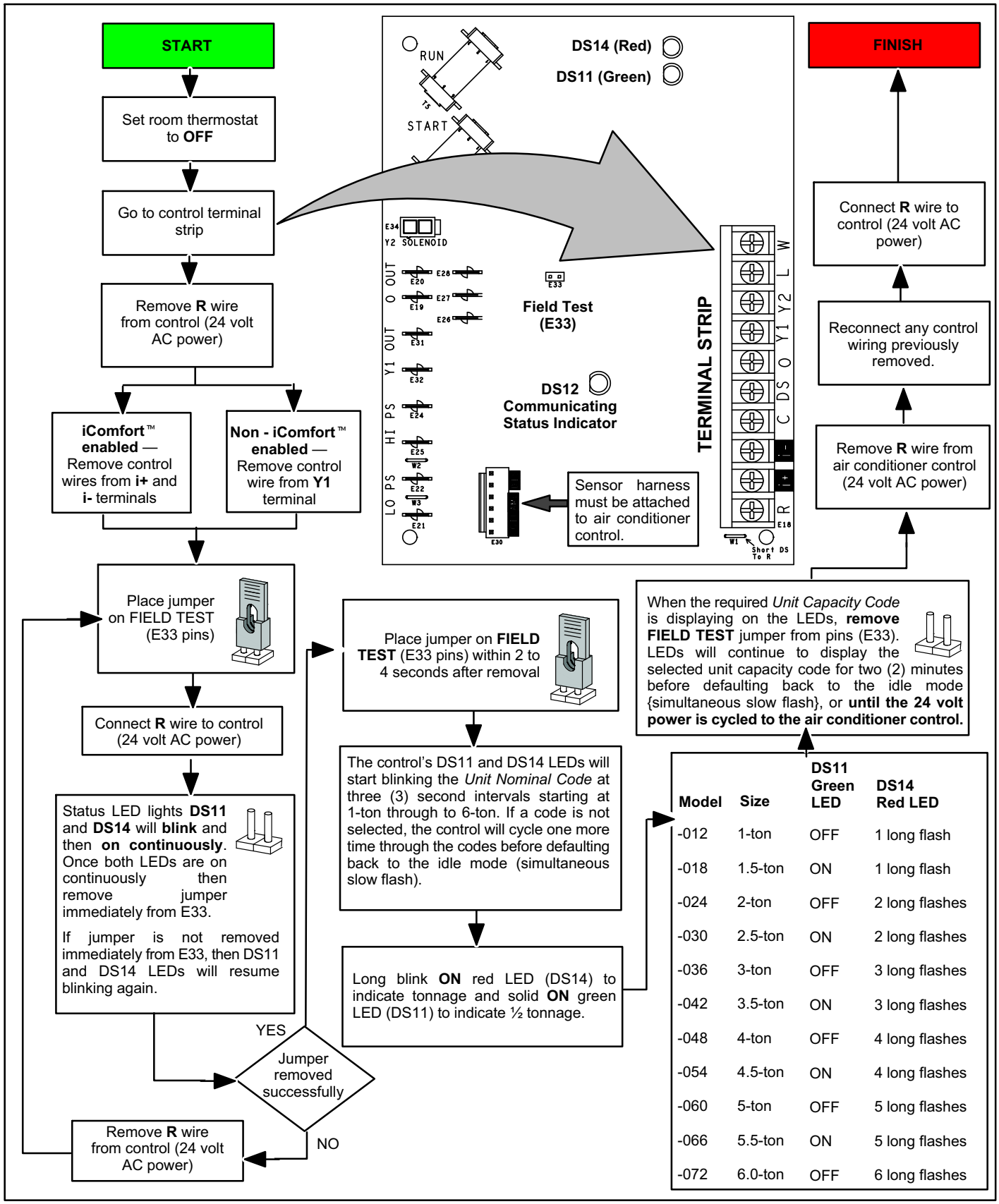


Figure 8. Heat Pump Control (A175) Unit Nominal Capacity Code Configuration

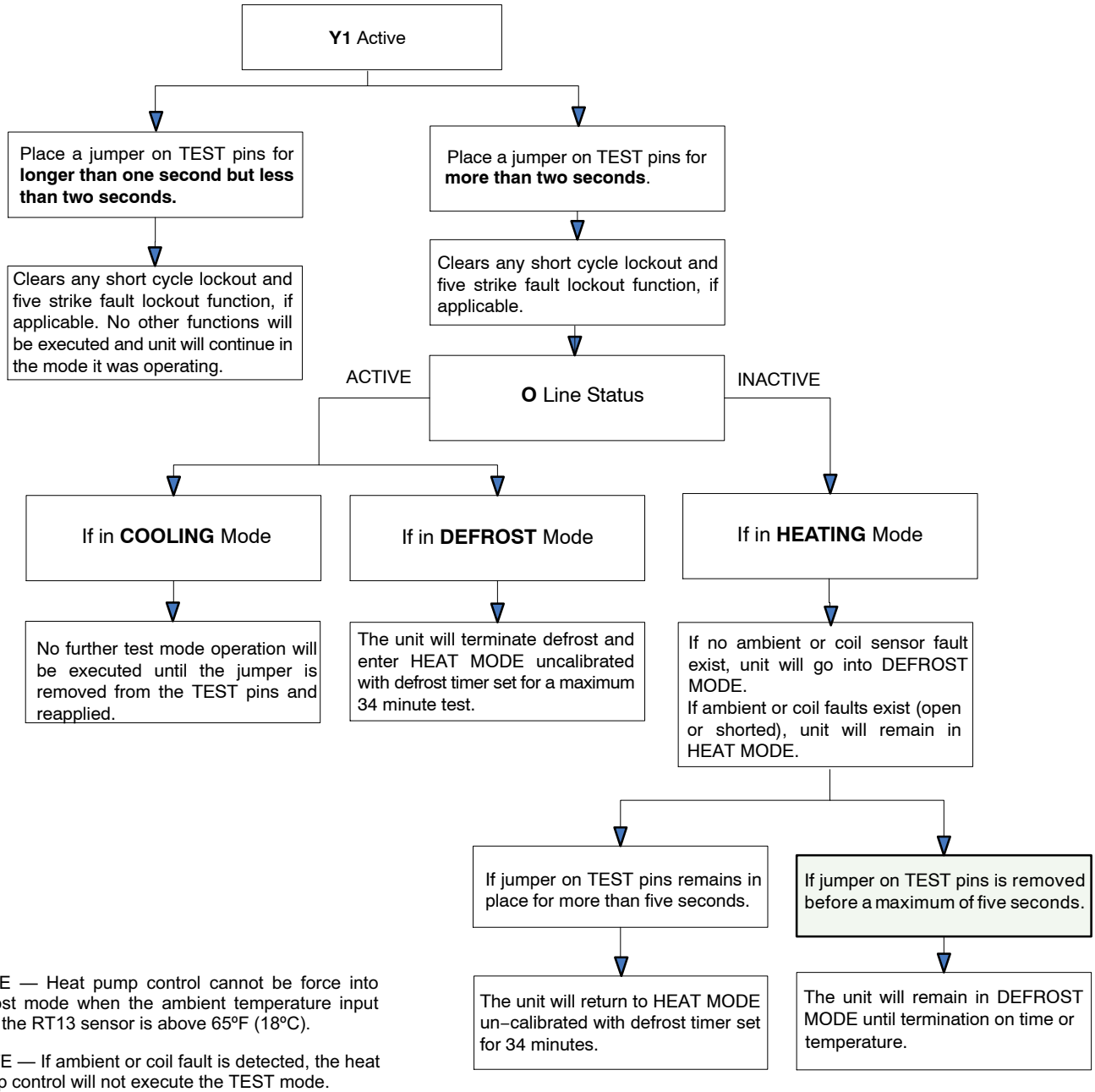
MULTI-FUNCTION TEST PINS (E33)

Placing the jumper on the field test pins (E33) using a specific sequence allows the technician to:

- Clear short cycle lockout
- Clear five-strike fault lockout
- Cycle the unit in and out of defrost mode
- Manually place the unit in defrost mode to clear the coil

When **Y1** is energized and 24V power is being applied to the heat pump control (A175), a test cycle can be initiated by placing a jumper on the heat pump control's **TEST** pins for 2 to 5 seconds. If the jumper remains on the **TEST** pins (E33) for longer than five seconds, the heat pump control will ignore the jumpered TEST pins and revert to normal operation.

The heat pump control will initiate one test event each time a jumper is placed on the TEST pins. For each TEST the jumper must be removed for at least one second and then reapplied.



NOTE — Heat pump control cannot be force into defrost mode when the ambient temperature input from the RT13 sensor is above 65ºF (18ºC).

NOTE — If ambient or coil fault is detected, the heat pump control will not execute the TEST mode.

Figure 9. Heat Pump Control's Multi-Function Test Pins (E33) (101796-XX Only)

FAN MOTOR SURGE PROTECTION (XP21-XXX-230-01 only)

Surge Protector (metal oxide varistor) - A component designed to protect electrical devices from voltage spikes that are 3-to-4 times the normal circuit voltage (See figure 10 for illustration of component).

How it works: It is essentially a batch of metallic-oxide grains separated by insulating layers. Repeated voltage surges break down the insulating layers, lowering the overall resistance and eventually causing the device to draw too much current and trip whatever over-current protection is inherent in the system.

Surge Protector Check: They are supposed to be located beyond the line fuse (though possibly not always). In this case, where the line fuse blows or circuit breaker trips but there is no visible damage to the surge protector, the simplest test may be to just temporarily remove the surge protector and see if the problem goes away.

See figure 1 for location of the surge protection device in the unit control box area.

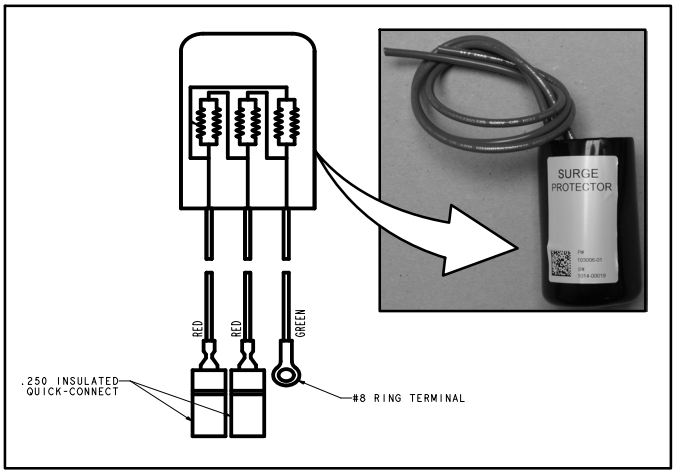


Figure 10. Fan Motor Surge Protection Device (XP21-XXX-230-01 only)

FAN MOTOR SURGE PROTECTION (XP21-XXX-230-02 and later)

Starting with the reference build above, the fan motor surge protection is in built into the fan motor itself.

103369-01 and -02 Jumper and Link Settings

Communication System

The jumper settings and link are default settings and ONLY control system operation if configuration settings in the iComfort™ thermostat are not available.

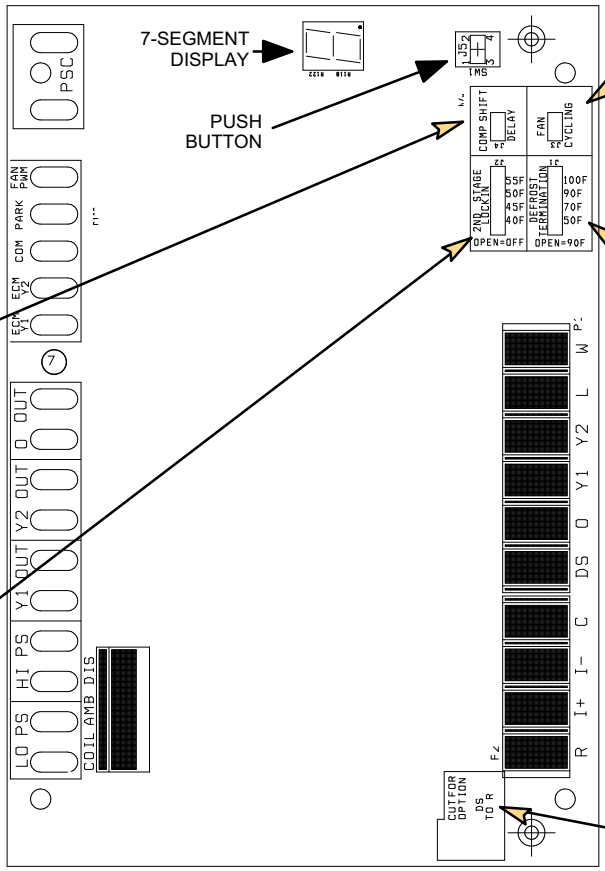
The Lennox iComfort™ thermostat must be used in communicating applications. Refer to page 32 for further information.

Non−Communicating System

The unit will operate based on jumper settings and **R TO DS** link on the **MAIN CONTROL**. All unit setting changes must be done at the **MAIN CONTROL**. The Lennox ComfortSense® 7000 thermostat may be used, as well as other non-communicating electronic-only thermostats.

NOTE — Fan cycling routine when activated will cycle the fan **ON** for five minutes if the outdoor ambient air temperature is between 15ºF and 35ºF and the compressor has been **OFF** for 25 to 30 minutes. This option is to help reduce the potential for ice build up on the orifice ring during system **OFF** cycles that are greater than 25 to 30 minutes.

Set up of jumpers on replacement outdoor control.



J3 ALL UNITS)

FAN CYCLING

JUMPER ON
FAN ON FOR 5 MINUTES

ON

JUMPER OFF
DISABLE (DEFAULT)

OFF

SEE NOTE ABOVE FOR FURTHER DETAILS.

(HP ONLY) J4

COMPRESSOR SHIFT DELAY

30 SECOND DELAY (DEFAULT)

30

0 SECOND DELAY

0

J1 (HP ONLY)

DEFROST TERMINATION TEMPERATURE

100 DEGREE TARGET

90 DEGREE TARGET

90

(DEFAULT WHEN JUMPER IS REMOVED OR MISSING)

70 DEGREE TARGET

50 DEGREE TARGET (DEFAULT)

(TWO-STAGE HEAT PUMP ONLY) J2

SECOND-STAGE LOCK-IN TEMPERATURE

55 DEGREE TARGET

50 DEGREE TARGET

45 DEGREE TARGET

40 DEGREE TARGET (DEFAULT)

DS TO R TWO-STAGE UNIT ONLY)

Cut for Humiditrol® - Enhanced Dehumification Accessory (EDA) applications.

NOTE - LINK NOT APPLICABLE TO ONE-STAGE UNITS. CUTTING LINK WILL HAVE NO AFFECT ON OPERATION OF ONE-STAGE UNITS.

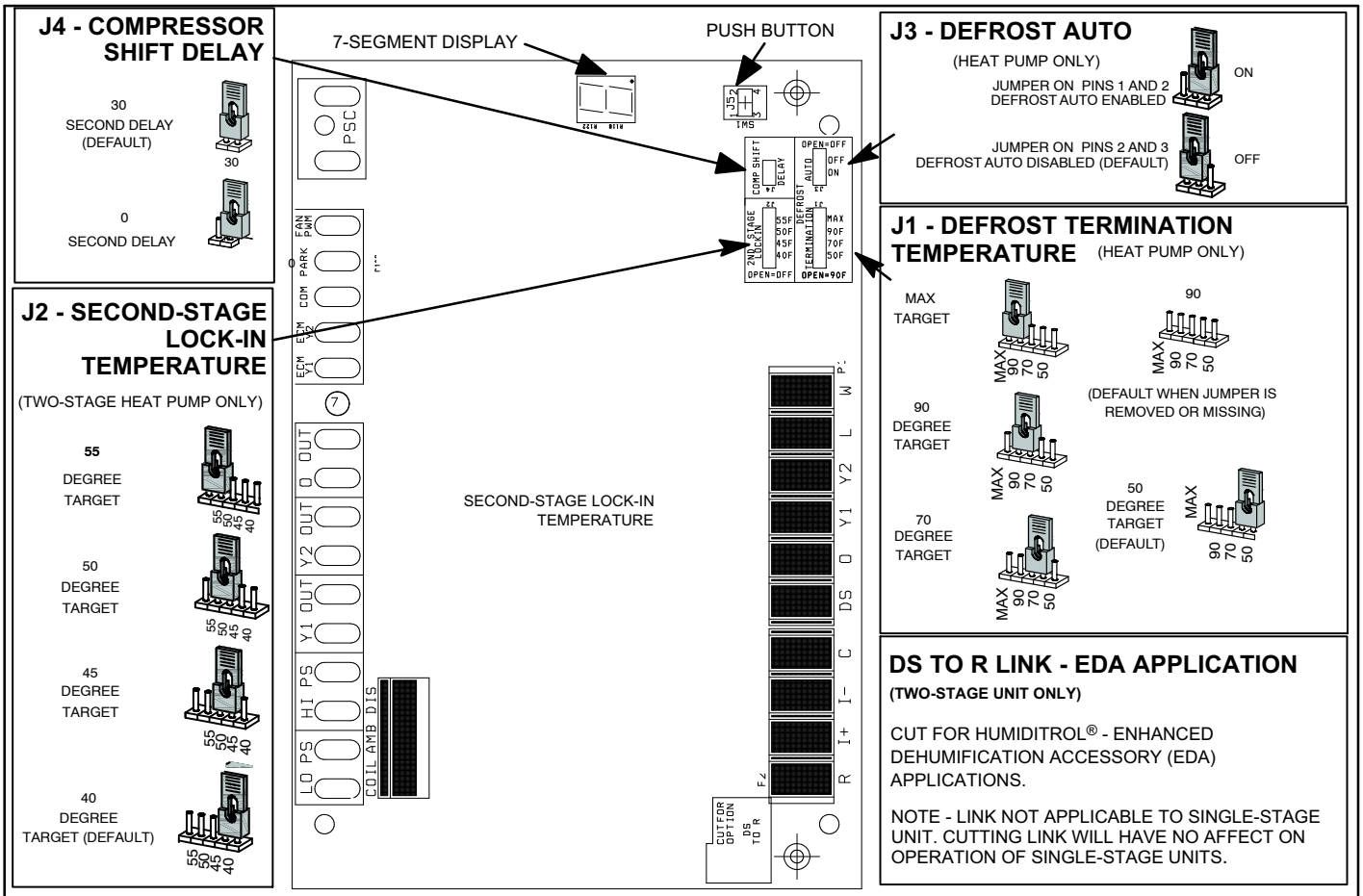
MANDATORY CONFIGURATION REQUIREMENTS — HEAT PUMP CONTROL — TWO-STAGE OPERATION

1. Set defrost termination temperature (**J1)** to ensure a completely clear coil before termination of defrost. Low outdoor temperatures could require higher defrost termination temperature setting. Factory default setting is **50ºF**. If jumper is removed or missing, default is **90ºF**.

IMPORTANT — All mandatory configuration requirements (jumpers and link) MUST be completed prior to starting unit.

2. Second-stage lock-in factory default setting for **J2** is **40ºF**. If jumper is removed or missing, default is **OFF**.

Jumper and Links (103369-03)



J1 - DEFROST TERMINATION TEMPERATURE

1. The **J1** jumper is factory-set to **50°F** (10°C). This jumper can repositioned to terminate defrost at **70°F**, **90°F** or **MAX** (21°C, 32°C and MAX). If there is no jumper on **J1**, the default termination temperature is **90°F**(325C).

NOTE - Colder climates may require a higher defrost termination temperature to maintain a clear coil.

2. If the **J1** jumper is set to **MAX**, defrost will run **maximum defrost sequence**.

J3 - DEFROST AUTO

1. **Defrost Auto** can be set to either **ON** or **OFF**. Factory setting is **OFF**.

   ***Note**: If the jumper is missing the default is **OFF**.*

2. **Defrost Auto** is set to **OFF**, the defrost cycle will run and terminate based on **J1** setting.
3. **Defrost Auto** is set to **ON**, the defrost termination will be determined based on the following rules:

   A.. The first defrost after the unit is powered up, or the first defrost after cooling call , will terminate based on the J1 setting.

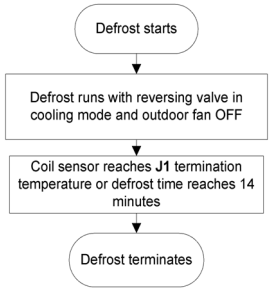
   B.. The accumulated heating run-time between defrost cycles:

   - ***<u>If the heating run time between defrost cycles is less than 50 minutes</u>,*** the defrost termination temperature will be increased for the next defrost cycle based on the current termination setting. If the current termination setting is **50°F** or **70°F,** then the next defrost termination will be **90°F**. If J1 is set at **90°F** or **MAX,** the next defrost cycle will terminate at the **MAX** setting.
   - ***<u>If the heating run time between defrosts is longer than 1 hour for 2 consecutive heating cycles</u>*** and the termination temperature is set at 50°F, 70°F, or 90°F, then the defrost control will follow the **JI** jumper setting during the next defrost cycle. If the **J1** jumper is set to **MAX**, then the next defrost termination temperature will be decreased to **90°F**.

   C.. If **J1** is set to **MAX**, the system will always run at **MAX** when accumulated compressor **OFF** time is longer than **<u>30 minutes and ambient temperature is less than 35°F</u>**.

   D.. When the ambient sensor temperature is **higher than 40°F** and **J1** is set to **MAX**, defrost termination will be **90°F**. If **J1** is **50°F**, **70°F**, **or 90°F**, defrost termination will follow the **J1** setting.

Normal Defrost Sequence



Maximum Defrost Sequence

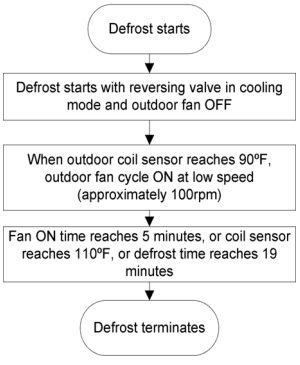
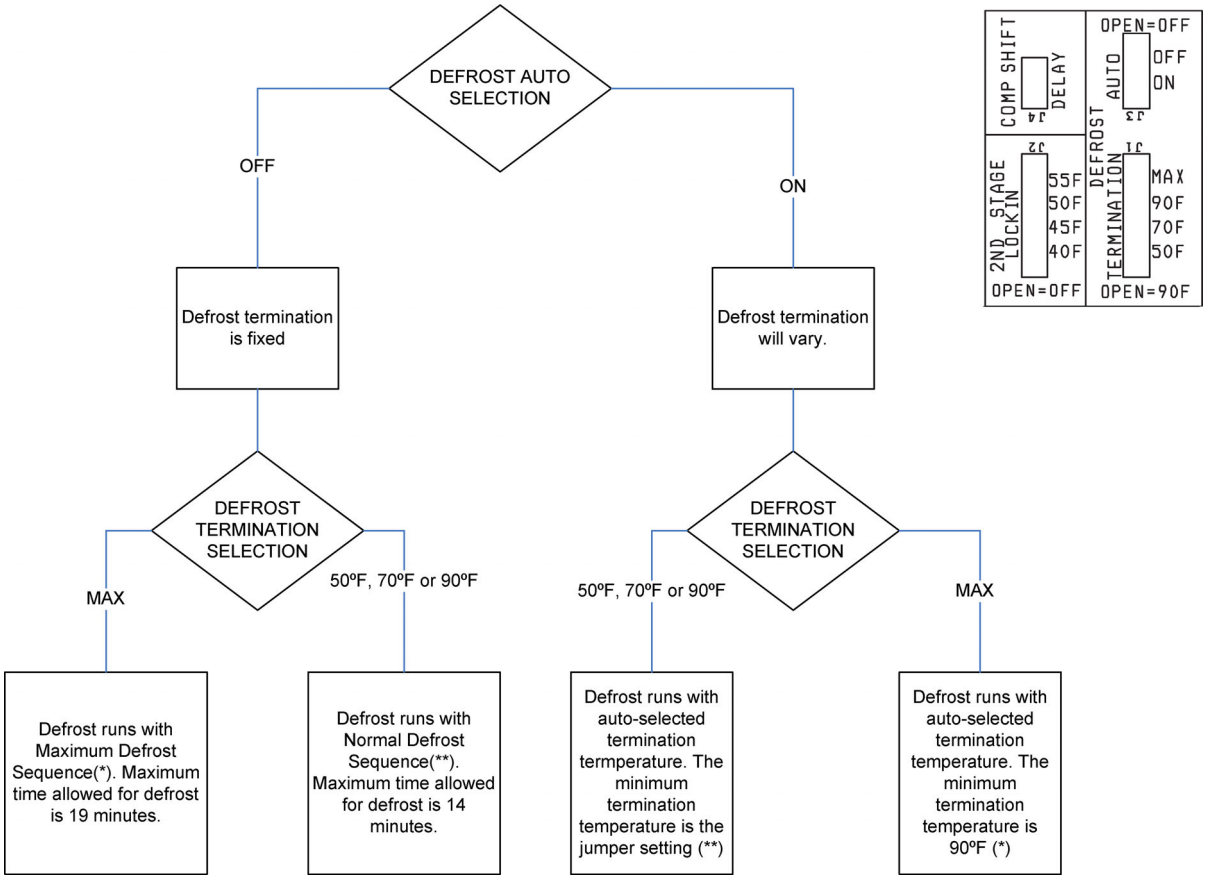
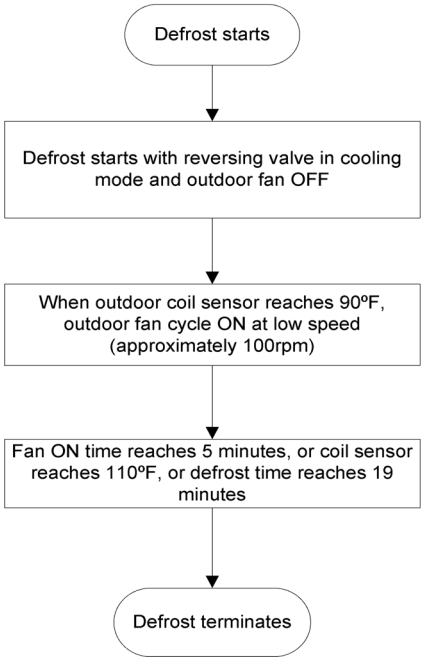


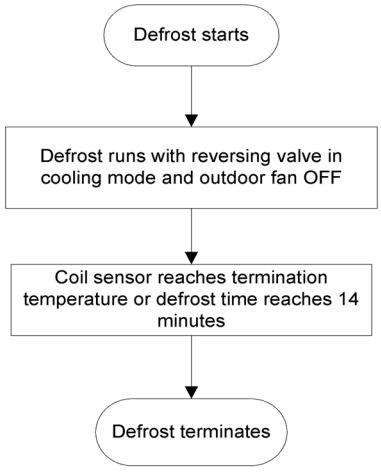
Figure 11. Jumpers and Links (Outdoor Control Part Number 103369-03)



(*) Maximum Defrost Sequence



(**) Normal Defrost Sequence



Note: If the defrost terminates by reaching the maximum allowed defrost time, it is not considered a successful defrost and the unit will enter defrost again after 30 minutes of compressor heating run time with the coil sensor below 35F

Figure 12. Defrost Auto Selection and Max Defrost Sequence of Operations (Outdoor Control Part Number 103369-03)

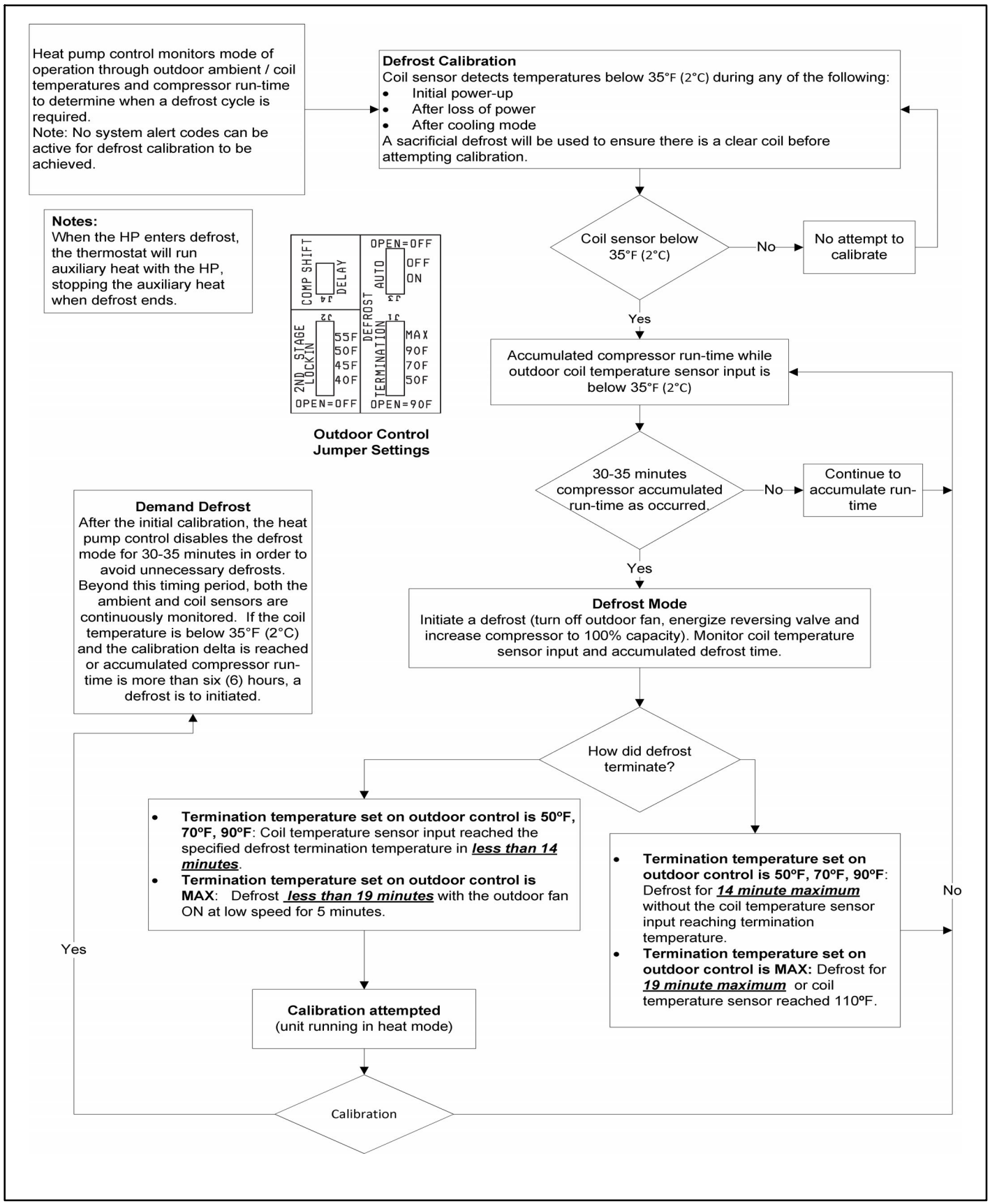


Figure 13. Demand Defrost - MAX Defrost (Outdoor Control Part Number 103369-03)

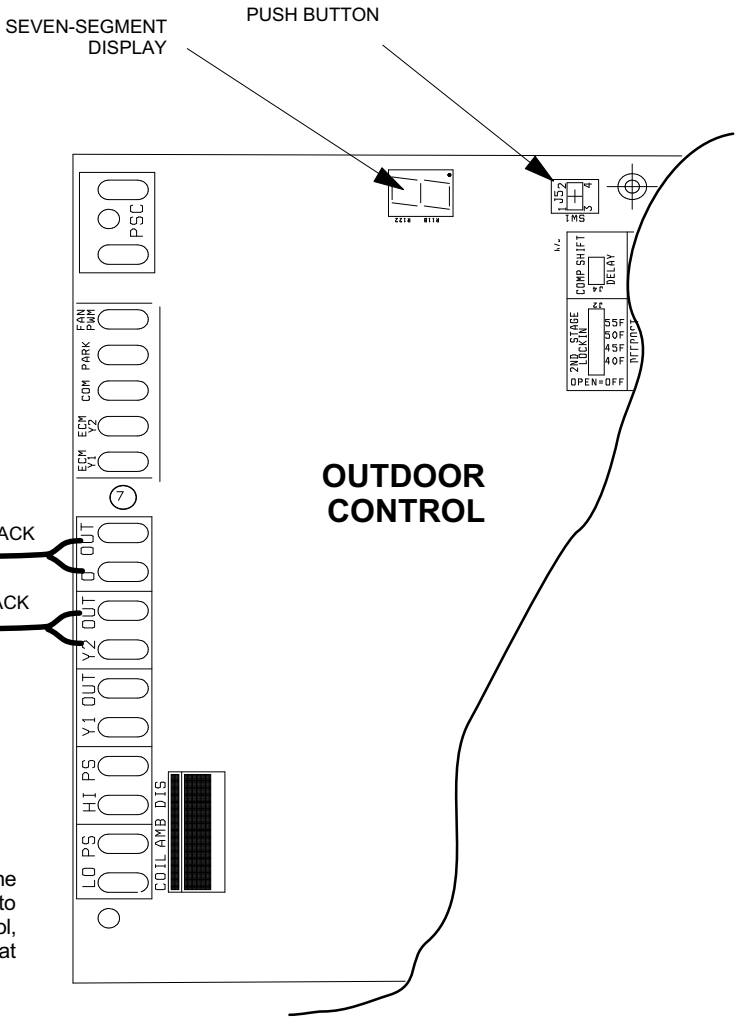
Configuring Unit

For the new outdoor control to work correctly, it **MUST BE** programmed for unit type (AC or HP and number of stages), unit capacity and outdoor fan profile (RPM). The new outdoor control has an auto-detection feature that will determine the unit type. The following set up procedures MUST be done on all new outdoor controls.

Auto-Detection of Unit Type (air conditioner or heat pump and number of stages)

During initial power-up the control will auto-detect the unit type. The unit type is determine by what is connected to various outputs on the new control.

The unit capacity and fan speed are manually configured. Until those parameters are configured the 7-segment display will show 3 bars for the unit capacity and fan speed.



- Anytime there is a connection to **O OUT** terminal, the control will detect the unit type as a heat pump.
- Anytime there is no connection to **O** terminal, the control will detect the unit type as an air conditioner.

BLACK

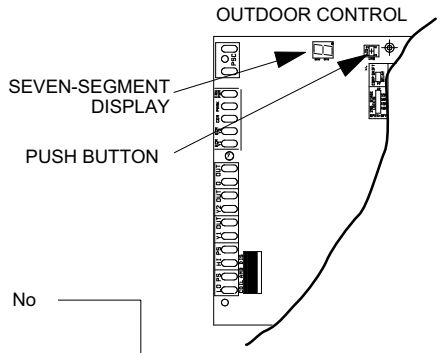
BLACK

- Anytime there is a connection to **Y2 OUT** terminal, the control will detect the unit as two-stage.
- Anytime there is no connection to **Y2** terminal, the control will detect the unit as one-stage.

If the control auto-detects the unit type incorrectly it may be due to the control being miswired, loose connection or missing connection to the required control output terminal. Disconnect power to the control, verify connections, correct wiring and reconnect power. Verify that the correct unit type is displayed on the seven-segment display.

Configuring Unit Type

During initial power-up the control will auto-detect the unit type. The unit type is automatically determine by what is connected to **Y2 OUT** and/or **O OUT** on the control**.** The unit type can be permanently stored in the control's memory by manually configuring the unit type using the following procedure. Typically the capacity and fan speed will not be configured and will display the three dashes for each. For manual configuration of the unit type, proceed as indicated.



Outdoor control is in **IDLE** mode (No heating or cooling demand)

Yes

No

Turn room thermostat to **OFF**

To enter **unit type configuration**, push and hold button next to single character display until **dash** symbol appears and immediately release button. Once dash starts blinking, proceed to next step.

Push and hold button until the solid Pt sequence is displayed on the seven-segment display and then immediately release the button.

[This configuration sequence allows the installer to select a unit type (number / letter combination) that matches the outdoor type and number of stages.]

Unit Type / Number of Stages

1AC	One stage air conditioner
2AC	Two stage air conditioner
1HP	One stage heat pump
2HP	Two stage heat pump

1. When the correct unit type is displayed, release button immediately. [Display will start flashing]
2. Push and hold button until selection stops flashing during one of the three cycles. [Release the button]
3. If selection is not made during those three cycles the control will return to idle mode.

NOT SELECTED

SELECTED

Press and hold the button during the Pt cycling display.

[The Pt sequence will repeat 5 times and if a selection is not made the control will return to idle mode.]

NOT SELECTED

SELECTED

The outdoor control will store unit type in memory and will automatically exit the configuration and reset control.

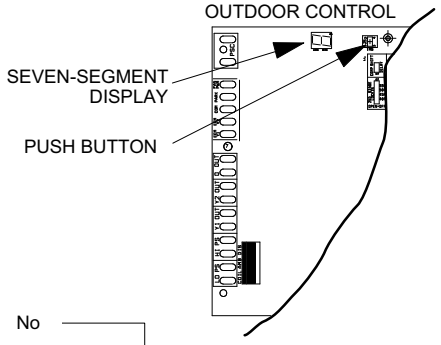
During power up of the outdoor control, the seven-segment display will show the stored number of stages unit type, capacity and outdoor fan speed.

2HP PAUSE 36 PAUSE 12

2HP	36	12
TWO STAGE HEAT PUMP	CAPACITY (3-TON)	FAN PROFILE

If three horizontal bars display in any part of the 7-segment string during power up, the outdoor control did not store that configuration. (Unit type, capacity or fan RPM. If this happens, the configuration sequence for that section of the string must be repeated.

Configuring Unit Capacity or Fan Profile



Power-up - Unit capacity (two-digit number) and displayed represents unit size code (outdoor unit capacity).
During initial power up, the number of stages / unit type, unit capacity and outdoor fan speed will appear on the 7-segment display.
If three horizontal bars display in any part of the 7-segment display string sections during power-up, the outdoor control did not store that configuration (unit type, capacity or fan RPM). If this happens, the configuration sequence for that section of the string must be repeated.

Outdoor control is in **IDLE** mode (No heating or cooling demand)

Yes

No

Turn room thermostat to **OFF**

To enter **unit capacity or fan profile configuration**, push and hold button next to single character display until **dash** symbol appears and immediately release button. Once dash starts blinking, proceed to next step.

Push and hold button until the solid *PC* or *PF* sequence is displayed on the seven-segment display and then immediately release the button. This configuration sequence allows the installer to select a unit type (number / letter combination) that matches the outdoor unit type and number of stages.

UNIT CAPACITY

FAN PROFILE

Either the *PC* or *PF* sequence will repeat 5 times and if a selection is not made the control will return to idle mode. Press and hold the button during the *PC* or *PF* cycling display.

NOT SELECTED

SELECTED

Unit Capacity Code

12	1-TON
18	1-1/2-TON
24	2-TON
30	2-1/2-TON
36	3-TON
42	3-1/2-TON
48	4-TON
60	5-TON

Fan Profile Code (**see notes**)

SEE NOTE 1

EBM fan motor with blades

SEE NOTE

See table 10 for fan profile.

1. When the correct unit capacity or fan profile is displayed, release button immediately. [Display will start blinking]
2. Push and hold button until selection stops flashing during one of the three cycles. [Release push button]
3. If selection is not made during those three cycles the control will return to idle mode.

NOT SELECTED

SELECTED

The outdoor control will store unit type in memory and will automatically exit the configuration and reset control.

During power up of the outdoor control, the seven-segment display will show the stored number of stages unit type, capacity and outdoor fan speed.

2 H P PAUSE 3 6 PAUSE 2

2-Stage Heat Pump | Capacity (3-Ton) | Fan Profile

If three horizontal bars display in any part of the 7-segment display string during power-up, the outdoor control did not store that configuration (unit type, capacity or fan profile). If this occurs, the configuration sequence for that section of the string must be repeated.

NOTE

Units with EBM motors - The fan motor RPM must be field set or three bars will appear in the fan profile string section of the 7-segment display. The factory default is 700 RPM.

Table 10. Fan RPM Profiles

Fan RPM Profile	Model Number	Stage 1 PWM %	Stage 1 RPM	Stage 2 PWM %	Stage 2 RPM	EDA Stage PWM %	EDA Stage RPM
0	XC/XP17-024	55	400	55	400	55	400
1	XC/XP17-030	62	450	62	450	62	450
2	Not assigned	69	500	69	500	69	500
3	Not assigned	71	550	76	550	71	550
4	XC/XP17-036 and -042	83	600	83	600	83	600
5	Not assigned	90	650	90	650	90	650
6	XC/XP17-048 and -060	92	675	92	675	92	675
7	Not assigned	97	700	97	700	97	700
8	Not assigned	48	350	55	400	27	200
9	Not assigned	55	400	62	450	27	200
10	XP21-024	58	425	69	500	27	200
11	XC21-024	65	475	76	550	27	200
12	XC/XP21-036	72	525	83	600	30	225
13	Not assigned	79	575	90	650	30	225
14	XC21-048, - 060 and XP21-048	83	600	92	675	30	225
15	XP21-060	86	625	97	700	30	225

Seven-Segment Alert and System Status Codes

Alert codes are displayed using the seven-segment display located on the outdoor control.

NOTE — System fault and lockout alarm code displays takes precedence over system status (cooling, heating stages or defrost/dehumidification).

The seven-segment will display an abnormal condition (error code) when detected in the system. A list of the codes are shown in table 11.

RESETTING ALERT CODES

Alert codes can be reset manually or automatically:

1. **Manual Reset**

   Manual reset can be achieved by one of the following methods:

   - Disconnecting **R** wire from the main control's **R** terminal.
   - Turning the indoor unit off and back on again

   After power up all existing codes are cleared.

2. **Automatic Reset**

   After an alert is detected, the main control continues to monitor the unit's system and compressor operations. When/if conditions return to normal, the alert code is turned off automatically.

Reconfiguring Outdoor Control using iComfort™ Thermostat

If any component of the HVAC system has been changed, e.g. replacing an outdoor sensor, reconfiguring the system will be required. To begin reconfiguring a system, press the **setup** tab. Note: Even though its in a communicating system, the fan profile will need to be set because the iComfort™ thermostat does not know what the profile should be.

Refer to the iComfort™ Thermostat Installer Setup Guide for configuration procedures.

Table 11. Seven-Segment Display Alert Codes

NOTE — System fault and lockout seven-segment display alarm codes takes precedence over system status codes (cooling, heating stages or defrost/dehumidification). Only the latest active fault or lockout alarm code if present will be displayed. If no fault or lockout codes are active, then system status are routinely displayed.

Alert Codes	Alarm Description	Possible Causes and Clearing Alarm
E 105	The outdoor unit has lost communication with the rest of the system.	Equipment is unable to communicate. This may indicate the existence of other alarms / codes. In most cases errors are related to electrical noise. Make sure high voltage power is separated from RSBus. Check for mis-wired and/or loose connections between the stat, indoor unit and outdoor unit. Check for a high voltage source of noise close to the system. This is a self-recoverable error.
E 120	There is a delay in the outdoor unit responding to the system.	Typically, this alarm/code does not cause any issues and will clear on its own. The alarm / code is usually caused by a delay in the outdoor unit responding to the thermostat. Check all wiring connections. Cleared after unresponsive device responds to any inquiry
E 124	The iComfort™ thermostat has lost communication with the outdoor unit for more than 3 minutes.	Equipment lost communication with the thermostat. Check the wiring connections, ohm wires and cycle power. The alarm stops all associated HVAC operations and waits for a heartbeat message from the unit that's not communicating. The alarm / fault clears after communication is re-established.
E 125	There is a hardware problem with the outdoor unit control.	There is a control hardware problem. Replace the outdoor control if the problem prevents operation and is persistent. The alarm / fault is cleared 300 seconds after the fault recovers
E 126	There is an internal communication problem with the outdoor unit control.	There is an internal hardware problem on the control. Typically the control will re-set itself. Replace the control if the problem prevents operation and is persistent. The alarm / fault is cleared 300 seconds after the fault recovers.
E 131	The outdoor unit control parameters are corrupted	Reconfigure the system. Replace the control if heating or cooling is not available
E 180	The iComfort™ thermostat has found a problem with the outdoor unit's ambient sensor.	In normal operation after outdoor control recognizes sensors, the alarm will be sent if valid temperature reading is lost. Compare outdoor sensor resistance to temperature/resistance charts in unit installation instructions. Replace sensor pack if necessary. At the beginning of (any) configuration, furnace or air-handler control will detect the presence of the sensor(s). If detected (reading in range), appropriate feature will be set as 'installed' and shown in the iComfort™ thermostat 'About' screen. The alarm / fault will clear upon configuration, or sensing normal values.
E 401	Either the compressor ran for more than 18 hours continuously.	Compressor ran more than 18 hours to satisfy a single thermostat demand. If the unit is 2-stage, the high-speed will lock-out and the unit will run at low-speed. If it is a HP and ODT <65ºF, the system will not raise an alarm. Confirm that the system is properly charged with refrigerant. Check for stuck reversing valve, excessive cooling load and properly sized equipment. Confirm that the evaporator coil is clean. The alarm clears after 30 consecutive normal run cycles or a power reset.
E 403	The compressor ran for less than 3 minutes to satisfy a thermostat demand (short-cycling)	Compressor runs less than 3 minutes to satisfy a thermostat demand (short-cycling). Confirm that the system is properly charged with refrigerant. Check the condensation float switch and TXV. The alarm clears after 4 consecutive normal compressor run cycles or a power reset.
E 409	The secondary voltage for the outdoor unit has fallen below 18VAC. If this continues for 10 minutes, the system will shut down.	Secondary voltage is below 18VAC. After 10 minutes, operation is discontinued. Check the indoor line voltage, transformer output voltage. The alarm clears after the voltage is higher than 20VAC for 2 seconds or after a power reset.
E 410	The outdoor unit cycled off due to low pressure switch opening.	Unit pressure is below the lower limit. The system is shut down. The low pressure switch for HFC-410A closes above 90PSIG and opens below 40PSIG. Confirm that the system is properly charged with refrigerant. Check TXV, indoor unit blower motor, dirty filters or clogged refrigerant filter. Confirm that the evaporator coil is clean. The alarm clears after the pressure switch closes or after a power reset
E 411	The low pressure switch has opened 5 times during one cooling cycle. As a result, the system will shutdown.	Open low pressure switch error count reached 5 strikes. The low pressure switch for R410A will open at 40PSIG and close at 90PSIG. Confirm that the system is properly charged with refrigerant. Check TXV, indoor unit blower motor, dirty filters or clogged refrigerant filter. Confirm that the evaporator coil is clean. The alarm clears after a power reset
E 412	The outdoor unit pressure is above the required limit. The system will shut down.	Unit pressure is above the upper limit. System is shut down. The high pressure switch for HFC-410A will open at 590PSIG and close at 418PSIG. Confirm that the system is properly charged with refrigerant. Check condenser fan motor, TXV, indoor unit blower motor, stuck reversing valve or clogged refrigerant filter. Confirm that the outdoor unit is clean. The alarm clears after 4 consecutive normal compressor run cycles, the pressure switch closes or a power reset
E 413	The high pressure switch has opened 5 times during one cooling cycle. As a result, the iComfort™ thermostat will shutdown.	Open high pressure switch error count reached 5 strikes. System is shut down. The high pressure switch for HFC-410A will open at 590PSIG and close at 418PSIG. Confirm that the system is properly charged with refrigerant. Check condenser fan motor, TXV, indoor unit blower motor, stuck reversing valve or clogged refrigerant filter. Confirm that the outdoor unit is clean. The alarm clears after a power reset.

Table 12. Seven-Segment Display Alert Codes (continued)

Alert Codes	Alarm Description	Possible Causes and Clearing Alarm
E 414	The discharge line temperature is higher than the recommended upper limit of 279ºF.	Discharge line temperature is > 279ºF. Confirm that the system is properly charged with refrigerant. Check system operating pressures and compare to unit charging charts in installation manual. Confirm that the outdoor unit is clean. The alarm clears after the discharge temperature is < 225ºF.
E 415	The discharge line temperature has been consistently higher than the recommended upper limit of 279ºF.	Discharge line high temperature error count reached 5 strikes. Confirm that the system is properly charged with refrigerant. Check system operating pressures and compare to unit charging charts in installation manual. Confirm that the outdoor unit is clean. The alarm clears after the discharge temperature is < 225ºF. The alarm clears after a power reset.
E 416	The outdoor coil sensor is either open, short-circuited or the temperature is out of sensor range. As a result the outdoor unit control will not perform any defrost tempering.	Coil sensor being detected open or shorted, or temperature is out of coil sensor range. Outdoor unit control will not perform demand or time/temperature defrost operation. System will still heat or cool. Check the resistance of the coil sensor and compare to temperature resistance chart. Replace coil sensor if needed. The alarm clears when outdoor unit control detects proper coil sensor readings or after a power reset.
E 417	The outdoor unit discharge sensor is either open, short-circuited or the temperature is out of sensor range. As a result the outdoor unit control will not perform any defrost tempering.	Outdoor unit control detects open or shorted discharge sensor, or temperature that is out of discharge sensor range. Check the resistance of the discharge sensor and compare to temperature resistance chart - replace if needed. Reset by replacing the discharge sensor. This fault is detected by allowing the unit to run for 90 seconds before checking discharge sensor resistance. If the discharge sensor resistance is not within range after 90 seconds, the board will count one fault. After 5 faults, the board will lock out. Check for proper sensor reading and attachment to line. The alarm clears after a power reset.
E 418	There is a faulty **W** output circuit.	**W** terminal is energized **while in cooling mode**. Possible cause may be a stuck closed relay on the control, or something external to the control that is energizing W terminal when it should not be energized. Solution: Disconnect any wiring from the W terminal. If 24 volts is still on the terminal, then it is a stuck relay. If the 24 volts disappears, then there is a need to check any of the wires hooked up to the W terminal.
E 419	The **W** output on the outdoor unit has reported more than 5 errors. As a result, the system has shutdown the outdoor unit.	The **W** output (code E418) on the outdoor unit has reported more than 5-strikes. As a result, the system has shut-down the outdoor unit. Disconnect thermostat lines from W and verify 24VAC on the W. If 24VAC is present, replace the control.
E 420	The heat pump defrost cycle has taken more than 20 minutes to complete.	Defrost cycle lasts longer than 20 minutes. This alarm is applicable with non-communicating heat pump system only. Check heat pump defrost operation. The alarm is cleared after the "W1" signal is removed.
E 421	The **W** output terminal on the outdoor unit is not wired correctly.	Voltage sensed on **W** and **O** when **Y1** thermostat input is deactivated. Another device or wiring fault is energizing **W** Check wiring. The alarm clears when wiring is corrected or after a power reset.

NOTE — Additional codes may be found in iComfort ™ thermostat manual.

Table 13. Outdoor Control Seven-Segment Unit Status Displays

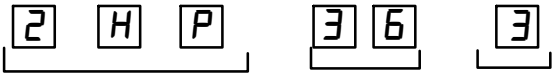
Description	Example of Display
Power up / Reset: Unit type and number of stages is displayed. Verify configuration with information published on the unit nameplate. If the information is incorrect, refer to flow chart *Manually Configuration of Unit Type* to re-configure control.	1 Stage AC: **1AC** 2 Stage AC: **2AC** 1 Stage AC: **1HP** 1 Stage AC: **2HP** POWER-UP 7-SEGMENT DISPLAY STRING 
Power up / Reset following display of self-discovered configuration: Unit nominal capacity is displayed, if not programmed then three horizontal lines and the decimal point are displayed for 2 seconds. 	Power up nominal capacity display of an XP21-036: **36** POWER-UP 7-SEGMENT DISPLAY STRING 
Power up / Reset following display of nominal capacity: Fan Profile code. (a single or two digit number) See table 10 for applicable fan RPM profile.	Displays the number of the selected fan profile. **3** POWER-UP 7-SEGMENT DISPLAY STRING 

Table 8. Outdoor Control Seven-Segment Unit Status Displays (*continued*)

Description	Example of Display
Idle Mode: Decimal point blinks at 1 Hz	Idle Mode: Decimal point blinks at 1 Hz (0.5 second on, 0.5 second off). Display OFF.
Soft Disabled: Top and bottom horizontal line and decimal point blink at 1 Hz.	Soft Disabled: Top and bottom horizontal line and decimal point blink at 1 Hz (0.5 second on, 0.5 second off). Note: Control should be replace.
O.E.M test mode	All segments flashing at 2 Hz (unless error is detected) Note: Control should be replace.
Anti-Short Cycle Delay	Middle line shall blink at 1 Hz for 2 seconds, followed by a 2 second display of the rounded up number of minutes left in the timer (2 minutes 1 second shall be displayed as "3"). The Anti-Short Cycle Delay time remaining is displayed whenever the delay is active.
Cooling Stage: Shows what stage of cooling is currently operating.	Following string is repeated if second stage cooling is active with outdoor fan speed set at 700 RPM. Note: **A** - If available, displays outdoor ambient temperature. C 2 pause F 7 0 0 pause
Heat Pump Stage: Shows what stage of heat pump is currently operating.	Following string is repeated if first stage heat pump is active with outdoor fan speed set at 600 RPM. Note: **A** - If available, displays outdoor ambient temperature. H 1 pause F 6 0 0 pause
Defrost Mode: Shown only while in an active defrost.	Following string is repeated if defrost is active while unit was in 1st stage heat pump heating mode: d F pause H 1 pause
Dehumidification mode: Shows that the unit is providing dehumidification instead of straight cooling.	Following string is repeated if dehumidification is active with outdoor fan speed set at 225 RPM: d pause F 2 2 5 pause
Diagnostic recall: Shows the last 10 stored diagnostic error codes.	If first error is E250, second E231: E pause 2 5 0 pause E pause 2 3 1 Next codes (up to 10) are show using same method. If there is no error codes stored: **E** pause **0 0 0**
Fault Memory clear	After the fault memory is cleared following string is displayed with 0.5 seconds character on/off time: 0 0 0 0 pause
Active error in outdoor control Idle mode: Shown all active error(s) codes.	Following string is repeated if Error E125 and E201 are present: E 1 2 5 pause E 2 0 1
Active error in run mode: Shown current status and all active error(s) codes.	Following string is repeated if Error E311 is present while blower speed at 700RPM: F 7 0 0 pause E 3 1 1
Outdoor Ambient Temperature (OAT): Any time OAT is sensed in operating range value is displayed if unit is in diagnostic and non-diagnostic modes.	Following string is repeated if second stage cooling is active with outdoor fan speed set at 650 RPM and OAT is 104ºF: C 2 pause F 6 5 0 pause A 1 0 4 pause
Outdoor Coil Temperature (OCT): Any time OCT is sensed in operating range value is displayed if unit is in diagnostic mode.	Following string is repeated if 2nd stage heat is active with outdoor fan speed set at 550 RPM and OCT is 25º F: H 2 pause F 5 5 0 pause c 2 5 pause
Discharge Line Temperature (DIS): Any time DIS is sensed in operating range value is displayed if unit is in diagnostic mode.	Following string is repeated if 2nd stage cooling is active with outdoor fan speed set at 650 RPM and DIS is 185º F: C 2 pause F 6 5 0 pause d 1 8 5 pause

Table 14. Error Recall Menu Options

Error Code Recall Mode (Note - control must be in idle mode)		
Solid	E	To enter error code recall mode, push and hold button until solid **E** appears, then release button. Control will display up to 10 error codes stored in memory. If E000 is displayed, there are no stored error codes.
Solid	- - -	To exit error code recall mode push and hold button until solid three horizontal bars appear, then release button. Note - Error codes are not cleared.
Solid	c	To clear error codes stored in memory, continue to hold push button while the 3 horizontal bars are displayed. Release push button when solid **c** is displayed.
Blinking	c	Hold push button for three seconds to confirm command to delete codes. Error codes are cleared.

**Note once the error history is deleted it cannot be recovered. After the history is deleted, the unit will reset itself.*

Table 15. Field Test and Program Menu Options

Display	Display and action (normal operation)	Display and action (configuration and test mode)
Power -UP	Display string displays > number of unit stages > pause > AC or HP unit > pause > unit capacity in BTUs > pause > RPM setting of outdoor fan. If 3 horizontal bars are displayed during any sequence of this string, it indicates that the specific parameter is not configured.	
-	Idle mode — decimal blinks at 1 Hertz > 0.5 second ON, 0.5 second OFF	
A	A in the display string represents the ambient temperature in °F at the outdoor sensor on the outdoor unit.	Enter A test mode: Display will string active error code(s) E, ambient A, coil c and discharge d temperature in °F at outdoor unit.
d	d - dehumidification mode string > d pause> F (Outdoor fan) **RPM** > pause > A (ambient temp displayed) > pause > repeat mode. **IMPORTANT**: On 2-stage unit R to DS link must be cut and correct RPM outdoor fan profile selected for outdoor fan to operate at lower RPM speed when EDA is active.	Enter d test mode: Forced defrost. (System must be configured as HP. Unit must be running in heating mode). Test defrost will terminate when coil terminate temperature is reached (or 10 seconds, whichever is longer) or 14 minutes if coil temperature remains below terminate temperature or by pushing button down for less than 2 seconds. Enter A test mode: Display will string active error codes E, ambient A , coil c and discharge d temperature in °F at outdoor unit.
d F	**d F** displays when system is in defrost mode - unit must be running in heating mode, outdoor ambient must be below 65°F and outdoor coil temperature must be below defrost termination temperature.	
F	F in the display string indicates RPM setting output on terminals PWM and com (used with EBM motors). RPM displayed does not apply to motor connected on ECM Y1 and ECM Y2.	Enter F test mode: Control outputs DC Voltage onto PWM and com terminals. Outdoor fan will cycle ON for 10 minutes at 490 RPM. To exit test - Push and hold button until three horizontal bars display. Release button, outdoor fan will cycle OFF. (Test DOES NOT output DC voltage to ECM Y1 and ECM Y2 terminals)
H1	Heat stage 1 string display > pause > F outdoor fan RPM displayed > pause > A (ambient temperature displayed > pause > repeat mode.	
H2	Heat stage 2 string display > pause > F outdoor fan RPM displayed > pause > A ambient temperature displayed > pause > repeat mode.	
C1	Cool stage 1 string display > pause > F outdoor fan RPM displayed > pause > A (ambient temperature displayed > pause > repeat mode.	
C2	Cool stage 2 string display > pause > F outdoor fan RPM displayed > pause > A (ambient temperature displayed > pause > repeat mode.	

Configuring Outdoor Fan Speed **(Note - Control must be in Idle Mode)**		
Display	**Code**	**Procedure**
Solid	PF	Release push button — Allows user to select outdoor fan RPM profile. **IMPORTANT**: New control may need to be manually configured to validate outdoor unit fan RPM setting is correct for unit capacity. Refer to RPM table on unit wiring diagram.
Blinking	PF	Push and hold button — Outdoor control will display a fan RPM profile 3 seconds. When the correct fan RPM profile is displayed, release button. Selected code will flash for a 10 second period. During that period, hold push button for 3 seconds to store code. Once code is stored control will automatically exit field test mode. If 10 second period expires or push button is held less than 3 seconds, control will automatically exit field test mode and go into idle mode without storing fan RPM profile. Repeat procedure to correct.
Configuring Unit Capacity **(Note - Control must be in Idle Mode)**		
Solid	PC	Release push button — Allows user to select Unit Capacity. **IMPORTANT**: Field replacement control may need to be manually configured to validate outdoor unit capacity. Refer to unit nameplate model number for capacity in 1,000 of BTUs. (18, 24, 30 ,36,42 48, 60)
Blinking	PC	Push and hold button — Control will display unit capacity numbe**r** 3 seconds. When the correct unit capacity number is displayed, release button. Selected code will flash for a 10 second period. During that period, hold push button for 3 seconds to store code. Once code is stored control will automatically exit *Field Test Mode.* If 10 second period expires or push button is held less than 3 seconds, control will automatically exit field test mode and go into idle mode without storing unit capacity Number. If this happens, configuring procedure must be repeated.

Table 10. Field Test and Program Menu Options (*continued*)

Display	**Code**	**Procedure**
Solid	Pt	Release push button — Allows user to select type and number of stages on outdoor unit.. **IMPORTANT**: Field replacement control may need to be manually configured to validate outdoor unit fan RPM setting is right for unit capacity. See RPM table on unit wiring diagram for proper RPM settings. Type and number of stages: 1AC, 2AC, 1HP, 2HP – AC – air conditioning and HP – Heat Pump
Blinking	Pt	Push and hold button — Control will display type and number of stages 3 seconds. When the correct type and number of stages is displayed, release button. Selected code will flash for a 10 second period. During that period, hold push button for 3 seconds to store code. Once code is stored control will automatically exit *field test mode.* If 10 second period expires or push button is held less than 3 seconds, control will automatically exit field test mode and go into idle mode without storing type and number of stages. If this happens, configuring procedure must be repeated.

Compressor Information and Testing

The XP21 uses either a ZPSK4 or ZPSK5 depending on model number. See table 17 for applicable compressor use by model number.

ELECTRICAL CHARACTERISTICS

Table 16 provides information concerning the electrical characteristics of both the ZPSK4 and ZPSK5 (single-phase).

Table 17. Compressor Electrical Characteristics Comparison

Lennox Model	Lennox Compressor Part Number	Copeland Model	Voltage	Phase	LRA	RLA	Minimum Circuit Ampacity	Max Fuse / Ckt Bkr	Run Capacitor	Start Kit
XP21-024-230-01 thru -04	100504-01	ZPS20K4E-PFV	208/230	1	52	10.3	14.9	25	35/5 370	63W22
XP21-024-230-05	103137-01	ZPS20K5E-PFV			58.3	11.7	20	25	35/5 440	10J42
XP21-036-230-01 thru -03	100504-02	ZPS30K4E-PFV			82	16.7	22.9	35	40/5 440	63W23
XP21-036-230-04	103137-02	ZPS30K5E-PFV			83	15.3	21.1	35	40/5 440	10J42
XP21-048-230-03	100504-03	ZPS40K4E-PFV			96	21.2	28.5	45	45/10 440	10J42
XP21-048-230-04	103137-03	ZPS40K5E-PFV			104	21.2	28.5	45	30/5 440	12J90
XP21-060-230-03	100504-14	ZPS49K4E-PFV			118	23.1	30.9	50	80/7.5 440	63W24
XP21-060-230-04	103137-04	ZPS49K5E-PFV			153	28.8	38	60	40/5 440	12J90

ELECTRICAL CHARACTERISTICS

External mechanical differences between the ZPS*K4 and ZPS*K5 are minimal. The suction and discharge tube height differences are less than 0.75”. The ZPS40K5 compressor is 0.50” taller than the ZPS40K4. All other ZPS*K5 compressors are shorter than the equivalent ZPS*K4 compressor. The mounting configuration is the same for both compressor families. The compressor frame sizes are different and a smaller crankcase heater may be required. In addition, there are difference sin mounting grommets because of the different frame sizes.

K4 COMPRESSOR MODULATING SOLENOID

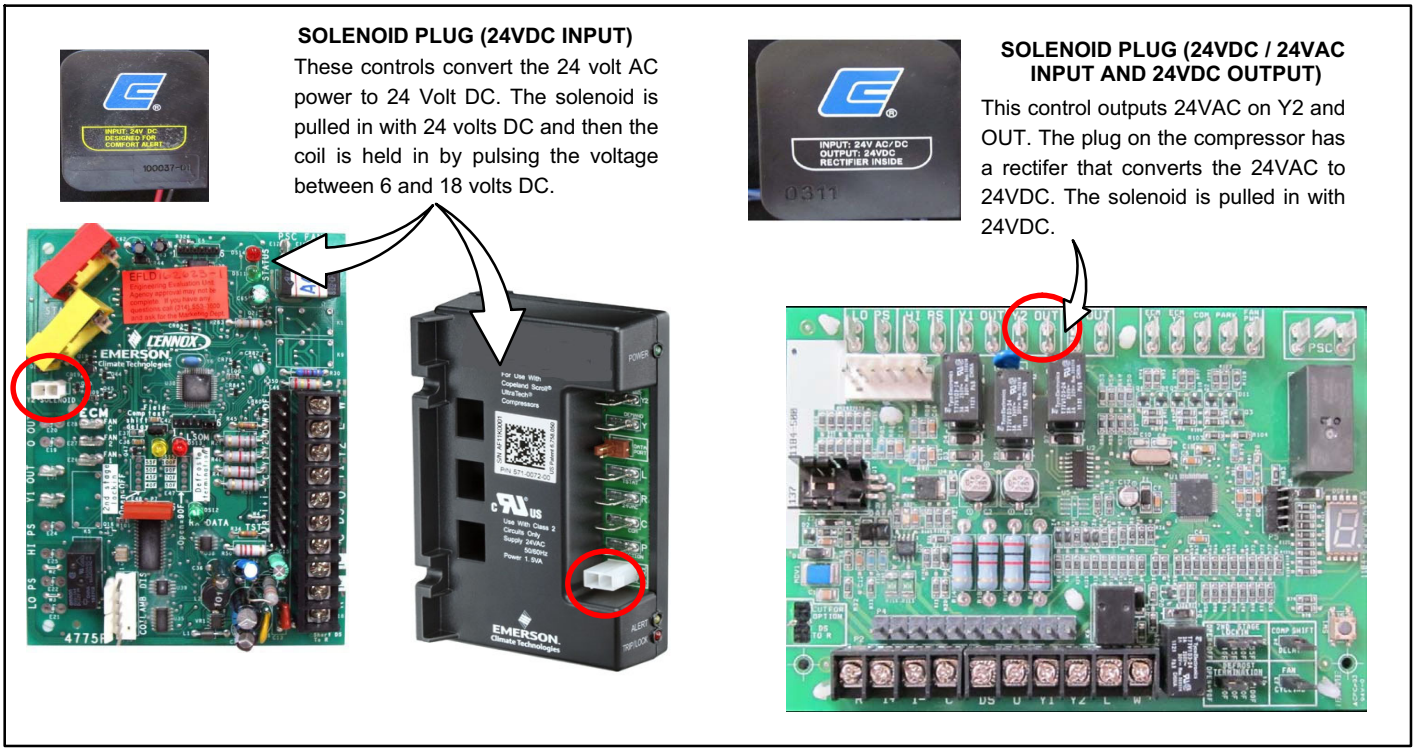
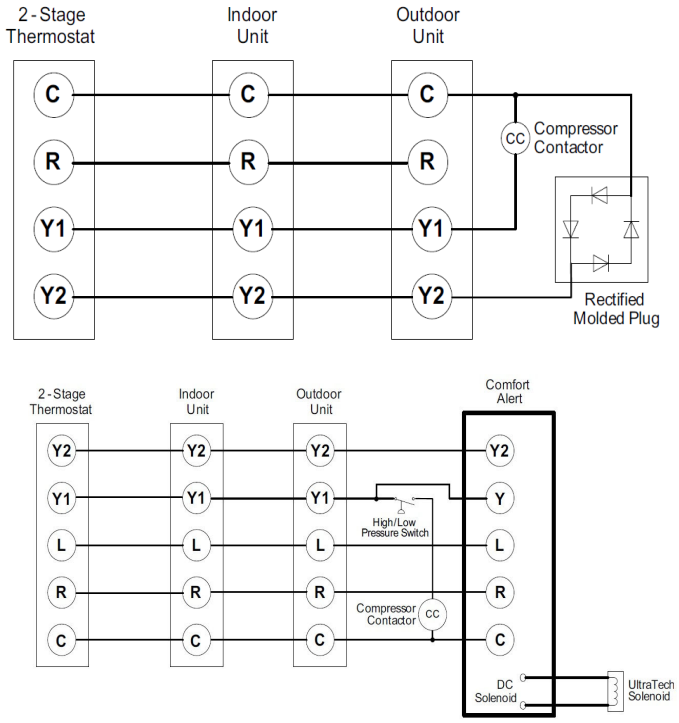
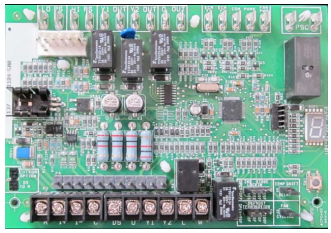


Figure 14. K4 Compressor Modulating Solenoid

K5 COMPRESSOR MODULATING SOLENOID



Standard wiring without LSOM or iComfort™ control with built-in LSOM



Wiring with the LSOM or iComfort™ control with the built-in LSOM

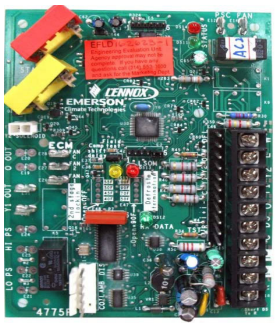


Figure 15. K4 Compressor Modulating Solenoid

COMPRESSOR INTERNAL SOLENOID (L34) TEST PROCEDURE

⚠ IMPORTANT

When checking compressor for two-stage operation, always cycle Y1 to Y2 from terminals on the outdoor control integrated LSOM function to the room thermostat connections. DO NOT cycle second-stage (Y2) of compressor by unplugging the 24VDC solenoid input to the outdoor control integrated LSOM function (E34) end of plug. The outdoor control integrated LSOM function will only output a 6 to 18VDC signal which will be insufficient voltage to pull the solenoid coil in for second stage.

⚠ IMPORTANT

This performance check is ONLY valid on systems that have clean indoor and outdoor coils, proper airflow over coils, and correct system refrigerant charge. All components in the system must be functioning proper to correctly perform compressor modulation operational check. (Accurate measurements are critical to this test as indoor system loading and outdoor ambient can affect variations between low and high capacity readings).

Tools required

- Refrigeration gauge set
- Digital volt/amp meter
- Electronic temperature thermometer
- On-off toggle switch

STEP A — Confirm low to high capacity compressor operation

Procedure

1. Turn main power **OFF** to outdoor unit.
2. Adjust room thermostat set point above (heating operation on heat pump) or below (cooling operation) the room temperature.
3. Remove control access panel. Install refrigeration gauges on unit. Attach the amp meter to the common (black wire) wire of the compressor harness. Attach thermometer to discharge line as close as possible to the compressor.
4. Cycle main power **ON**.
5. Confirm **Y1** operation only.
6. Allow pressures and temperatures to stabilize before taking any measured reading (may take up to 10 minutes).

7. Record all of the readings for the **Y1** demand on table 19.
8. Energize **Y2** demand.
9. Allow pressures and temperatures to stabilize before taking any measured reading (this may take up to 10 minutes).
10. Record all of the readings of **Y2** demand on table 19.
11. Compare Y1 to Y2 readings. Readings match table 19 the proper operation is verified. If readings do not match, proceed to **Step A**.

NOTE — On new installations or installations that have shut down for an extended period of time, if the compressor does not cycle from low-stage to high-stage on the first attempt, it may be necessary to recycle the compressor back down to low-stage and back up to high-stage a few times in order to get the bypass seals to properly seat. It might be necessary to restrict the air flow over the indoor coil (heating) or outdoor coil (cooling) to maintain pressures high enough to determine pressure differences between low and high stages.

STEP 2 — Verify Compressor Solenoid has Correct Ohm Values.

1. Turn main power **OFF** to outdoor unit (main power and low voltage).
2. Unplug the 2-pin solenoid plug from the fusite connection on the compressor.

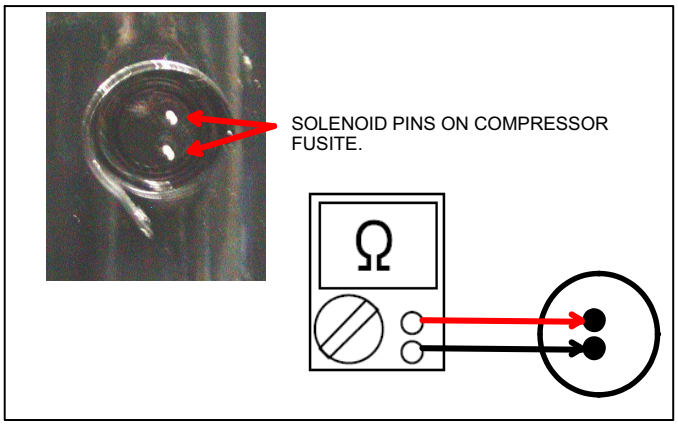


Figure 16. Testing

Figure 17.Solenoid Pins

3. Using a multi-meter set on ohms, check the ohms valve of the solenoid coil in the compressor and compare the value to table 18.

Table 18. Ohm Reading

Compressor Family	Compressor Model	Solenoid Resistance	
ZPS*K4	All Models	33.6 Ω	
ZPS*K5		Source A	1640 Ω
		Source B	350 Ω

*NOTE - There are 2 ohm readings for the solenoids used in the ZPS*K5 compressor.*

STEP 3 — Verify solenoid plug has DC output voltage.

1. Turn main power **OFF** to outdoor unit (main power and low voltage).
2. Unplug the 2-pin solenoid plug from the fusite connection on the compressor.
3. Turn main power **ON** and input a 2-stage demand to the outdoor unit.
4. Using the multi-meter set on DC volts, check the DC volt value at the plug-in after the five (5) second Y2 delay. Voltage at the plug connections should be between 18 and 28 VDC for non-LSOM applications and 4 to 9 VDC in LSOM applications.

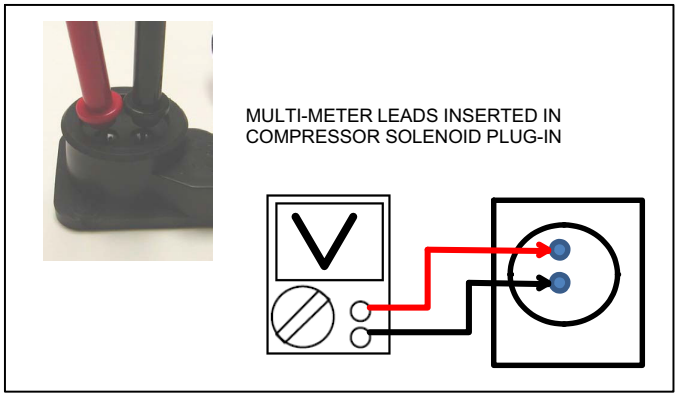


Figure 18. Testing

Table 19. Two-Stage Modulation Compressor Field Operational Checklist

Two-Stage Modulation Compressors Field Operational Checklist			
Unit Readings	**Y1 - First Stage**	**Expected results during Y2 demand (Toggle switch On)**	**Y2 - Second Stage**
COMPRESSOR			
Voltage		Same	
Amperage		Higher	
CONDENSER FAN MOTOR			
Amperage		Same or Higher	
TEMPERATURE			
Ambient		Same	
Outdoor Coil Discharge Air		Higher	
Compressor Discharge Line		Higher	
Indoor Return Air		Same	
Indoor Coil Discharge Air		Lower	
PRESSURES			
Suction (Vapor)		Lower	
Liquid		Higher	

System Overview

IMPORTANT

Some scroll compressor have internal vacuum protector that will unload scrolls when suction pressure goes below 20 psig. A hissing sound will be heard when the compressor is running unloaded. Protector will reset when low pressure in system is raised above 40 psig. DO NOT REPLACE COMPRESSOR.

The heat pump control (A175) provides the following functions:

- Demand defrost algorithm
- Field-selectable defrost termination temperatures
- Internal switching of outputs
- Compressor anti-short-cycle delay.
- Five strikes lockout safety function
- High (S4) and low (S87) pressure switches
- Ambient (RT13), coil (RT21) and discharge line (RT28) temperatures monitoring and protection.

COMPRESSOR PROTECTION — ANTI-SHORT CYCLE DELAY

The heat pump control protects the compressor from:

- Short cycling (five minutes) when there is initial power up
- Interruption in power to the unit
- Pressure or sensor trips
- Delay after Y1 demand is removed.

In non-communicating systems the delay is set for 300 seconds (five minutes) and can not be changed. To override timer when active or inactive, place a jumper on the field test pins between 1 and 2 seconds.

In communicating system, the iComfort™ thermostat has a separate built-in 5-minute non-adjustable short cycle protection.

Resetting Anti-Short Cycle Delay (101796-XX Only)

The **FIELD TEST** pins (E33) on the heat pump control can be jumpered between 1 to 2 seconds to bypass delay.

HIGH (S4) AND LOW (S87) PRESSURE SWITCHES

The unit's pressure switches (LO PS - S87 and HI PS - S4) are factory-wired into the control on the LO-PS and HI-PS terminals, respectively.

Low Pressure Switch (LO-PS) — See figure 33 for low pressure switch sequence of operation.

High Pressure Switch (HI-PS) — See figure 34 for high pressure switch sequence of operation.

Pressure Switch Event Settings

The following pressures are the auto reset event value triggers for low and high pressure thresholds:

- **High Pressure** (auto reset) - trip at 590 psig; reset at 418.
- **Low Pressure** (auto reset) - trip at 25 psig; reset at 40.

COMPRESSOR PROTECTION — FIVE-STRIKE LOCKOUT SAFETY FUNCTION

The five-strike lockout safety function is designed to protect the unit's compressor from damage. The five-strike feature is used for high pressure (S4) and low (S87) pressure switch trips, high discharge temperature (RT28) sensor input and **W** input fault or miswire.

Resetting Five-Strike Lockout

Once the condition has been rectified, power to the heat pump control's **R** terminal must be cycled OFF, or a jumper placed on the **FIELD TEST** pins between 1- to 2-seconds to reset the heat pump control.

Defrost System

The heat pump control (A175) measures differential temperatures to detect when the system is performing poorly because of ice build-up on the outdoor coil. The controller self-calibrates (see figure 36) when the defrost system starts and after each system defrost cycle. The heat pump control monitors ambient temperature, outdoor coil temperature, and total run-time to determine when a defrost cycle is required. The coil temperature sensor is designed with a spring clip to allow mounting to the outside coil tubing. The location of the coil sensor is important for proper defrost operation (see figure 1 for location of coil sensor).

NOTE — The heat pump control accurately measures the performance of the system as frost accumulates on the outdoor coil. This typically will translate into longer running time between defrost cycles as more frost accumulates on the outdoor coil before the heat pump control initiates defrost cycles.

DEFROST OPERATING MODES

The heat pump control has three operational modes which are:

- Defrost calibration and operation (see figure 36)
- Defrost test (see figure 9)

DEFROST TERMINATION TEMPERATURES

The heat pump control selections are: 50, 70, 90, and 100°F (10, 21, 32 and 38°C). The jumper termination pin is factory set at **50°F (10°C)**.

If the temperature jumper is **not installed**, the termination temperature is **90°F (32°C)**. See figure 36 for on how this settings affects defrost calibration and defrost modes.

NOTE - Colder climates could require a high discharge termination temperature setting to maintain a clear coil.

UNIT SENSORS

Sensors connect to the heat pump control through a field-replaceable harness assembly that plugs into the control. Through the sensors, the control detects outdoor ambient, coil, and discharge temperature fault conditions. As the detected temperature changes, the resistance across the sensor changes. Tables 21 and 22 shows how the resistance varies as the temperature changes for both type of sensors. Sensor resistance values can be checked by ohming across pins shown in table 20.

NOTE — When checking the ohms across a sensor, be aware that a sensor showing a resistance value that is not within the range shown in table 20, may be performing as designed. However, if a shorted or open circuit is detected, then the sensor may be faulty and the sensor harness will need to be replaced.

Ambient Temperature Sensor (RT13)

The ambient sensor (location shown in figure 1) considers outdoor temperatures below -35°F (-37°C) or above 120°F (48°C) as a fault. If the ambient sensor is detected as being open, shorted or out of the temperature range of the sensor, the control will not perform demand defrost operation. The control will revert to time/temperature defrost operation and will display the appropriate alert code. Heating and cooling operation will be allowed in this fault condition.

Coil Temperature Sensor (RT21)

This sensor (location shown in figure 1) considers coil temperatures below -35°F (-37°C) or above 120°F (48°C) to be a fault. If the defrost coil sensor is open, shorted or out of the temperature range of the sensor, the heat pump control will not perform demand or time/temperature defrost operation and will display the appropriate fault code. Heating and cooling operation will be allowed in this fault condition.

High Discharge Line Temperature Sensor (RT28)

The high discharge line temperature sensor (location shown in figure 1 monitors temperature range and open/short conditions. See figure 35 for the high discharge line temperature sensor sequence of operation.

Table 20. Sensor Temperature / Resistance Range

Sensor	Temperature Range °F (°C)	Resistance values range (ohms)	Pins/Wire Color
Discharge (RT28)	24 (-4) to 350 (176)	41,000 to 103	1 and 2 (Yellow)
Outdoor (Ambient) (RT13)	-35 (-37) to 120 (48)	280,000 to 3750	3 and 4 (Black)
Coil (RT21)	-35 (-37) to 120 (48)	280,000 to 3750	5 and 6 (Brown)
NOTE — Sensor resistance decreases as sensed temperature increases (see tables 21 and 22).			

W Input Fault or Miswire

In case of a W input fault or possible miswire, the system will function as listed in the sequence of operation in figure 37.

SECOND-STAGE OPERATION

If the control receives a call for second-stage compressor operation **Y2** in heating or cooling mode and the first-stage compressor output is active, the second-stage compressor solenoid output will be energized by the heat pump control system operation function.

*NOTE — Figure 23 illustrates the correct **Y2** field wiring configuration.*

*NOTE — The heat pump control system operation monitor has a five second delay between **Y2** being powered and the solenoid energizing.*

Second Stage Lock-in

If first-stage compressor output is active in heating mode and the outdoor ambient temperature is below the selected compressor lock-in temperature, the second-stage compressor solenoid output will be energized even without a **Y2** room thermostat input.

If the jumper is not connected to one of the temperature selection pins (40, 45, 50, 55°F), the default lock-in temperature of 40°F (4.5°C) will be used.

The heat pump control de-energizes the second-stage compressor solenoid output immediately when the **Y2** signal is removed or the outdoor ambient temperature is 5°F above the selected compressor lock-in temperature, or the first-stage compressor output is de-energized for any reason.

Shift Delay

The heat pump control has a field-selectable function to reduce occasional sounds that may occur while the unit is cycling in and out of the defrost mode. Units are shipped with jumper installed on pins.

* When the jumper is installed: There is a 30-second compressor shift delay which de-energizes the compressor contactor output and ECM fan outputs. After the delay expires, the compressor contactor and ECM fan outputs are energized.
* When the jumper is not installed: The reversing valve is changed by de-energizing the outputs immediately.

Table 21. Ambient (RT13) and Coil (RT21) Sensors Temperature / Resistance Range

Degrees Fahrenheit	Resistance	Degrees Fahrenheit	Resistance	Degrees Fahrenheit	Resistance	Degrees Fahrenheit	Resistance
136.3	2680	56.8	16657	21.6	44154	-11.3	123152
133.1	2859	56.0	16973	21.0	44851	-11.9	125787
130.1	3040	55.3	17293	20.5	45560	-12.6	128508
127.3	3223	54.6	17616	20.0	46281	-13.2	131320
124.7	3407	53.9	17942	19.4	47014	-13.9	134227
122.1	3592	53.2	18273	18.9	47759	-14.5	137234
119.7	3779	52.5	18607	18.4	48517	-15.2	140347
117.5	3968	51.9	18945	17.8	49289	-15.9	143571
115.3	4159	51.2	19287	17.3	50074	-16.5	146913
113.2	4351	50.5	19633	16.8	50873	-17.2	150378
111.2	4544	49.9	19982	16.3	51686	-17.9	153974
109.3	4740	49.2	20336	15.7	52514	-18.6	157708
107.4	4937	48.5	20695	15.2	53356	-19.3	161588
105.6	5136	47.9	21057	14.7	54215	-20.1	165624
103.9	5336	47.3	21424	14.1	55089	-20.8	169824
102.3	5539	46.6	21795	13.6	55979	-21.5	174200
100.6	5743	46.0	22171	13.1	56887	-22.3	178762
99.1	5949	45.4	22551	12.5	57811	-23.0	183522
97.6	6157	44.7	22936	12.0	58754	-23.8	188493
96.1	6367	44.1	23326	11.5	59715	-24.6	193691
94.7	6578	43.5	23720	11.0	60694	-25.4	199130
93.3	6792	42.9	24120	10.4	61693	-26.2	204829
92.0	7007	42.3	24525	9.9	62712	-27.0	210805
90.6	7225	41.7	24934	9.3	63752	-27.8	217080
89.4	7444	41.1	25349	8.8	64812	-28.7	223677
88.1	7666	40.5	25769	8.3	65895	-29.5	230621
86.9	7890	39.9	26195	7.7	67000	-30.4	237941
85.7	8115	39.3	26626	7.2	68128	-31.3	245667
84.5	8343	38.7	27063	6.7	69281	-32.2	253834
83.4	8573	38.1	27505	6.1	70458	-33.2	262482
82.3	8806	37.5	27954	5.6	71661	-34.1	271655
81.2	9040	37.0	28408	5.0	72890	-35.1	281400
80.1	9277	36.4	28868	4.5	74147	-36.1	291774
79.0	9516	35.8	29335	3.9	75431	-37.1	302840
78.0	9757	35.2	29808	3.4	76745	-38.2	314669
77.0	10001	34.7	30288	2.8	78090	-39.2	327343
76.0	10247	34.1	30774	2.3	79465		
75.0	10496	33.5	31267	1.7	80873		
74.1	10747	33.0	31766	1.2	82314		
73.1	11000	32.4	32273	0.6	83790		
72.2	11256	31.9	32787	0.0	85302		
71.3	11515	31.3	33309	-0.5	86852		
70.4	11776	30.7	33837	-1.1	88440		
69.5	12040	30.2	34374	-1.7	90068		
68.6	12306	29.6	34918	-2.2	91738		
67.7	12575	29.1	35471	-2.8	93452		
66.9	12847	28.6	36031	-3.4	95211		
66.0	13122	28.0	36600	-4.0	97016		
65.2	13400	27.5	37177	-4.6	98870		
64.4	13681	26.9	37764	-5.2	100775		
63.6	13964	26.4	38359	-5.7	102733		
62.8	14251	25.8	38963	-6.3	104746		
62.0	14540	25.3	39577	-6.9	106817		
61.2	14833	24.8	40200	-7.5	108948		
60.5	15129	24.2	40833	-8.2	111141		
59.7	15428	23.7	41476	-8.8	113400		
59.0	15730	23.2	42130	-9.4	115727		
58.2	16036	22.6	42794	-10.0	118126		
57.5	16345	22.1	43468	-10.6	120600		

Table 22. High Discharge Sensor (RT28) Temperature / Resistance Range

Degrees Fahrenheit	Resistance	Degrees Fahrenheit	Resistance	Degrees Fahrenheit	Resistance	Degrees Fahrenheit	Resistance
303.1	183	186.1	1052	136.8	2656	94.5	6613
298.1	195	185.0	1072	136.0	2698	93.6	6739
293.4	207	183.9	1093	135.2	2740	92.8	6869
289.0	220	182.8	1114	134.5	2783	92.0	7002
284.8	232	181.8	1135	133.7	2827	91.2	7139
280.9	245	180.7	1157	132.9	2872	90.3	7281
277.1	258	179.6	1179	132.2	2917	89.5	7426
273.6	270	178.6	1201	131.4	2963	88.6	7575
270.2	283	177.6	1223	130.6	3010	87.8	7729
267.0	297	176.6	1245	129.9	3057	86.9	7888
263.9	310	175.5	1268	129.1	3105	86.0	8051
260.9	323	174.6	1291	128.4	3154	85.2	8220
258.1	336	173.6	1315	127.6	3204	84.3	8394
255.3	350	172.6	1338	126.8	3255	83.4	8574
252.7	364	171.6	1362	126.1	3307	82.5	8759
250.1	378	170.6	1386	125.3	3359	81.6	8951
247.7	391	169.7	1411	124.6	3413	80.7	9149
245.3	405	168.7	1435	123.8	3467	79.8	9354
243.0	420	167.8	1460	123.1	3523	78.8	9566
240.8	434	166.9	1486	122.3	3579	77.9	9786
238.6	448	165.9	1511	121.6	3637	76.9	10013
236.5	463	165.0	1537	120.8	3695	76.0	10250
234.4	478	164.1	1563	120.1	3755	75.0	10495
232.4	492	163.2	1590	119.3	3816	74.1	10749
230.5	507	162.3	1617	118.5	3877	73.1	11014
228.6	523	161.4	1644	117.8	3940	72.1	11289
226.7	538	160.5	1672	117.0	4005	71.1	11575
224.9	553	159.7	1699	116.3	4070	70.0	11873
223.2	569	158.8	1728	115.5	4137	69.0	12184
221.5	584	157.9	1756	114.8	4205	68.0	12509
219.8	600	157.1	1785	114.0	4274	66.9	12848
218.1	616	156.2	1815	113.2	4345	65.8	13202
216.5	632	155.3	1845	112.5	4418	64.7	13573
214.9	649	154.5	1875	111.7	4491	63.6	13961
213.4	665	153.6	1905	111.0	4567	62.5	14368
211.9	682	152.8	1936	110.2	4644	61.3	14796
210.4	698	152.0	1968	109.4	4722	60.2	15246
208.9	715	151.1	1999	108.7	4802	59.0	15719
207.5	732	150.3	2032	107.9	4884	57.8	16218
206.0	750	149.5	2064	107.1	4968	56.6	16744
204.6	767	148.7	2098	106.4	5054	55.3	17301
203.3	785	147.9	2131	105.6	5141	54.0	17891
201.9	803	147.1	2165	104.8	5231	52.7	18516
200.6	821	146.2	2200	104.0	5323	51.4	19180
199.3	839	145.4	2235	103.3	5416	50.0	19887
198.0	857	144.6	2270	102.5	5512	48.6	20641
196.8	876	143.8	2306	101.7	5610	47.2	21448
195.5	894	143.0	2343	100.9	5711	45.7	22311
194.3	913	142.3	2380	100.1	5814		
193.1	932	141.5	2418	99.3	5920		
191.9	952	140.7	2456	98.5	6028		
190.7	971	139.9	2495	97.7	6139		
189.5	991	139.1	2534	96.9	6253		
188.4	1011	138.3	2574	96.1	6370		
187.2	1031	137.6	2615	95.3	6489		

TOP GRILLE OR FAN MOTOR MOUNT ADJUSTMENT FOR FAN CLEARANCE

Sometimes during shipping, either the fan motor mounting or top grille may become out of alignment. This may cause the fan motor blade to not clear the orifice ring. If this situation occurs, simply adjust either or both the fan motor mount or top grille positions to allow proper clearance. The top grille four fastener insertion points to the plastic top and motor mount locations are larger than the fasteners used to secure the grille and fan motor mounts. Use the procedures provided in figure 19 to adjust for fan clearance.

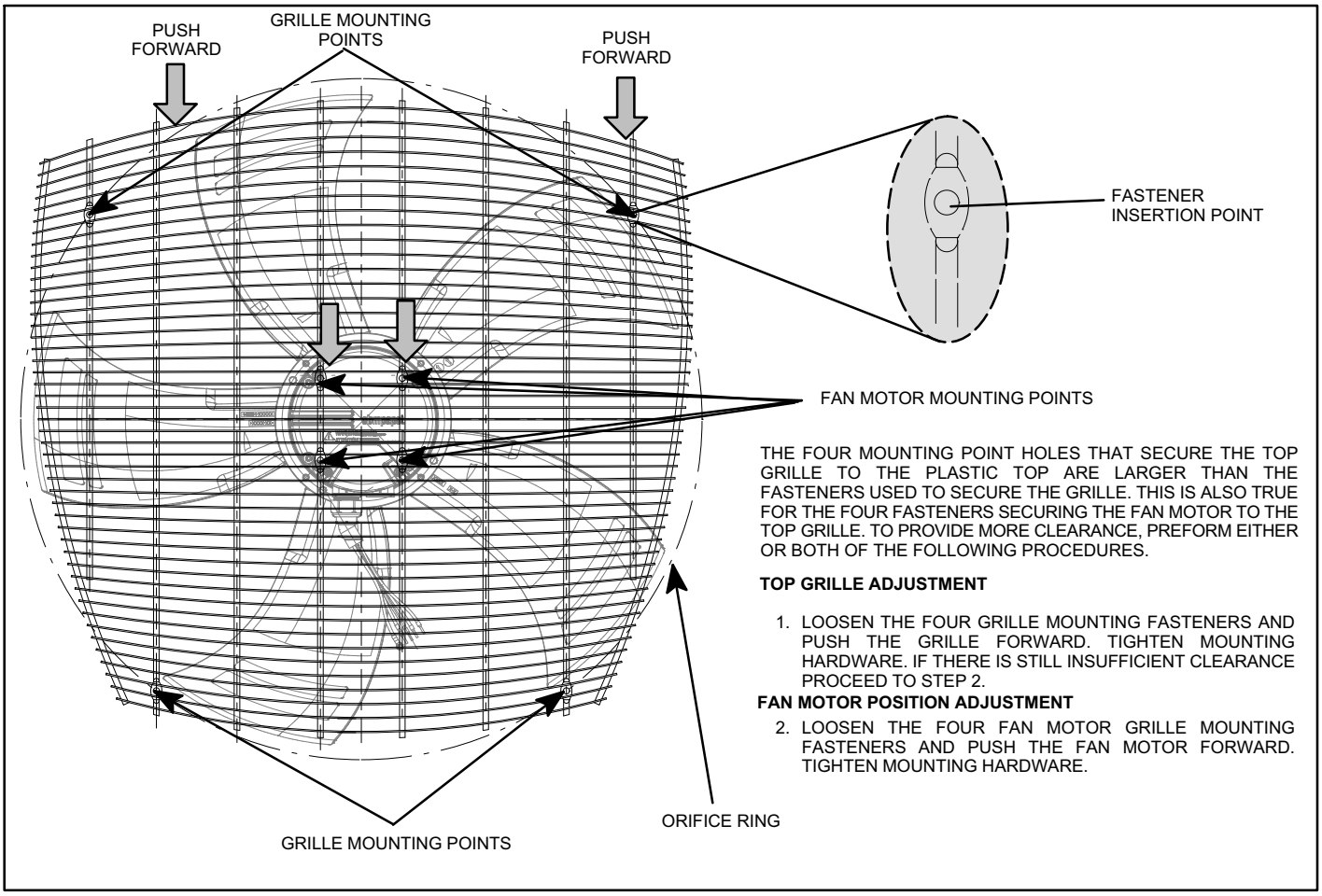


Figure 19. Fan Blade Clearance Adjustment

CRANKCASE HEATER (HR1)

Compressors in all units are equipped with a 70 watt belly band type crankcase heater. HR1 prevents liquid from accumulating in the compressor. HR1 is controlled by the crankcase heater thermostat.

CRANKCASE HEATER THERMOSTAT (S40)

Thermostat S40 controls the crankcase heater in all units. S40 is located on the liquid line. When liquid line temperature drops below 50°F the thermostat S40 closes energizing HR1. The thermostat will open, de-energizing HR1 once liquid line temperature reaches 70°F .

REVERSING VALVE (L1)

The primary components of the reversing valve are reversing valve, solenoid and wiring harness.

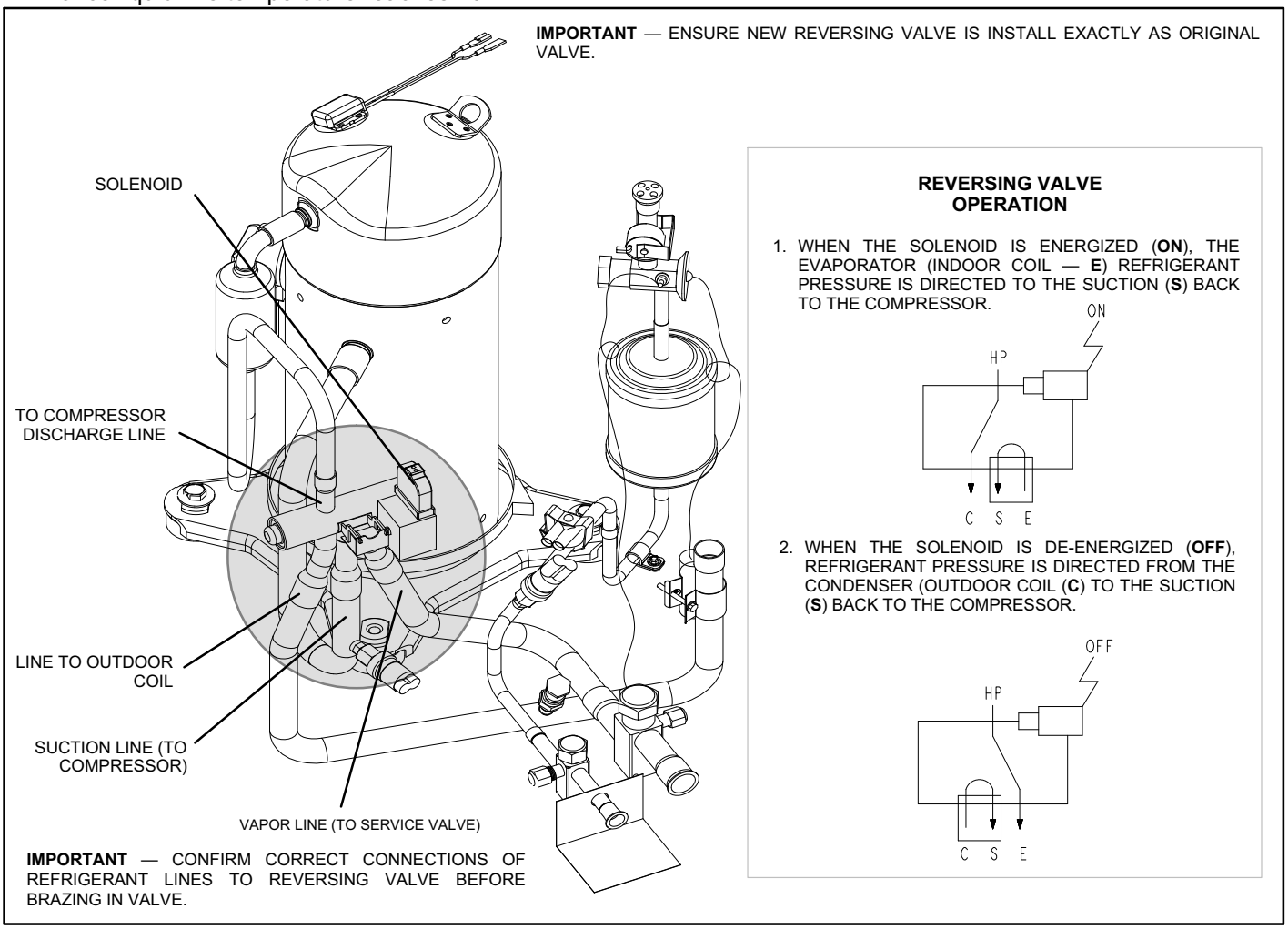


Figure 20. Typical Reversing Valve Components and Operation

Maintenance

DEALER

Outdoor Unit

Maintenance and service must be performed by a qualified installer or service agency. At the beginning of each cooling season, the system should be checked as follows:

1. Clean and inspect outdoor coil (may be flushed with a water hose). Ensure power is off before cleaning.
2. Outdoor unit fan motor is pre-lubricated and sealed. No further lubrication is needed.
3. Visually inspect all connecting lines, joints and coils for evidence of oil leaks.
4. Check all wiring for loose connections.
5. Check for correct voltage at unit (unit operating).
6. Check amp draw on outdoor fan motor.

   Motor Nameplate:_____ **Actual**:_____.
7. Inspect drain holes in coil compartment base and clean if necessary.

NOTE — If insufficient heating or cooling occurs, the unit should be gauged and refrigerant charge should be checked.

Outdoor Coil

It may be necessary to flush the outdoor coil more frequently if it is exposed to substances which are corrosive or which block airflow across the coil (e.g., pet urine, cottonwood seeds, fertilizers, fluids that may contain high levels of corrosive chemicals such as salts)

- Outdoor Coil — The outdoor coil may be flushed with a water hose.
- Outdoor Coil (Sea Coast) — Moist air in ocean locations can carry salt, which is corrosive to most metal. Units that are located near the ocean require frequent inspections and maintenance. These inspections will determine the necessary need to wash the unit including the outdoor coil. Consult your installing contractor for proper intervals/procedures for your geographic area or service contract.

INDOOR UNIT MAINTENANCE

Indoor Unit

1. Clean or change filters.
2. Lennox blower motors are prelubricated and permanently sealed. No more lubrication is needed.
3. Adjust blower speed for cooling. Measure the pressure drop over the coil to determine the correct blower CFM. Refer to the unit information service manual for pressure drop tables and procedure.
4. *Belt Drive Blowers* - Check belt for wear and proper tension.
5. Check all wiring for loose connections.
6. Check for correct voltage at unit. (blower operating)
7. Check amp draw on blower motor.

   Motor Nameplate:_____ **Actual**:_____.

Indoor Coil

1. Clean coil if necessary.
2. Check connecting lines, joints and coil for evidence of oil leaks.
3. Check condensate line and clean if necessary.

Locations with Possibility of Heavy Snow or Freezing Rain Accumulation

Heavy snow and/or freezing rain can interfere with the performance of the outdoor fan assembly. Lennox recommends use of the optional snow guard (X8782) in these areas.

Figure 21. Snow Guard Top Cover — X8782

Checklists

TWO — STAGE COMPRESSOR CHECKOUT

Use this check-out procedure to verify part- and full-load capacity operation of two-stage modulation compressor.

⚠ IMPORTANT

This performance check is ONLY valid on systems that have clean indoor and outdoor coils, proper airflow over coils, and correct system refrigerant charge. All components in the system must be functioning proper to correctly perform compressor modulation operational check. (Accurate measurements are critical to this test as indoor system loading and outdoor ambient can affect variations between low and high capacity readings).

TOOLS REQUIRED

- Refrigeration gauge set
- Digital volt/amp meter
- Electronic temperature thermometer
- On-off toggle switch

PROCEDURE

1. Turn main power OFF to outdoor unit.
2. Adjust room thermostat set point 5ºF above (heating operation) or 5ºF below (cooling operation) the room temperature.
3. Remove control access panel. Install refrigeration gauges on unit. Attach the amp meter to the common (black wire) wire of the compressor harness. Attach thermometer to discharge line as close as possible to the compressor.
4. Turn toggle switch OFF. Install switch in series with Y2 wire from room thermostat (see note ** in the *Field Operational Checklist* on page 49).
5. Cycle main power ON.
6. Allow pressures and temperatures to stabilize before taking any measured reading (may take up to 10 minutes).
7. Record all of the readings for the Y1 demand.
8. Close switch to energize Y2 demand. Verify power is going to compressor solenoid (see note ** in the *Field Operational Checklist* on page 49).
9. Allow pressures and temperatures to stabilize before taking any measured reading (this may take up to 10 minutes).
10. Record all of the readings with the Y1 and Y2 demand.
11. If temperatures and pressures change in the direction noted in chart, the compressor is properly modulating from low to high capacity. (If no amperage, pressures or temperature readings change when this test is performed, the compressor is not switching between low and high capacity and replacement is necessary).
12. After testing is complete, return unit to original set up.

XP21 Field Operational Checklist

Unit Readings	Cooling***			Heating***		
	Y1 First Stage	Expected results during Y2 demand (Toggle switch On)	Y2 Second Stage	Y1 First Stage	Expected results during Y2 demand (Toggle switch On)	Y2 Second Stage
Compressor						
Voltage		Same			Same	
Amperage		Higher			Higher	
Condenser Fan motor						
Amperage		Same or Higher			Same or Higher	
Temperature						
Ambient		Same			Same	
Outdoor Coil Discharge Air		Higher			Lower	
Compressor Discharge Line		Higher			Higher	
Indoor Return Air		Same			Same	
Indoor Coil Discharge Air		Lower			Higher	
Pressures						
Suction (Vapor)		Lower			Down	
Liquid		Higher			Higher	

Note - Heat pump may have a low ambient control or Control that locks in second-stage below its set point. It may be necessary to remove a wire from the control when performing this check out.

** On the XP21 units, the System Operation Monitor controls the second-stage solenoid coil in compressor.

*** Cooling Mode Operation - Block outdoor coil to maintain a minimum of 375 psig during testing.
Heating Mode Operation - Block indoor coil to maintain a minimum of 375 psig during testing.

Unit Wiring Diagrams

The following wiring diagrams were used during various stages of unit production. Service technician will need to visually inspect the unit being service to determine which wiring diagram is applicable. Quick verification can usually be made by comparing the wiring diagram located on the unit access panel to the following diagrams.

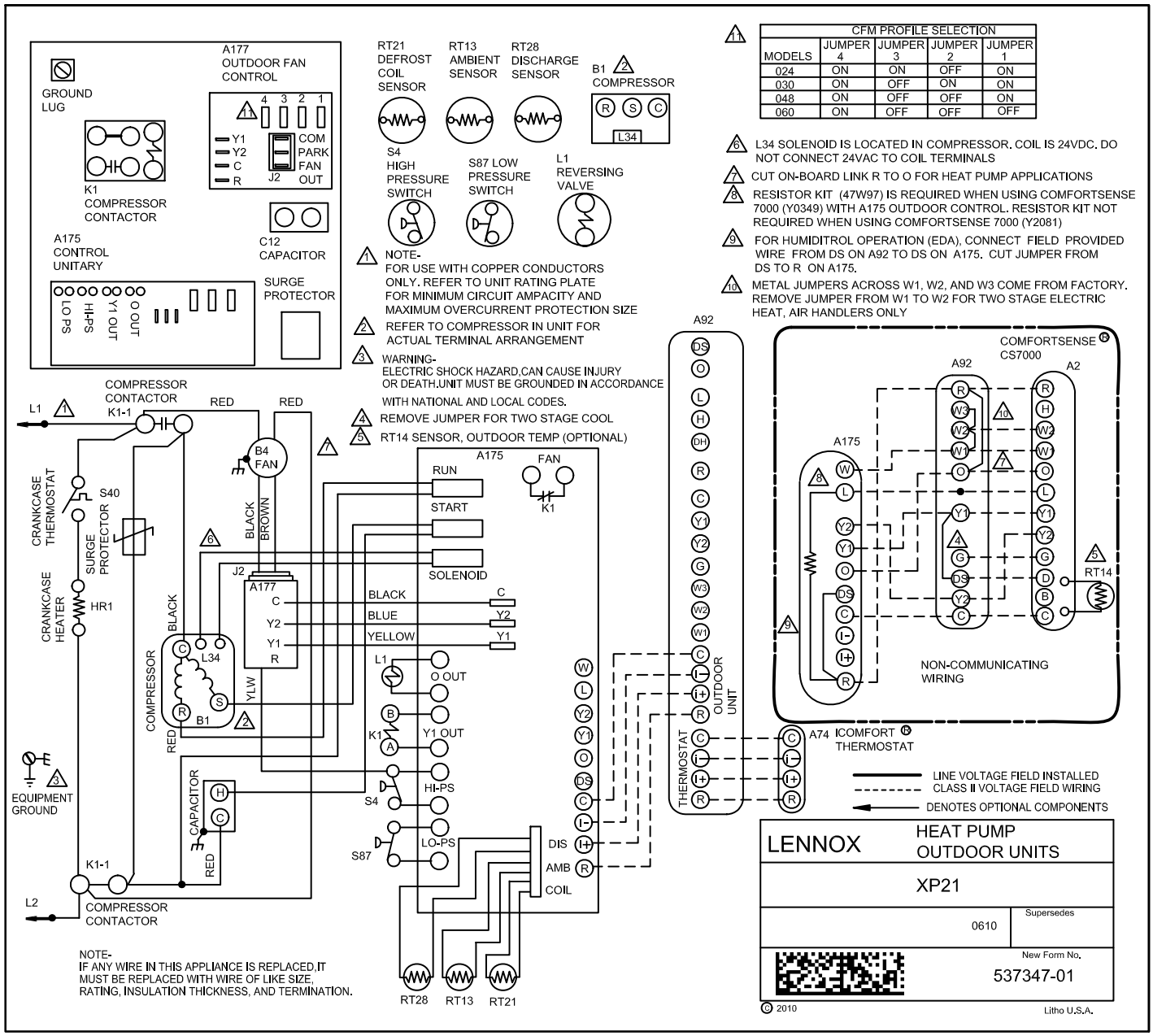


Figure 22. Typical XP21 Wiring (XP21-XXX-230-01 only)

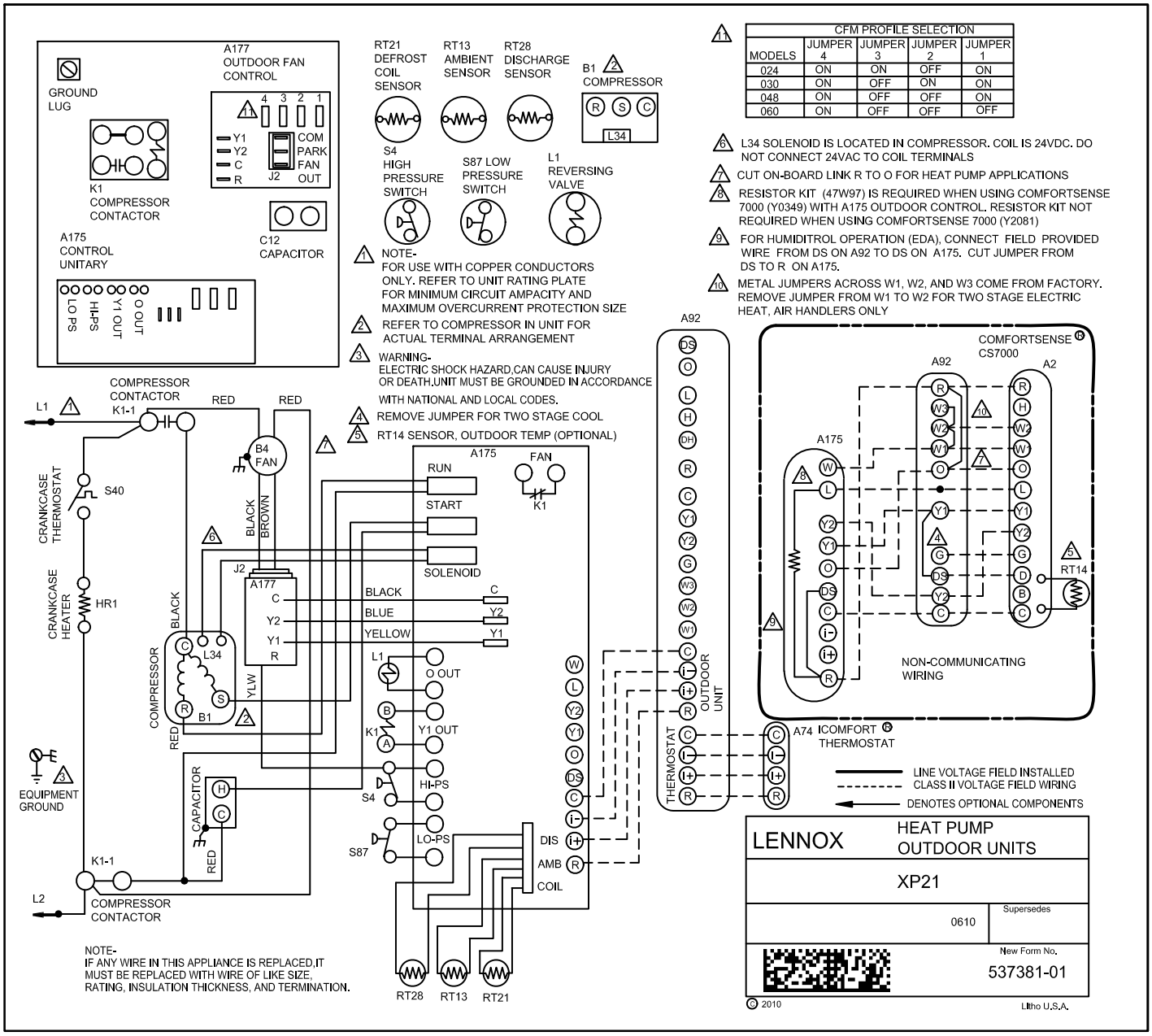


Figure 23. Typical XP21 Wiring (XP21-024-230-02, -03 and -04, XP21-036-230-02 and -03, XP21-048-230-02 and -03, XP21-060-230-02 and -03)

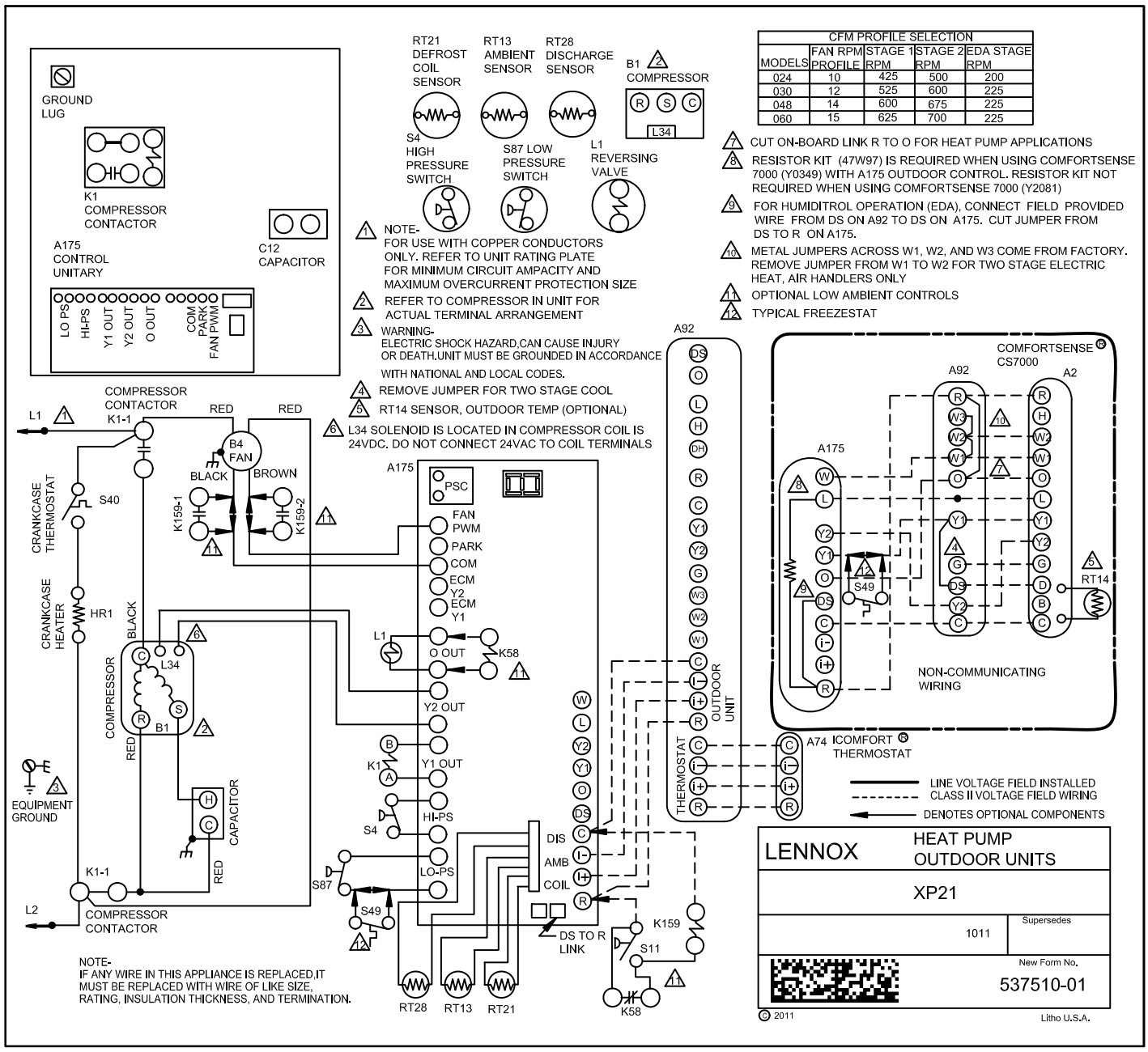


Figure 24. Typical XP21 Wiring (XP21-024-230-05, XP21-036-230-04, XP21-048-230-04 and XP21-060-230-04)

Factory Wiring Diagrams

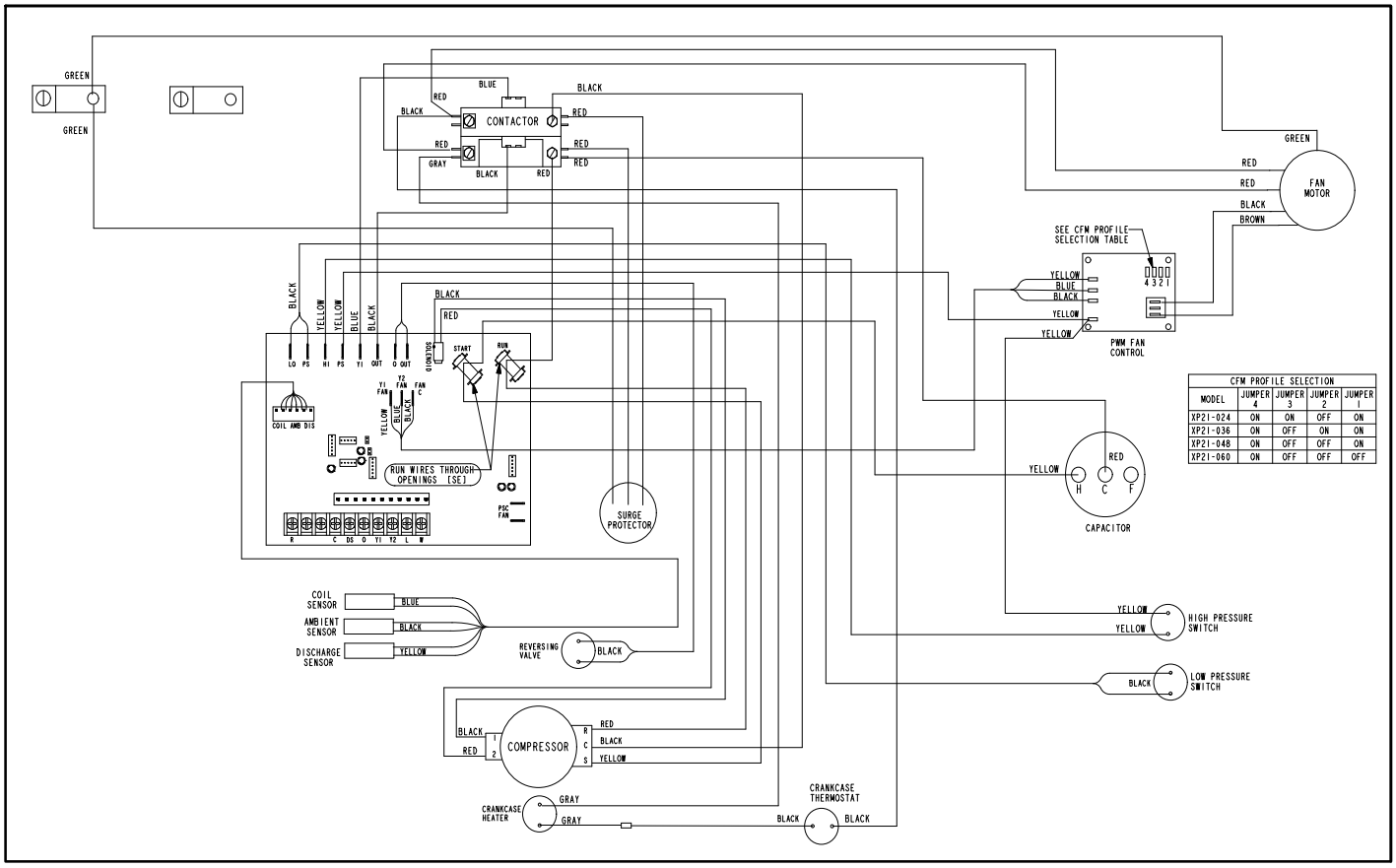


Figure 25. Typical Factory Wiring (XP21-XX-230-01)

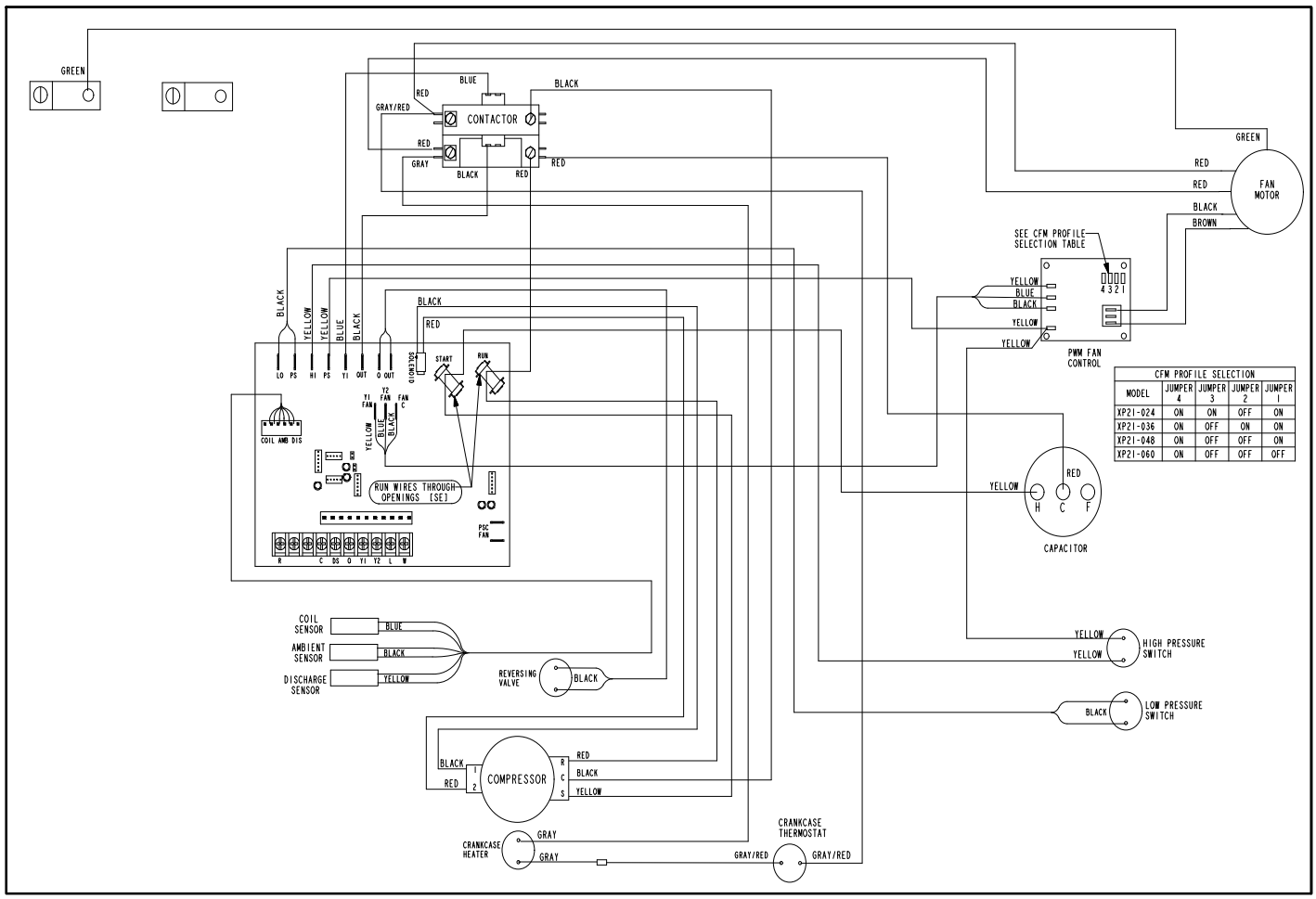
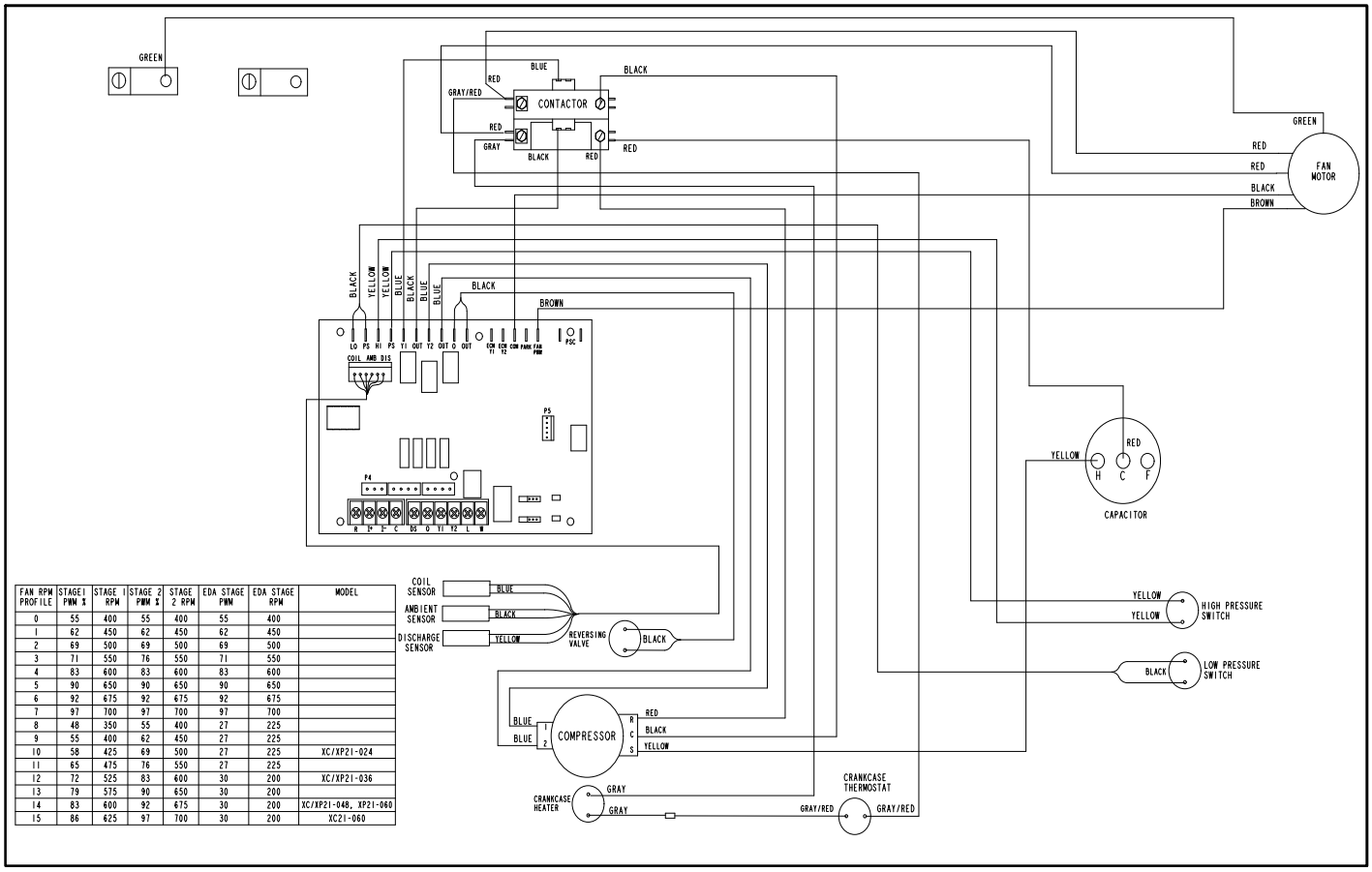


Figure 26. Typical Factory Wiring (XP21-024-230-02, -03 and -04, XP21-036-230-02 and -03, XP21-048-230-02 and -03, XP21-060-230-02 and -03)



FAN RPM PROFILE	STAGE1 PWM %	STAGE 1 RPM	STAGE 2 PWM %	STAGE 2 RPM	EDA STAGE PWM	EDA STAGE RPM	MODEL
0	55	400	55	400	55	400	
1	62	450	62	450	62	450	
2	69	500	69	500	69	500	
3	71	550	76	550	71	550	
4	83	600	83	600	83	600	
5	90	650	90	650	90	650	
6	92	675	92	675	92	675	
7	97	700	97	700	97	700	
8	48	350	55	400	27	225	
9	55	400	62	450	27	225	
10	58	425	69	500	27	225	XC/XP21-024
11	65	475	76	550	27	225	
12	72	525	83	600	30	200	XC/XP21-036
13	79	575	90	650	30	200	
14	83	600	92	675	30	200	XC/XP21-048, XP21-060
15	86	625	97	700	30	200	XC21-060

Figure 27. Typical Factory Wiring (XP21-024-230-05, XP21-036-230-04, XP21-048-230-04, XP21-060-230-04)

Load Shed Wiring

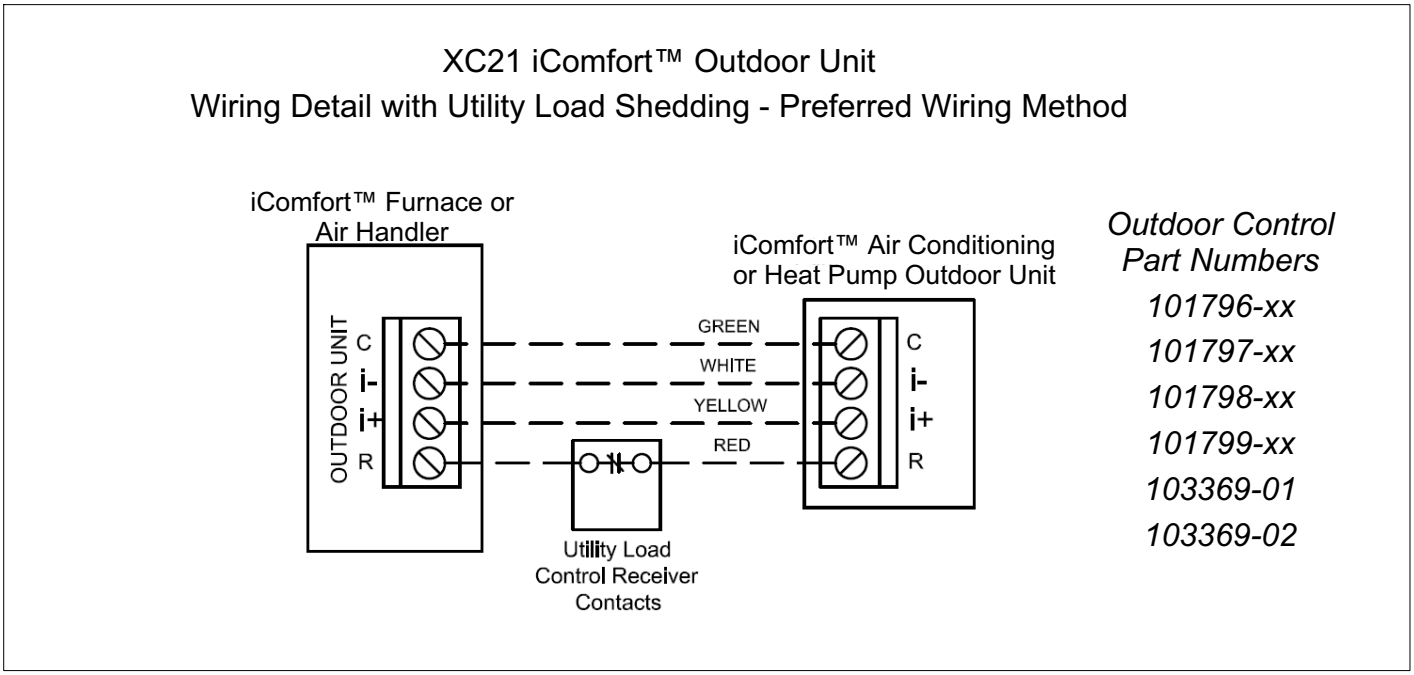


Figure 28. Preferred Method - Outdoor Controls - 101796-xx, 101797-xx, 101798-xx, 101799-xx, 103369-01 and 103369-02)

Information in this note shows the proper application and interface wiring of utility load control devices to Lennox iComfort™-enabled outdoor units installed on iComfort™-enabled communicating thermostat systems.

PREFERRED WIRING (OUTDOOR CONTROLS - 101796-XX, 101797-XX, 101798-XX, 101799-XX, 103369-01 AND 103369-02)

1. **Utility Load Shedding Mode ACTIVATED (Utility Cycled Unit OFF)** – The normally closed set of contacts in the utility load control receiver **open**. This interrupts the **R** iComfort™ communication wire between the indoor unit and iComfort™-enabled outdoor unit. The iComfort™-enabled outdoor unit will be cycled **OFF**. A "Lost Communication alert" will appear on the display of the iComfort Wi-Fi® thermostat. If the customer has selected the option to be notified when an alert occurs, the customer will be notified by email when the alert occurs.
2. **Utility Load Shedding Mode DEACTIVATED (Normal Equipment Operation)** – When load shedding is deactivated, the contacts in the utility load control receiver are closed. The **R** iComfort™ communication wire between the indoor unit and iComfort™ outdoor unit is connected and iComfort™ communication is restored. The outdoor unit will return to normal operation and the alert code will clear.

PREFERRED WIRING (OUTDOOR CONTROL - 103369-03)

1. **Utility Load Shedding Mode ACTIVATED (Utility Cycled Unit OFF)** – The normally closed set of contacts in the utility load control receiver “open”. This removes 24VAC from the coil of the field-provided relay (catalog # 69J79). The relay contacts close (terminal **7** to terminal **2**), completing the circuit between terminals **R** and **L** on the outdoor control. This 24VAC input to terminal **L** activates the load shedding mode in the outdoor control and the outdoor unit will be cycled **OFF**. The 7-Segment display on the outdoor control will display a load shedding alert code **E600** and an alert will appear on the display of the iComfort Wi-Fi® thermostat. If the customer has selected the option to be notified when an alert occurs, the customer will be notified by email when the alert occurs.
2. **Utility Load Shedding Mode DEACTIVATED (Normal Equipment Operation)** – When load shedding not required, the contacts in the utility load control receiver are closed. This provides 24VAC to the coil of the field provided relay (catalog # 69J79).The relay contacts **OPEN** (terminal **7** to terminal **2**) removing 24VAC from the **L** terminal on the outdoor control. This deactivates the load shedding mode in the outdoor control. The outdoor unit will return to normal operation and alert code will clear.

XC21 iComfort™ Outdoor Unit

Wiring Detail with Utility Load Shedding - Preferred and Only Wiring Method

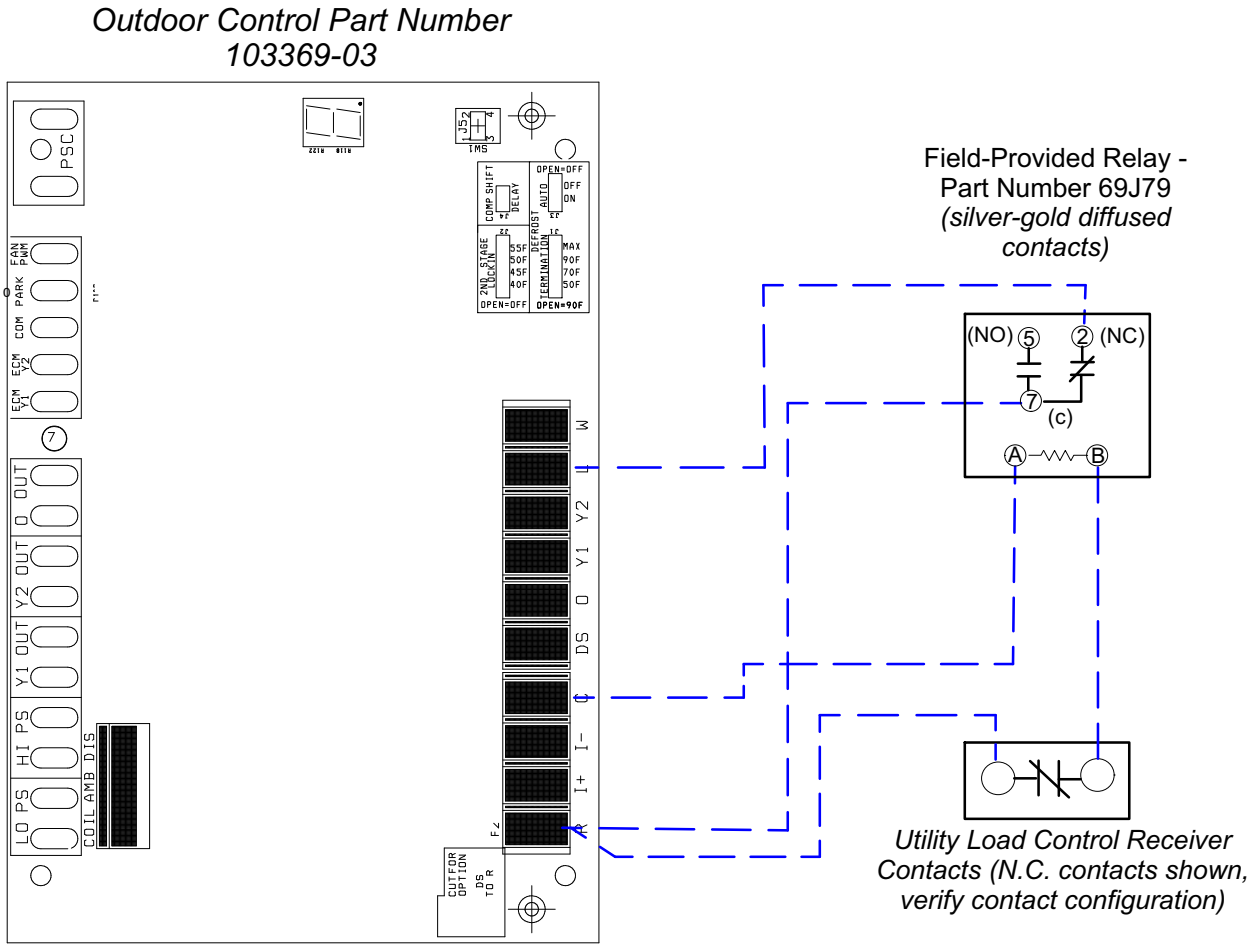


Figure 29. Preferred Method - Outdoor Control - 103369-03

NON- PREFERRED WIRING (OUTDOOR CONTROLS - 103369-01 AND 103369-02 ONLY)

1. **Utility Load Shedding Mode ACTIVATED (Utility Cycled Unit OFF)** – The normally closed set of contacts in the utility load control receiver **open**. This interrupts the 24VAC signal from the **Y1 Out** terminal on the outdoor control to the compressor contactor coil and the compressor will be cycled **OFF**. The outdoor fan will continue to operate during a thermostat demand. The 7-segment display on the outdoor control will **NOT** display an alert code and the iComfort Wi-Fi® thermostat will **NOT** display an alert. The customer will not be notified by email when the load shedding mode is activated by the utility company.

   ***Note** - Some utilities may require the entire outdoor unit to cycle off during utility load shedding. If the entire outdoor unit is required to cycle off, the "preferred wiring method" shown in figure 29 must be used.*

2. **Utility Load Shedding Mode DEACTIVATED (Normal Equipment Operation)** – When load shedding is not required, the contacts in the utility load control receiver are closed. The circuit is completed between the **Y1 Out** terminal on the outdoor control to the compressor contactor coil. The outdoor unit will return to normal operation.

XC21 iComfort™ Outdoor Unit

Wiring Detail with Utility Load Shedding - Alternate Wiring Method

NOTE: This alternate wiring method is not applicable to early production XC17, XP17, XC21 and XP21 outdoor units that used outdoor control 101796-xx, 101797-xx, 101798-xx and 101799-xx.

Outdoor Control Part Numbers

103369-01

103369-02

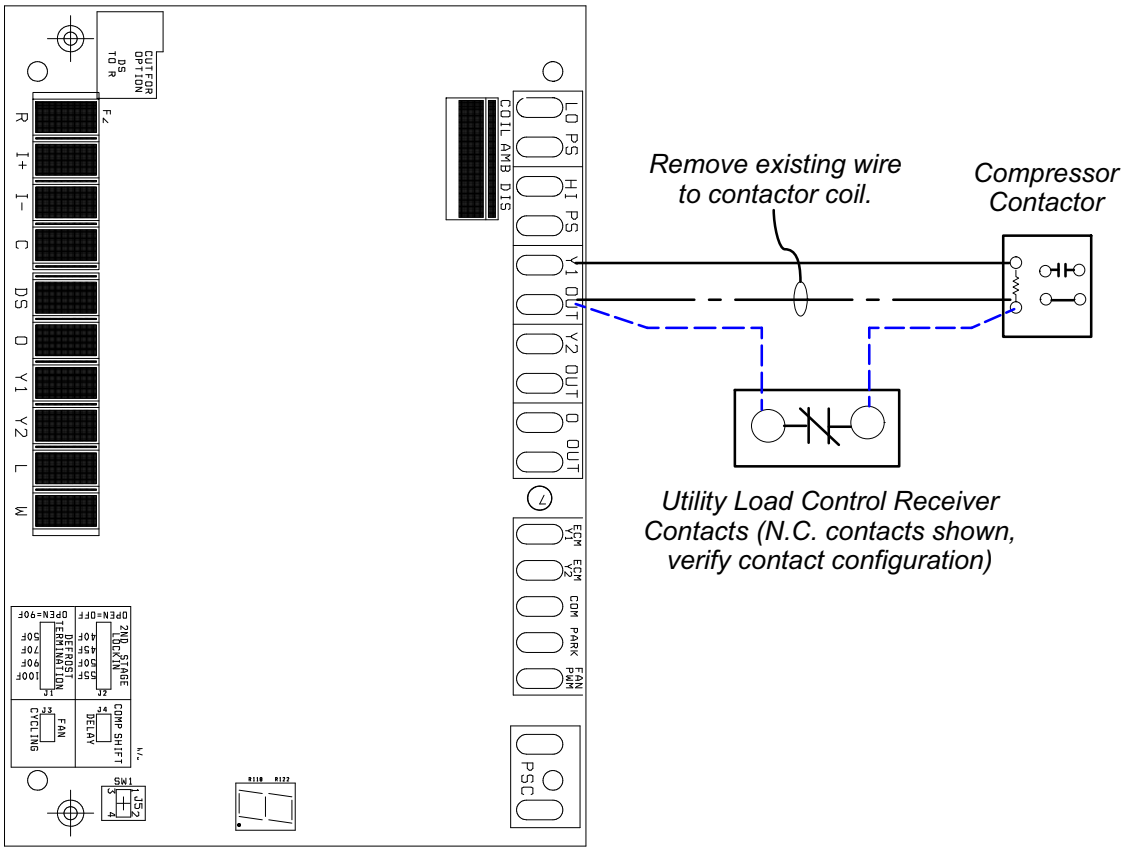


Figure 30. Non-Preferred Method - Outdoor Control- 103369-01 and 103369-02 Only)

Unit Sequence of Operations

The following figures illustrated the overall unit sequence of operations along with various pressure switches and temperature sensor operations. The figures also illustration the use of the compressor anti-short cycle function in relations to unit Status, Fault and Lockout LED Codes system operations interaction.

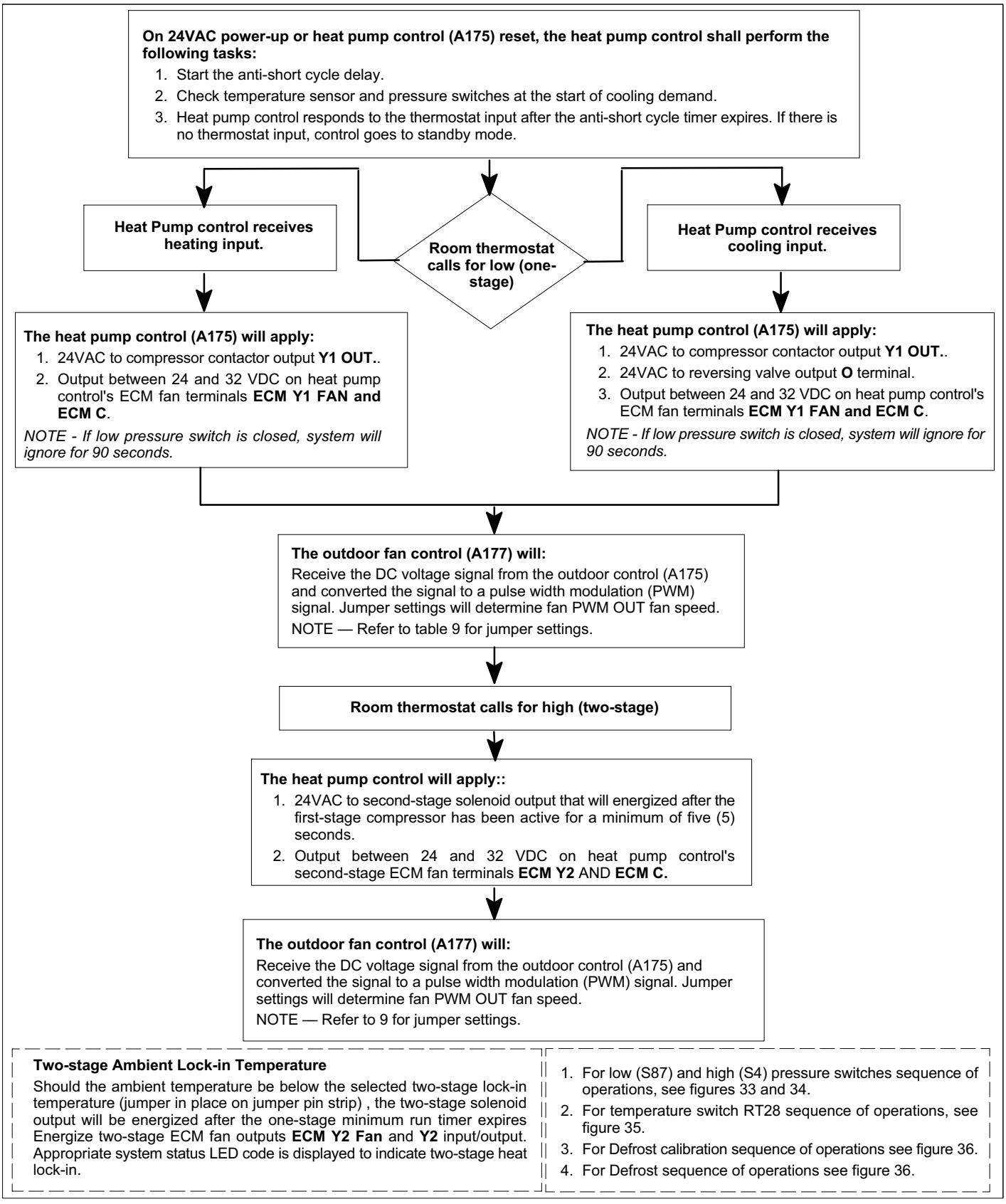


Figure 31. One- and Two-Stage Cooling Sequence of Operations (101796-XX Only)

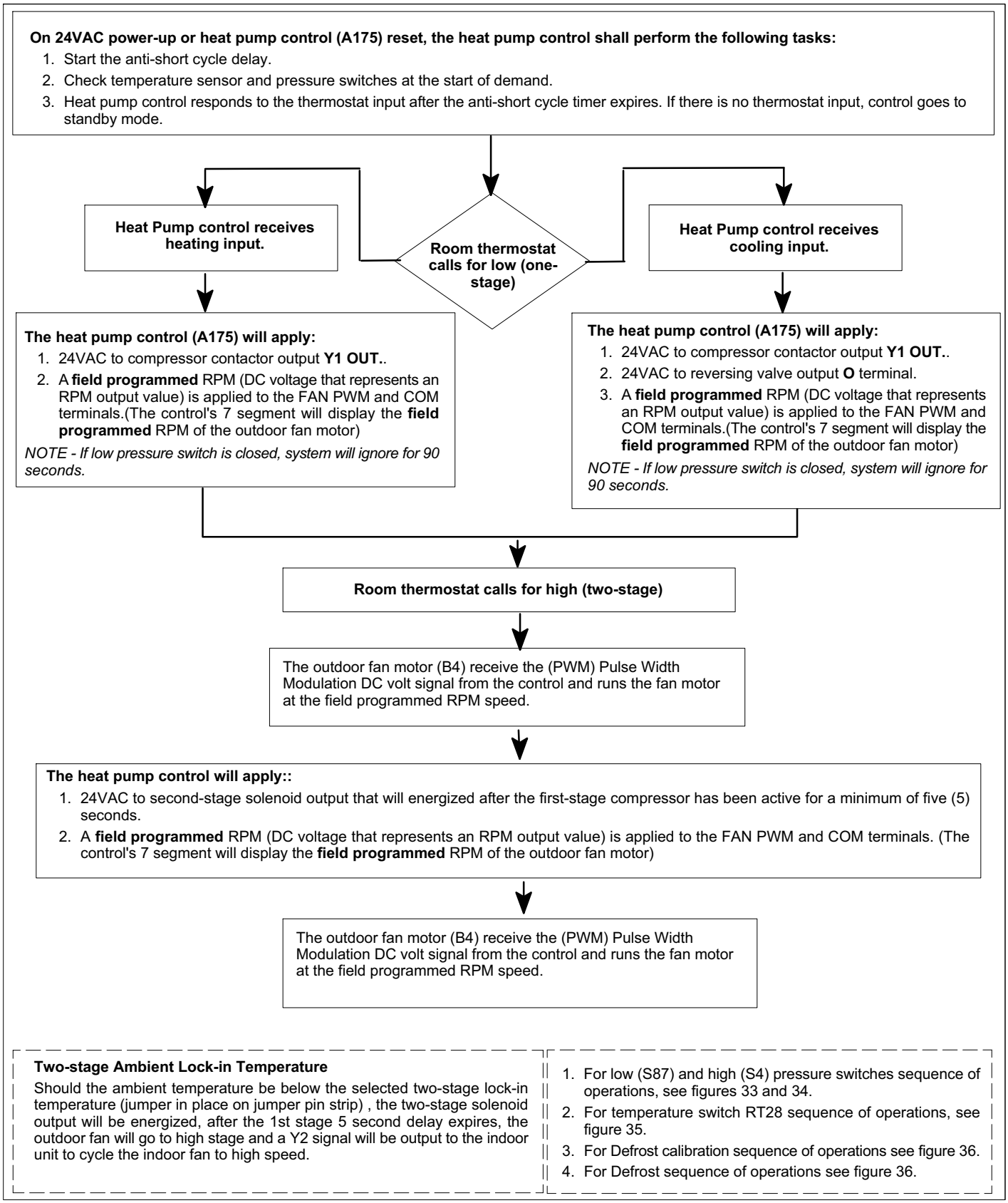


Figure 32. One- and Two-Stage Cooling Sequence of Operations (103369-01 Only)

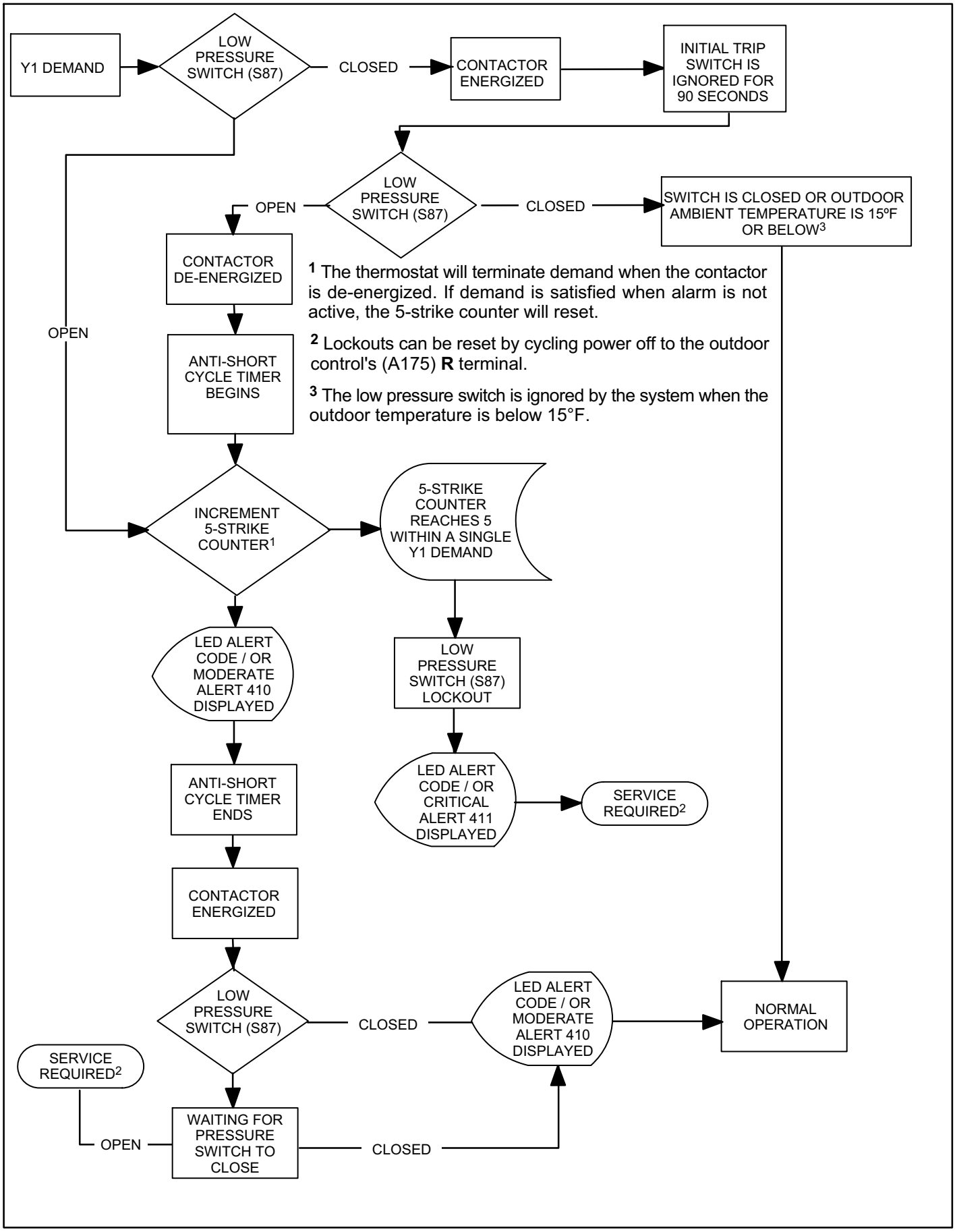


Figure 33. Low Pressure Switch (S87) Sequence of Operation (All Versions)

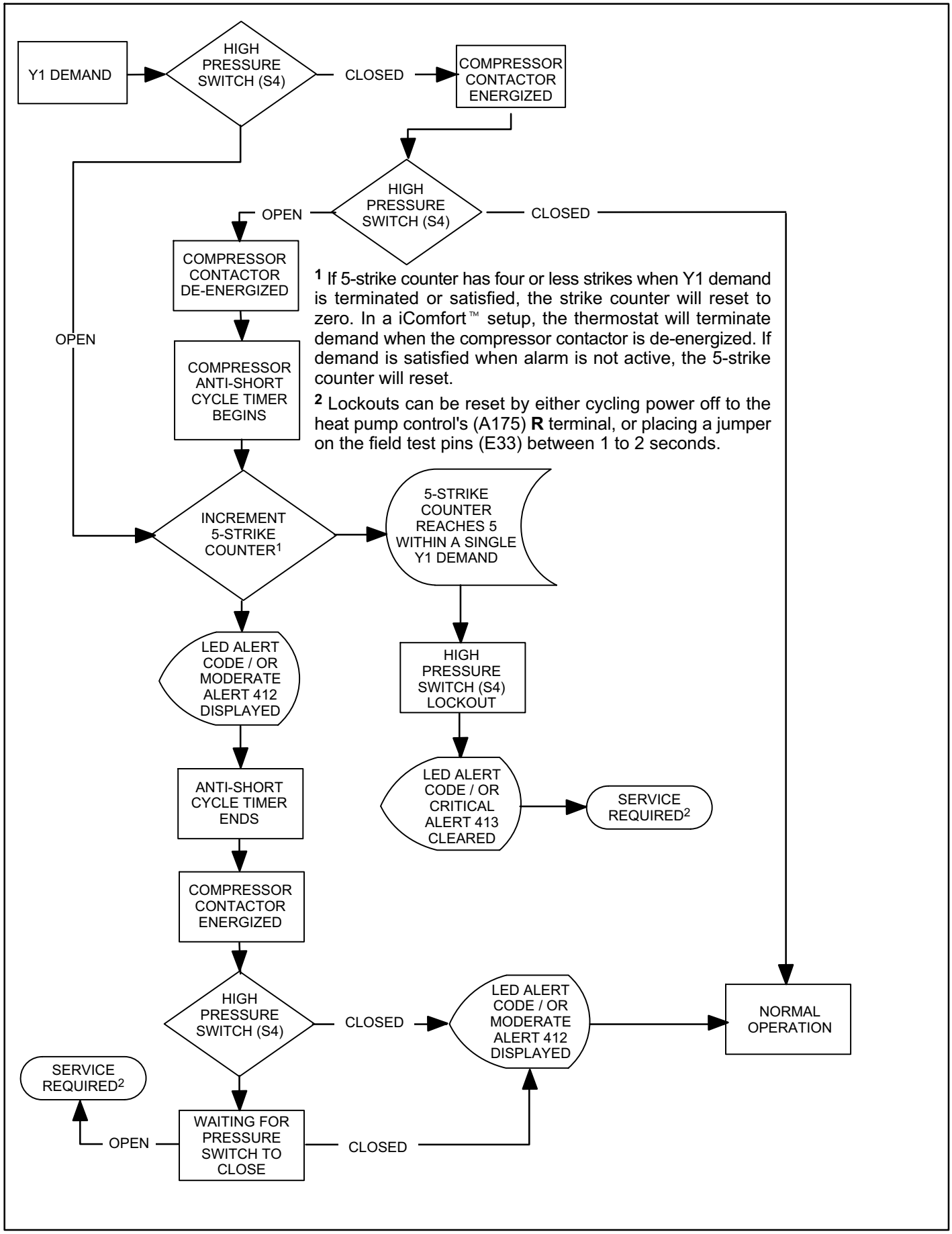


Figure 34. High Pressure Switch (S4) Sequence of Operation (All Versions)

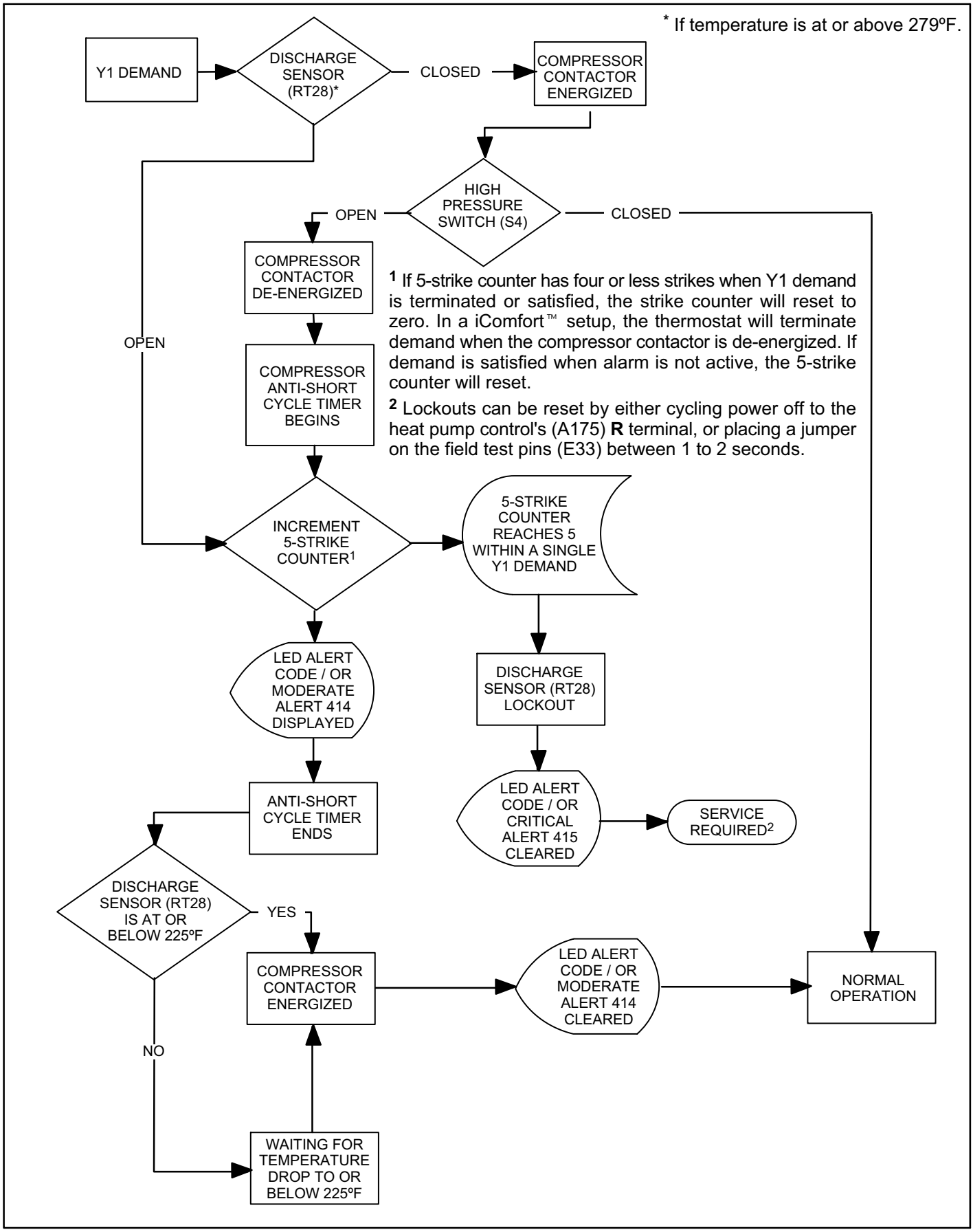


Figure 35. High Discharge Temperature Sensor (RT28) Sequence of Operation (All Versions)

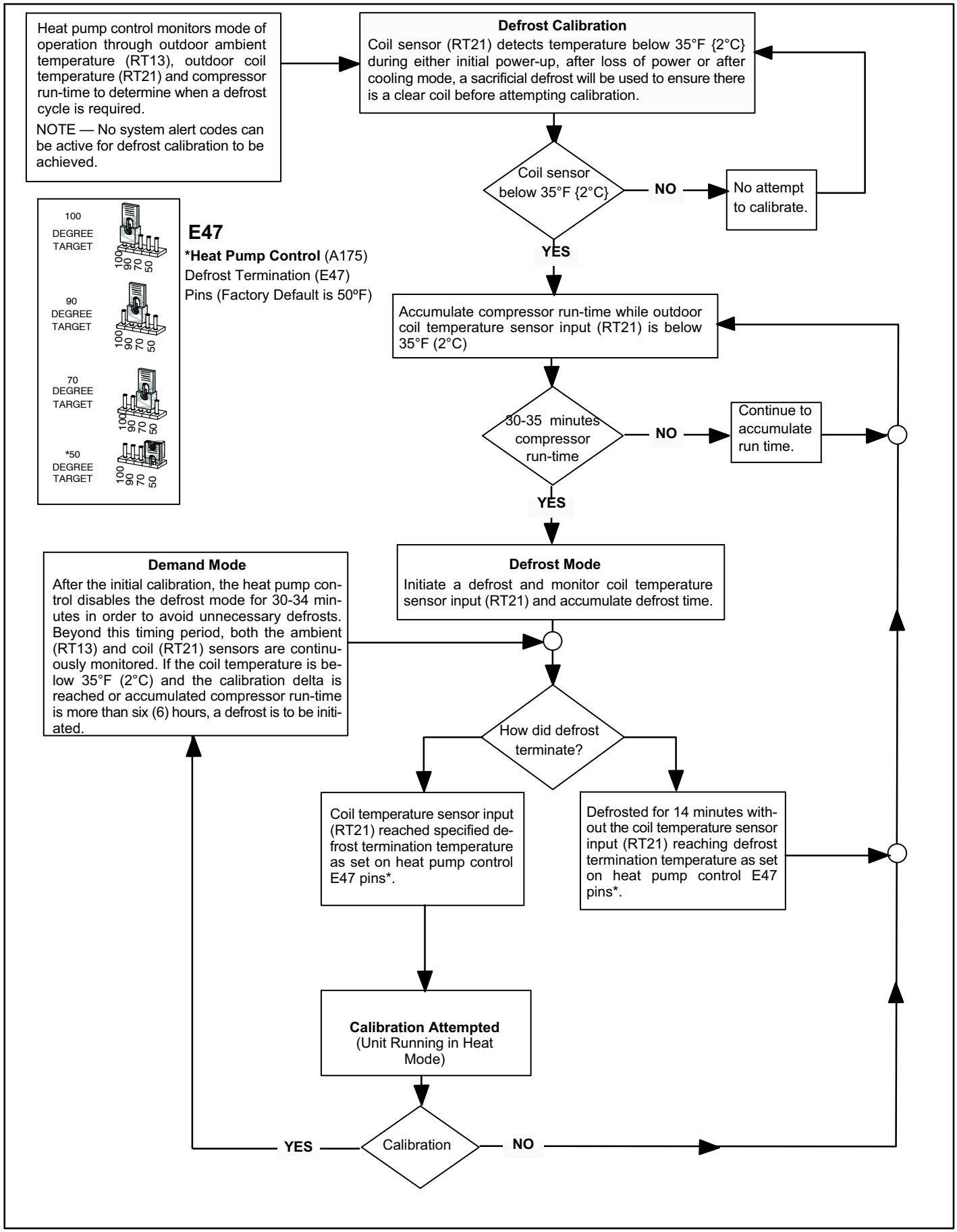
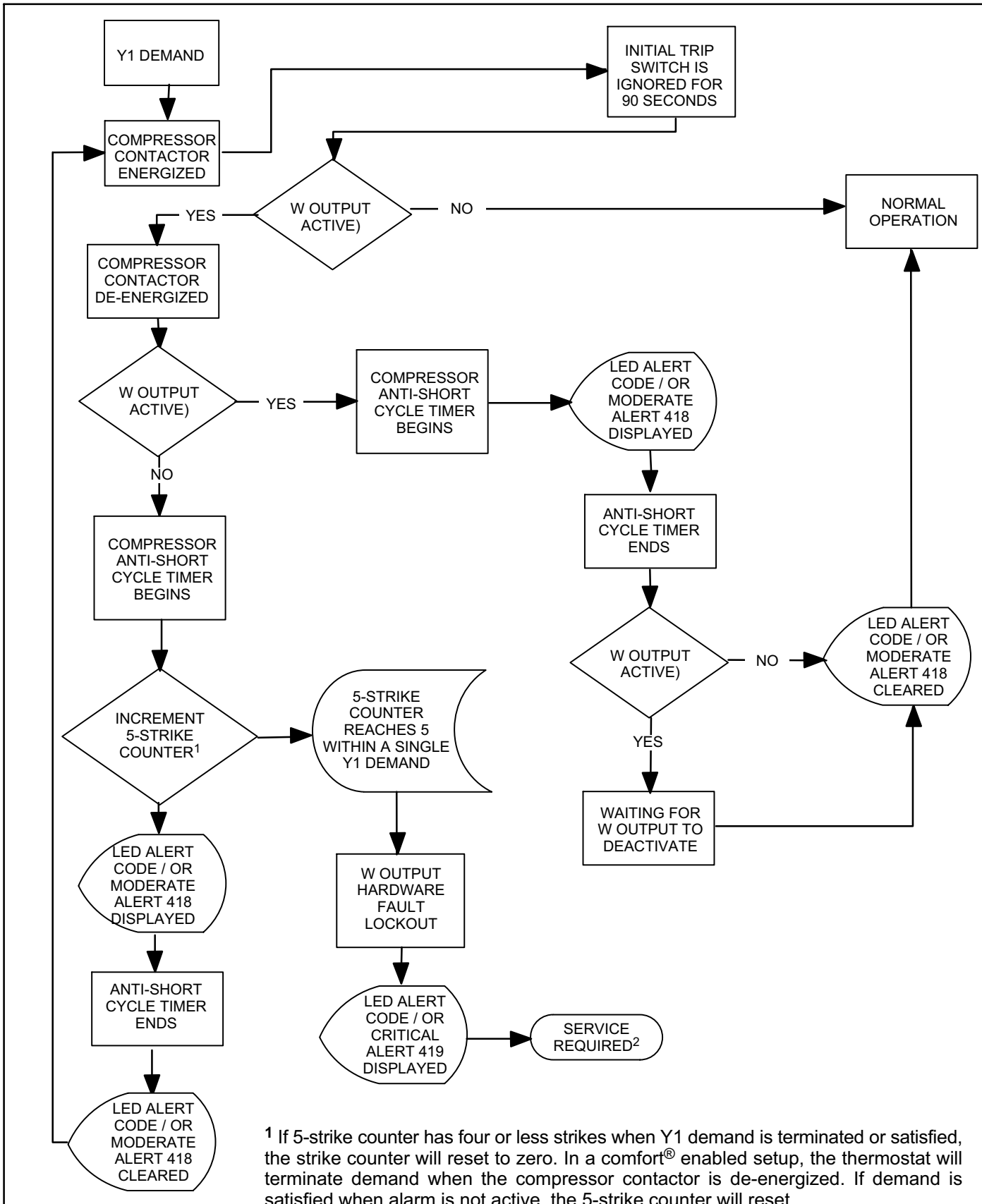


Figure 36. Defrost Calibration and Defrost Mode Sequence of Operations (All Versions)



1 If 5-strike counter has four or less strikes when Y1 demand is terminated or satisfied, the strike counter will reset to zero. In a comfort® enabled setup, the thermostat will terminate demand when the compressor contactor is de-energized. If demand is satisfied when alarm is not active, the 5-strike counter will reset.

2 Lockouts can be reset by either cycling power off to the heat pump control's (A175) **R** terminal, or placing a jumper on the field test pins (E33) between 1 to 2 seconds.

Figure 37. W Input Fault or Miswire Sequence of Operation (All Versions)

III. INSTALLATION

Unit Placement

⚠ CAUTION

In order to avoid injury, take proper precaution when lifting heavy objects.

See *Unit Dimensions* on page 3 for sizing mounting slab, platforms or supports. Refer to figure 38 for mandatory installation clearance requirements.

POSITIONING CONSIDERATIONS

Consider the following when positioning the unit:

- Some localities are adopting sound ordinances based on the unit's sound level registered from the adjacent property, not from the installation property. Install the unit as far as possible from the property line.
- When possible, do not install the unit directly outside a window. Glass has a very high level of sound transmission. For proper placement of unit in relation to a window see the provided illustration in figure 40, detail A.

PLACING UNIT ON SLAB

When installing unit at grade level, the top of the slab should be high enough above grade so that water from higher ground will not collect around the unit. The slab should have a slope tolerance as described in figure 40, detail B.

NOTE — If necessary for stability, anchor unit to slab as described in figure 40, detail D.

ELEVATING THE UNIT

Units are outfitted with elongated support feet as illustrated in figure 40, detail C.

If additional elevation is necessary, raise the unit by extending the height of the unit support feet. This may be achieved by using a 2-inch (50.8mm) Schedule 40 female threaded adapter.

The specified coupling will fit snuggly into the recessed portion of the feet. Use additional 2-inch (50.8mm) Schedule 40 male threaded adaptors which can be threaded into the female threaded adaptors to make additional adjustments to the level of the unit.

NOTE — Keep the height of extenders short enough to ensure a sturdy installation. If it is necessary to extend further, consider a different type of field-fabricated framework that is sturdy enough for greater heights.

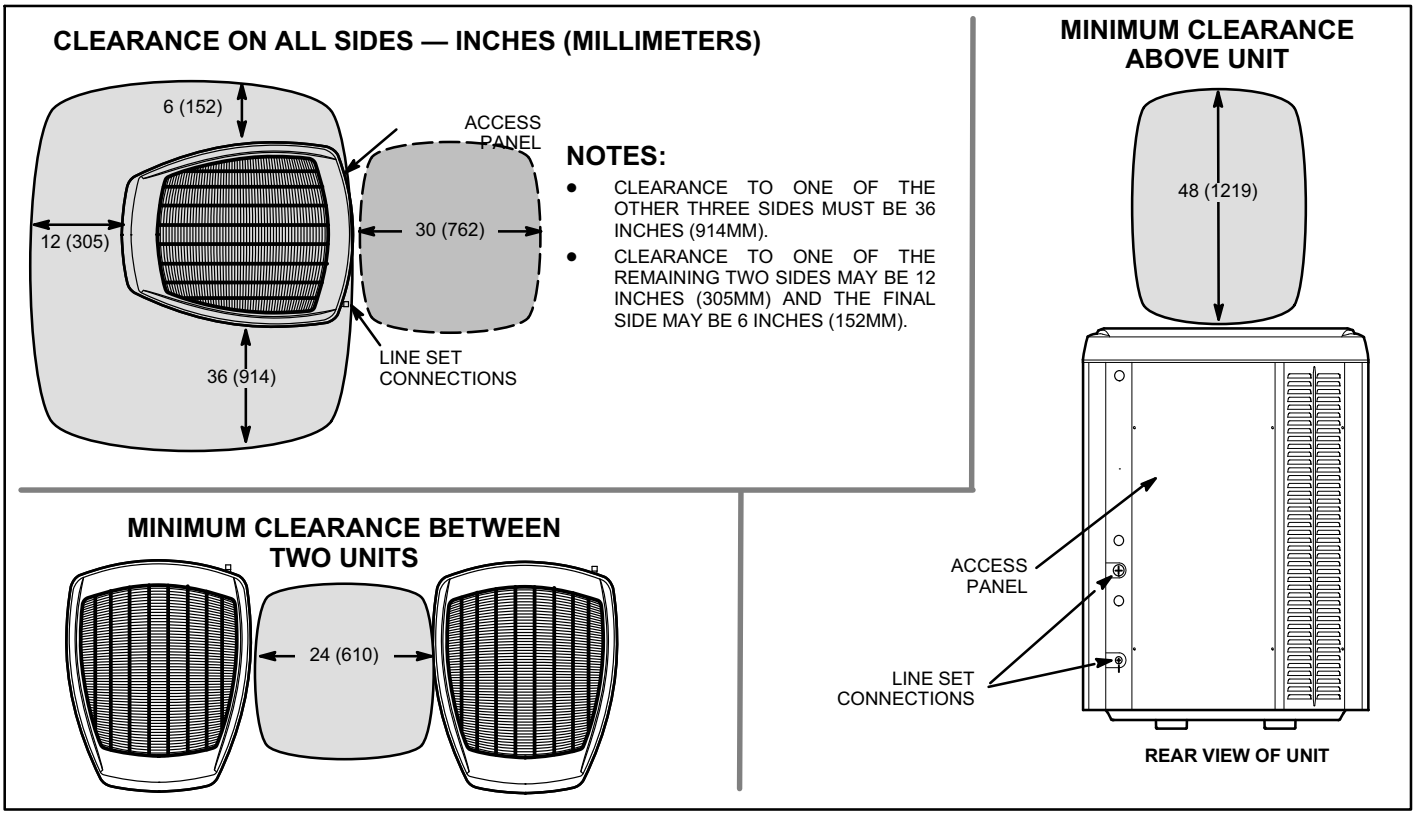


Figure 38. Installation Clearances

STABILIZING UNIT ON UNEVEN SURFACES

⚠ IMPORTANT

Unit Stabilizer Bracket Use (field-provided):

Always use stabilizers when unit is raised above the factory height. (Elevated units could become unstable in gusty wind conditions).

Stabilizers may be used on factory height units when mounted on unstable an uneven surface.

1. Remove two side louvered panels to expose the unit base.
2. Install the brackets as illustrated in figure 40, detail D using conventional practices.
3. Replace the panels after installation is complete.

ROOF MOUNTING

NOTICE

Roof Damage!

This system contains both refrigerant and oil. Some rubber roofing material may absorbed oil and cause the rubber to swell when it comes into contact with oil. The rubber will then bubble and could cause leaks. Protect the roof surface to avoid exposure to refrigerant and oil during service and installation. Failure to follow this notice could result in damage to roof surface.

Install the unit a minimum of six inches (152 mm) above the roof surface to avoid ice build-up around the unit. Locate the unit above a load bearing wall or area of the roof that can adequately support the unit. Consult local codes for rooftop applications.

If unit coil cannot be mounted away from prevailing winter winds, a wind barrier should be constructed. Size barrier at least the same height and width as outdoor unit. Mount barrier 24 inches (610 mm) from the sides of the unit in the direction of prevailing winds.

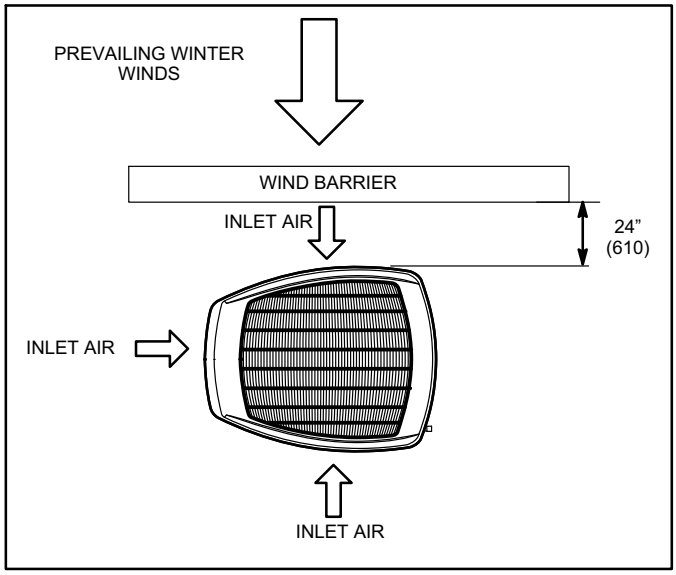
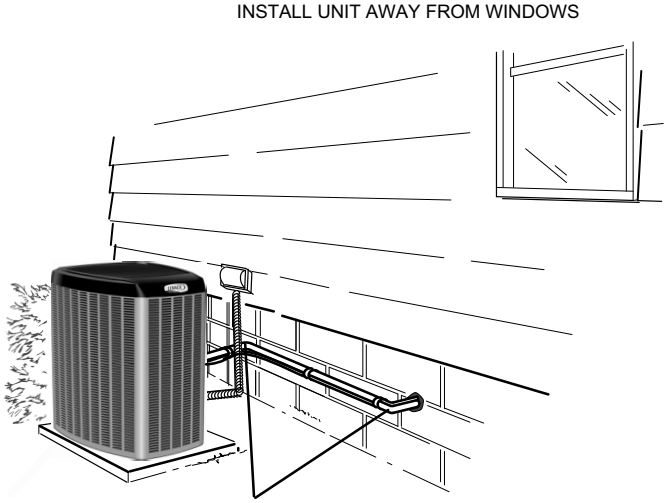


Figure 39. Rooftop Application and Wind Barrier

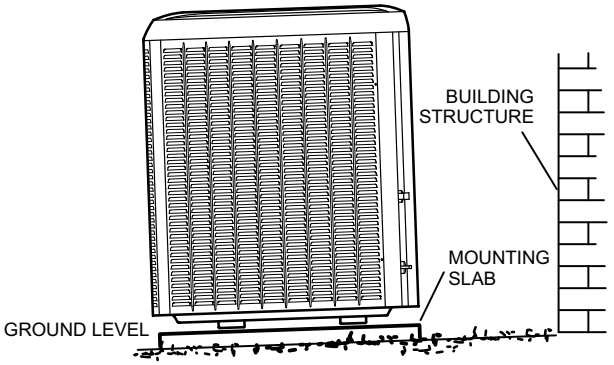
DETAIL A



Outside Unit Placement

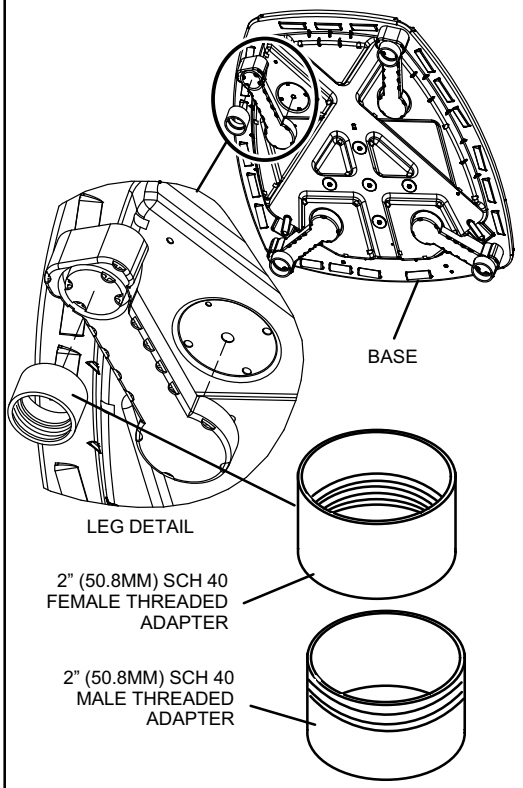
DETAIL B

INSTALL UNIT LEVEL OR, IF ON A SLOPE, MAINTAIN SLOPE TOLERANCE OF 2 DEGREES (OR 2 INCHES PER 5 FEET [50 MM PER 1.5 M]) AWAY FROM BUILDING STRUCTURE.



Slab Mounting at Ground Level

DETAIL C

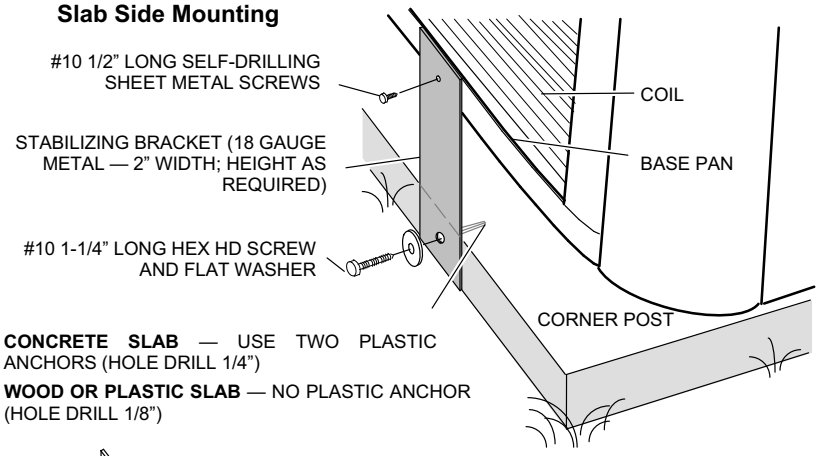


USE ADDITIONAL 2" SCH 40 MALE THREADED ADAPTERS WHICH CAN BE THREADED INTO THE FEMALE THREADED ADAPTERS TO MAKE ADDITIONAL ADJUSTMENTS TO THE LEVEL OF THE UNIT.

Elevated Slab Mounting using Feet Extenders

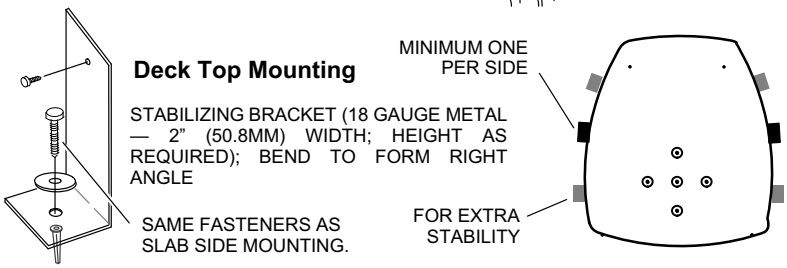
DETAIL D

Slab Side Mounting



CONCRETE SLAB — USE TWO PLASTIC ANCHORS (HOLE DRILL 1/4")

WOOD OR PLASTIC SLAB — NO PLASTIC ANCHOR (HOLE DRILL 1/8")



ONE BRACKET PER SIDE (MIN.); FOR EXTRA STABILITY, TWO BRACKETS PER SIDE, 2" (50.8MM) FROM EACH CORNER.

Stabilizing Unit on Uneven Surfaces

IMPORTANT — To help stabilize an outdoor unit, some installations may require strapping the unit to the pad using brackets and anchors commonly available in the marketplace.

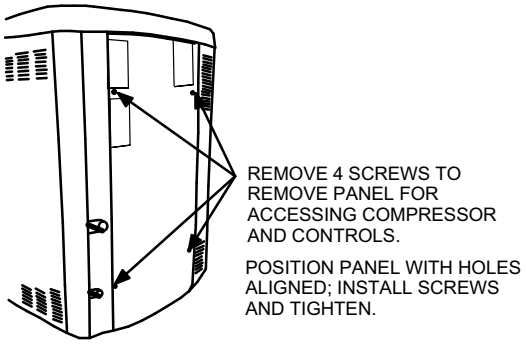
Figure 40. Placement and Slab Mounting

PANELS

ACCESS AND LOUVERED

ACCESS PANEL REMOVAL

REMOVAL AND RE-INSTALLATION OF THE ACCESS PANEL IS AS ILLUSTRATED.



WARNING

To prevent personal injury, or damage to panels, unit or structure, be sure to observe the following:

While installing or servicing this unit, carefully stow all removed panels out of the way, so that the panels will not cause injury to personnel, nor cause damage to objects or structures nearby, nor will the panels be subjected to damage (e.g., being bent or scratched).

While handling or stowing the panels, consider any weather conditions, especially windy conditions, that may cause panels to be blown around and battered.

IMPORTANT — Do not allow panels to hang on unit by top tab. Tab is for alignment and not designed to support weight of panel.

PANEL SHOWN SLIGHTLY ROTATED TO ALLOW TOP TAB TO EXIT (OR ENTER) TOP SLOT FOR REMOVING (OR INSTALLING) PANEL.

LOUVERED PANEL REMOVAL

REMOVE THE LOUVERED PANELS AS FOLLOWS:

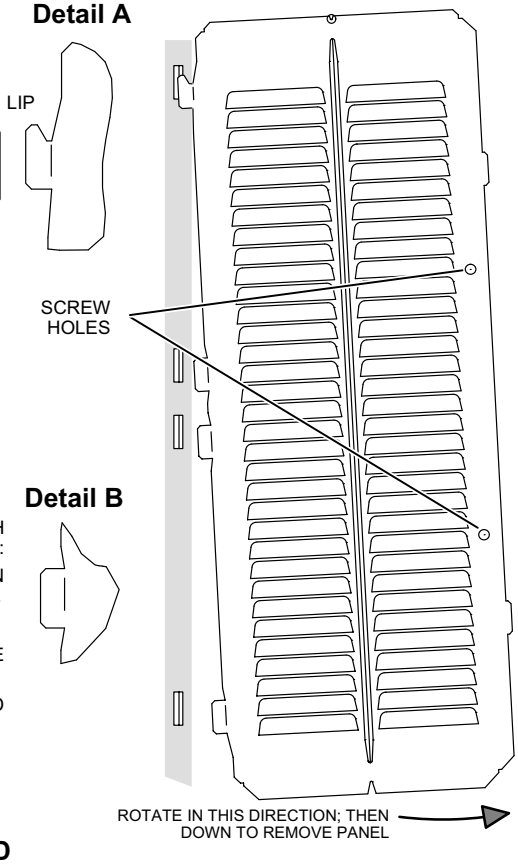
1. REMOVE TWO SCREWS, ALLOWING THE PANEL TO SWING OPEN SLIGHTLY.
2. HOLD THE PANEL FIRMLY THROUGHOUT THIS PROCEDURE ROTATE BOTTOM CORNER OF PANEL AWAY FROM HINGED CORNER POST UNTIL LOWER THREE TABS CLEAR THE SLOTS AS ILLUSTRATED IN **DETAIL B.**
3. MOVE PANEL DOWN UNTIL LIP OF UPPER TAB CLEARS THE TOP SLOT IN CORNER POST AS ILLUSTRATED IN **DETAIL A**.

LOUVERED PANEL INSTALLATION

POSITION THE PANEL ALMOST PARALLEL WITH THE UNIT AS ILLUSTRATED IN **DETAIL D** WITH THE SCREW SIDE AS CLOSE TO THE UNIT AS POSSIBLE. THEN, IN A CONTINUOUS MOTION:

1. SLIGHTLY ROTATE AND GUIDE THE LIP OF TOP TAB INWARD AS ILLUSTRATED IN **DETAIL A** AND **C**; THEN UPWARD INTO THE TOP SLOT OF THE HINGE CORNER POST.
2. ROTATE PANEL TO VERTICAL TO FULLY ENGAGE ALL TABS.
3. HOLDING THE PANEL'S HINGED SIDE FIRMLY IN PLACE, CLOSE THE RIGHT-HAND SIDE OF THE PANEL, ALIGNING THE SCREW HOLES.
4. WHEN PANEL IS CORRECTLY POSITIONED AND ALIGNED, INSERT THE SCREWS AND TIGHTEN.

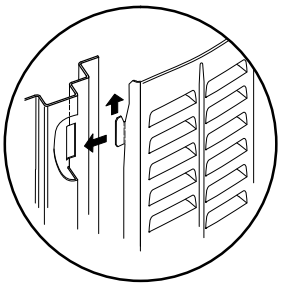
Detail A



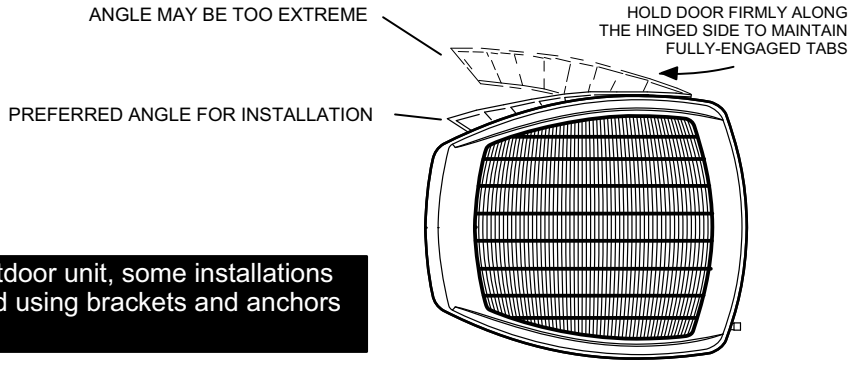
Detail B

Detail C

MAINTAIN MINIMUM PANEL ANGLE (AS CLOSE TO PARALLEL WITH THE UNIT AS POSSIBLE) WHILE INSTALLING PANEL.



Detail D



IMPORTANT — To help stabilize an outdoor unit, some installations may require strapping the unit to the pad using brackets and anchors commonly available in the marketplace.

Figure 41. Removing and Installing Panels

Electrical

In the U.S.A., wiring must conform with current local codes and the current National Electric Code (NEC). In Canada, wiring must conform with current local codes and the current Canadian Electrical Code (CEC).

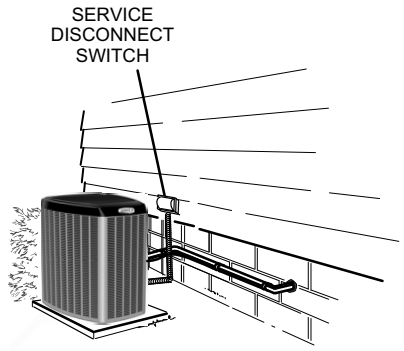
Refer to the furnace or air handler installation instructions for additional wiring application diagrams and refer to unit nameplate for minimum circuit ampacity and maximum overcurrent protection size.

24VAC TRANSFORMER

Use the transformer provided with the furnace or air handler for low-voltage control power (24VAC - 40 VA minimum)

1 SIZE CIRCUIT AND INSTALL DISCONNECT SWITCH

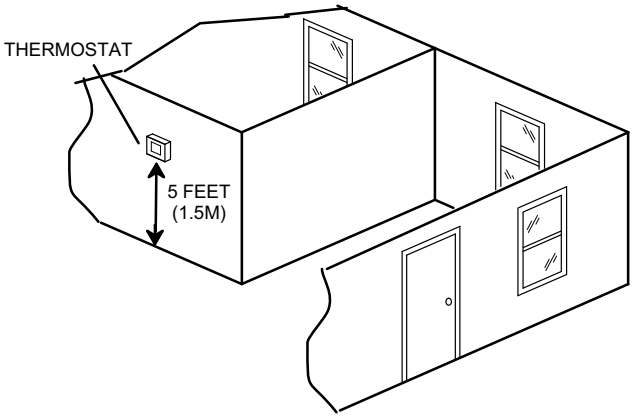
REFER TO THE UNIT NAMEPLATE FOR MINIMUM CIRCUIT AMPACITY, AND MAXIMUM FUSE OR CIRCUIT BREAKER (HACR PER NEC). INSTALL POWER WIRING AND PROPERLY SIZED DISCONNECT SWITCH.



NOTE — UNITS ARE APPROVED FOR USE ONLY WITH COPPER CONDUCTORS. GROUND UNIT AT DISCONNECT SWITCH OR TO AN EARTH GROUND.

2 INSTALL THERMOSTAT

INSTALL ROOM THERMOSTAT (ORDERED SEPARATELY) ON AN INSIDE WALL APPROXIMATELY IN THE CENTER OF THE CONDITIONED AREA AND 5 FEET (1.5M) FROM THE FLOOR. IT SHOULD NOT BE INSTALLED ON AN OUTSIDE WALL OR WHERE IT CAN BE AFFECTED BY SUNLIGHT OR DRAFTS.



NOTE — 24VAC, CLASS II CIRCUIT CONNECTIONS ARE MADE IN THE CONTROL BOX.

⚠ WARNING

Electric Shock Hazard. Can cause injury or death. Unit must be grounded in accordance with national and local codes.

Line voltage is present at all components when unit is not in operation on units with single-pole contactors. Disconnect all remote electric power supplies before opening access panel. Unit may have multiple power supplies.

⚠ CAUTION

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

Electrostatic discharge can affect electronic components. Take precautions during unit installation and service to protect the unit's electronic controls. Precautions will help to avoid control exposure to electrostatic discharge by putting the unit, the control and the technician at the same electrostatic potential. Neutralize electrostatic charge by touching hand and all tools on an unpainted unit surface before performing any service procedure

3 A. ROUTE CONTROL WIRES — NON-COMMUNICATING

INSTALL LOW VOLTAGE CONTROL WIRING FROM OUTDOOR TO INDOOR UNIT AND FROM THERMOSTAT TO INDOOR UNIT AS ILLUSTRATED.

A RUN 24VAC CONTROL WIRES THROUGH HOLE WITH GROMMET.

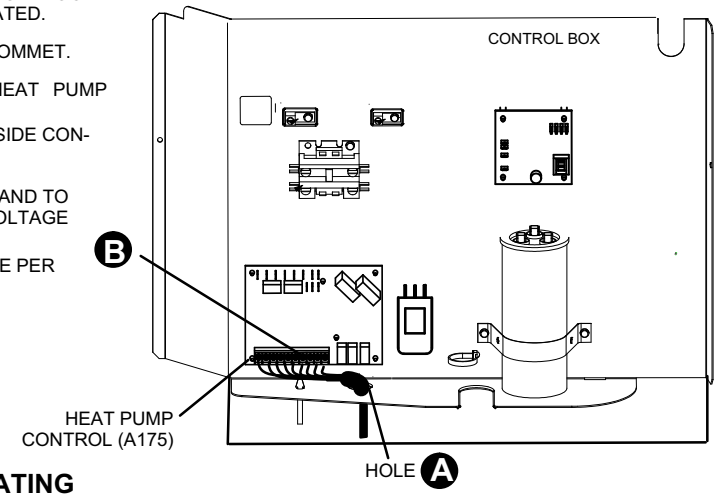
B MAKE 24VAC CONTROL WIRE CONNECTIONS TO HEAT PUMP CONTROL (A175) .

NOTE — DO NOT BUNDLE ANY EXCESS 24VAC CONTROL WIRES INSIDE CONTROL BOX.

NOTE — WIRE TIE PROVIDES LOW VOLTAGE WIRE STRAIN RELIEF AND TO MAINTAIN SEPARATION OF FIELD INSTALLED LOW AND HIGH VOLTAGE CIRCUITS.

NOTE — FOR PROPER VOLTAGES, SELECT CONTROL WIRES GAUGE PER TABLE BELOW.

WIRE RUN LENGTH	AWG#	INSULATION TYPE
LESS THAN 100' (30 METERS)	18	TEMPERATURE RATING
MORE THAN 100' (30 METERS)	16	35ºC MINIMUM.

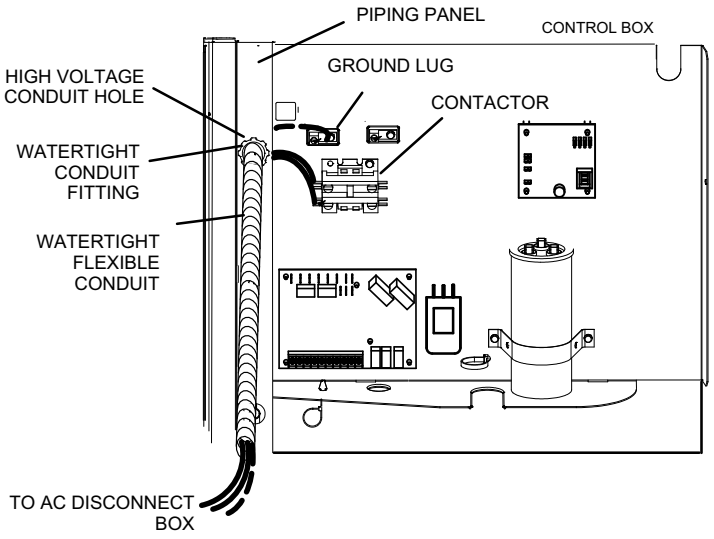


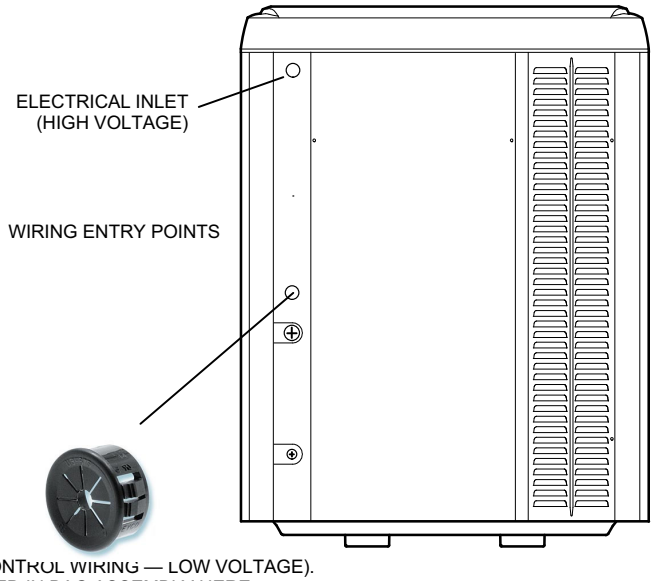
B. ROUTE CONTROL WIRES — COMMUNICATING

MAXIMUM LENGTH OF WIRING (18 GAUGE) FOR ALL CONNECTIONS ON THE RSBUS IS LIMITED TO 1500 FEET (457 METERS). COLOR-CODED, TEMPERATURE RATING 95°F (35°C) MINIMUM, SOLID CORE. (CLASS II RATED WIRING)

4 ROUTE HIGH VOLTAGE AND GROUND WIRES

ANY EXCESS HIGH VOLTAGE FIELD WIRING SHOULD BE TRIMMED AND SECURED AWAY FROM ANY LOW VOLTAGE FIELD WIRING. TO FACILITATE A CONDUIT, A CUTOUT IS LOCATED IN THE BOTTOM OF THE CONTROL BOX. CONNECT CONDUIT TO THE CONTROL BOX USING A PROPER CONDUIT FITTING.



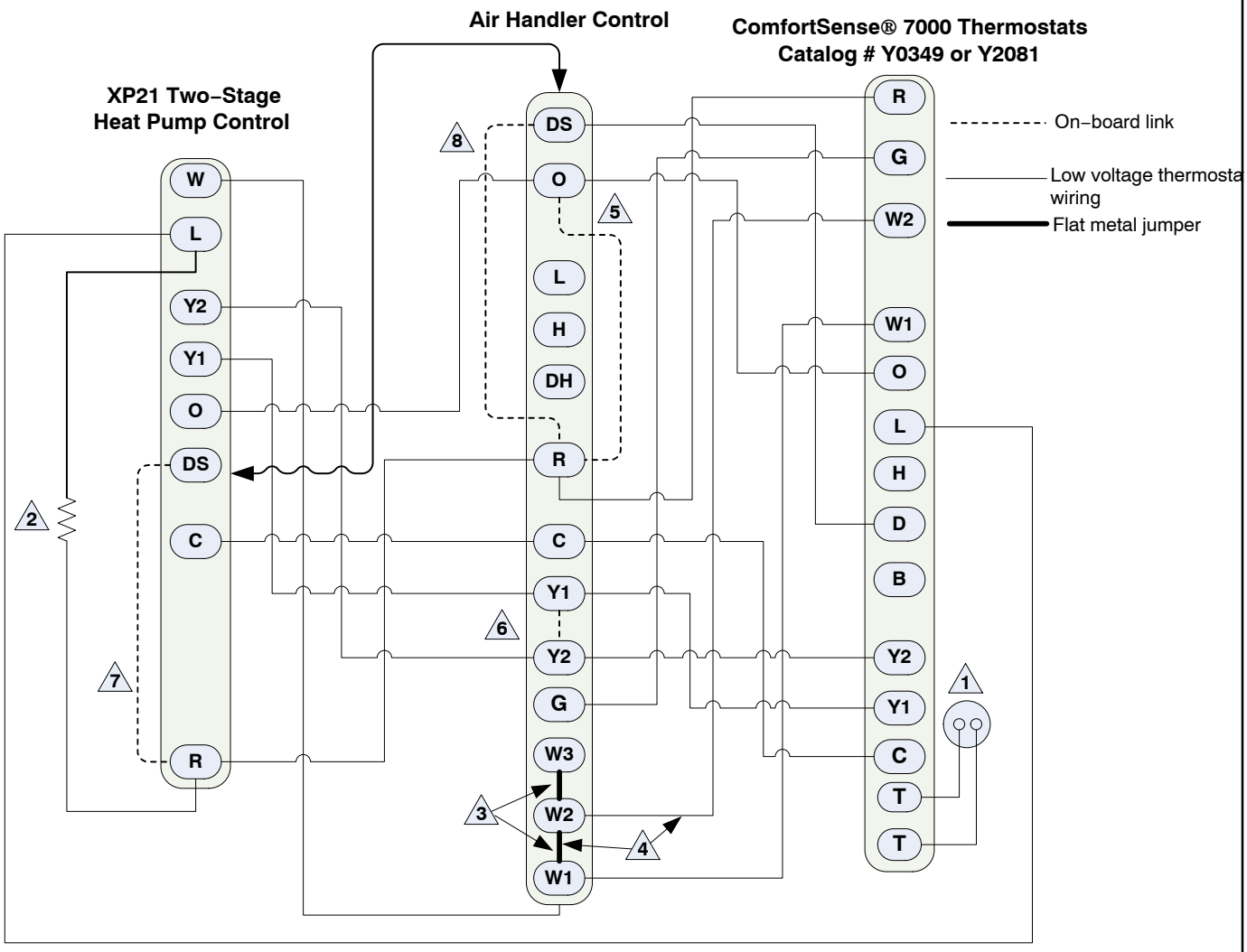


ELECTRICAL INLET (CONTROL WIRING — LOW VOLTAGE). USE BUSHING PROVIDED IN BAG ASSEMBLY HERE.

ACCESS VIEW

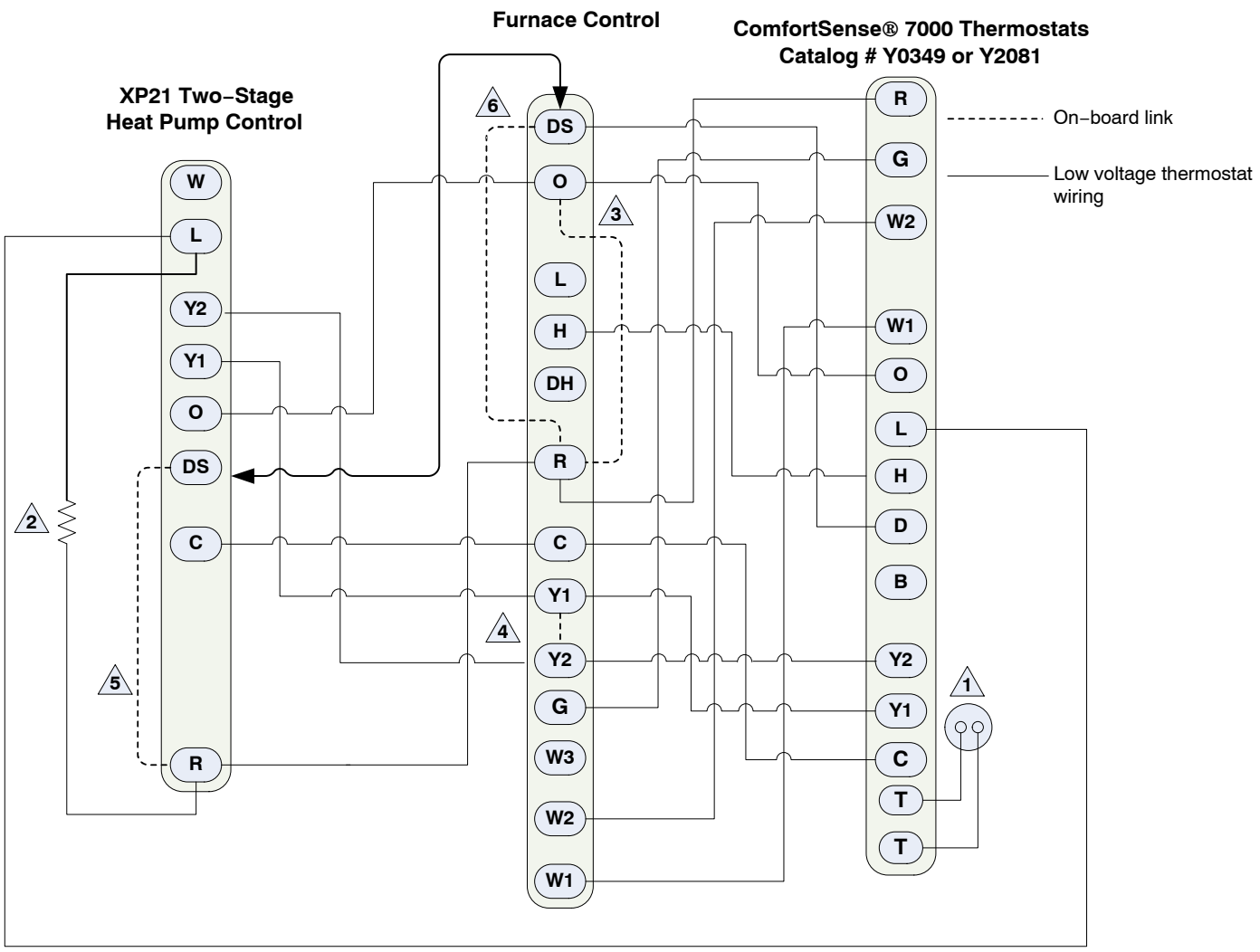
Field Control Wiring

The following two illustrations provide examples on how to install control wiring using a non-communicating thermostat. For examples of how to install control wiring in complete or partial communicating systems, see the iComfort™ thermostat ***Quick Start Guide*** which is provided with the thermostat.



1. Thermostat **T** terminals are used for outdoor sensor input. Use for thermostat's outdoor temperature display (optional).
2. **R** to **L** connection is required for this model when using the ComfortSense® 7000 - catalog number Y0349 only. Resistor Kit (catalog number 47W97) required and ordered separately.
3. Air handler control ships from factory with metal jumpers installed across **W1**, **W2** and **W3**. For one-stage electric heat, do not remove factory installed metal jumpers.
4. Air handler control ships from factory with metal jumpers installed across **W1**, **W2** and **W3**. For two-stage electric heat, remove factory installed metal jumper between **W1** to **W2.** Then connect thermostat wire between the air handler control's **W2** and the thermostat's **W2** terminal.
5. Cut on-board link (clippable wire) from **R-O HEAT PUMP** for heat pump applications.
6. Cut on-board link (clippable wire) from **Y1-Y2 2 STAGE COMPR** for two-stage compressor and two-speed fan operation.
7. Cut loop jumper (clippable wire) **Short DS to R** for Humiditrol® applications. This will slow the outdoor unit's fan speed to a specific RPM. A wire must be installed between the **DS** terminals on the air handler and outdoor unit controls. See table 9 for fan speed based on unit capacity.
8. Cut on-board link (clippable wire) **DS-R** for Humiditrol® or Harmony III™ applications. This will slow the indoor blower motor to the lowest speed setting. See air handler installation instruction or Product Specification bulletin for lowest fan speed information.

Figure 42. ComfortSense® 7000 Series Thermostat — Air Hander/Two-Stage Heat Pump



1. Thermostat **T** terminals are used for outdoor sensor input. Use for thermostat's outdoor temperature display (optional).
2. **R** to **L** connection is required for this model when using the ComfortSense® 7000 - catalog number Y0349 only. Resistor Kit (catalog number 47W97) required and ordered separately.
3. Cut on-board link **W951** (clippable wire) from **R-O HEAT PUMP** for heat pump applications.
4. Cut on-board link **W915** (clippable wire) for two-stage operation.
5. Cut loop jumper (clippable wire) **Short DS to R** for Humiditrol® applications. This will slow the outdoor unit's fan speed to a specific RPM. A wire must be installed between the **DS** terminals on the furnace and outdoor unit controls. See table 9 for fan speed based on unit capacity.
6. Cut on−board link (clippable wire) **DS−R** for Humiditrol® or Harmony III™ applications. This will slow the indoor blower motor to the lowest speed setting. See furnace installation instruction or Product Specification bulletin for lowest fan speed information.

NOTE - For defrost temper with furnace, the optional 67M41 temper kit would be wired between W of from the heat pump control (A175) to the W1 of the furnace control The kit allows for the furnace to cycle on and off during a defrost. It protects the compressor from high refrigeration pressures during defrost.

Figure 43. ComfortSense® 7000 Series Thermostat — Furnace/Two-Stage Heat Pump

New or Replacement Line Set

REFRIGERANT LINE SET

This section provides information on installation or replacement of existing line set. If new or replacement line set is not being installed then proceed to *Brazing Connections* on page 76.

⚠ IMPORTANT

Lennox highly recommends changing line set when converting the existing system from HCFC-22 to HFC-410A If that is not possible and the line set is the proper size as reference in table 2, use the procedure outlined under *Flushing the System* on page 76.

If refrigerant lines are routed through a wall, then seal and isolate the opening so vibration is not transmitted to the building. Pay close attention to line set isolation during installation of any HVAC system. When properly isolated from building structures (walls, ceilings. floors), the refrigerant lines will not create unnecessary vibration and subsequent sounds. See figure 75 for recommended installation practices. Also, consider the following when placing and installing a high-efficiency outdoor unit.

Liquid lines that meter the refrigerant, such as RFC1 liquid lines, must not be used in this application. Existing line set of proper size as listed in table 23 may be reused. If system was previously charged with HCFC-22 refrigerant, then existing line set must be flushed (see *Flushing the System* on page 76).

Field refrigerant piping consists of liquid and vapor lines from the outdoor unit to the indoor unit coil (braze connections). Use Lennox L15 (sweat, non-flare) series line set, or field-fabricated refrigerant line sizes as listed in table 23.

Table 23. Refrigerant Line Set

Models	Liquid Line	Vapor/ Suction Line	L15 Line Set
-024, -036 and-048	3/8 (10)	7/8 (22)	L15 line set sizes are dependent on unit match up. See XP21 Product Specification bulletin to determine correct line set sizes.
-060	3/8 (10)	1-1/8“ (29)	Field Fabricated
NOTE — Some applications may require a field-provided 7/8” to 1-1/8” adapter.			

NOTE — When installing refrigerant lines longer than 50 feet, see the Lennox Refrigerant Piping Design and Fabrication Guidelines, or contact Lennox Technical Support Product Applications for assistance. To obtain the correct information from Lennox, be sure to communicate the following points:

- Model (XP21) and size of unit (e.g. -036).
- Line set diameters for the unit being installed as listed in table 23 and total length of installation.
- Number of elbows vertical rise or drop in the piping.

⚠ IMPORTANT

Mineral oils are not compatible with HFC-410A If oil must be added, it must be a Polyol ester oil.

The compressor is charged with sufficient Polyol ester oil for line set lengths up to 50 feet. Recommend adding oil to system based on the amount of refrigerant charge in the system. No need to add oil in system with 20 pounds of refrigerant or less. For systems over 20 pounds - add one ounce of every five pounds of refrigerant.

Recommended topping-off POE oils are Mobil EAL ARCTIC 22 CC or ICI EMKARATE™ RL32CF.

⚠ WARNING

Danger of fire. Bleeding the refrigerant charge from only the high side may result in the low side shell and suction tubing being pressurized. Application of a brazing torch while pressurized may result in ignition of the refrigerant and oil mixture - check the high and low pressures before unbrazing.

⚠ WARNING

When using a high pressure gas such as dry nitrogen to pressurize a refrigeration or air conditioning system, use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).

⚠ CAUTION

Brazing alloys and flux contain materials which are hazardous to your health.

Avoid breathing vapors or fumes from brazing operations. Perform operations only in well ventilated areas.

Wear gloves and protective goggles or face shield to protect against burns.

Wash hands with soap and water after handling brazing alloys and flux.

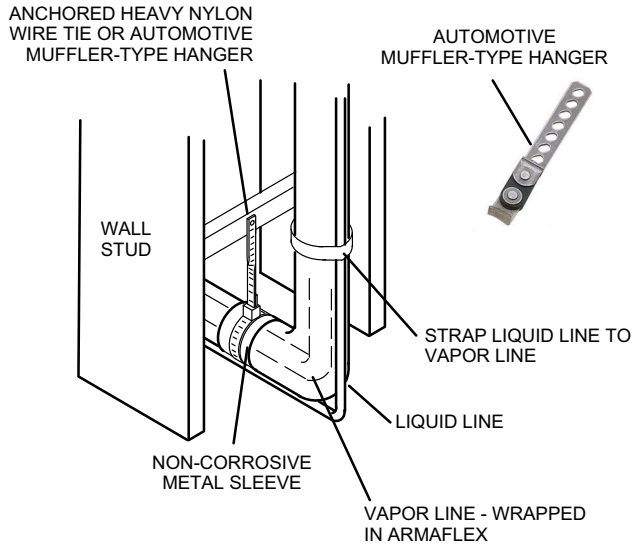
LINE SET

IMPORTANT — Refrigerant lines must not contact structure.

INSTALLATION

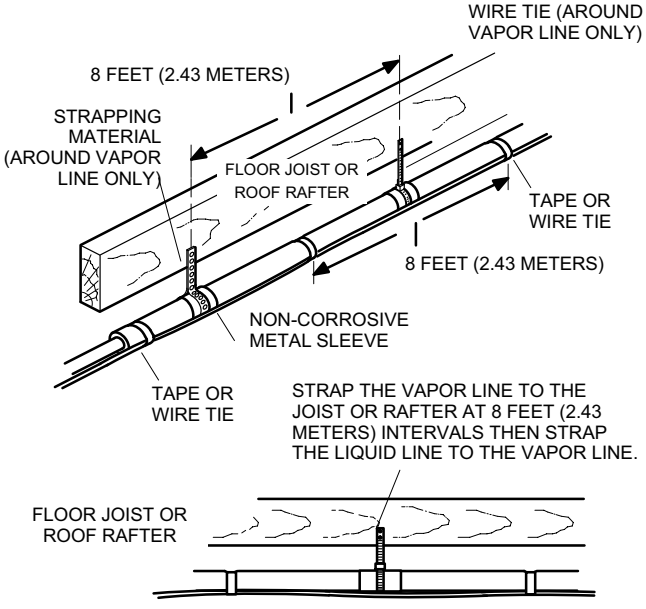
LINE SET ISOLATION — THE FOLLOWING ILLUSTRATIONS ARE EXAMPLES OF PROPER REFRIGERANT LINE SET ISOLATION:

REFRIGERANT LINE SET — TRANSITION FROM VERTICAL TO HORIZONTAL



REFRIGERANT LINE SET — INSTALLING HORIZONTAL RUNS

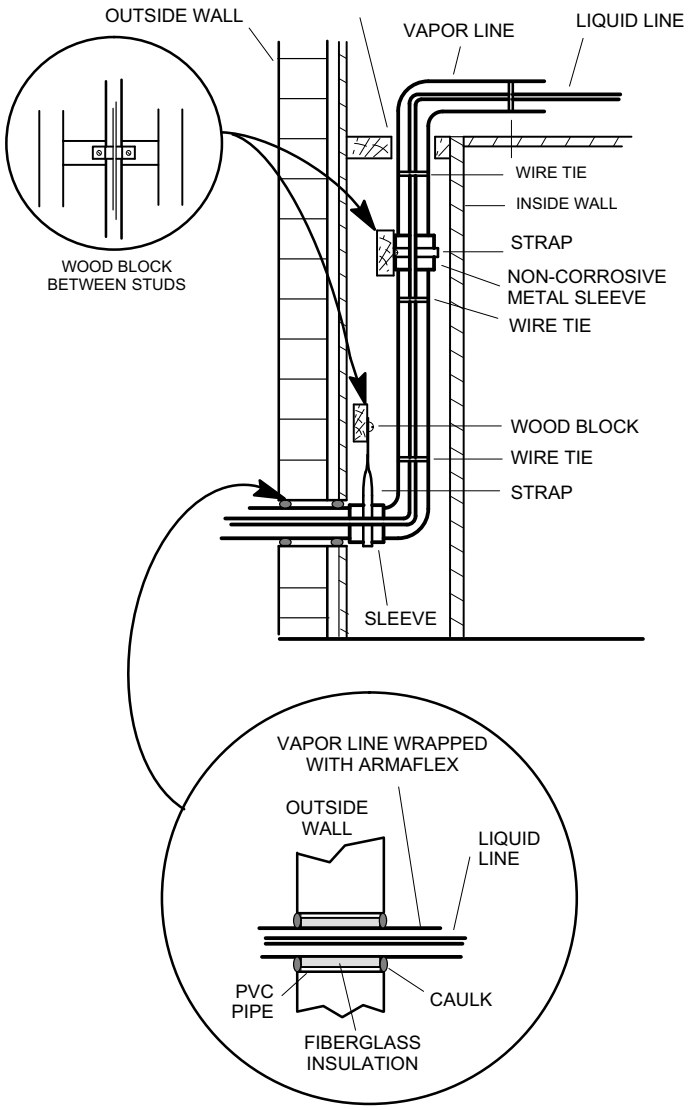
TO HANG LINE SET FROM JOIST OR RAFTER, USE EITHER METAL STRAPPING MATERIAL OR ANCHORED HEAVY NYLON WIRE TIES.



REFRIGERANT LINE SET — INSTALLING VERTICAL RUNS (NEW CONSTRUCTION SHOWN)

NOTE — INSULATE LIQUID LINE WHEN IT IS ROUTED THROUGH AREAS WHERE THE SURROUNDING AMBIENT TEMPERATURE COULD BECOME HIGHER THAN THE TEMPERATURE OF THE LIQUID LINE OR WHEN PRESSURE DROP IS EQUAL TO OR GREATER THAN 20 PSIG.

IMPORTANT — Refrigerant lines must not contact wall



NOTE — SIMILAR INSTALLATION PRACTICES SHOULD BE USED IF LINE SET IS TO BE INSTALLED ON EXTERIOR OF OUTSIDE WALL.

WARNING — Polyol ester (POE) oils used with HFC-410A refrigerant absorb moisture very quickly. It is very important that the refrigerant system be kept closed as much as possible. DO NOT remove line set caps or service valve stub caps until you are ready to make connections.

Figure 44. Line Set Installation

Brazing Connections

Use the procedures outline in figures 45 and 46 for brazing line set connections to service valves.

⚠ WARNING

Danger of fire. Bleeding the refrigerant charge from only the high side may result in pressurization of the low side shell and suction tubing. Application of a brazing torch to a pressurized system may result in ignition of the refrigerant and oil mixture - Check the high and low pressures before applying heat.

⚠ WARNING

When using a high pressure gas such as dry nitrogen to pressurize a refrigeration or air conditioning system, use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).

⚠ CAUTION

Brazing alloys and flux contain materials which are hazardous to your health.

Avoid breathing vapors or fumes from brazing operations. Perform operations only in well-ventilated areas.

Wear gloves and protective goggles or face shield to protect against burns.

Wash hands with soap and water after handling brazing alloys and flux.

⚠ IMPORTANT

Connect gauge set low pressure side to vapor line service valve and repeat procedure starting at paragraph 4 for brazing the liquid line to service port valve.

⚠ IMPORTANT

Allow braze joint to cool before removing the wet rag from the service valve. Temperatures above 250ºF can damage valve seals.

⚠ IMPORTANT

Use silver alloy brazing rods with 5% minimum silver alloy for copper-to-copper brazing. Use 45% minimum alloy for copper-to-brass and copper-to-steel brazing.

⚠ WARNING

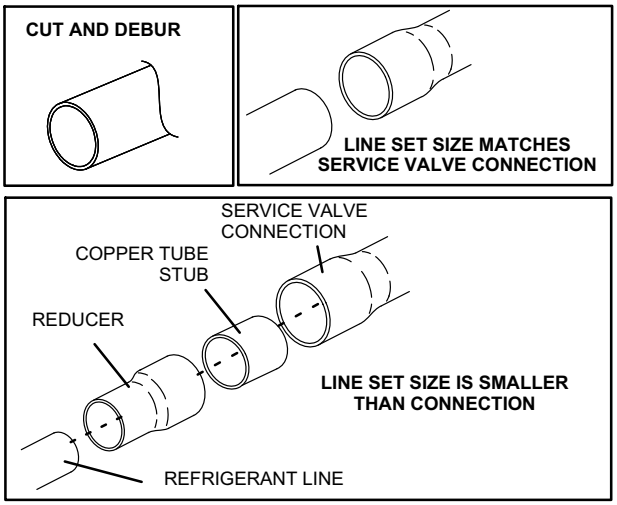
Fire, Explosion and Personal Safety Hazard.

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

Never use oxygen to pressurize or purge refrigeration lines. Oxygen, when exposed to a spark or open flame, can cause fire and/or an explosion, that could result in property damage, personal injury or death.

1 PIPING PANEL REMOVAL AND PREPARING LINE SET

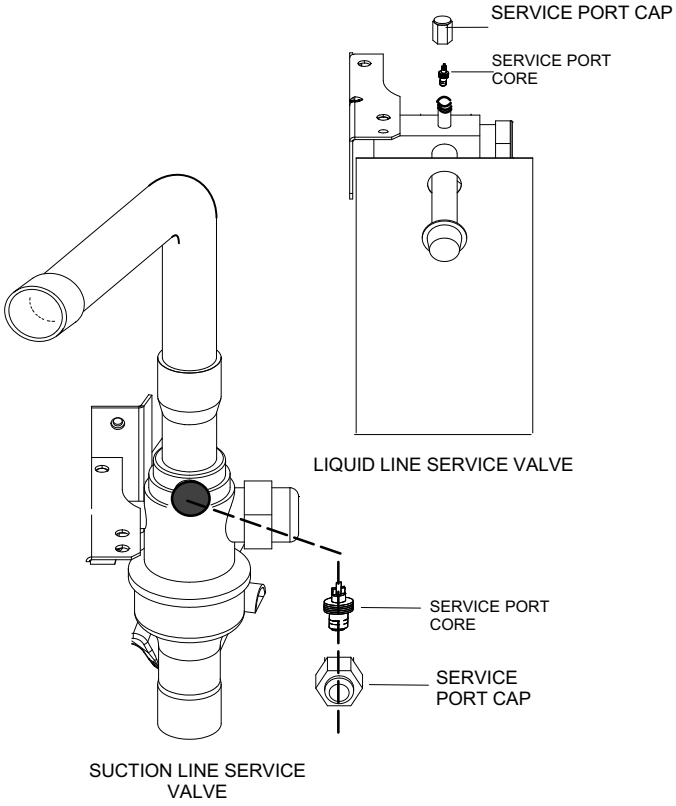
Remove piping panel for easier access to service valves. Cut ends of the refrigerant lines square (free from nicks or dents) and debur the ends. The pipe must remain round. Do not crimp end of the line.



DO NOT CRIMP SERVICE VALVE CONNECTOR WHEN PIPE IS SMALLER THAN CONNECTION

2 CAP AND CORE REMOVAL

Remove service cap and core from both the suction and liquid line service ports.



3 ATTACH THE MANIFOLD GAUGE SET FOR BRAZING LIQUID AND SUCTION LINE SERVICE VALVES

A Connect gauge set low pressure side to liquid line service valve (service port).

B Connect gauge set center port to bottle of nitrogen with regulator.

C With valve core removed from the suction line service port, nitrogen flow will have an exit point.

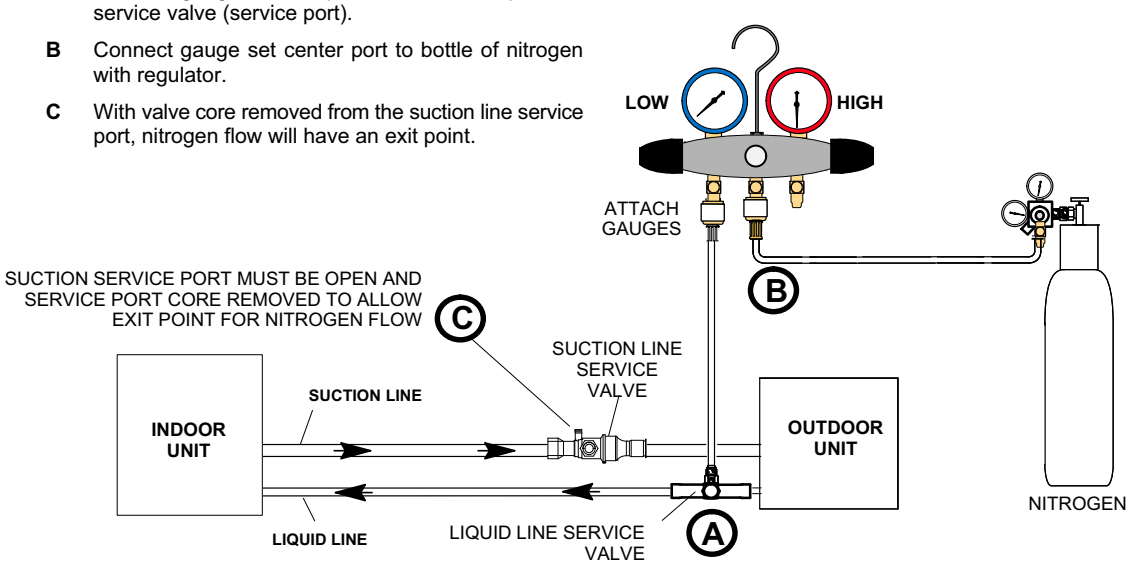


Figure 45. Brazing Procedures

4 WRAP SERVICE VALVES

To help protect service valve seals during brazing, wrap water saturated cloths around service valve bodies and copper tube stubs. Use additional water saturated cloths underneath the valve body to protect the base paint.

5 FLOW NITROGEN

Flow regulated nitrogen (at 1 to 2 psig) through the refrigeration gauge set into the valve stem port connection on the liquid service valve and out of the suction / vapor valve stem port. See steps **3A, 3B** and **3C** on previous page and below for manifold gauge setup.

WARNING

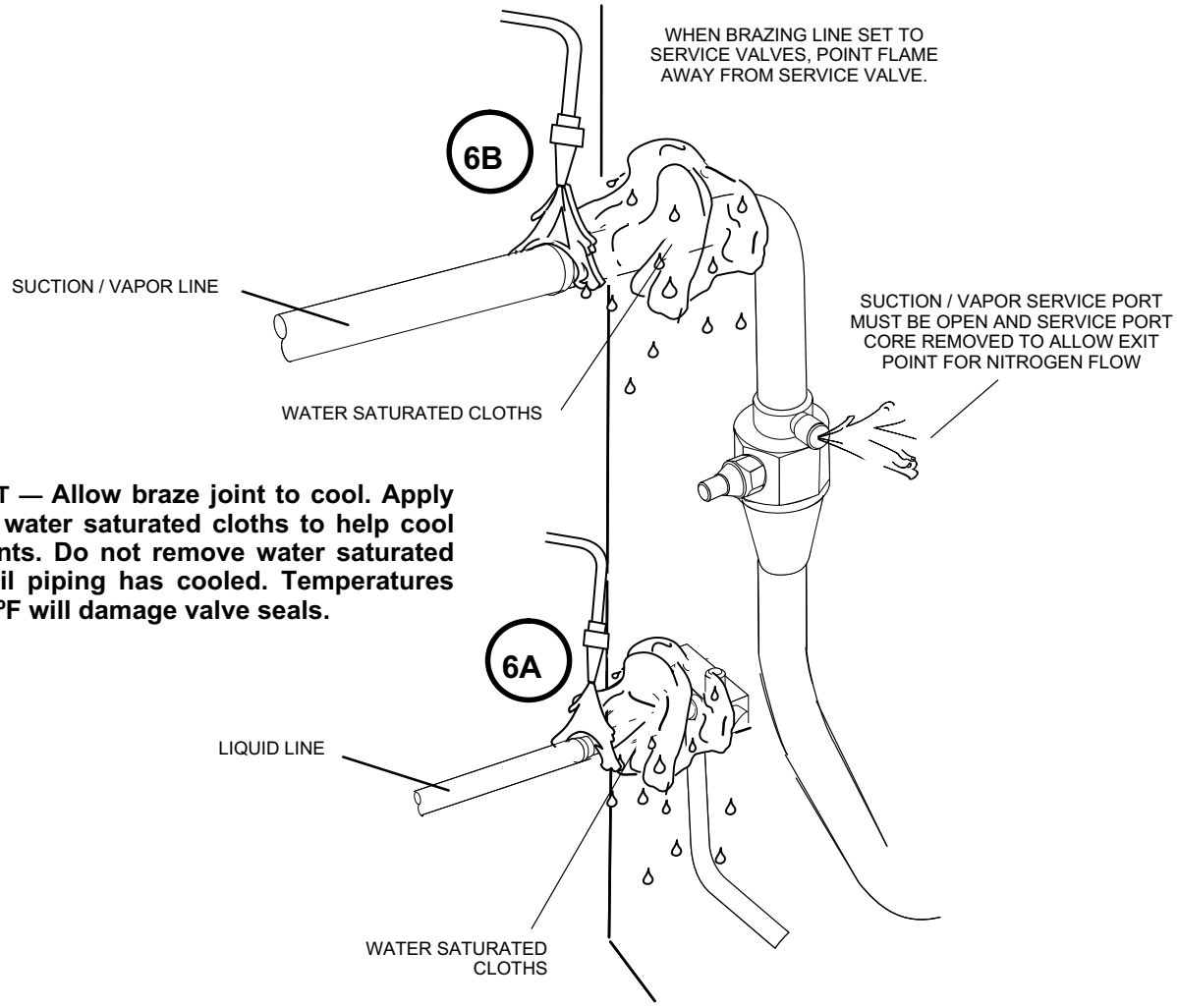
1. **FIRE, PERSONAL INJURY, OR PROPERTY DAMAGE** will result if you do not wrap a water saturated cloth around both liquid and suction line service valve bodies and copper tube stub while brazing in the line set! The braze, when complete, must be quenched with water to absorb any residual heat.
2. Do not open service valves until refrigerant lines and indoor coil have been leak-tested and evacuated. Refer to procedures provided in this supplement.

6 BRAZE LINE SET

Water saturated cloths must remain water saturated throughout the brazing and cool-down process.

A Braze liquid line to liquid line service valve.

B Braze suction / vapor line to suction / vapor service valve.



IMPORTANT — Allow braze joint to cool. Apply additional water saturated cloths to help cool brazed joints. Do not remove water saturated cloths until piping has cooled. Temperatures above 250ºF will damage valve seals.

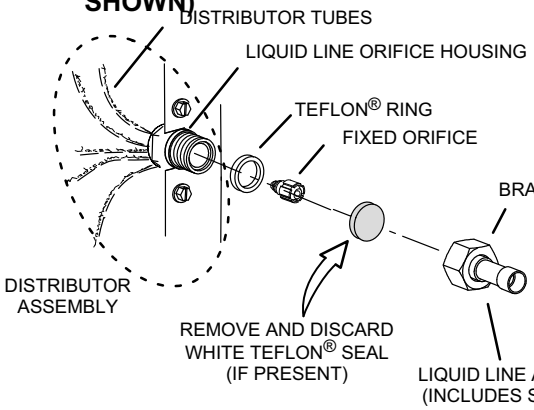
7 PREPARATION FOR NEXT STEP

After all connections have been brazed, disconnect manifold gauge set from service ports. Apply additional water saturated cloths to both services valves to cool piping. Once piping is cool, remove all water saturated cloths. Refer to the unit installation instructions for the next step in preparing the unit.

Figure 46. Brazing Procedures (Continued)

LINE SET AND INDOOR COIL (1 OF 2)

1A TYPICAL EXISTING FIXED ORIFICE REMOVAL PROCEDURE (UNCASED COIL SHOWN)



OR

A ON FULLY CASED COILS, REMOVE THE COIL ACCESS AND PLUMBING PANELS.

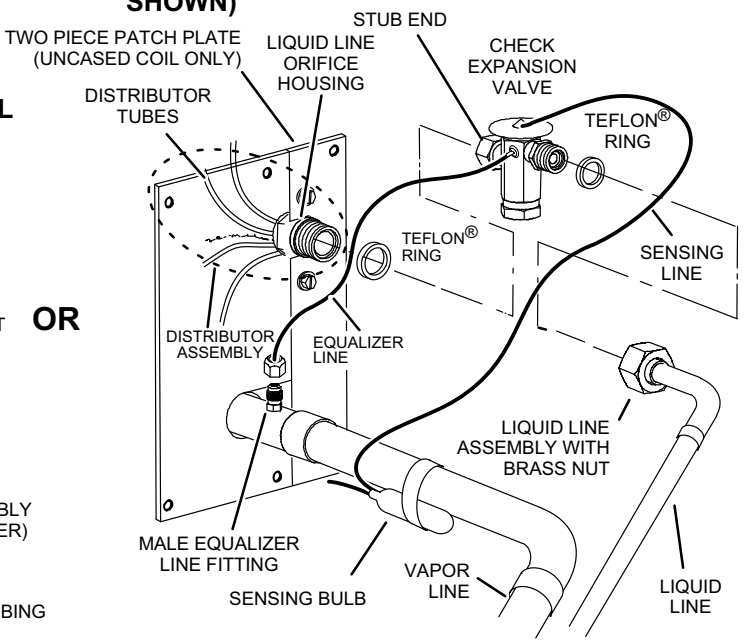
B REMOVE ANY SHIPPING CLAMPS HOLDING THE LIQUID LINE AND DISTRIBUTOR ASSEMBLY.

C USING TWO WRENCHES, DISCONNECT LIQUID LINE FROM LIQUID LINE ORIFICE HOUSING. TAKE CARE NOT TO TWIST OR DAMAGE DISTRIBUTOR TUBES DURING THIS PROCESS.

D REMOVE AND DISCARD FIXED ORIFICE, VALVE STEM ASSEMBLY IF PRESENT AND TEFLON® WASHER AS ILLUSTRATED ABOVE.

E USE A FIELD-PROVIDED FITTING TO TEMPORARY RECONNECT THE LIQUID LINE TO THE INDOOR UNIT'S LIQUID LINE ORIFICE HOUSING.

1B TYPICAL EXISTING EXPANSION VALVE REMOVAL PROCEDURE (UNCASED COIL SHOWN)



A ON FULLY CASED COILS, REMOVE THE COIL ACCESS AND PLUMBING PANELS.

B REMOVE ANY SHIPPING CLAMPS HOLDING THE LIQUID LINE AND DISTRIBUTOR ASSEMBLY.

C DISCONNECT THE EQUALIZER LINE FROM THE CHECK EXPANSION VALVE EQUALIZER LINE FITTING ON THE VAPOR LINE.

D REMOVE THE VAPOR LINE SENSING BULB.

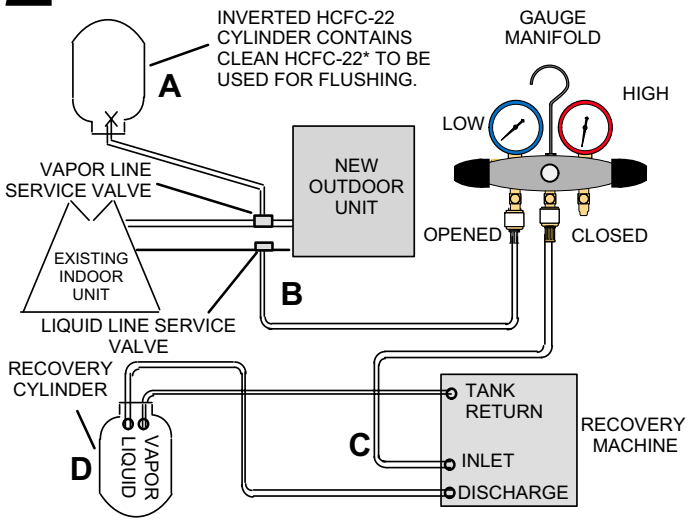
E DISCONNECT THE LIQUID LINE FROM THE CHECK EXPANSION VALVE AT THE LIQUID LINE ASSEMBLY.

F DISCONNECT THE CHECK EXPANSION VALVE FROM THE LIQUID LINE ORIFICE HOUSING. TAKE CARE NOT TO TWIST OR DAMAGE DISTRIBUTOR TUBES DURING THIS PROCESS.

G REMOVE AND DISCARD CHECK EXPANSION VALVE AND THE TWO TEFLON® RINGS.

H USE A FIELD-PROVIDED FITTING TO TEMPORARY RECONNECT THE LIQUID LINE TO THE INDOOR UNIT'S LIQUID LINE ORIFICE HOUSING.

2 CONNECT GAUGES AND EQUIPMENT FOR FLUSHING PROCEDURE



A INVERTED HCFC-22 CYLINDER WITH CLEAN REFRIGERANT* TO THE VAPOR SERVICE VALVE.

B HCFC-22 GAUGE SET (LOW SIDE) TO THE LIQUID LINE VALVE.

C HCFC-22 GAUGE SET CENTER PORT TO INLET ON THE RECOVERY MACHINE WITH AN EMPTY RECOVERY TANK TO THE GAUGE SET.

D CONNECT RECOVERY TANK TO RECOVERY MACHINES PER MACHINE INSTRUCTIONS.

CAUTION —This procedure should not be performed on systems which contain contaminants (Example compressor burn out.

3 FLUSHING LINE SET

THE LINE SET AND INDOOR UNIT COIL MUST BE FLUSHED WITH AT LEAST THE SAME AMOUNT OF CLEAN REFRIGERANT* THAT PREVIOUSLY CHARGED THE SYSTEM. CHECK THE CHARGE IN THE FLUSHING CYLINDER BEFORE PROCEEDING.

A SET THE RECOVERY MACHINE FOR LIQUID RECOVERY AND START THE RECOVERY MACHINE. OPEN THE GAUGE SET VALVES TO ALLOW THE RECOVERY MACHINE TO PULL A VACUUM ON THE EXISTING SYSTEM LINE SET AND INDOOR UNIT COIL.

B INVERT THE CYLINDER OF CLEAN HCFC-22* AND OPEN ITS VALVE TO ALLOW LIQUID REFRIGERANT TO FLOW INTO THE SYSTEM THROUGH THE VAPOR LINE VALVE. ALLOW THE REFRIGERANT TO PASS FROM THE CYLINDER AND THROUGH THE LINE SET AND THE INDOOR UNIT COIL BEFORE IT ENTERS THE RECOVERY MACHINE.

C AFTER ALL OF THE LIQUID REFRIGERANT HAS BEEN RECOVERED, SWITCH THE RECOVERY MACHINE TO VAPOR RECOVERY SO THAT ALL OF THE HCFC-22 VAPOR IS RECOVERED. ALLOW THE RECOVERY MACHINE TO PULL DOWN TO 0 THE SYSTEM.

D CLOSE THE VALVE ON THE INVERTED HCFC-22 DRUM AND THE GAUGE SET VALVES. PUMP THE REMAINING REFRIGERANT OUT OF THE RECOVERY MACHINE AND TURN THE MACHINE OFF.

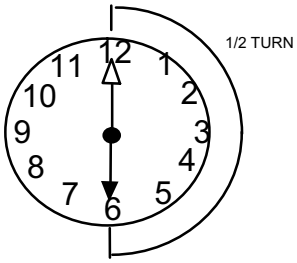
***IMPORTANT - Clean refrigerant is any refrigerant in a system that has not had compressor burn out. If the system has experienced burn out, it is recommended that the existing line set and indoor coil be replaced.**

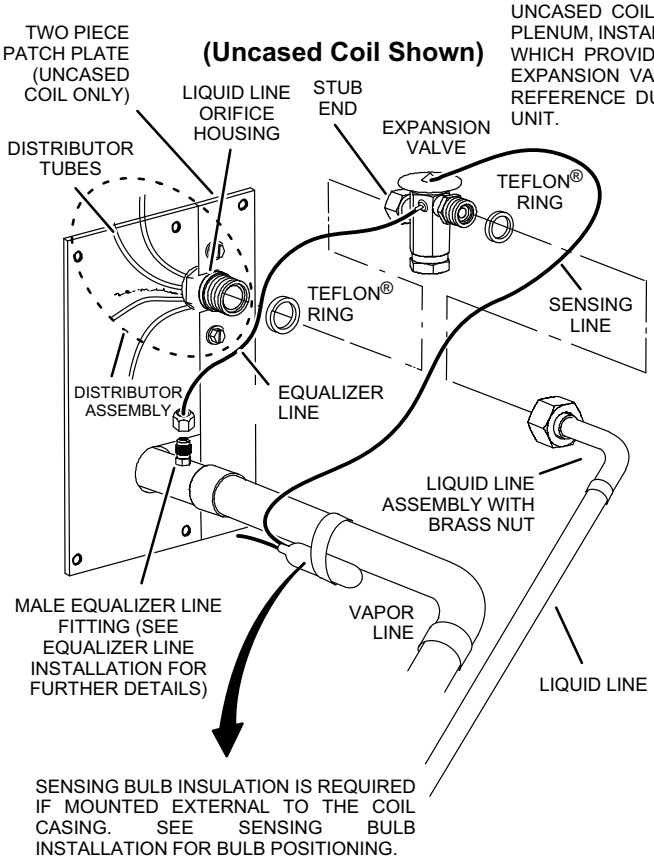
FLUSHING LINE SET AND INDOOR COIL (2 OF 2)

4 TYPICAL NEW CHECK EXPANSION VALVE INSTALLATION PROCEDURE

THIS OUTDOOR UNIT IS DESIGNED FOR USE IN SYSTEMS THAT USE A CHECK EXPANSION VALVE METERING DEVICE. SEE THE *LENNOX XP21 PRODUCT SPECIFICATION* FOR APPROVED EXPANSION VALVE KIT MATCH-UPS AND APPLICATION INFORMATION.

THE EXPANSION VALVE UNIT CAN BE INSTALLED INTERNAL OR EXTERNAL TO THE INDOOR COIL. IN APPLICATIONS WHERE AN UNCASED COIL IS BEING INSTALLED IN A FIELD-PROVIDED PLENUM, INSTALL THE CHECK EXPANSION VALVE IN A MANNER WHICH PROVIDES ACCESS FOR FIELD SERVICING OF THE EXPANSION VALVE. REFER TO BELOW ILLUSTRATION FOR REFERENCE DURING INSTALLATION OF EXPANSION VALVE UNIT.





A REMOVE THE FIELD-PROVIDED FITTING THAT TEMPORARILY RECONNECTED THE LIQUID LINE TO THE INDOOR UNIT'S DISTRIBUTOR ASSEMBLY.

B INSTALL ONE OF THE PROVIDED TEFLON® RINGS AROUND THE STUBBED END OF THE EXPANSION VALVE AND LIGHTLY LUBRICATE THE CONNECTOR THREADS AND EXPOSE SURFACE OF THE TEFLON® RING WITH REFRIGERANT OIL.

C ATTACH THE STUBBED END OF THE EXPANSION VALVE TO THE LIQUID LINE ORIFICE HOUSING. FINGER TIGHTEN AND USE AN APPROPRIATELY SIZED WRENCH TO TURN AN ADDITIONAL 1/2 TURN CLOCKWISE AS ILLUSTRATED IN THE FIGURE ABOVE, OR 20 FT-LB.

D PLACE THE REMAINING TEFLON® WASHER AROUND THE OTHER END OF THE EXPANSION VALVE. LIGHTLY LUBRICATE CONNECTOR THREADS AND EXPOSE SURFACE OF THE TEFLON® RING WITH REFRIGERANT OIL.

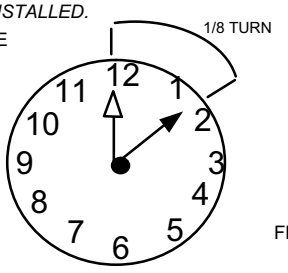
E ATTACH THE LIQUID LINE ASSEMBLY TO THE EXPANSION VALVE. FINGER TIGHTEN AND USE AN APPROPRIATELY SIZED WRENCH TO TURN AN ADDITIONAL 1/2 TURN CLOCKWISE AS ILLUSTRATED IN THE FIGURE ABOVE OR 20 FT-LB.

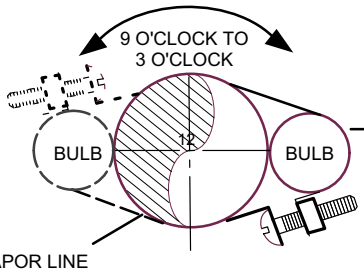
SENSING BULB INSTALLATION

A ATTACH THE VAPOR LINE SENSING BULB IN THE PROPER ORIENTATION AS ILLUSTRATED TO THE RIGHT USING THE CLAMP AND SCREWS PROVIDED.

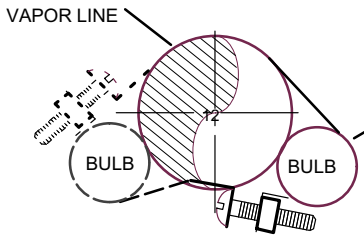
NOTE - CONFIRM PROPER THERMAL CONTACT BETWEEN VAPOR LINE AND CHECK EXPANSION BULB BEFORE INSULATING THE SENSING BULB ONCE INSTALLED.

B CONNECT THE EQUALIZER LINE FROM THE EXPANSION VALVE TO THE EQUALIZER VAPOR PORT ON THE VAPOR LINE. FINGER TIGHTEN THE FLARE NUT PLUS 1/8 TURN (7 FT-LBS) AS ILLUSTRATED BELOW.





ON LINES SMALLER THAN 7/8", MOUNT SENSING BULB BETWEEN THE 9 AND 3 O'CLOCK POSITIONS.

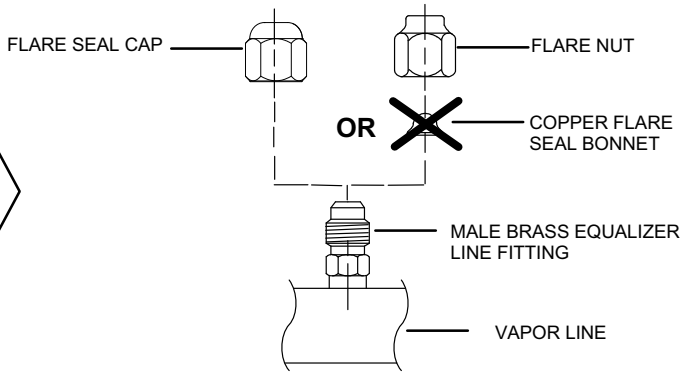


ON 7/8" AND LARGER LINES, MOUNT SENSING BULB AT EITHER THE 4 OR 8 O'CLOCK POSITION. NEVER MOUNT THE SENSING BULB ON BOTTOM OF LINE.

NOTE - NEVER MOUNT THE SENSING BULB ON BOTTOM OF LINE.

EQUALIZER LINE INSTALLATION

REMOVE AND DISCARD EITHER THE FLARE SEAL CAP OR FLARE NUT WITH COPPER FLARE SEAL BONNET FROM THE EQUALIZER LINE PORT ON THE VAPOR LINE AS ILLUSTRATED IN THE FIGURE TO THE RIGHT.



INSTALLING ISOLATION GROMMETS

Locate the isolation grommets (provided). Slide grommets onto vapor and liquid lines. Insert grommets into piping panel to isolate refrigerant lines from sheet metal edges.

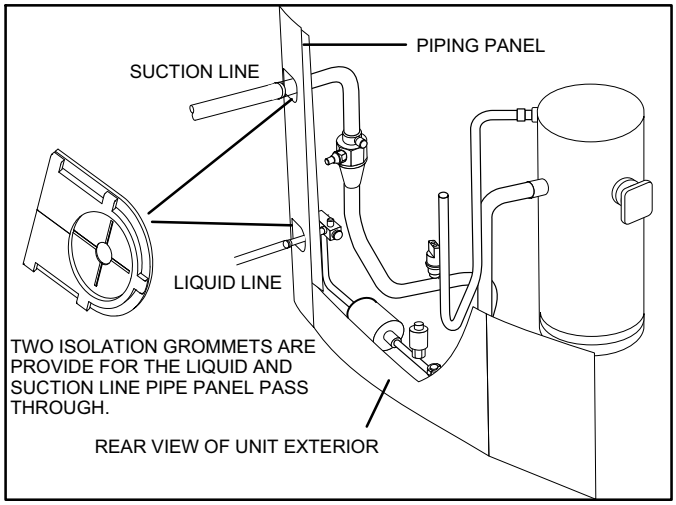


Figure 47. Isolation Grommets

⚠ IMPORTANT

The Environmental Protection Agency (EPA) prohibits the intentional venting of HFC refrigerants during maintenance, service, repair and disposal of appliance. Approved methods of recovery, recycling or reclaiming must be followed.

⚠ IMPORTANT

If this unit is being matched with an approved line set or indoor unit coil which was previously charged with mineral oil, or if it is being matched with a coil which was manufactured before January of 1999, the coil and line set must be flushed prior to installation. Take care to empty all existing traps. Polyol ester (POE) oils are used in Lennox units charged with HFC-410A refrigerant. Residual mineral oil can act as an insulator, preventing proper heat transfer. It can also clog the expansion device, and reduce the system performance and capacity.

Failure to properly flush the system per the instructions below will void the warranty.

Leak Testing

⚠ IMPORTANT

Leak detector must be capable of sensing HFC refrigerant.

⚠ WARNING

When using a high pressure gas such as dry nitrogen to pressurize a refrigeration or air conditioning system, use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).

⚠ WARNING

Refrigerant can be harmful if it is inhaled. Refrigerant must be used and recovered responsibly.

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

⚠ WARNING

Fire, Explosion and Personal Safety Hazard.

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

Never use oxygen to pressurize or purge refrigeration lines. Oxygen, when exposed to a spark or open flame, can cause damage by fire and/or an explosion, that could result in personal injury or death.

LEAK TEST

LINE SET AND INDOOR COIL

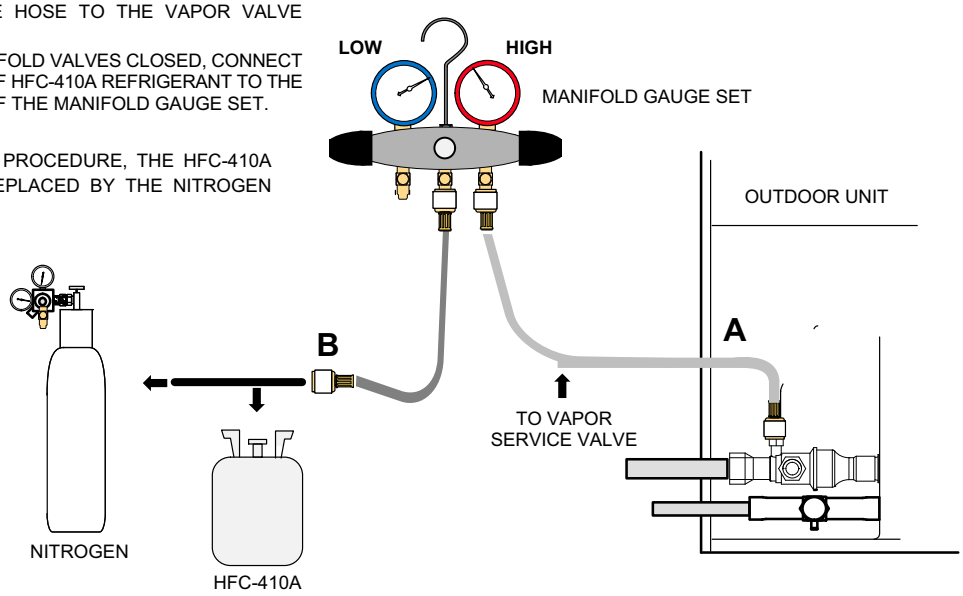
NOTE — NORMALLY, THE HIGH PRESSURE HOSE IS CONNECTED TO THE LIQUID LINE PORT. HOWEVER, CONNECTING IT TO THE VAPOR PORT BETTER PROTECTS THE MANIFOLD GAUGE SET FROM HIGH PRESSURE DAMAGE.

1 CONNECT GAUGE SET

A CONNECT AN HFC-410A MANIFOLD GAUGE SET HIGH PRESSURE HOSE TO THE VAPOR VALVE SERVICE PORT.

B WITH BOTH MANIFOLD VALVES CLOSED, CONNECT THE CYLINDER OF HFC-410A REFRIGERANT TO THE CENTER PORT OF THE MANIFOLD GAUGE SET.

NOTE — LATER IN THE PROCEDURE, THE HFC-410A CONTAINER WILL BE REPLACED BY THE NITROGEN CONTAINER.



2 TEST FOR LEAKS

AFTER THE LINE SET HAS BEEN CONNECTED TO THE INDOOR AND OUTDOOR UNITS, CHECK THE LINE SET CONNECTIONS AND INDOOR UNIT FOR LEAKS. USE THE FOLLOWING PROCEDURE TO TEST FOR LEAKS:

A WITH BOTH MANIFOLD VALVES CLOSED, CONNECT THE CYLINDER OF HFC-410A REFRIGERANT TO THE CENTER PORT OF THE MANIFOLD GAUGE SET. OPEN THE VALVE ON THE HFC-410A CYLINDER (VAPOR ONLY).

B OPEN THE HIGH PRESSURE SIDE OF THE MANIFOLD TO ALLOW HFC-410A INTO THE LINE SET AND INDOOR UNIT. WEIGH IN A TRACE AMOUNT OF HFC-410A. *[A TRACE AMOUNT IS A MAXIMUM OF TWO OUNCES (57 G) REFRIGERANT OR THREE POUNDS (31 KPA) PRESSURE].* CLOSE THE VALVE ON THE HFC-410A CYLINDER AND THE VALVE ON THE HIGH PRESSURE SIDE OF THE MANIFOLD GAUGE SET. DISCONNECT THE HFC-410A CYLINDER.

C CONNECT A CYLINDER OF DRY NITROGEN WITH A PRESSURE REGULATING VALVE TO THE CENTER PORT OF THE MANIFOLD GAUGE SET.

D ADJUST DRY NITROGEN PRESSURE TO 150 PSIG (1034 KPA). OPEN THE VALVE ON THE HIGH SIDE OF THE MANIFOLD GAUGE SET IN ORDER TO PRESSURIZE THE LINE SET AND THE INDOOR UNIT.

E AFTER A FEW MINUTES, OPEN ONE OF THE SERVICE VALVE PORTS AND VERIFY THAT THE REFRIGERANT ADDED TO THE SYSTEM EARLIER IS MEASURABLE WITH A LEAK DETECTOR.

F AFTER LEAK TESTING DISCONNECT GAUGES FROM SERVICE PORTS.

Figure 48. System Leak Test

Evacuating

Evacuating the system of non-condensables is critical for proper operation of the unit. Non-condensables are defined as any gas that will not condense under temperatures and pressures present during operation of an air conditioning system. Non-condensables and water suction combine with refrigerant to produce substances that corrode copper piping and compressor parts.

⚠ WARNING

Danger of Equipment Damage. Avoid deep vacuum operation. Do not use compressors to evacuate a system. Extremely low vacuums can cause internal arcing and compressor failure. Damage caused by deep vacuum operation will void warranty.

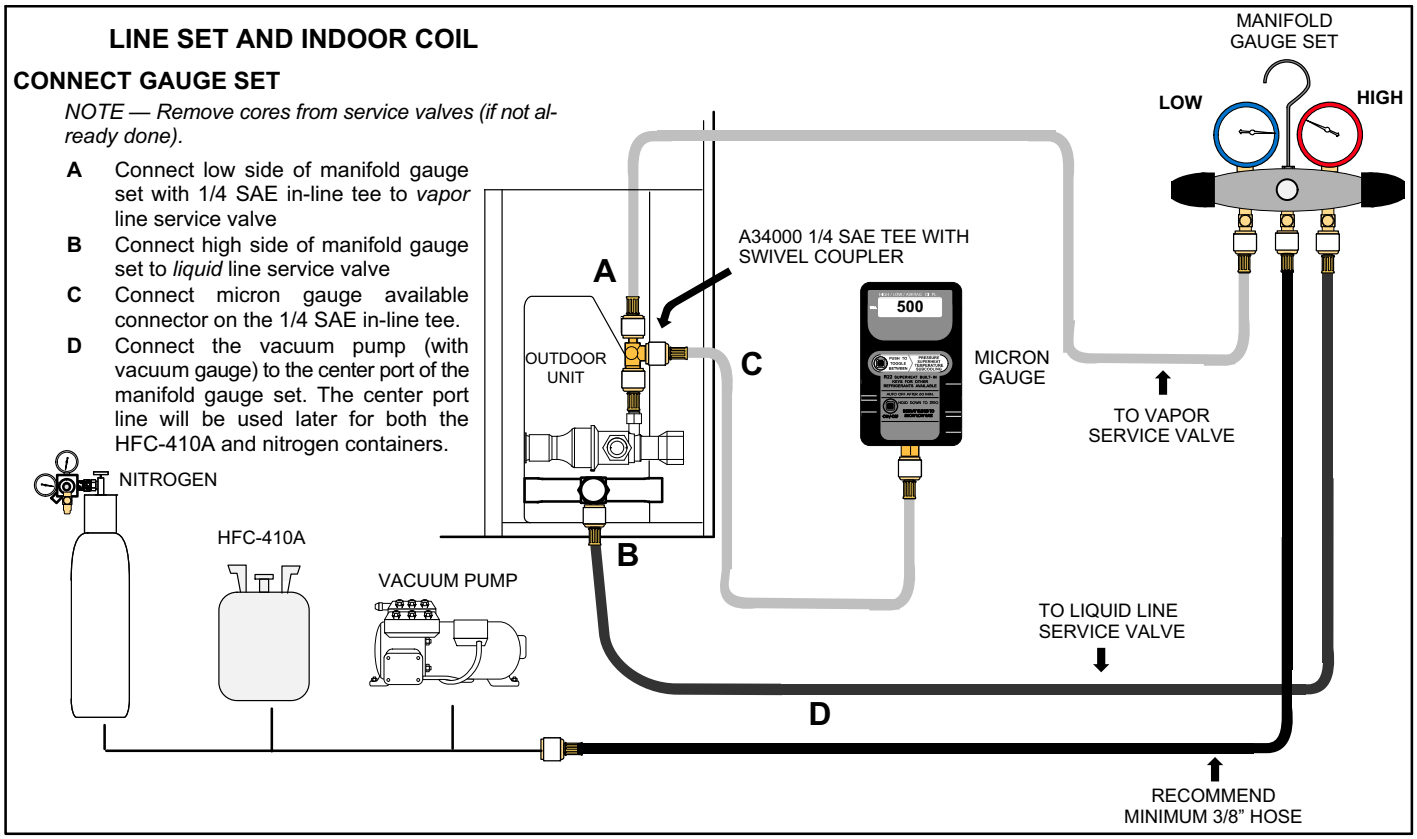


Figure 49. Connecting Gauge Set

EVACUATE LINE SET AND INDOOR COIL

The unit is shipped with a factory refrigerant charge. The liquid and suction line valves were closed after final testing at the factory. Do not operate these valves until the line set and indoor coil have been evacuated and leak checked, or the charge is lost.

Note: Do not use any portion of the factory charge for purging or leak testing. The factory charge is for filling the system only after a complete evacuation and leak check has been performed.

Line set and indoor coil should be evacuated using the recommend deep vacuum method of 500 microns. If deep vacuum equipment is not available, the alternate triple evacuation method may be used by following the specified procedure.

If vacuum must be interrupted during the evacuation procedure, always break vacuum with dry nitrogen.

Deep Vacuum Method

The deep vacuum method requires a vacuum pump capable of pulling a vacuum to 500 microns and a vacuum gauge capable of accurately measuring this vacuum level. The deep vacuum method is the most positive way of assuring a system is free of air and water.

Watch the vacuum gauge as the system is pulling down. The response of the gauge is an indicator of the condition of the system (refer to figure 50).

With no leaks in the system, allow the vacuum pump to run for 30 minutes minimum at the deep vacuum level.

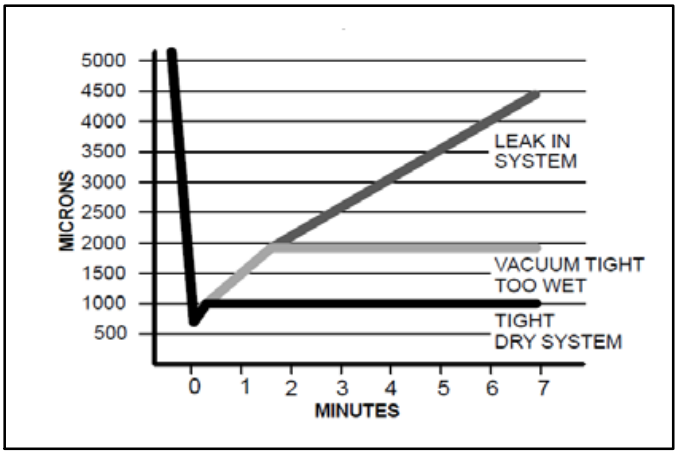


Figure 50. Deep Vacuum Gauge Response and System Conditions

Triple Evacuation Method

The triple evacuation method should only be used when system does not contain any water in liquid form and vacuum pump is only capable of pulling down to 28 inches of mercury (711mm Hg). Refer to figure 51 and proceed as follows:

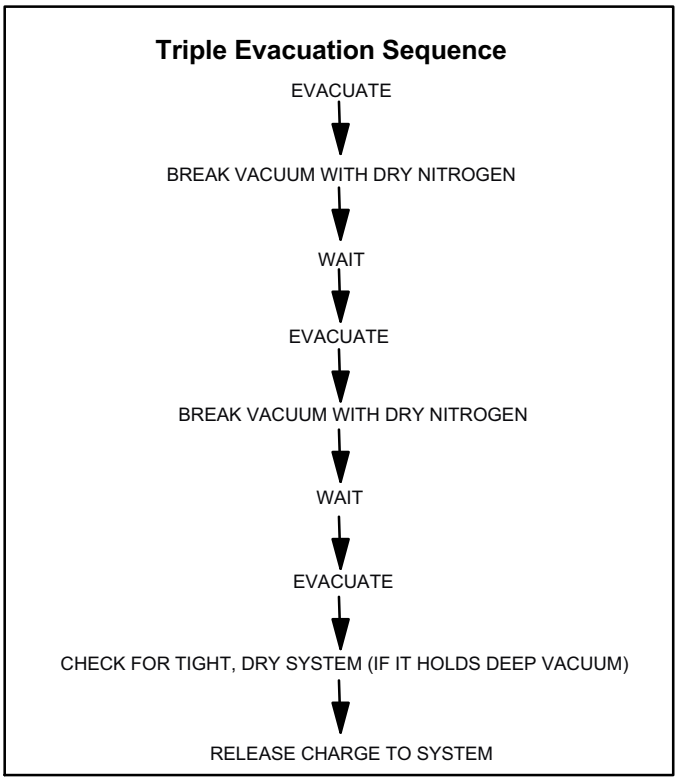


Figure 51. Triple Evacuation Sequence

1. Pull system down to 28 inches of mercury (711mm Hg) and allow pump to continue operating for an additional 15 minutes.
2. Close manifold valves or valve at vacuum pump and shut off vacuum pump.
3. Connect a nitrogen cylinder and regulator to system and fill with nitrogen until system pressure is 2 psig.
4. Close nitrogen valve and allow system to stand for one hour. During this time, dry nitrogen will diffuse throughout the system absorbing moisture.
5. Repeat this procedure as indicated in figure 51. System will then be free of any airborne containment and water vapor.
6. After the final evacuate sequence, confirm there are no leaks in the system. If a leak is found, repeat the entire process after repair is made.
7. Reconnect the manifold gauge to the vacuum pump, turn the pump on, and continue to evacuate the line set and indoor unit until the absolute pressure does not rise above 500 microns (29.9 inches of mercury) within a 20 – minute period after shutting off the vacuum pump and closing the manifold gauge valves.
8. Disconnect the manifold hose from the vacuum pump and connect it to an inverted cylinder of HFC – 410A positioned to deliver liquid refrigerant. Open the manifold gauge valve 1 to 2 psig in order to release the vacuum in the line set and indoor unit.
9. Perform the following:
   - Close manifold gauge valves.
   - Shut off HFC – 410A cylinder.
   - Slowly open the service valves.
   - Refer to the charging sticker on the unit to complete the outdoor unit installation.

IV. SYSTEM CHARGE

Servicing Units Delivered Void of Charge

If the outdoor unit is void of refrigerant, clean the system using the procedure described below.

1. Leak check system using procedure outlined on page 82.
2. Evacuate the system using procedure outlined on page 49.
3. Use nitrogen to break the vacuum and install a new filter drier in the system.
4. Evacuate the system again using procedure outlined on page 49.
5. Weigh in refrigerant using procedure outlined in figure 54.
6. Monitor the system to determine the amount of moisture remaining in the oil. It may be necessary to replace the filter drier several times to achieve the required dryness level. **If system dryness is not verified, the compressor will fail in the future.**

Unit Start-Up

⚠ IMPORTANT

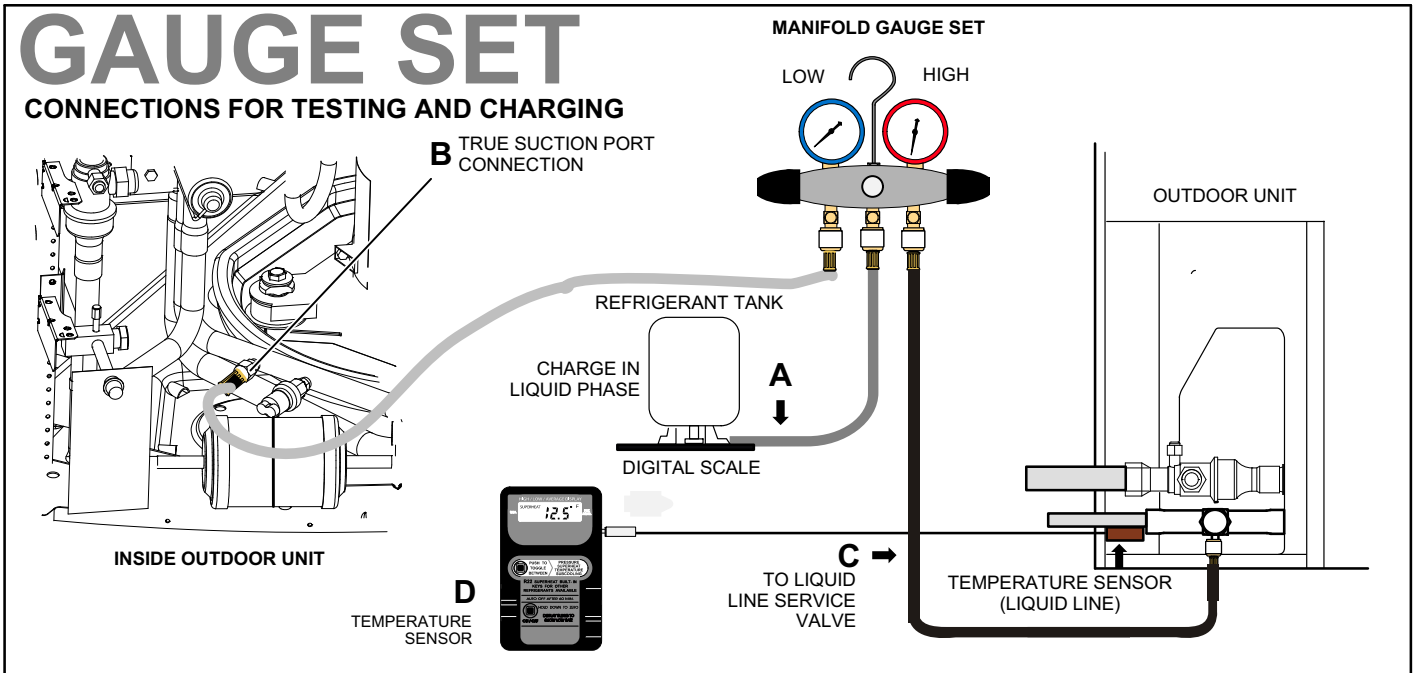
If unit is equipped with a crankcase heater, it should be energized 24 hours before unit start-up to prevent compressor damage as a result of slugging.

1. Rotate fan to check for binding.
2. Inspect all factory- and field-installed wiring for loose connections.
3. After evacuation is complete, open both the liquid and vapor line service valves to release the refrigerant charge contained in outdoor unit into the system.
4. Replace the stem caps and tighten to the value listed in table 1.
5. Check voltage supply at the disconnect switch. The voltage must be within the range listed on the unit's nameplate. If not, do not start the equipment until you have consulted with the power company and the voltage condition has been corrected.
6. Set the thermostat for a cooling demand. Turn on power to the indoor indoor unit and close the outdoor unit disconnect switch to start the unit.
7. Recheck voltage while the unit is running. Power must be within range shown on the nameplate.
8. Check system for sufficient refrigerant by using the procedures listed under *System Refrigerant.*

System Refrigerant

This section outlines procedures for:

1. Connecting gauge set for testing and charging as illustrated in figure 52.
2. Checking and adjusting indoor airflow as described in figure 53.
3. Add or remove refrigerant using the weigh in method provided in figure 54, and verifying charge using subcooling method described in figure 55.



A CLOSE MANIFOLD GAUGE SET VALVES AND CONNECT THE CENTER HOSE TO A CYLINDER OF HFC-410A. SET FOR LIQUID PHASE CHARGING.
B CONNECT THE MANIFOLD GAUGE SET'S LOW PRESSURE SIDE TO THE TRUE SUCTION PORT.
C CONNECT THE MANIFOLD GAUGE SET'S HIGH PRESSURE SIDE TO THE LIQUID LINE SERVICE PORT.
D POSITION TEMPERATURE SENSOR ON LIQUID LINE NEAR LIQUID LINE SERVICE PORT.

Figure 52. Gauge Set Connections

ADDING OR REMOVING REFRIGERANT

This system uses HFC-410A refrigerant which operates at much higher pressures than HCFC-22. The pre-installed liquid line filter drier is approved for use with HFC-410A only. Do not replace it with components designed for use with HCFC-22.

COOLING MODE INDOOR AIRFLOW CHECK

Check airflow using the Delta-T (DT) process using the illustration in figure 53.

HEATING MODE INDOOR AIRFLOW CHECK

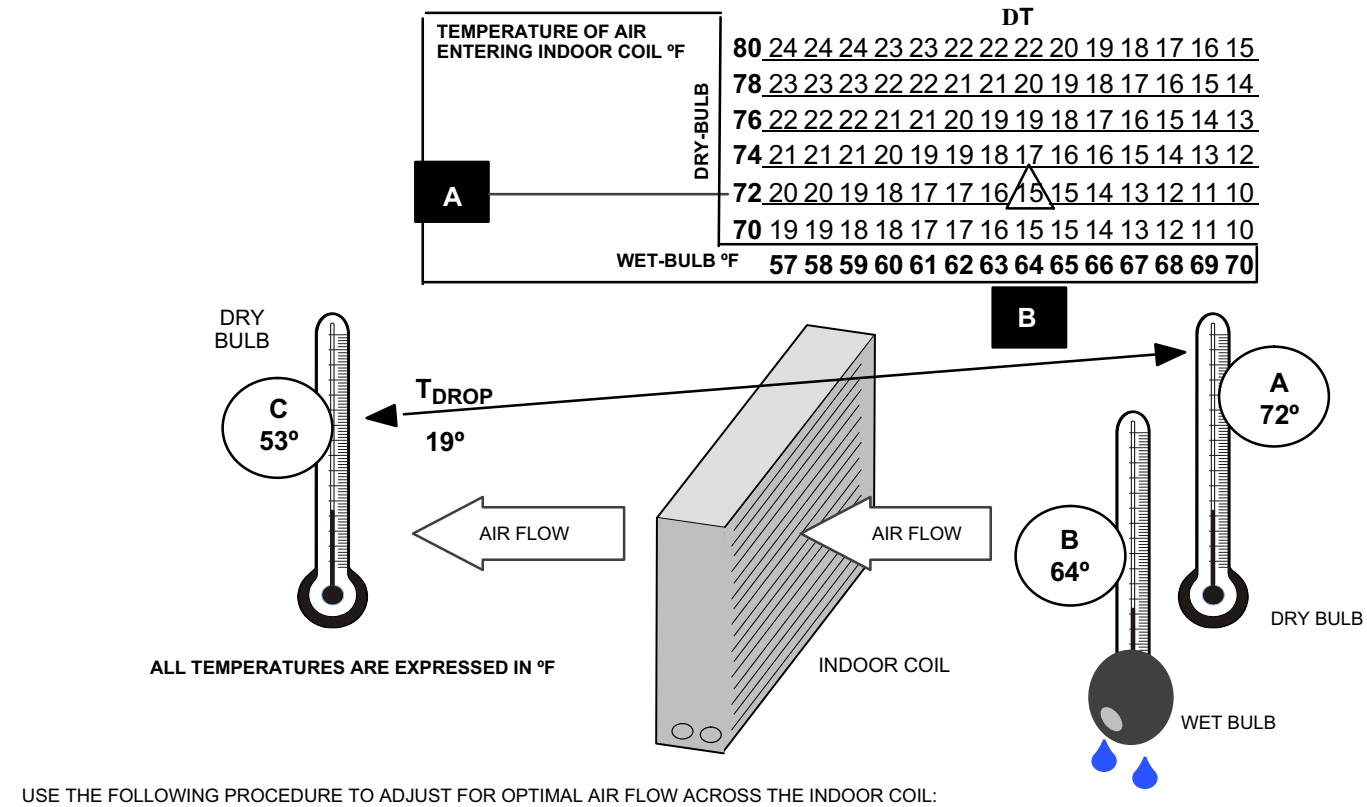
Blower airflow cubic feet per minute (CFM) may be calculated by energizing electric heat and measuring:

- Temperature rise between the return air and supply air temperatures at the indoor coil blower unit,
- Measuring voltage supplied to the unit,
- Measuring amperage being drawn by the heat unit(s).

Then, apply the measurements taken in following formula to determine CFM:

$$\text{CFM} = \frac{\text{Amps x Volts x 3.41}}{\text{1.08 x Temperature rise (F)}}$$

AIRFLOW INDOOR COIL



USE THE FOLLOWING PROCEDURE TO ADJUST FOR OPTIMAL AIR FLOW ACROSS THE INDOOR COIL:

1. **DETERMINE THE DESIRED DT** — MEASURE ENTERING AIR TEMPERATURE USING DRY BULB (**A**) AND WET BULB (**B**). **DT** IS THE INTERSECTING VALUE OF **A** AND **B** IN THE TABLE (SEE TRIANGLE).

2. FIND TEMPERATURE DROP ACROSS COIL — MEASURE THE COIL'S DRY BULB ENTERING AND LEAVING AIR TEMPERATURES (**A** AND **C**). TEMPERATURE DROP FORMULA: (T_{DROP}) = **A** MINUS **C**.

3. **DETERMINE IF FAN NEEDS ADJUSTMENT** — IF THE DIFFERENCE BETWEEN THE MEASURED T_{DROP} AND THE DESIRED **DT** (T_{DROP}–DT) IS WITHIN ±3°, NO ADJUSTMENT IS NEEDED. SEE EXAMPLE BELOW:

ASSUME **DT** = 15 AND **A** TEMP. = 72°, THESE **C** TEMPERATURES WOULD NECESSITATE STATED ACTIONS:

C°	T_{DROP}	–	DT	=	°F	*ACTION*
53°	19	–	15	=	4	*INCREASE THE AIRFLOW*
58°	14	–	15	=	-1	*(WITHIN ±3° RANGE) NO CHANGE*
62°	10	–	15	=	-5	*DECREASE THE AIRFLOW*

CHANGING AIR FLOW AFFECTS ALL TEMPERATURES; RECHECK TEMPERATURES TO CONFIRM THAT THE TEMPERATURE DROP AND DT ARE WITHIN ±3°.

4. **ADJUST THE FAN SPEED** — See indoor unit instructions to increase/decrease fan speed.

Figure 53. Checking Indoor Airflow over Evaporator Coil using Delta-T Chart

Use **WEIGH IN** method for adding initial refrigerant charge, and then use **SUBCOOLING** method for for verifying refrigerant charge.

WEIGH IN CHARGING METHOD

CALCULATING SYSTEM CHARGE FOR OUTDOOR UNIT VOID OF CHARGE

IF THE SYSTEM IS VOID OF REFRIGERANT, FIRST, LOCATE AND REPAIR ANY LEAKS AND THEN WEIGH IN THE REFRIGERANT CHARGE INTO THE UNIT. TO CALCULATE THE TOTAL REFRIGERANT CHARGE:

AMOUNT SPECIFIED ON NAMEPLATE		ADJUST AMOUNT. FOR VARIATION IN LINE SET LENGTH LISTED ON LINE SET LENGTH TABLE BELOW.		ADDITIONAL CHARGE SPECIFIED PER INDOOR UNIT MATCH-UPS FROM APPLICABLE CHARGING STICKER.		TOTAL CHARGE
_____	±	_____	+	_____	=	_____

Refrigerant Charge per Line Set Length

LIQUID LINE SET DIAMETER	OUNCES PER 5 FEET (G PER 1.5 M) ADJUST FROM 15 FEET (4.6 M) LINE SET*
3/8" (9.5 MM)	3 OUNCE PER 5' (85 G PER 1.5 M)

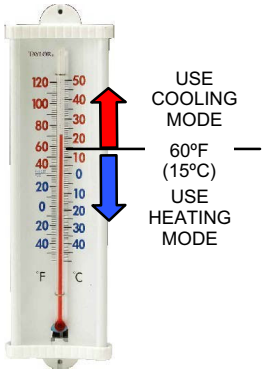
*IF LINE LENGTH IS GREATER THAN 15 FT. (4.6 M), ADD THIS AMOUNT. IF LINE LENGTH IS LESS THAN 15 FT. (4.6 M), SUBTRACT THIS AMOUNT.

NOTE — INSULATE LIQUID LINE WHEN IT IS ROUTED THROUGH AREAS WHERE THE SURROUNDING AMBIENT TEMPERATURE COULD BECOME HIGHER THAN THE TEMPERATURE OF THE LIQUID LINE OR WHEN PRESSURE DROP IS EQUAL TO OR GREATER THAN 20 PSIG.

NOTE — THE ABOVE NAMEPLATE IS FOR ILLUSTRATION PURPOSES ONLY. GO TO ACTUAL NAMEPLATE ON OUTDOOR UNIT FOR CHARGE INFORMATION.

Figure 54. Using HFC-410A Weigh In Method

SUBCOOLING CHARGING METHOD



USE COOLING MODE

60°F (15°C)

USE HEATING MODE

SATº _____

LIQº – _____

SCº = _____

1. CHECK THE AIRFLOW AS ILLUSTRATED IN FIGURE 53 TO BE SURE THE INDOOR AIRFLOW IS AS REQUIRED. (MAKE ANY AIR FLOW ADJUSTMENTS BEFORE CONTINUING WITH THE FOLLOWING PROCEDURE.)
2. MEASURE OUTDOOR AMBIENT TEMPERATURE; DETERMINE WHETHER TO USE **COOLING MODE** OR **HEATING MODE** TO CHECK CHARGE.
3. CONNECT GAUGE SET.
4. CHECK LIQUID AND VAPOR LINE PRESSURES. COMPARE PRESSURES WITH EITHER HEAT OR COOLING MODE NORMAL OPERATING PRESSURES IN THE APPLICABLE CHARGING STICKER, NORMAL OPERATING PRESSURES, HIGH STAGE.

   NOTE — THE REFERENCE TABLE IS A GENERAL GUIDE. EXPECT MINOR PRESSURE VARIATIONS. SIGNIFICANT DIFFERENCES MAY MEAN IMPROPER CHARGE OR OTHER SYSTEM PROBLEM.
5. SET THERMOSTAT FOR HEAT/COOL DEMAND, DEPENDING ON MODE BEING USED:

   USING COOLING MODE — WHEN THE OUTDOOR AMBIENT TEMPERATURE IS 60°F (15°C) AND ABOVE. TARGET SUBCOOLING VALUES (SECOND STAGE - HIGH CAPACITY) IN APPLICABLE CHARGING STICKER ARE BASED ON 70 TO 80°F (21-27°C) INDOOR RETURN AIR TEMPERATURE; IF NECESSARY, OPERATE HEATING TO REACH THAT TEMPERATURE RANGE; THEN SET THERMOSTAT TO COOLING MODE SETPOINT TO 68ºF (20ºC) WHICH SHOULD CALL FOR SECOND-STAGE (HIGH STAGE) COOLING. WHEN PRESSURES HAVE STABILIZED, CONTINUE WITH STEP 6.

   USING HEATING MODE — WHEN THE OUTDOOR AMBIENT TEMPERATURE IS BELOW 60°F (15°C). TARGET SUBCOOLING VALUES (SECOND-STAGE - HIGH CAPACITY) IN APPLICABLE CHARGING STICKER ARE BASED ON 65-75°F (18-24°C) INDOOR RETURN AIR TEMPERATURE; IF NECESSARY, OPERATE COOLING TO REACH THAT TEMPERATURE RANGE; THEN SET THERMOSTAT TO HEATING MODE SETPOINT TO 77ºF (25ºC) WHICH SHOULD CALL FOR SECOND-STAGE (HIGH STAGE) HEATING. WHEN PRESSURES HAVE STABILIZED, CONTINUE WITH STEP 6.
6. READ THE LIQUID LINE TEMPERATURE; RECORD IN THE LIQº SPACE.
7. READ THE LIQUID LINE PRESSURE; THEN FIND ITS CORRESPONDING TEMPERATURE IN THE TEMPERATURE/ PRESSURE CHART LISTED IN THE APPLICABLE CHARGING STICKER AND RECORD IT IN THE SATº SPACE.
8. SUBTRACT LIQº TEMPERATURE FROM SATº TEMPERATURE TO DETERMINE SUBCOOLING; RECORD IT IN SCº SPACE.
9. COMPARE SCº RESULTS WITH APPLICABLE CHARGING STICKER, BEING SURE TO NOTE ANY ADDITIONAL CHARGE FOR LINE SET AND/OR MATCH-UP.
10. IF SUBCOOLING VALUE IS GREATER THAN SHOWN IN APPLICABLE CHARGING STICKER FOR THE APPLICABLE UNIT, REMOVE REFRIGERANT; IF LESS THAN SHOWN, ADD REFRIGERANT.
11. IF REFRIGERANT IS ADDED OR REMOVED, REPEAT STEPS 6 THROUGH 10 TO VERIFY CHARGE.
12. DISCONNECT GAUGE SET AND RE-INSTALL BOTH THE LIQUID AND SUCTION SERVICE VALVE CAPS.

Figure 55. Using HFC-410A Subcooling Method — High Stage (High Capacity)

Table 24. HFC-410A Temperature (°F) - Pressure (Psig)

°F	Psig	°F	Psig	°F	Psig	°F	Psig	°F	Psig	°F	Psig	°F	Psig	°F	Psig
32	100.8	48	137.1	63	178.5	79	231.6	94	290.8	110	365.0	125	445.9	141	545.6
33	102.9	49	139.6	64	181.6	80	235.3	95	295.1	111	370.0	126	451.8	142	552.3
34	105.0	50	142.2	65	184.3	81	239.0	96	299.4	112	375.1	127	457.6	143	559.1
35	107.1	51	144.8	66	187.7	82	242.7	97	303.8	113	380.2	128	463.5	144	565.9
36	109.2	52	147.4	67	190.9	83	246.5	98	308.2	114	385.4	129	469.5	145	572.8
37	111.4	53	150.1	68	194.1	84	250.3	99	312.7	115	390.7	130	475.6	146	579.8
38	113.6	54	152.8	69	197.3	85	254.1	100	317.2	116	396.0	131	481.6	147	586.8
39	115.8	55	155.5	70	200.6	86	258.0	101	321.8	117	401.3	132	487.8	148	593.8
40	118.0	56	158.2	71	203.9	87	262.0	102	326.4	118	406.7	133	494.0	149	601.0
41	120.3	57	161.0	72	207.2	88	266.0	103	331.0	119	412.2	134	500.2	150	608.1
42	122.6	58	163.9	73	210.6	89	270.0	104	335.7	120	417.7	135	506.5	151	615.4
43	125.0	59	166.7	74	214.0	90	274.1	105	340.5	121	423.2	136	512.9	152	622.7
44	127.3	60	169.6	75	217.4	91	278.2	106	345.3	122	428.8	137	519.3	153	630.1
45	129.7	61	172.6	76	220.9	92	282.3	107	350.1	123	434.5	138	525.8	154	637.5
46	132.2	62	175.4	77	224.4	93	286.5	108	355.0	124	440.2	139	532.4	155	645.0
47	134.6			78	228.0			109	360.0			140	539.0		

APPENDIX A - UNIT CHARGING STICKERS

This section contains all published charging stickers for the various versions of this model. Below is a table listing the applicable sticker to unit model number.

Table 25. Applicable Charging Sticker by Unit Model Number

Unit Model Number	Unit Charging Sticker Numbers		
	580296-01	580318-01	580325-01
	Reference charging stickers above are located at the end of this manual.		
XP21-024-230-XX	-01		-02, -03, -04, -05, -06
XP21-036-230-XX	-01		-02, -03, -04, -05
XP21-048-230-XX	-01		-02, -03, -04, -05
XP21-060-230-XX		-01	-02, -03, -04, -05

See charging stickers at end of this manual.

HFC-410A CHARGING INFORMATION
FOR COMPLETE CHARGING DETAILS, REFER TO THE OUTDOOR UNIT INSTALLATION INSTRUCTION.

Maintenance checks using the Normal Operating Pressures table

Table 1 may be used to help perform maintenance checks. This table is not a procedure for charging the system and any minor variations in the pressures may be expected due to differences in installations. However, significant deviations could mean that the system is not properly charged or that a problem exists with some component in the system. The values in Table 2 are "most-popular-match-up" pressures; indoor match up, indoor air quantity, and indoor load will cause the pressures to vary.

Match-ups/Charge Levels and Line Set Lengths

Table 2 lists all the Lennox recommended indoor unit match-ups along with the charge levels for the various sizes of outdoor units. **Charge levels on the unit nameplate are based on installations with 15' (4.6m) line sets; be sure to consider any difference in line set length (see Installation Instructions for more details).**

Charge Using the Weigh-in Method

If the system is void of refrigerant, locate and repair any leaks and then weigh in the refrigerant charge into the unit. For charge adjustments, be sure to consider line set length differences and, referring to table 2, adjust for the matchup difference.

13 - Weigh in the unit nameplate charge, adjusting for matchup and line set length differences. If weighing facilities are not available use the Subcooling method.
14 - Conduct leak check; evacuate as previously outlined.
15 - Recover the refrigerant from the unit.

Charge Using the Subcooling Method

Cooling Mode—When the outdoor ambient temperature is 60°F (15°C) and above, use the cooling mode to adjust the charge using the subcooling method. Target subcooling values in table 2 are based on 70 to 80°F (21-27°C) indoor return air temperature.

Heating Mode—When the outdoor ambient temperature is below 60°F (15°C), use the heating mode to adjust the charge using the subcooling charge levels (table). Target subcooling values in table 2 are based on 65-75°F (18-24°C) indoor return air temperature.

Table 1 - Normal Operating Pressures (Liquid ±10 and Suction ±5 psig)

*Temperature of the air entering the outdoor coil.		-024		-036		-048		-060	
	°F (°C)*	Liq	Vap	Liq	Vap	Liq	Vap	Liq	Vap
Low Stage Heating Operation	40 (4)	319	104	369	91	367	92	371	93
	50 (10)	345	122	331	117	385	113	402	111
Low Stage Cooling Operation	65 (18)	224	149	224	145	229	142	235	138
	75 (24)	260	150	261	148	266	143	273	140
	85 (29)	303	151	303	150	311	145	317	143
	95 (35)	348	154	350	152	358	147	364	145
	105 (41)	397	156	400	154	410	150	417	147
	115 (46)	453	155	456	157	468	152	476	150
High Stage Heating Operation	20 (-7)	312	67	293	62	326	63	340	59
	30 (-1)	351	82	309	76	353	76	353	68
	40 (4)	364	98	322	90	375	93	373	89
	50 (10)	390	117	341	109	405	110	404	104
High Stage Cooling Operation	65 (18)	231	144	237	140	240	138	247	131
	75 (24)	270	146	275	142	279	140	286	134
	85 (29)	312	148	315	146	323	142	327	143
	95 (35)	360	150	363	148	371	144	374	146
	105 (41)	411	152	415	151	423	146	428	148
	115 (46)	467	154	473	153	481	149	489	151

Table 2 - Indoor Units Matchups and Subcooling Charge Levels

INDOOR MATCHUP / HEAT PUMP	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	*Add charge lb	*Add charge oz
XP21-024			**lb**	**oz**
CB(X)27UH-024	15	4	0	0
CB(X)27UH-030	22	7	1	10
CBX32MV-036 and CBX32M-036	22	7	1	10
CBX32MV-24/30 and CBX32M-030	15	4	0	0
CBX40UHV-024	22	7	1	10
CBX40UHV-030	22	7	1	10
CBX40UHV-036	22	7	1	10
CH23-51	18	4	0	10
CH33-31	18	4	0	10
CH33-42	18	4	0	10
CR33-48	28	4	0	0
CX34-31	27	4	0	10
CX34-44/48B	22	5	1	3
CX34-38	25	6	1	7
XP21-036			**lb**	**oz**
CB(X)27UH-036	17	5	0	0
CB(X)27UH-042	12	5	1	10
CBX32MV-036 and CBX32M-036	17	5	0	0
CBX32MV-048 and CBX32M-048	12	5	1	10
CBX40UHV-036	17	5	0	0
CBX40UHV-042	12	5	1	10
CBX40UHV-048	12	5	1	10
CH23-51	19	7	0	0
CH33-43	11	5	0	7
CH33-44/48B	11	5	0	7
CH33-48C	11	5	0	7
CH33-50/60C	12	7	1	6
CR33-48	28	4	0	0
CX34-38	15	5	0	7
CX34-44/48B	19	4	0	10
CX34-49	10	10	1	10
CX34-50/60C	11	5	0	7

INDOOR MATCHUP / HEAT PUMP	Target Subcooling Heating (±5ºF)	Target Subcooling Cooling (±1ºF)	*Add charge lb	*Add charge oz
XP21-048			**lb**	**oz**
CB(X)27UH-048	24	4	1	0
CB(X)27UH-060	14	4	1	6
CBX32MV-048 and CBX32M-048	24	4	1	0
CBX32MV-060 and CBX32M-060	21	4	1	14
CBX32MV-068	14	4	1	0
CBX40UHV-048	24	4	1	0
CBX40UHV-060	21	4	1	14
CH23-68	14	4	1	6
CH33-49C	21	4	1	14
CH33-50/60C	21	4	1	14
CH33-62D	20	4	1	7
CR33-50/60	32	4	0	0
CR33-60D	32	4	0	0
CX34-49	21	5	0	10
CX34-62C	11	4	1	5
CX34-62D	11	4	1	5
XP21-060			**lb**	**oz**
CB(X)27UH-060	15	4	1	2
CBX32MV-060 and CBX32M-060	12	4	1	10
CBX32MV-068	14	4	1	0
CBX40UHV-060	12	4	1	10
CH23-68	15	4	1	6
CH33-49C	16	4	1	0
CH33-50/60C	16	4	1	0
CH33-62D	13	5	1	3
CR33-50/60	23	5	0	0
CR33-60D	23	5	0	0
CX34-49	16	4	1	0
CX34-62C	13	5	1	3
CX34-62D	13	5	1	3

***Amount of charge required in additional to charge shown on unit nameplate. (Remember to consider line set length difference.)**

HFC-410A CHARGING INFORMATION
FOR COMPLETE CHARGING DETAILS, REFER TO THE OUTDOOR UNIT INSTALLATION INSTRUCTION.

Maintenance checks using the Normal Operating Pressures table

Table 1 may be used to help perform maintenance checks. This table is not a procedure for charging the system and any minor variations in the pressures may be expected due to differences in installations. However, significant deviations could mean that the system is not properly charged or that a problem exists with some component in the system. The values in Table 2 are "most-popular-match-up" pressures; indoor match up, indoor air quantity, and indoor load will cause the pressures to vary.

Match-ups/Charge Levels and Line Set Lengths

Table 2 lists all the Lennox recommended indoor unit match-ups along with the charge levels for the various sizes of outdoor units. **Charge levels on the unit nameplate are based on installations with 15' (4.6m) line sets; be sure to consider any difference in line set length (see Installation Instructions for more details).**

Charge Using the Weigh-in Method

If the system is void of refrigerant, locate and repair any leaks and then weigh in the refrigerant charge into the unit. For charge adjustments, be sure to consider line set length differences and, referring to table 2, adjust for the matchup difference.

1 - Weigh in the unit nameplate charge, adjusting for matchup and line set length differences. If weighing facilities are not available use the Subcooling method.
2 - Conduct leak check; evacuate as previously outlined.
3 - Recover the refrigerant from the unit.

Charge Using the Subcooling Method

Cooling Mode—When the outdoor ambient temperature is 60°F (15°C) and above, use the cooling mode to adjust the charge using the subcooling method. Target subcooling values in table 2 are based on 70 to 80°F (21-27°C) indoor return air temperature.

Heating Mode—When the outdoor ambient temperature is below 60°F (15°C), use the heating mode to adjust the charge using the subcooling charge levels (table). Target subcooling values in table 2 are based on 65-75°F (18-24°C) indoor return air temperature.

Table 1 - Normal Operating Pressures (Liquid ±10 and Suction ±5 psig)

*Temperature of the air entering the outdoor coil.		-024		-036		-048		-060	
	°F (°C)*	Liq	Vap	Liq	Vap	Liq	Vap	Liq	Vap
Low Stage Heating Operation	40 (4)	319	104	369	91	367	92	353	91
	50 (10)	345	122	331	117	385	113	352	115
Low Stage Cooling Operation	65 (18)	224	149	224	145	229	142	227	139
	75 (24)	260	150	261	148	266	143	263	142
	85 (29)	303	151	303	150	311	145	305	144
	95 (35)	348	154	350	152	358	147	352	147
	105 (41)	397	156	400	154	410	150	402	150
	115 (46)	453	155	456	157	468	152	458	153
High Stage Heating Operation	20 (-7)	312	67	293	62	326	63	305	62
	30 (-1)	351	82	309	76	353	76	320	72
	40 (4)	364	98	322	90	375	93	347	90
	50 (10)	390	117	341	109	405	110	366	105
High Stage Cooling Operation	65 (18)	231	144	237	140	240	138	236	134
	75 (24)	270	146	275	142	279	140	272	136
	85 (29)	312	148	315	146	323	142	316	139
	95 (35)	360	150	363	148	371	144	364	141
	105 (41)	411	152	415	151	423	146	416	144
	115 (46)	467	154	473	153	481	149	475	146

Table 2 - Indoor Units Matchups and Subcooling Charge Levels

INDOOR MATCHUP HEAT PUMP	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	*Add charge lb	*Add charge oz
XP21-024			lb	oz
CB(X)27UH-024	15	4	0	0
CB(X)27UH-030	22	7	1	10
CBX32MV-036 and CBX32M-036	22	7	1	10
CBX32MV-24/30 and CBX32M-030	15	4	0	0
CBX40UHV-024	22	7	1	10
CBX40UHV-030	22	7	1	10
CBX40UHV-036	22	7	1	10
CH23-51	18	4	0	10
CH33-31	18	4	0	10
CH33-42	18	4	0	10
CR33-48	28	4	0	0
CX34-31	27	4	0	10
CX34-44/48B	22	5	1	3
CX34-38	25	6	1	7
XP21-036			lb	oz
CB(X)27UH-036	17	5	0	0
CB(X)27UH-042	12	5	1	10
CBX32MV-036 and CBX32M-036	17	5	0	0
CBX32MV-048 and CBX32M-048	12	5	1	10
CBX40UHV-036	17	5	0	0
CBX40UHV-042	12	5	1	10
CBX40UHV-048	12	5	1	10
CH23-51	19	7	0	0
CH33-43	11	5	0	7
CH33-44/48B	11	5	0	7
CH33-48C	11	5	0	7
CH33-50/60C	12	7	1	6
CR33-48	28	4	0	0
CX34-38	15	5	0	7
CX34-44/48B	19	4	0	10
CX34-49	10	10	1	10
CX34-50/60C	11	5	0	7

INDOOR MATCHUP HEAT PUMP	Target Subcooling Heating (±5ºF)	Target Subcooling Cooling (±1ºF)	*Add charge lb	*Add charge oz
XP21-048			lb	oz
CB(X)27UH-048	24	4	1	0
CB(X)27UH-060	14	4	1	6
CBX32MV-048 and CBX32M-048	24	4	1	0
CBX32MV-060 and CBX32M-060	21	4	1	14
CBX32MV-068	14	4	1	0
CBX40UHV-048	24	4	1	0
CBX40UHV-060	21	4	1	14
CH23-68	14	4	1	6
CH33-49C	21	4	1	14
CH33-50/60C	21	4	1	14
CH33-62D	20	4	1	7
CR33-50/60	32	4	0	0
CR33-60D	32	4	0	0
CX34-49	21	5	0	10
CX34-62C	11	4	1	5
CX34-62D	11	4	1	5
XP21-060			lb	oz
CB(X)27UH-060	7	6	0	10
CBX32MV-060 and CBX32M-060	10	4	0	0
CBX32MV-068	9	4	0	10
CBX40UHV-060	10	4	0	0
CH23-68	10	4	0	10
CH33-49C	7	5	0	0
CH33-50/60C	7	5	0	0
CH33-62D	9	4	0	7
CR33-50/60	22	5	0	4
CR33-60D	22	5	0	4
CX34-49	10	5	0	0
CX34-62C	7	5	0	0
CX34-62D	7	5	0	0

***Amount of charge required in additional to charge shown on unit nameplate. (Remember to consider line set length difference.)**

HFC-410A CHARGING PROCEDURE

FOR COMPLETE CHARGING DETAILS, REFER TO THE OUTDOOR UNIT INSTALLATION AND SERVICE PROCEDURE (CORP 1031-L7)

Maintenance checks using the Normal Operating Pressures table

Table 1 may be used to help perform maintenance checks. This table is not a procedure for charging the system and any minor variations in the pressures may be expected due to differences in installations. However, significant deviations could mean that the system is not properly charged or that a problem exists with some component in the system. The values in Table 2 are "most-popular-match-up" pressures; indoor match up, indoor air quantity, and indoor load will cause the pressures to vary. **Charge levels on the unit nameplate are based on installations with 15' (4.6m) line sets; be sure to consider any difference in line set length (see Installation Instructions for more details).**

Charge Using the Weigh-in Method

If the system is void of refrigerant, locate and repair any leaks and then weigh in the refrigerant charge into the unit. For charge adjustments, be sure to consider line set length differences and, referring to table 2, adjust for the matchup difference.

1 - Weigh in the unit nameplate charge, adjusting for matchup and line set length differences. If weighing facilities are not available use the Subcooling method.
2 - Conduct leak check; evacuate as previously outlined.
3 - Recover the refrigerant from the unit.

Charge Using the Subcooling Method

Cooling Mode—When the outdoor ambient temperature is 60°F (15°C) and above, use the cooling mode to adjust the charge using the subcooling method. Target subcooling values in table 2 are based on 70 to 80°F (21-27°C) indoor return air temperature.

Heating Mode—When the outdoor ambient temperature is below 60°F (15°C), use the heating mode to adjust the charge using the subcooling charge levels (table). Target subcooling values in table 2 are based on 65-75°F (18-24°C) indoor return air temperature.

Table 1 - Normal Operating Pressures (Liquid ±10 and Suction ±5 psig)

*Temperature of the air entering the outdoor coil.		-024		-036		-048		-060	
	°F (°C)*	Liq	Vap	Liq	Vap	Liq	Vap	Liq	Vap
Low Stage Heating Operation	40 (4)	319	104	307	99	367	92	322	96
	50 (10)	345	122	331	117	385	113	352	115
Low Stage Cooling Operation	65 (18)	224	149	224	145	229	142	227	139
	75 (24)	260	150	261	148	266	143	263	142
	85 (29)	303	151	303	150	311	145	305	144
	95 (35)	348	154	350	152	358	147	352	147
	105 (41)	397	156	400	154	410	150	402	150
	115 (46)	453	155	456	157	468	152	458	153
High Stage Heating Operation	20 (-7)	312	67	293	62	326	63	305	62
	30 (-1)	351	82	309	76	353	76	320	72
	40 (4)	364	98	322	90	375	93	347	90
	50 (10)	390	117	341	109	405	110	366	105
High Stage Cooling Operation	65 (18)	231	144	237	140	240	138	236	134
	75 (24)	270	146	275	142	279	140	272	136
	85 (29)	312	148	315	146	323	142	316	139
	95 (35)	360	150	363	148	371	144	364	141
	105 (41)	411	152	415	151	423	146	416	144
	115 (46)	467	154	473	153	481	149	475	146

Table 2 - Indoor Units Matchups and Subcooling Charge Levels

INDOOR MATCHUP / HEAT PUMP	Target Subcooling Heating (±5ºF)	Target Subcooling Cooling (±1ºF)	*Add charge lb	*Add charge oz
XP21-024			lb	oz
CB(X)27UH-024	15	4	0	0
CB(X)27UH-030	22	7	1	10
CBX32MV-036 and CBX32M-036	22	7	1	10
CBX32MV-24/30 and CBX32M-030	15	4	0	0
CBX40UHV-024	22	7	1	10
CBX40UHV-030	22	7	1	10
CBX40UHV-036	22	7	1	10
CH23-51	18	4	0	10
CH33-31	18	4	0	10
CH33-42	18	4	0	10
CR33-48	32	4	0	0
CR33-50/60C	14	7	1	10
CX34-31	27	4	0	10
CX34-44/48B	22	5	1	3
CX34-38	25	6	1	7
XP21-036			lb	oz
CB(X)27UH-036	17	5	0	0
CB(X)27UH-042	12	5	1	10
CBX32MV-036 and CBX32M-036	17	5	0	0
CBX32MV-048 and CBX32M-048	12	5	1	10
CBX40UHV-036	17	5	0	0
CBX40UHV-042	12	5	1	10
CBX40UHV-048	12	5	1	10
CH23-51	19	7	0	0
CH33-43	11	5	0	7
CH33-44/48B	11	5	0	7
CH33-48C	11	5	0	7
CH33-49C and CH33-50/60C	12	7	1	6
CR33-48	32	4	0	0
CR33-50/60C	11	4	1	8
CX34-38	15	5	0	7
CX34-44/48B	19	4	0	10
CX34-49	10	10	1	10
CX34-43 and CX34-50/60C	11	5	0	7

INDOOR MATCHUP / HEAT PUMP	Target Subcooling Heating (±5ºF)	Target Subcooling Cooling (±1ºF)	*Add charge lb	*Add charge oz
XP21-048			lb	oz
CB(X)27UH-048	24	4	1	0
CB(X)27UH-060	14	4	1	6
CBX32MV-048 and CBX32M-048	24	4	1	0
CBX32MV-060 and CBX32M-060	21	4	1	14
CBX32MV-068	14	4	1	0
CBX40UHV-048	24	4	1	0
CBX40UHV-060	21	4	1	14
CH23-68	14	4	1	6
CH33-49C	21	4	1	14
CH33-50/60C	21	4	1	14
CH33-62D	20	4	1	7
CR33-50/60	32	4	0	0
CR33-60D	32	4	0	0
CX34-49	21	5	0	10
CX34-62C	11	4	1	5
CX34-62D	11	4	1	5
XP21-060			lb	oz
CB(X)27UH-060	7	6	0	10
CBX32MV-060 and CBX32M-060	10	4	0	0
CBX32MV-068	9	4	0	10
CBX40UHV-060	10	4	0	0
CH23-68	10	4	0	10
CH33-49C	7	5	0	0
CH33-50/60C	7	5	0	0
CH33-62D	9	4	0	7
CR33-50/60	22	5	0	4
CR33-60D	22	5	0	4
CX34-49	10	5	0	0
CX34-60D	15	5	0	4
CX34-62C	7	5	0	0
CX34-62D	7	5	0	0

***Amount of charge required in additional to charge shown on unit nameplate. (Remember to consider line set length difference.)**

HFC-410A CHARGING PROCEDURE

FOR COMPLETE CHARGING DETAILS, REFER TO THE OUTDOOR UNIT INSTALLATION AND SERVICE PROCEDURE (CORP 1031-L7)

Maintenance checks using the Normal Operating Pressures table

Table 1 may be used to help perform maintenance checks. This table is not a procedure for charging the system and any minor variations in the pressures may be expected due to differences in installations. However, significant deviations could mean that the system is not properly charged or that a problem exists with some component in the system. The values in Table 2 are "most-popular-match-up" pressures; indoor match up, indoor air quantity, and indoor load will cause the pressures to vary. **Charge levels on the unit nameplate are based on installations with 15' (4.6m) line sets; be sure to consider any difference in line set length (see Installation Instructions for more details).**

Charge Using the Weigh-in Method

If the system is void of refrigerant, locate and repair any leaks and then weigh in the refrigerant charge into the unit. For charge adjustments, be sure to consider line set length differences and, referring to table 2, adjust for the matchup difference.

1 - Weigh in the unit nameplate charge, adjusting for matchup and line set length differences. If weighing facilities are not available use the Subcooling method.
2 - Conduct leak check; evacuate as previously outlined.
3 - Recover the refrigerant from the unit.

Charge Using the Subcooling Method

Cooling Mode—When the outdoor ambient temperature is 60°F (15°C) and above, use the cooling mode to adjust the charge using the subcooling method. Target subcooling values in table 2 are based on 70 to 80°F (21-27°C) indoor return air temperature.

Heating Mode—When the outdoor ambient temperature is below 60°F (15°C), use the heating mode to adjust the charge using the subcooling charge levels (table). Target subcooling values in table 2 are based on 65-75°F (18-24°C) indoor return air temperature.

Table 1 - Normal Operating Pressures (Liquid ±10 and Suction ±5 psig)

*Temperature of the air entering the outdoor coil.		-024		-036		-048		-060	
	°F (°C)*	Liq	Vap	Liq	Vap	Liq	Vap	Liq	Vap
Low Stage Heating Operation	40 (4)	319	104	307	99	367	92	322	96
	50 (10)	345	122	331	117	385	113	352	115
Low Stage Cooling Operation	65 (18)	224	149	224	145	229	142	227	139
	75 (24)	260	150	261	148	266	143	263	142
	85 (29)	303	151	303	150	311	145	305	144
	95 (35)	348	154	350	152	358	147	352	147
	105 (41)	397	156	400	154	410	150	402	150
	115 (46)	453	155	456	157	468	152	458	153
High Stage Heating Operation	20 (-7)	312	67	293	62	326	63	305	62
	30 (-1)	351	82	309	76	353	76	320	72
	40 (4)	364	98	322	90	375	93	347	90
	50 (10)	390	117	341	109	405	110	366	105
High Stage Cooling Operation	65 (18)	231	144	237	140	240	138	236	134
	75 (24)	270	146	275	142	279	140	272	136
	85 (29)	312	148	315	146	323	142	316	139
	95 (35)	360	150	363	148	371	144	364	141
	105 (41)	411	152	415	151	423	146	416	144
	115 (46)	467	154	473	153	481	149	475	146

Table 2 - Indoor Units Matchups and Subcooling Charge Levels

INDOOR MATCHUP / HEAT PUMP	Target Subcooling Heating (±5ºF)	Target Subcooling Cooling (±1ºF)	*Add charge lb	*Add charge oz
XP21-024			**lb**	**oz**
CBX27UH-024	15	4	0	0
CBX27UH-030	22	7	1	10
CBX32MV-036 and CBX32M-036	22	7	1	10
CBX32MV-24/30 and CBX32M-030	15	4	0	0
CBX40UHV-024	22	7	1	10
CBX40UHV-030	22	7	1	10
CBX40UHV-036	22	7	1	10
CH23-51	18	4	0	10
CH33-31	18	4	0	10
CH33-42	18	4	0	10
CH35-42B	9	9	2	0
CH35-42C	23	7	1	14
CR33-48	32	4	0	0
CR33-50/60C	14	7	1	10
CX34-31	27	4	0	10
CX34-44/48B	22	5	1	3
CX34-38	25	6	1	7
CX35-48B	19	9	1	4
CX35-49C	15	10	1	4
XP21-036			**lb**	**oz**
CBX27UH-036	17	5	0	14
CBX27UH-042	12	5	2	8
CBX32MV-036 and CBX32M-036	17	5	0	14
CBX32MV-048 and CBX32M-048	12	5	2	8
CBX40UHV-036	17	5	0	14
CBX40UHV-042	12	5	2	8
CBX40UHV-048	12	5	2	8
CH23-51	19	7	0	14
CH33-43	11	5	1	5
CH33-44/48B	11	5	1	5
CH33-48C	11	5	1	5
CH33-49C and CH33-50/60C	12	7	2	4
CH35-42C	18	10	2	12
CH35-48B	11	7	0	0
CH35-48C	16	9	0	8
CH35-51C	15	12	2	8
CR33-48	32	4	0	0
CR33-50/60C	11	4	2	6
CX34-38	15	5	1	5
CX34-44/48B	19	4	1	8
CX34-49	10	10	2	8
CX34-43 and CX34-50/60C	11	5	1	5
CX35-48B	19	10	0	8
CX35-49C	7	9	0	5
XP21-048			**lb**	**oz**
CB(X)27UH-048	24	4	1	0
CB(X)27UH-060	14	4	1	6
CBX32MV-048 and CBX32M-048	24	4	1	0
CBX32MV-060 and CBX32M-060	21	4	1	14
CBX32MV-068	14	4	1	0
CBX40UHV-048	24	4	1	0
CBX40UHV-060	21	4	1	14
CH23-68	14	4	1	6
CH33-49C	21	4	1	14
CH33-50/60C	21	4	1	14
CH33-62D	20	4	1	7
CH35-60D	32	10	1	6
CR33-50/60	32	4	0	0
CR33-60D	32	4	0	0
CX34-49	21	5	0	10
CX34-62C	11	4	1	5
CX34-62D	11	4	1	5
CX35-49C	21	6	0	3
CX35-60D	24	7	0	14
XP21-060			**lb**	**oz**
CB(X)27UH-060	7	6	0	15
CBX32MV-060 and CBX32M-060	10	4	0	5
CBX32MV-068	9	4	0	15
CBX40UHV-060	10	4	0	5
CH23-68	10	4	0	15
CH33-49C	7	5	0	5
CH33-50/60C	7	5	0	5
CH33-62D	9	4	0	12
CH35-51C	20	8	0	0
CH35-60D	17	8	0	1
CR33-50/60	22	5	0	9
CR33-60D	22	5	0	9
CX34-49	10	5	0	5
CX34-60D	15	5	0	9
CX34-62C	7	5	0	5
CX34-62D	7	5	0	5
CX35-49C	21	9	0	4
CX35-60C	18	12	0	15

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HFC-410A CHARGING PROCEDURE

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XP21-024			lb	oz	CX38/CX34-43 and CX34-50/60C	11	5	1	5
CBX27UH-024	15	4	0	0	CX35-48B	19	10	0	8
CBX27UH-030	22	7	1	10	CX35-49C	7	9	0	5
CBX32MV-036 and CBX32M-036	22	7	1	10	**XP21-048**			lb	oz
CBX32MV-24/30 and CBX32M-030	15	4	0	0	CB(X)27UH-048	24	4	1	0
CBX40UHV-024	22	7	1	10	CB(X)27UH-060	14	4	1	6
CBX40UHV-030	22	7	1	10	CBX32MV-048 and CBX32M-048	24	4	1	0
CBX40UHV-036	22	7	1	10	CBX32MV-060 and CBX32M-060	21	4	1	14
CH23-51	18	4	0	10	CBX32MV-068	14	4	1	0
CH33-31	18	4	0	10	CBX40UHV-048	24	4	1	0
CH33-42	18	4	0	10	CBX40UHV-060	21	4	1	14
CH35-42B	9	9	2	0	CBA27UHE-060	21	7	0	0
CH35-42C	23	7	1	14	CH23-68	14	4	1	6
CR33-48	32	4	0	0	CH33-49C	21	4	1	14
CR33-50/60C	14	7	1	10	CH33-50/60C	21	4	1	14
CX38/CX34-31	27	4	0	10	CH33-62D	20	4	1	7
CX38/CX34-44/48B	22	5	1	3	CH35-60D	32	10	1	6
CX38/CX34-38	25	6	1	7	CR33-50/60	32	4	0	0
CX35-48B	19	9	1	4	CR33-60D	32	4	0	0
CX35-49C	15	10	1	4	CX38/CX34-49	21	5	0	10
XP21-036			lb	oz	CX38/CX34-62C	11	4	1	5
CBX27UH-036	17	5	0	14	CX38/CX34-62D	11	4	1	5
CBX27UH-042	12	5	2	8	CX35-49C	21	6	0	3
CBX32MV-036 and CBX32M-036	17	5	0	14	CX35-60D	24	7	0	14
CBX32MV-048 and CBX32M-048	12	5	2	8	**XP21-060**			lb	oz
CBX40UHV-036	17	5	0	14	CB(X)27UH-060	7	6	0	15
CBX40UHV-042	12	5	2	8	CBX32MV-060 and CBX32M-060	10	4	0	5
CBX40UHV-048	12	5	2	8	CBX32MV-068	9	4	0	15
CBA27UHE-042	13	5	0	0	CBX40UHV-060	10	4	0	5
CH23-51	19	7	0	14	CH23-68	10	4	0	15
CH33-43	11	5	1	5	CH33-49C	7	5	0	5
CH33-44/48B	11	5	1	5	CH33-50/60C	7	5	0	5
CH33-48C	11	5	1	5	CH33-62D	9	4	0	12
CH33-49C and CH33-50/60C	12	7	2	4	CH35-51C	20	8	0	0
CH35-42C	18	10	2	12	CH35-60D	17	8	0	1
CH35-48B	11	7	0	0	CR33-50/60	22	5	0	9
CH35-48C	16	9	0	8	CR33-60D	22	5	0	9
CH35-51C	15	12	2	8	CX38/CX34-49	10	5	0	5
CR33-48	32	4	0	0	CX38/CX34-60D	15	5	0	9
CR33-50/60C	11	4	2	6	CX38/CX34-62C	7	5	0	5
CX38/CX34-38	15	5	1	5	CX38/CX34-62D	7	5	0	5
CX38/CX34-44/48B	19	4	1	8	CX35-49C	21	9	0	4
CX38/CX34-49	10	10	2	8	CX35-60C	18	12	0	15

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