LENNOX

Service Literature®

UNIT INFORMATION

Corp. 0810-L6

Revised 06-2009

TPA*H4

3 to 5 ton

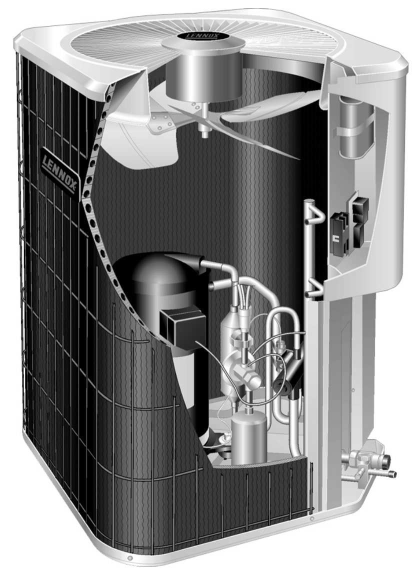
TPAH4 SERIES UNITS

The TPAH4 is a commercial split-system heat pump. The series is designed for use with expansion valves (TXV) and HFC-410A refrigerant. All TPAH4 units utilize scroll compressors.

TPAH4 series units are available in 3, 3-1/2, 4 and 5 ton capacities. All major components (indoor blower and coil) must be matched according to Lennox recommendations for the compressor to be covered under warranty. Refer to the Engineering Handbook for approved system match-ups.

This manual is divided into sections which discuss the major components, refrigerant system, charging procedure, maintenance and operation sequence.

Information contained in this manual is intended for use by qualified service technicians only. All specifications are subject to change.



ELECTROSTATIC DISCHARGE (ESD)

Precautions and Procedures

⚠ CAUTION

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.

Table of Contents

MODEL NUMBER IDENTIFICATION

T P A 036 H 4 n 4 1 Y

Brand/Family
T = T-Class™ Product Line

Unit Type
P = Heat Pump Outdoor Unit

Major Design Sequence
A = 1st Generation
B = 2nd Generation

Nominal Cooling Capacity - Tons
036 = 3 Tons
042 = 3.5 Tons
048 = 4 Tons
060 = 5 Tons

Cooling Efficiency
H = High Efficiency

Refrigerant Type
4 = R-410A

Part Load Capability
N = No part load, single stage compressor

Coil type
4 = Four-sided

Minor Design Sequence
1 = 1st Revision
2 = 2nd Revision
3 = 3rd Revision

Voltage
Y = 208/230V-3 phase-60hz
G = 460V-3 phase-60hz

SPECIFICATIONS

General Data	Model No.	TPA036H4	TPA042H4	TPA048H4	TPA060H4
	Nominal Tonnage	3	3.5	4	5
[1] **Sound Rating Number**		79	79	80	80
Connections (sweat)	Liquid line o.d. - in.	3/8	3/8	3/8	3/8
	Vapor line o.d. - in.	7/8	7/8	7/8	1-1/8
[2] **Refrigerant**	R-410A charge furnished	9 lbs. 12 oz.	12 lbs. 7 oz.	12 lbs. 10 oz.	16 lbs. 0 oz.
Outdoor Coil	Net face area sq. ft. Outer coil	19.39	24.93	24.93	29.09
	Net face area sq. ft. Inner coil	18.77	24.13	24.13	28.16
	Tube diameter - in.	5/16	5/16	5/16	5/16
	No. of rows	2	2	2	2
	Fins per inch	22	22	22	22
Outdoor Fan	Diameter - in.	26	26	26	26
	No. of Blades	4	4	4	4
	Motor hp	1/3	1/3	1/3	1/3
	Cfm	4090	4347	4347	4550
	Rpm	844	843	843	830
	Watts	299	299	299	307
Shipping Data - lbs. 1 package		212	257	262	307

ELECTRICAL DATA

		TPA036H4		TPA042H4		TPA048H4		TPA060H4	
	Line voltage data - 60 hz - 1ph	208/230V	460V	208/230V	460V	208/230V	460V	208/230V	460V
	[3] Maximum overcurrent protection (amps)	20	15	30	15	30	15	35	15
	[4] Minimum circuit ampacity	13.1	8.1	18.6	8.4	18.9	8.7	21.8	10.7
Compressor	Rated Load Amps	9.6	5.6	13.5	6.0	13.7	6.2	16.0	7.8
	Locked Rotor Amps	71	38	88	44	83.1	41.	110	52
	Power Factor	.85	.84	.83	.81	.90	.92	.90	.91
Outdoor Fan Motor	Full Load Amps	1.8	1.0	1.8	1.0	1.8	1.0	1.8	1.0
	Locked Rotor Amps	2.9	2.5	2.9	2.5	2.9	2.5	2.9	2.5

OPTIONAL ACCESSORIES - must be ordered extra

Accessory		Cat. No.	TPA036H4	TPA042H4	TPA048H4	TPA060H4
Compressor Sound Cover		**69J03**	•	•	•	•
Freezestat	3/8 in. tubing	**93G35**	•	•	•	•
	5/8 in. tubing	**50A93**	•	•	•	•
Hail Guards		**27W34**	•			
		27W36		•	•	
		94M94				•
Indoor Blower Off Delay Relay		**58M81**	•	•	•	•
Loss of Charge Kit		**84M23**	•	•	•	•
Low Ambient Control Options			•	•	•	•
Mild Weather Kit		**33M07**	•	•	•	•
Monitor Kit - Service Light		**76F53**	•	•	•	•
Mounting Base		**69J07**	•	•	•	•
Outdoor Thermostat Kit	Thermostat	**56A87**	•	•	•	•
	Mounting Box	**31461**	•	•	•	
Refrigerant Line Sets	L15-65-30	L15-65-40 L15-65-50	•	•	•	
		Field Fabricate				•
Unit Stand-Off Kit		**94J45**	•	•	•	•

NOTE - Extremes of operating range are plus 10% and minus 5% of line voltage.
[1] Sound Rating Number rated in accordance with test conditions included in ARI Standard 270.
[2] Refrigerant charge sufficient for 15 ft. length of refrigerant lines.
[3] HACR type circuit breaker or fuse.
[4] Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

⚠ 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.

⚠ CAUTION

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

I - UNIT COMPONENTS

Unit components are illustrated in figure 1.

TPAH4 UNIT COMPONENTS

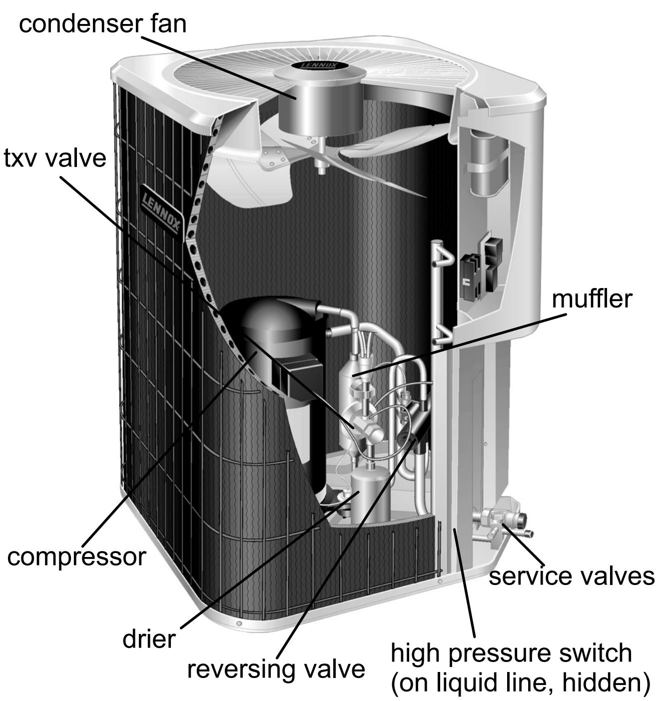


FIGURE 1

TPAH4 UNIT CONTROL BOX

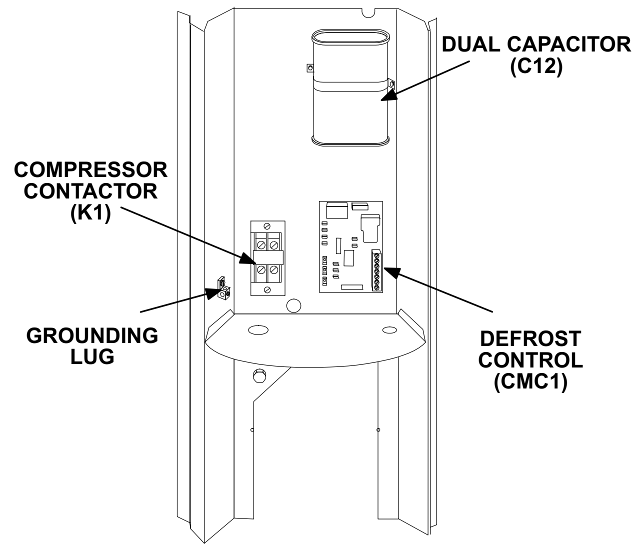


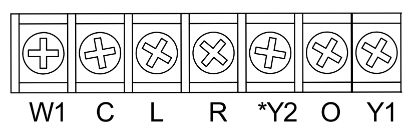
FIGURE 2

A - Control Box (Figure 2)

TPAH4 units are not equipped with a 24V transformer. All 24 VAC controls are powered by the indoor unit. Refer to wiring diagram.

Electrical openings are provided under the control box cover. Field thermostat wiring is made to a 24V terminal strip located on the defrost control board located in the control box. See figure 3.

24V THERMOSTAT TERMINAL STRIP



**not used*

FIGURE 3

1 - Compressor Contactor (K1)

The compressor is energized by a contactor located in the control box. See figure 2. Single-pole contactors are used in TPAH4 series units. See wiring diagrams for specific unit. K1 is energized through the CMC1 board by the indoor thermostat terminal Y1 (24V) when thermostat demand is present.

DANGER

Electric Shock Hazard.
May cause injury or death.

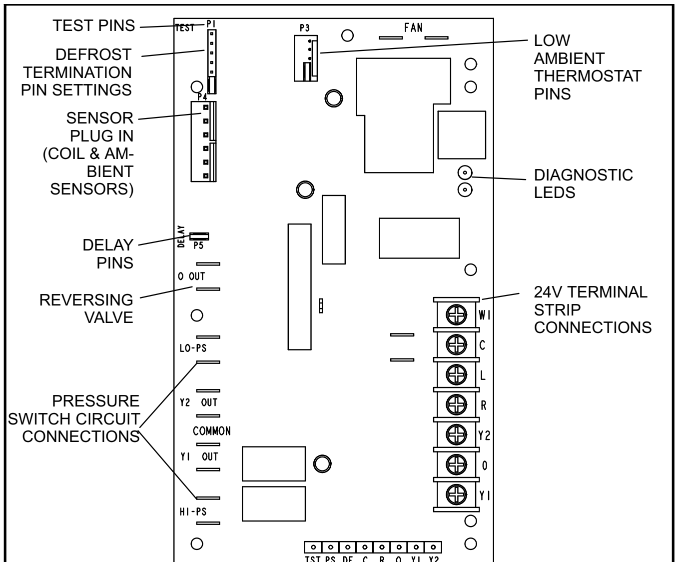
Disconnect all remote electrical power supplies before opening unit panel. Unit may have multiple power supplies.

Some units are equipped with single-pole contactors. When unit is equipped with a single-pole contactor, line voltage is present at all components (even when unit is not in operation).

2 - Dual Capacitor (C12)

The compressor and fan in TPAH4 series units use permanent split capacitor motors. The capacitor is located inside the unit control box (see figure 2). A single “dual” capacitor (C12) is used for both the fan motor and the compressor (see unit wiring diagram). The fan side and the compressor side of the capacitor have different MFD ratings.

3 - Defrost System (CMC1)



NOTE - Component Locations Vary by Board Manufacturer.
Y2 not used on TPAH4

FIGURE 4

The demand defrost control measures differential temperatures to detect when the system is performing poorly because of ice build-up on the outdoor coil. The controller “self-calibrates” when the defrost system starts and after each system defrost cycle. The defrost control board components are shown in figure 4.

The control monitors ambient temperature, outdoor coil temperature, and total run time to determine when a defrost cycle is required. The coil temperature probe 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.

NOTE - The demand defrost board 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 board initiates defrost cycles.

Diagnostic LEDs

The state (Off, On, Flashing) of two LEDs on the defrost board (DS1 [Red] and DS2 [Green]) indicate diagnostics conditions that are described in table 2.

Defrost Control Pressure Switch Connections

The unit’s automatic reset pressure switches (LO PS - S87 and HI PS - S4) are factory-wired into the defrost board on the LO-PS and HI-PS terminals, respectively.

(OPTIONAL) Low Pressure Switch (LO-PS)—When the low pressure switch trips, the defrost board will cycle off the compressor, and the strike counter in the board will count one strike. The low pressure switch is ignored under the following conditions:

- during the defrost cycle and 90 seconds after the termination of defrost
- when the average ambient sensor temperature is below 15° F (-9°C)
- for 90 seconds following the start up of the compressor
- during ”test” mode

High Pressure Switch (HI-PS)—When the high pressure switch trips, the defrost control will cycle off the compressor, and the strike counter in the control will count one strike.

Defrost Control Pressure Switch Settings

High Pressure (auto reset) - trip at 590 psig; reset at 418.

Low Pressure (auto reset) - trip at 25 psig; reset at 40.

5-Strike Lockout Feature

The internal control logic of the control counts the pressure switch trips only while the Y1 (Input) line is active. If a pressure switch opens and closes four times during a Y1 (Input), the control logic will reset the pressure switch trip counter to zero at the end of the Y1 (Input). If the pressure switch opens for a fifth time during the current Y1 (Input), the control will enter a lockout condition.

The 5-strike pressure switch lockout condition can be reset by cycling OFF the 24-volt power to the control board or by shorting the TEST pins between 1 and 2 seconds. All timer functions (run times) will also be reset.

If a pressure switch opens while the Y1 Out line is engaged, a 5-minute short cycle will occur after the switch closes.

Defrost System Sensors

Sensors connect to the defrost control through a field-replaceable harness assembly that plugs into the board. Through the sensors, the control detects outdoor ambient and coil temperature fault conditions. As the detected temperature changes, the resistance across the sensor changes. Figure 6 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 1.

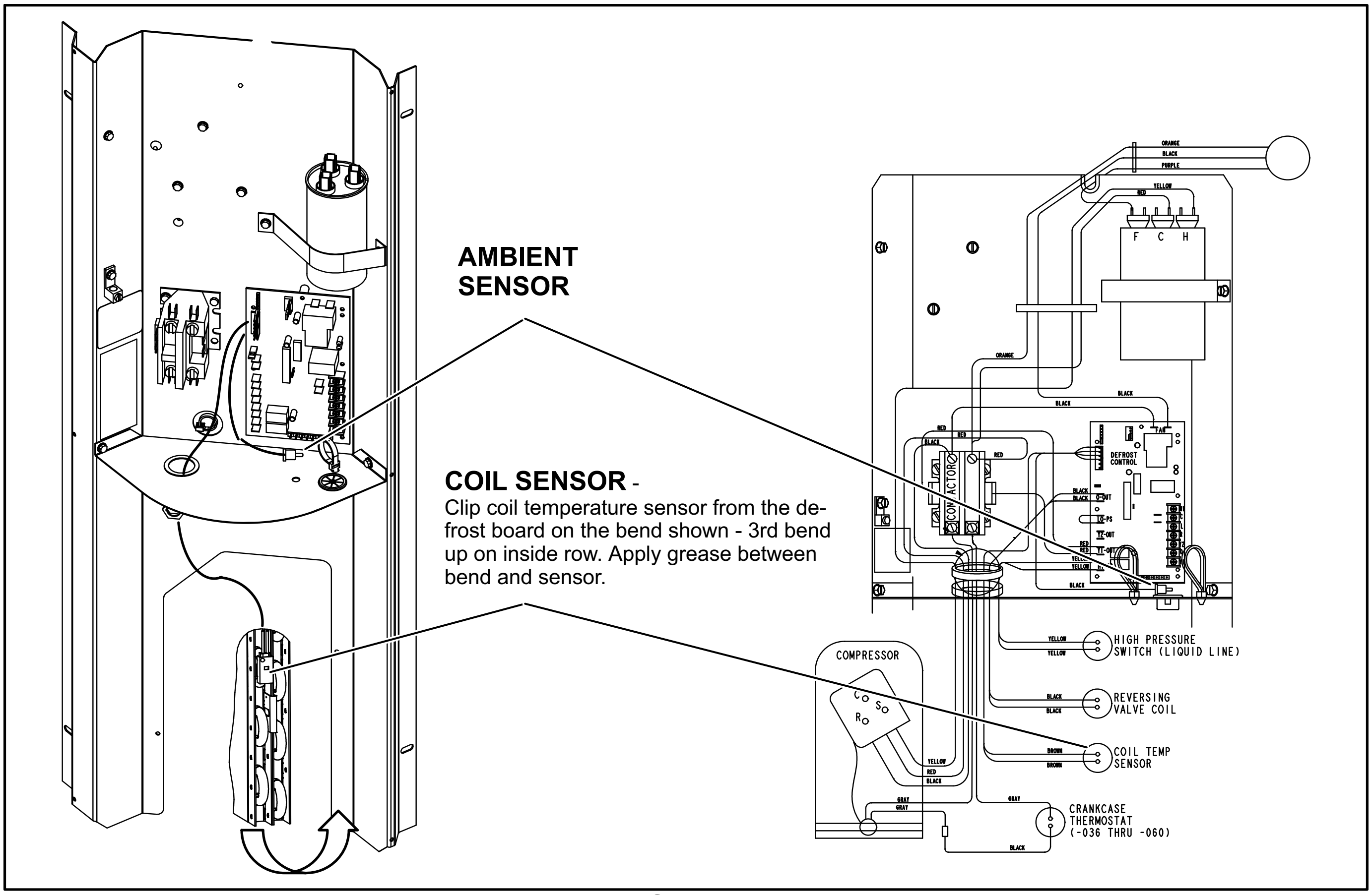


FIGURE 5

TABLE 1

Sensor	Temperature Range °F (°C)	Resistance values range (ohms)	Pins/Wire Color
Outdoor (Ambient)	-35 (-37) to 120 (48)	280,000 to 3750	3 & 4 (Black)
Coil	-35 (-37) to 120 (48)	280,000 to 3750	5 & 6 (Brown)
Discharge (if applicable)	24 (-4) to 350 (176)	41,000 to 103	1 & 2 (Yellow)
Note: Sensor resistance decreases as sensed temperature increases (see figure6).			

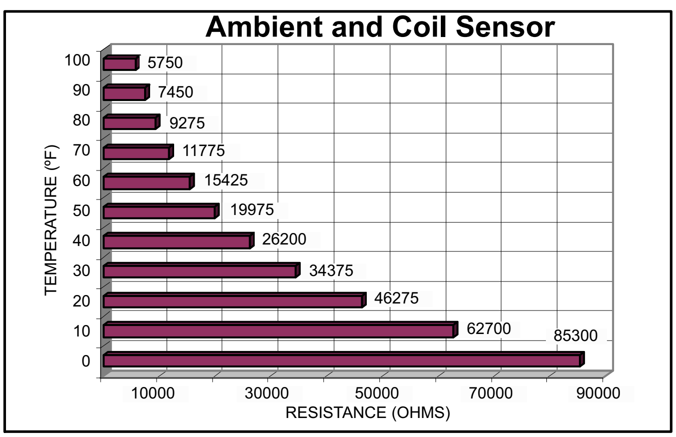


FIGURE 6

NOTE - When checking the ohms across a sensor, be aware that a sensor showing a resistance value that is <u>*not*</u> *within the range shown in table 1, 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 needs to be replaced.*

Coil Sensor—The coil temperature sensor (shown in figure 5) considers outdoor temperatures below -35°F (-37°C) or above 120°F (48°C) as a fault. If the coil temperature sensor is detected as being open, shorted or out of the temperature range of the sensor, the board 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.

Ambient Sensor—The ambient sensor (shown in figure 5) 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 fault code. Heating and cooling operation will be allowed in this fault condition.

NOTE - Within a single room thermostat demand, if 5-strikes occur, the board will lockout the unit. Defrost board 24 volt power "R" must be cycled "OFF" or the "TEST" pins on board must be shorted between 1 to 2 seconds to reset the board.

Defrost Temperature Termination Shunt (Jumper) Pins—The defrost control selections are: 50, 70, 90, and 100°F (10, 21, 32 and 38°C). The shunt termination pin is factory set at 50°F (10°C). If the temperature shunt is not installed, the default termination temperature is 90°F (32°C).

Delay Mode

The defrost 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, 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.

NOTE - The 30 second off cycle is NOT functional when jumpering the TEST pins.

Operational Description

The defrost control has three basic operational modes: normal, calibration, and defrost.

Normal Mode—The demand defrost control monitors the O line, to determine the system operating mode (heat/cool), outdoor ambient temperature, coil temperature (outdoor coil) and compressor run time to determine when a defrost cycle is required.

Calibration Mode—The control is considered uncalibrated when power is applied to the control, after cool mode operation, or if the coil temperature exceeds the termination temperature when it is in heat mode.

Calibration of the control occurs after a defrost cycle to ensure that there is no ice on the coil. During calibration, the temperature of both the coil and the ambient sensor are measured to establish the temperature differential which is required to allow a defrost cycle.

Defrost Mode—The following paragraphs provide a detailed description of the defrost system operation.

Detailed Defrost System Operation

Defrost Cycles—The demand defrost control initiates a defrost cycle based on either frost detection or time.

- **Frost Detection**—If the compressor runs longer than 30 minutes and the actual difference between the clear coil and frosted coil temperatures exceeds the maximum difference allowed by the control, a defrost cycle will be initiated.

  IMPORTANT - The demand defrost control will allow a greater accumulation of frost and will initiate fewer defrost cycles than a time/temperature defrost system.

- **Time**—If 6 hours of heating mode compressor run time has elapsed since the last defrost cycle while the coil temperature remains below 35°F (2°C), the demand defrost control will initiate a defrost cycle.

Actuation—When the reversing valve is de-energized, the Y1 circuit is energized, and the coil temperature is below 35°F (2°C), the board logs the compressor run time. If the board is not calibrated, a defrost cycle will be initiated after 30 minutes of heating mode compressor run time. The control will attempt to self-calibrate after this (and all other) defrost cycle(s).

Calibration success depends on stable system temperatures during the 20-minute calibration period. If the control fails to calibrate, another defrost cycle will be initiated after 45 minutes of heating mode compressor run time. Once the defrost board is calibrated, it initiates a demand defrost cycle when the difference between the clear coil and frosted coil temperatures exceeds the maximum difference allowed by the control OR after 6 hours of heating mode compressor run time has been logged since the last defrost cycle.

NOTE - If ambient or coil fault is detected, the control will not execute the "TEST" mode.

Termination—The defrost cycle ends when the coil temperature exceeds the termination temperature or after 14 minutes of defrost operation. If the defrost is terminated by the 14-minute timer, another defrost cycle will be initiated after 30 minutes of run time.

Test Mode—When Y1 is energized and 24V power is being applied to the control, a test cycle can be initiated by placing the termination temperature jumper across the "Test" pins for 2 to 5 seconds. If the jumper remains across the "Test" pins longer than 5 seconds, the control will ignore the test pins and revert to normal operation. The jumper will initiate one cycle per test.

Enter the "TEST" mode by placing a shunt (jumper) across the "TEST" pins on the control **after** power-up. (The "TEST" pins are ignored and the test function is locked out if the shunt is applied on the "TEST" pins before power-up). Control timings are reduced, the low-pressure switch is ignored and the control will clear any active lockout condition.

Each test pin shorting will result in one test event. For each "TEST" the shunt (jumper) must be removed for at least 1 second and reapplied. Refer to flow chart (figure 7) for "TEST" operation.

Note: The Y1 input must be active (ON) and the "O" room thermostat terminal into board must be inactive.

Defrost Control Diagnostics

See table 2 to determine defrost control operational conditions and to diagnose cause and solution to problems.

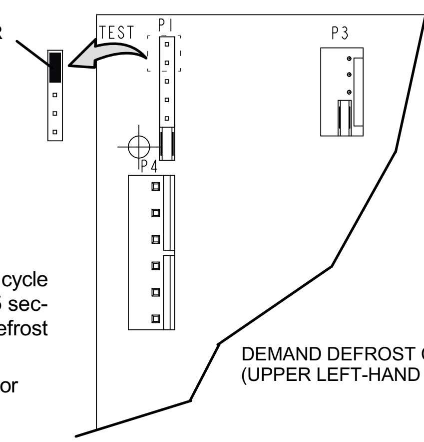
TEST

Placing the jumper on the test pins allows the technician to:

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

When Y1 is energized and 24V power is being applied to the Demand Defrost Control, a test cycle can be initiated by placing a jumper on the Demand Defrost Control's TEST pins for 2 to 5 seconds. If the jumper remains on the TEST pins for longer than five seconds, the Demand Defrost Control will ignore the jumpered TEST pins and revert to normal operation.

The 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.



Y1 Active

→ Place a jumper on TEST pins for **longer than one second but less than two seconds.**
  → Clears any short cycle lockout and five strike fault lockout function, if applicable. No other functions will be executed and unit will continue in the mode it was operating.

→ Place a jumper on TEST pins for **more than two seconds**.
  → Clears any short cycle lockout and five strike fault lockout function, if applicable.
  → **O** Line Status

ACTIVE:

- If in **COOLING** Mode → No further test mode operation will be executed until the jumper is removed from the TEST pins and reapplied.
- If in **DEFROST** Mode → The unit will terminate defrost and enter HEAT MODE uncalibrated with defrost timer set for 30 minute test.

INACTIVE:

- If in **HEATING** Mode → If no ambient or coil sensor ault exist, unit will go into DEFROST MODE. If ambient or coil faults exist (open or shorted), unit will remain in HEAT MODE.
  - If jumper on TEST pins remains in place for more than five seconds. → The unit will return to HEAT MODE un–calibrated with defrost timer set for 30 minutes.
  - If jumper on TEST pins is removed before a maximum of five seconds. → The unit will remain in DEFROST MODE until termination on time or temperature.

NOTE — Placing a jumper on the TEST pins will not bring the unit out of inactive mode. The only way manually activate the heat pump from an inactive mode is to cycle the 24VAC power to the Demand Defrost Control.

FIGURE 7

TABLE 2

DS2 Green	DS1 Red	Condition/Code	Possible Cause(s)	Solution
OFF	OFF	Power problem	No power (24V) to control terminals R & C or board failure.	1. Check control transformer power (24V). 2. If power is available to board and LED(s) do not light, replace board.
Simultaneous SLOW Flash		Normal operation	Unit operating normally or in standby mode.	None required.
Alternating SLOW Flash		5-minute anti-short cycle delay	Initial power up, safety trip, end of room thermostat demand.	None required (Jumper TEST pins to override)
Simultaneous FAST Flash		Ambient Sensor Problem	Sensor being detected open or shorted or out of temperature range. Control will revert to time/temperature defrost operation. (System will still heat or cool).	
Alternating FAST Flash		Coil Sensor Problem	Sensor being detected open or shorted or out of temperature range. Control will not perform demand or time/temperature defrost operation. (System will still heat or cool).	
ON	ON	Circuit Board Failure	Indicates that control has internal component failure. Cycle 24 volt power to board. If code does not clear, replace control.	
FAULT & LOCKOUT CODES (Each fault adds 1 strike to that code's counter; 5 strikes per code = LOCKOUT)				
OFF	SLOW Flash	Low Pressure Fault	1. Restricted air flow over indoor or outdoor coil. 2. Improper refrigerant charge in system. 3. Improper metering device installed or incorrect operation of metering device. 4. Incorrect or improper sensor location or connection to system.	1. Remove any blockages or restrictions from coils and/or fans. Check indoor and outdoor fan motor for proper current draws. 2. Check system charge using approach & subcooling temperatures. 3. Check system operating pressures and compare to unit charging charts. 4. Make sure all pressure switches and sensors have secure connections to system to prevent refrigerant leaks or errors in pressure and temperature measurements.
OFF	ON	Low Pressure ***LOCKOUT***		
SLOW Flash	OFF	High Pressure Fault		
ON	OFF	High Pressure ***LOCKOUT***		

B - Compressor (B1)

All TPAH4 units utilize a scroll compressor. The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 9. The scrolls are located in the top of the compressor can and the motor is located just below. The oil level is immediately below the motor.

The scroll is a simple compression concept centered around the unique spiral shape of the scroll and its inherent properties. Figure 8 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 10). One scroll remains stationary, while the other is allowed to "orbit" (figure 11). Note that the orbiting scroll does not rotate or turn but merely orbits the stationary scroll.

SCROLL FORM

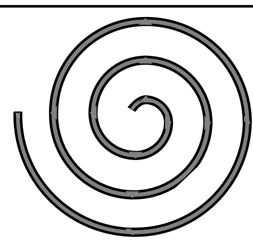


FIGURE 8

SCROLL COMPRESSOR

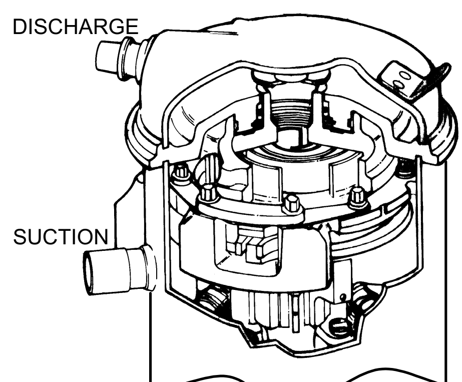


FIGURE 9

NOTE - During operation, the head of a scroll compressor may be hot since it is in constant contact with discharge gas.

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 11 - 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 11 - 2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 11 - 3). When the compressed gas reaches the center, it is discharged vertically into a chamber and discharge port in the top of the compressor (figure 10). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 10). During a single orbit, several pockets of gas are compressed simultaneously providing smooth continuous compression.

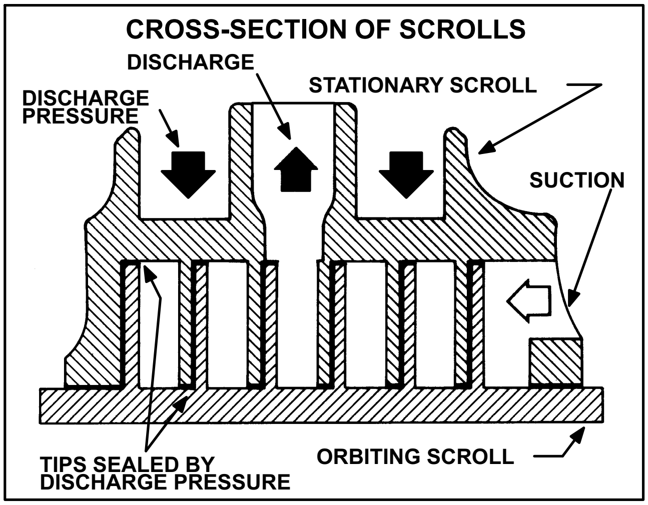


FIGURE 10

The scroll compressor is tolerant to the effects of liquid return. If liquid enters the scrolls, the orbiting scroll is allowed to separate from the stationary scroll. The liquid is worked toward the center of the scroll and is discharged. If the compressor is replaced, conventional Lennox cleanup practices must be used.

Due to its efficiency, the scroll compressor is capable of drawing a much deeper vacuum than reciprocating compressors. Deep vacuum operation can cause internal fusite arcing resulting in damaged internal parts and will result in compressor failure. Never use a scroll compressor for evacuating or "pumping-down" the system. This type of damage can be detected and will result in denial of warranty claims.

The scroll compressor is quieter than a reciprocating compressor, however, the two compressors have much different sound characteristics. The sounds made by a scroll compressor do not affect system reliability, performance, or indicate damage.

See compressor nameplate and ELECTRICAL DATA table on page 2 for compressor specifications.

C - Outdoor Fan Motor (B4)

All units use single-phase PSC fan motors which require a run capacitor. In all units, the condenser fan is controlled by the compressor contactor (and defrost control during defrost cycles).

ELECTRICAL DATA tables in this manual show specifications for condenser fans used in TPAH4s.

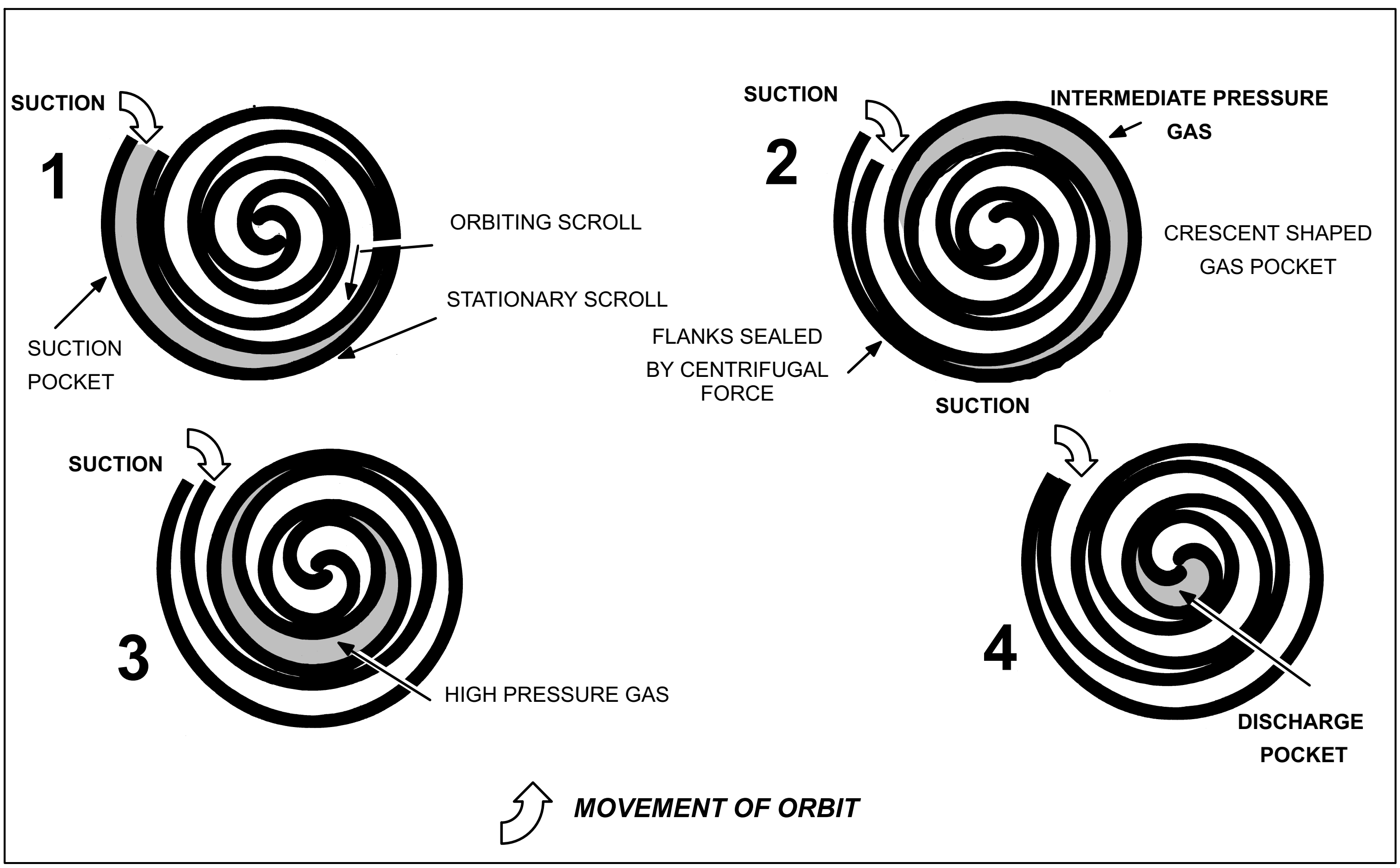


FIGURE 11

Access to the condenser fan motor on all units is gained by removing the seven screws securing the fan assembly. See figure 12. The outdoor fan motor is removed from the fan guard by removing the four nuts found on the top panel. If replacing outdoor fan motor on the TPAH4-060, align motor shaft 1/4” from the hub. For all other TPAH4 model units, motor shaft should be flush with hub. See figure 12. Drip loops should be used in wiring when servicing motor.

D - Reversing Valve (L1) and Solenoid

A refrigerant reversing valve with electromechanical solenoid is used to reverse refrigerant flow during unit operation. The reversing valve requires no maintenance. The only replaceable part is the solenoid. If the reversing valve itself has failed, it must be replaced.

If replacement is necessary, access reversing valve by removing the outdoor fan motor. Refer to figure 12.

CONDENSER FAN MOTOR AND COMPRESSOR ACCESS

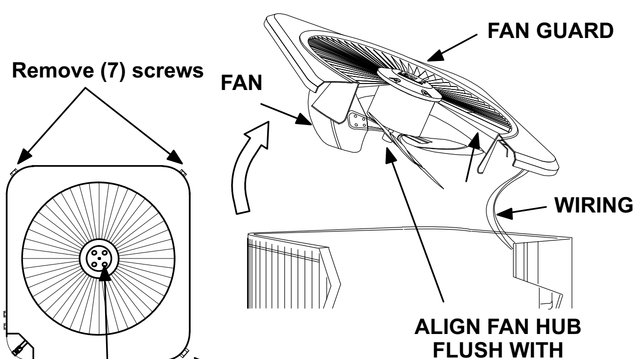


FIGURE 12

⚠ DANGER

Make sure all power is disconnected before beginning electrical service procedures.

E - High Pressure Switch (S4)

⚠ IMPORTANT

Pressure switch settings for R-410A refrigerant will be significantly higher than units with R-410A.

An auto-reset, single-pole/single-throw high pressure switch is located in the liquid line. This switch shuts off the compressor when liquid line pressure rises above the factory setting. The switch is normally closed and is permanently adjusted to trip (open) at 590 $\pm$ 10 psi. See *Pressure Switch Circuit* in the Defrost Control description.

F - Low Pressure Switch (S87) (option)

An auto-reset, single-pole/single-throw low pressure switch is located in the suction line. This switch shuts off the compressor when suction pressure drops below the factory setting. The switch is closed during normal operating pressure conditions and is permanently adjusted to trip (open) at 25 $\pm$ 5 psi. The switch automatically resets when suction line pressure rises above 40 $\pm$ 5 psi. Under certain conditions the low pressure switch is ignored. See *Pressure Switch Circuit* in the Defrost Control description.

G - Loss of Charge Switch (S24) (option)

The loss of charge switch is NC, auto re-set and located on the suction line of the compressor. The switch opens when suction line pressure exceeds the factory setting of 25 $\pm$ 5 psig and shuts down the compressor. The switch closes at 55 psig $\pm$ 5.

H - Start Kit (option)

The start kit consist of a potential relay K31 and start capacitor C7. The potential relay controls the operation of the starting circuit. The relay is normally closed when contactor K1 is de-energized. When K1 is energized, the compressor immediately begins start up. K31 remains closed during compressor start up and capacitor C7 remains in the circuit. When compressor reaches approximately 75% of its speed, K31 is energized. When K31 energizes, the contacts open and start capacitor C7 is taken out of the circuit.

I - Drier

A filter drier designed for all TPAH4 model units is factory installed in the liquid line. The filter drier is designed to remove moisture and foreign matter, which can lead to compressor failure.

Moisture and / or Acid Check

Because POE oils absorb moisture, the dryness of the system must be verified any time the refrigerant system is exposed to open air. A compressor oil sample must be taken to determine if excessive moisture has been introduced to the oil. Table 3 lists kits available from Lennox to check POE oils.

If oil sample taken from a system that has been exposed to open air does not test in the dry color range, the filter drier MUST be replace.

⚠ IMPORTANT

Replacement filter drier MUST be approved for HFC-410A refrigerant and POE application.

Foreign Matter Check

It is recommended that a liquid line filter drier be replaced when the pressure drop across the filter drier is greater than 4 psig. To safeguard against moisture entering the system follow the steps in section III - sub section E - "Evacuating the System" when replacing the drier.

J - Crankcase Heater (HR1) & Thermostat (S40)

Crankcase heater HR1 and thermostat S40 are standard on TPAH4-036, -042, -048 and -060 units and an option for the other sizes. HR1 is a 40 watt heater that prevents liquid from accumulating in the compressor. HR1 is controlled by thermostat S40 located in the liquid line. When liquid line temperature drops below 50° F, S40 closes energizing HR1. S40 will open once liquid line temperature reaches 70°, de-energizing HR1.

TABLE 3 Acid and Moisture Test Kits

KIT	CONTENTS	TUBE SHELF LIFE
10N46 - Refrigerant Analysis	Checkmate-RT700	
10N45 - Acid Test Tubes	Checkmate-RT750A (three pack)	2 - 3 years @ room temperature. 3+ years refrigerated
10N44 - Moisture Test Tubes	Checkmate - RT751 Tubes (three pack)	6 - 12 months @ room temperature. 2 years refrigerated
74N40 - Easy Oil Test Tubes	Checkmate - RT752C Tubes (three pack)	2 - 3 years @ room temperature. 3+ years refrigerated
74N39 - Acid Test Kit	Sporian One Shot - TA-1	

II - REFRIGERANT SYSTEM

TPAH4 COOLING CYCLE (SHOWING MANIFOLD GAUGE CONNECTIONS)

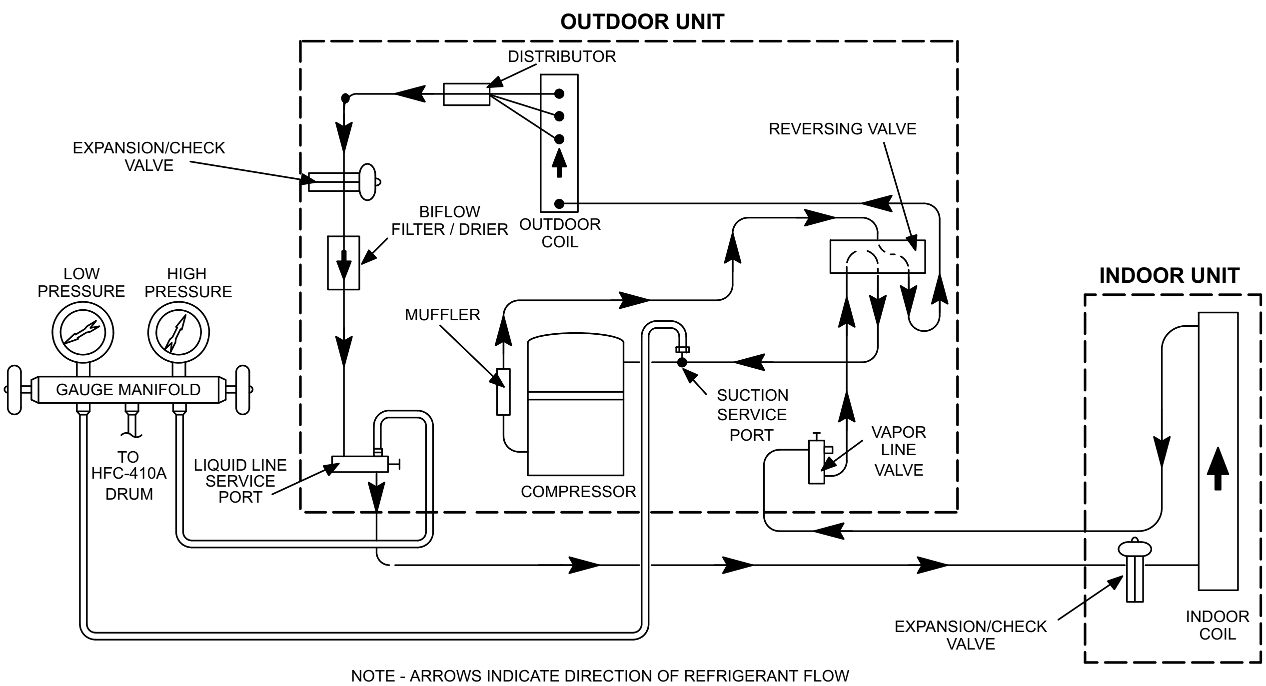


FIGURE 13

TPAH4 HEATING CYCLE (SHOWING MANIFOLD GAUGE CONNECTIONS)

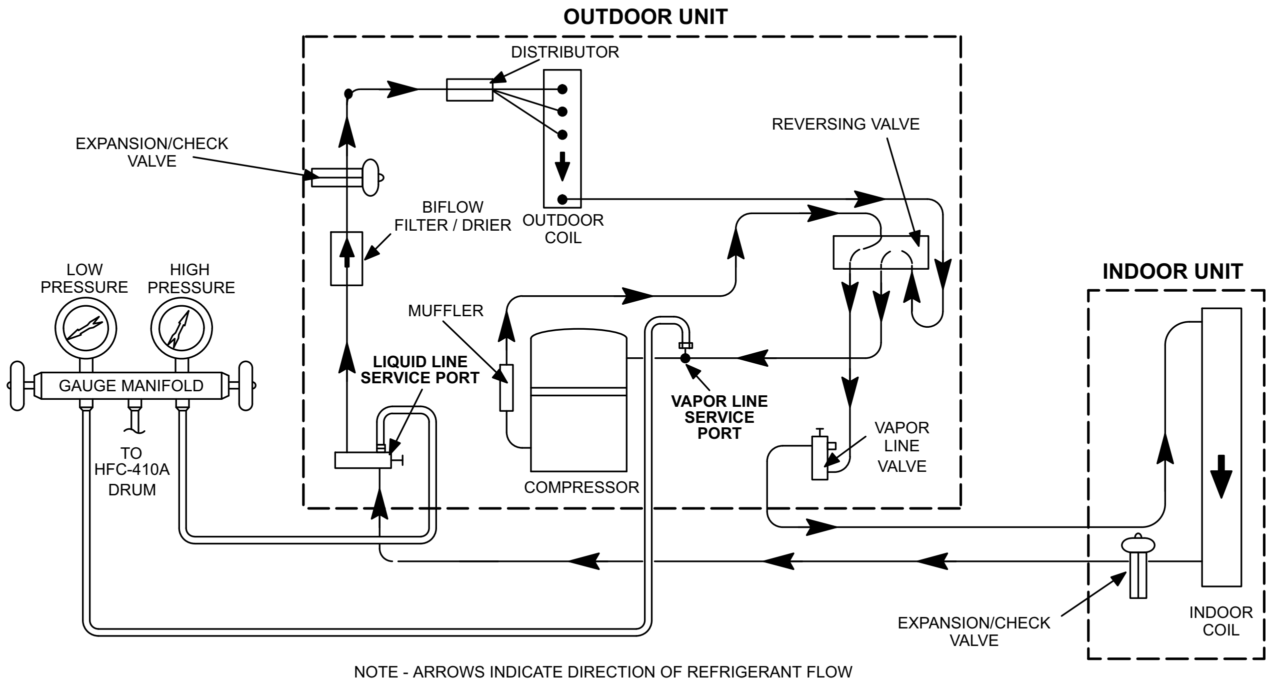


FIGURE 14

A - Plumbing

Field refrigerant piping consists of liquid and vapor lines from the outdoor unit (sweat connections). Use Lennox L15 (sweat) series line sets as shown in table 4.

TABLE 4

Refrigerant Line Sets					
Model	**Field Connections**		**Recommended Line Set**		
-018 -024 -030	3/8 in. (10 mm)	3/4 in (19 mm)	3/8 in. (10 mm)	3/4 in (19 mm)	L15-41 15 ft. - 50 ft. (4.6 m - 15 m)
-036 -042 -048	3/8 in. (10 mm)	7/8 in (22 mm)	3/8 in. (10 mm)	7/8 in (22 mm)	L15-65 15 ft. - 50 ft. (4.6 m - 15 m)
-060	3/8 in. (10 mm)	1-1/8 in. (29 mm)	3/8 in. (10 mm)	1-1/8 in. (29 mm)	Field Fabricated

B - Service Valves

The liquid and vapor line service valves (figures 15 and 16) and gauge ports are accessible from outside the unit.

Each valve is equipped with a service port. The service ports are used for leak testing, evacuating, charging and checking charge. A schrader valve is factory installed. A service port cap is supplied to protect the schrader valve from contamination and serve as the primary leak seal.

NOTE-Always keep valve stem caps clean.

To Access Schrader Port:

1 - Remove service port cap with an adjustable wrench.
2 - Connect gauge to the service port.
3 - When testing is completed, replace service port cap. Tighten finger tight, then an additional 1/6 turn.

To Open Liquid or Vapor Line Service Valve:

1 - Remove stem cap with an adjustable wrench.
2 - Using service wrench and hex head extension (5/16 for vapor line and 3/16 for liquid line), back the stem out counterclockwise until the valve stem just touches the retaining ring.
3 - Replace stem cap and tighten finger tight, then tighten an additional 1/6 turn.

DANGER

Do not attempt to backseat this valve. Attempts to backseat this valve will cause snap ring to explode from valve body under pressure of refrigerant. Personal injury and unit damage will result.

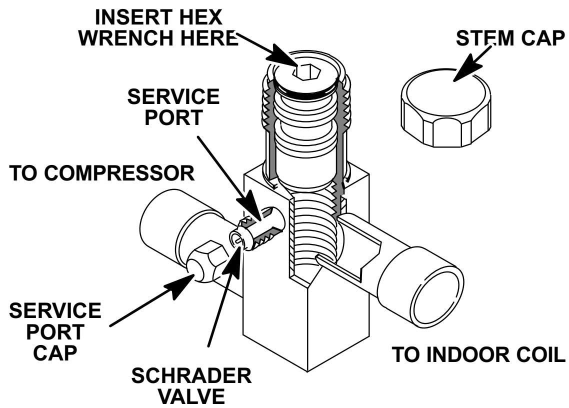
To Close Liquid or Vapor Line Service Valve:

1 - Remove stem cap with an adjustable wrench.

2 - Using service wrench and hex head extension (5/16 for vapor line and 3/16 for liquid line), turn stem clockwise to seat the valve. Tighten firmly.

3 - Replace stem cap. Tighten finger tight, then tighten an additional 1/6 turn.

LIQUID LINE SERVICE VALVE (VALVE OPEN)



LIQUID LINE SERVICE VALVE (VALVE CLOSED)

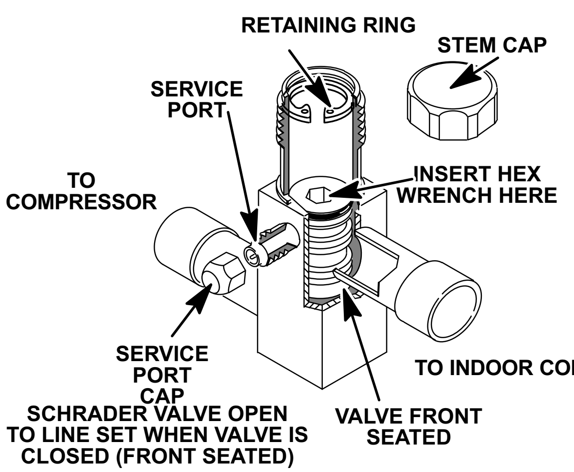


FIGURE 15

Vapor Line (Ball Type) Service Valve

A ball-type full service valve is used on TPAH4. Valves are not rebuildable. If a valve has failed it must be replaced. A ball valve is illustrated in figure 16.

The ball valve is equipped with a service port. A schrader valve is factory installed. A service port cap is supplied to protect the schrader valve from contamination and assure a leak free seal.

C - Pumping Down System

⚠ CAUTION

Deep vacuum operation (operating compressor at 0 psig or lower) can cause internal fusite arcing resulting in a damaged or failed compressor. This type of damage will result in denial of warranty claim.

The system may be pumped down when leak checking the line set and indoor coil or making repairs to the line set or indoor coil.

1- Attach gauge manifold.

2- Front seat (close) liquid line valve.

3- Start outdoor unit.

4- Monitor suction gauge. Stop unit when 0 psig is reached.

5- Front seat (close) suction line valve.

SUCTION LINE (BALL TYPE) SERVICE VALVE (VALVE OPEN)

USE ADJUSTABLE WRENCH ROTATE STEM CLOCKWISE 90° TO CLOSE ROTATE STEM COUNTER-CLOCKWISE 90° TO OPEN

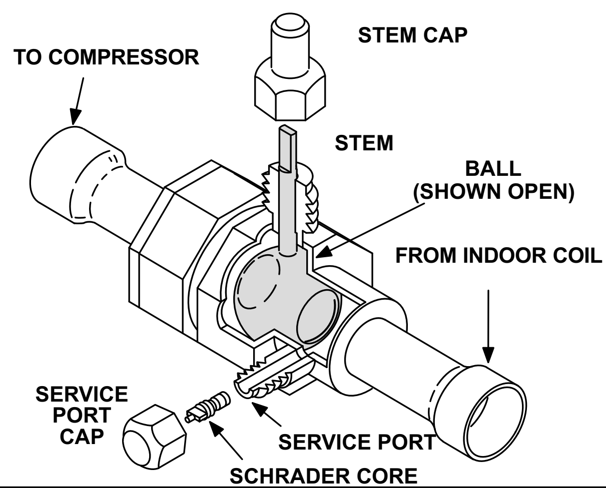


FIGURE 16

D - Leak Testing (To Be Done Before Evacuating)

1- Attach gauge manifold and connect a drum of dry nitrogen to center port of gauge manifold.

2- Open high pressure valve on gauge manifold and pressurize line set and indoor coil to 150 psig (1034 kPa).

3- Check lines and connections for leaks.

NOTE-The preferred method is to use an electronic leak or Halide detector. Add a small amount of HFC-410A (3 to 5 psig [20kPa to 34kPa]) then pressurize with nitrogen to 150 psig.

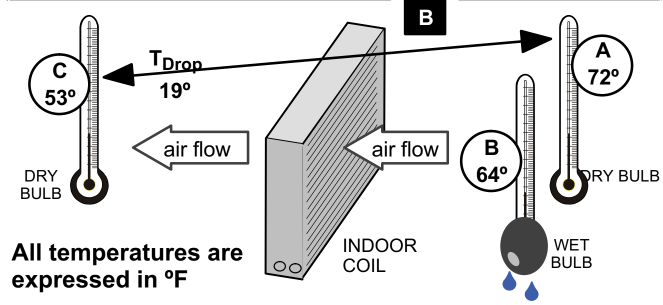
4- Release nitrogen pressure from the system, correct any leaks and recheck.

⚠ DANGER

When using dry nitrogen, a pressure reducing regulator must be used to prevent excessive pressure in gauge manifold, connecting hoses, and within the system. Regulator setting must not exceed 150 psig (1034 kpa). Failure to use a regulator can cause equipment failure resulting in injury or death.

DT

Temp. of air entering indoor coil ºF (Dry-bulb)	57	58	59	60	61	62	63	64	65	66	67	68	69	70
80	24	24	24	23	23	22	22	22	20	19	18	17	16	15
78	23	23	23	22	22	21	21	20	19	18	17	16	15	14
76	22	22	22	21	21	20	19	19	18	17	16	15	14	13
74	21	21	21	20	19	19	18	17	16	16	15	14	13	12
A 72	20	20	19	18	17	17	16	15	15	14	13	12	11	10
70	19	19	18	18	17	17	16	15	15	14	13	12	11	10
Wet-bulb ºF	57	58	59	60	61	62	63	64 (B)	65	66	67	68	69	70



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 ±3º, no adjustment is needed. See examples: Assume **DT** = 15 and **A** temp. = 72º, these **C** temperatures would necessitate stated actions:

Cº	T_{Drop}	–	DT	=	ºF	*ACTION*
53º	19	–	15	=	4	*Increase the airflow*
58º	14	–	15	=	-1	*(within ±3º range) no change*
62º	10	–	15	=	-5	*Decrease the airflow*

4. Adjust the fan speed—See indoor unit instructions to increase/decrease fan speed.

Changing air flow affects all temperatures; recheck temperatures to confirm that the temperature drop and DT are within ±3º.

FIGURE 17

E - Evacuating the System

1- Attach gauge manifold. Connect vacuum pump (with vacuum gauge) to center port of gauge manifold. With both manifold service valves open, start pump and evacuate indoor coil and refrigerant lines.

⚠ IMPORTANT

A temperature vacuum gauge, mercury vacuum (U-tube), or thermocouple gauge should be used. The usual Bourdon tube gauges are not accurate enough in the vacuum range.

⚠ IMPORTANT

The compressor should never be used to evacuate a refrigeration or air conditioning system.

2- Evacuate the system to 29 inches (737mm) vacuum. During the early stages of evacuation, it is desirable to stop the vacuum pump at least once to determine if there is a rapid loss of vacuum. A rapid loss of vacuum would indicate a leak in the system and a repeat of the leak testing section would be necessary.

3- After system has been evacuated to 29 inches (737mm), close gauge manifold valves to center port, stop vacuum pump and disconnect from gauge manifold. Attach an upright nitrogen drum to center port of gauge manifold and open drum valve slightly to purge line at manifold. Break vacuum in system with nitrogen pressure by opening manifold high pressure valve. Close manifold high pressure valve to center port.

4- Close nitrogen drum valve and disconnect from gauge manifold center port. Release nitrogen pressure from system.

5- Connect vacuum pump to gauge manifold center port. Evacuate system through manifold service valves until vacuum in system does not rise above .5mm of mercury absolute pressure or 500 microns within a 20-minute period after stopping vacuum pump.

6- After evacuation is complete, close manifold center port, and connect refrigerant drum. Pressurize system slightly with refrigerant to break vacuum.

III - CHARGING

TESTING AND CHARGING SYSTEM

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. This unit is NOT approved for use with coils which use capillary tubes as a refrigerant metering device.

SETTING UP TO CHECK CHARGE

1. Close manifold gauge set valves. Connect the center manifold hose to an upright cylinder of HFC-410A.
2. Connect the manifold gauge set to the unit's service ports as illustrated in figure 14.
   - low pressure gauge to ***vapor service port***
   - high pressure gauge to ***liquid service port***

COOLING MODE INDOOR AIRFLOW CHECK

Check airflow using the Delta-T (DT) process using the illustration in figure 17.

HEATING MODE INDOOR AIRFLOW CHECK

Blower airflow (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:

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

CALCULATING 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 name plate		Adjust amount. for variation in line set length listed in table 4.		Additional charge specified per indoor unit match-up listed in table 6.		Total charge
_______	±	___________	+	___________	=	_____

CHARGE USING THE WEIGH-IN METHOD - OUTDOOR TEMPERATURE < 65°F (18°C)

1. Recover the refrigerant from the unit.
2. Conduct leak check; evacuate as previously outlined.
3. Weigh in the unit nameplate charge plus any charge required for line set differences from 15 feet and any extra indoor unit match-up amount per table 6.

NOTE - If weighing facilities are not available, use the subcooling method.

TABLE 5
Charge per Line Set Lengths

Liquid Line Set Diameter	Oz. per 5 ft. (g per 1.5m) adjust from 15 ft. (4.6m) line set*
3/8 in. (9.5mm)	3 ounce per 5 ft. (85g per 1.5m)
NOTE - *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.	

CHARGE USING THE SUBCOOLING METHOD - OUTDOOR TEMPERATURE < 65°F (18°C)

Requirements—these items are required for charging:

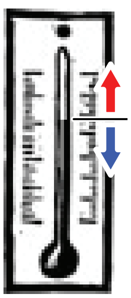
- Manifold gauge set connected to unit.
- Thermometers for measuring outdoor ambient, liquid line, and vapor line temperatures.

When to use cooling mode—When outdoor temperature is 60°F (15°C) and above, use cooling mode to adjust charge.

When to use heating mode—When the outdoor temperature is below 60°F (15°C), use the heating mode to adjust the charge.

Adding Charge for Indoor Matchups—Table 6 lists all the Lennox recommended indoor unit match-ups along with the charge levels for the various sizes of outdoor units.

TABLE 6 Adding Charge per Indoor Unit Match-Up using Subcooling Method



Use cooling mode
60ºF (15ºC) –
Use heating mode

1. Check the airflow using figure 17 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 Normal Operating Pressures table 11, (*Table* 11 *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 in table below 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). 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 in table below 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). When pressures have stabilized, continue with step 6.

SATº		_______
LIQº	–	_______
SCº	=	_______

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 table 12) and record it in the SATº space.
8. Subtract LIQº temp. from SATº temp. to determine subcooling; record it in SCº space.
9. Compare SCº results with table below, being sure to note any additional charge for line set and/or match-up.
10. If subcooling value is greater than shown in tables, remove refrigerant; if less than shown, add refrigerant.
11. If refrigerant is added or removed, repeat steps 5. through 10. to verify charge.

Table 7. TPAH4-036

INDOOR MATCHUPS	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	*Add charge lb	*Add charge oz
C33-44C	13	6	0	0
CBX26UH-036	26	5	0	0
CBX26UH-037	25	4	1	9
CBX27UH-036	13	6	0	3
CBX32M-036	13	6	0	2
CBX32M-042	13	6	0	3
CBX32MV-036	13	6	0	3
CBX32MV-048	11	8	2	5
CBX40UHV-036	13	6	0	3
CBX40UHV-042, -048	11	8	2	5
CH33-50/60C	11	8	2	5
CH33-44B	13	6	1	7
CH33-48B	13	6	1	8
CR33-50/60C	25	4	1	15
CR33-48B/C	25	5	0	9
CX34-49C	13	6	2	4
CX34-43B/C, -50/60C	13	6	1	8
CX34-38A/B S/N# 6007 and after	6	6	0	0
CX34-38A/B before S/N# 6007	13	6	0	0

Table 8. TPAH4-042

INDOOR MATCHUPS	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	*Add charge lb	*Add charge oz
CBX26UH-042	27	6	0	0
CBX27UH-042	12	6	0	8
CBX32M-048	12	6	0	7
CBX32MV-048	12	6	0	8
CBX40UHV-042, -048	11	8	2	5
CH23-68	20	9	0	13
CH33-43	12	6	0	7
CH33-62D	12	6	0	10
CH33-50/60C	12	6	0	7
CH33-60D	12	6	0	4
CR33-50/60C,-60D	26	6	0	4
CX34-62C, -62D	12	6	0	9
CX34-49C	12	6	0	7
CX34-60D	12	6	0	4

Table 9. TPAH4-048

INDOOR MATCHUPS	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	*Add charge lb	*Add charge oz
CBX26UH-048	8	7	1	9
CBX27UH-048	11	8	1	2
CBX32M-048, -060	11	8	1	2
CBX32MV-048, -060	11	8	1	2
CBX32MV-068	10	7	1	12
CBX40UHV-048, -060	11	8	1	2
CH23-68	20	9	2	9
CH33-50/60C	11	8	1	1
CH33-62D	10	7	1	14
CH33-60D	11	8	0	0
CR33-50/60C	35	5	0	0
CR33-60D	37	6	0	0
CX34-62C, -62D	10	7	1	7
CX34-49D	11	8	0	14
CX34-60D	11	8	0	0

Table 10. TPAH4-060

INDOOR MATCHUPS	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	*Add charge lb	*Add charge oz
CBX26UH-048	12	7	1	0
CBX26UH-060	14	4	0	0
CBX27UH-060	12	5	0	0
CBX32M-048, -060	12	5	0	0
CBX32MV-048, -060	12	5	0	0
CBX32MV-068	12	7	1	0
CBX40UHV-048, -060	11	8	1	2
CH23-68	12	5	0	0
CH33-50/60C	12	5	0	0
CH33-62D	12	5	0	0
CX34-62C, -62D	12	7	1	0

*NOTE - *Add charge = Extra matchup amount required in addition to charge indicated on Heat Pump nameplate (remember to also add any charge required for lineset differences from 15 feet).*

⚠ IMPORTANT

Use table 11 as a general guide when performing maintenance checks. This is not a procedure for charging the unit (Refer to Charging / Checking Charge section). Minor variations in these pressures may be expected due to differences in installations. Significant differences could mean that the system is not properly charged or that a problem exists with some component in the system.

TABLE 11
CTXV Normal Operating Pressures - Liquid ±10 and Vapor ±5 PSIG*

°F (°C)**	TPAH4-036 Liquid/ Vapor	TPAH4-042 Liquid / Vapor	TPAH4-048 Liquid / Vapor	TPAH4-060 Liquid / Vapor
HEATING				
60 (15)	350 / 134	373 / 139	355 / 130	351 / 117
50 (10)	331 / 117	363 / 117	336 / 113	333 / 105
40 (4)	313 / 97	348 / 97	315 / 88	316 / 88
30 (-1)	298 / 83	336 / 74	296 / 72	308 / 70
20 (-7)	284 / 66	322 / 64	286 / 64	300 / 61
COOLING				
65 (18)	220 / 138	223 / 125	231 / 136	243 / 136
70 (21)	236 / 140	241 / 130	248 / 139	263 / 137
75 (24)	256 / 141	261 / 134	271 / 140	282 / 138
80 (27)	276 / 142	282 / 138	291 / 142	306 / 139
85 (29)	298 / 143	302 / 139	312 / 143	327 / 140
90 (32)	321 / 144	326 / 140	335 / 144	351 / 141
95 (35)	344 / 144	349 / 141	359 / 145	376 / 142
100 (38)	369 / 146	374 / 142	384 / 146	401 / 143
105 (41)	394 / 147	399 / 143	411 / 148	426 / 145
110 (38)	421 / 148	428 / 145	439 / 149	452 / 146
115 (45)	449 / 149	455 / 146	468 / 150	484 / 148

**These are most-popular-match-up pressures. Indoor match up, indoor air quality, and indoor load cause pressures to vary.*

**Temperature of the air entering the outside coil (outdoor ambient temperature).

TABLE 12
HFC-410A Temp. (°F) - Pressure (Psig)

°F	Psig	°F	Psig	°F	Psig	°F	Psig
-40	10.1	21	80.5	56	158.2	91	278.2
-35	13.5	22	82.3	57	161.0	92	282.3
-30	17.2	23	84.1	58	163.9	93	286.5
-25	21.4	24	85.9	59	166.7	94	290.8
-20	25.9	25	87.8	60	169.6	95	295.1
-18	27.8	26	89.7	61	172.6	96	299.4
-16	29.7	27	91.6	62	175.4	97	303.8
-14	31.8	28	93.5	63	178.5	98	308.2
-12	33.9	29	95.5	64	181.6	99	312.7
-10	36.1	30	97.5	65	184.3	100	317.2
-8	38.4	31	99.5	66	187.7	101	321.8
-6	40.7	32	100.8	67	190.9	102	326.4
-4	43.1	33	102.9	68	194.1	103	331.0
-2	45.6	34	105.0	69	197.3	104	335.7
0	48.2	35	107.1	70	200.6	105	340.5
1	49.5	36	109.2	71	203.9	106	345.3
2	50.9	37	111.4	72	207.2	107	350.1
3	52.2	38	113.6	73	210.6	108	355.0
4	53.6	39	115.8	74	214.0	109	360.0
5	55.0	40	118.0	75	217.4	110	365.0
6	56.4	41	120.3	76	220.9	111	370.0
7	57.9	42	122.6	77	224.4	112	375.1
8	59.3	43	125.0	78	228.0	113	380.2
9	60.8	44	127.3	79	231.6	114	385.4
10	62.3	45	129.7	80	235.3	115	390.7
11	63.9	46	132.2	81	239.0	116	396.0
12	65.4	47	134.6	82	242.7	117	401.3
13	67.0	48	137.1	83	246.5	118	406.7
14	68.6	49	139.6	84	250.3	119	412.2
15	70.2	50	142.2	85	254.1	120	417.7
16	71.9	51	144.8	86	258.0	121	423.2
17	73.5	52	147.4	87	262.0	122	428.8
18	75.2	53	150.1	88	266.0	123	434.5
19	77	54	152.8	89	270.0	124	440.2
20	78.7	55	155.5	90	274.1	125	445.9

IV - MAINTENANCE

⚠WARNING

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

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

Outdoor Unit

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.
   Unit 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.

Indoor Coil

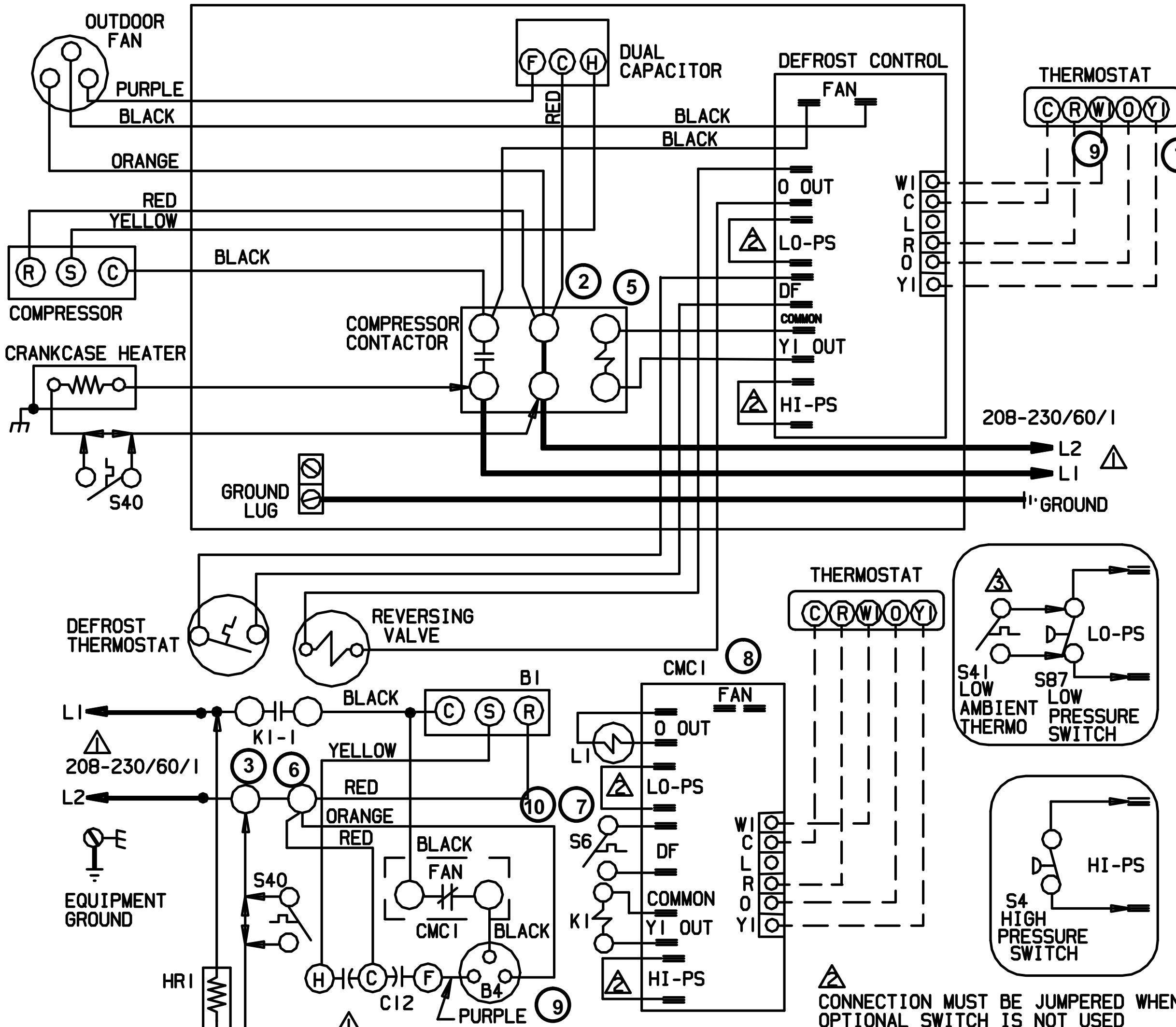
1. Clean coil if necessary.
2. Check connecting lines, joints and coil for evidence of oil leaks.
3. Check condensate line and clean if necessary.

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 indoor unit 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__________.

V - WIRING DIAGRAM AND SEQUENCE OF OPERATION

TPAH4 UNIT DIAGRAM



CONNECTION MUST BE JUMPERED WHEN OPTIONAL SWITCH IS NOT USED

DESCRIPTION	
KEY	COMPONENT
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN
C12	CAPACITOR- DUAL
CMC1	CONTROL-DEFROST
HR1	HEATER-COMPRESSOR
K1,-1	CONTACTOR-COMPRESSOR
L1	VALVE-REVERSING
S4	SWITCH-HIGH PRESSURE
S6	SWITCH-DEFROST
S40	THERMOSTAT-CRANKCASE
S41	THERMOSTAT-LOW AMBIENT
S87	SWITCH-LOW PRESSURE

NOTE-
FOR USE WITH COPPER CONDUCTORS ONLY. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVER-CURRENT PROTECTION SIZE.

S41 TO BE MOUNTED IN CONTROL BOX AND WIRED IN PARALLEL WITH LOW PRESSURE SWITCH

WARNING-
ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES.

DENOTES OPTIONAL COMPONENTS
LINE VOLTAGE FIELD INSTALLED
CLASS II VOLTAGE FIELD INSTALLED

09/05	Supersedes Form No.
	New Form No. 534,774W

TPAH4 OPERATING SEQUENCE

This is the sequence of operation for TPAH4 series units. The sequence is outlined by numbered steps which correspond to circled numbers on the adjacent diagram. The steps are identical for both cooling and first stage heating demand with the exception reversing valve L1 is energized during cooling demand and de-energized during heating demand.

NOTE- The thermostat used may be electromechanical or electronic.

NOTE- Transformer in indoor unit supplies power (24 VAC) to the thermostat and outdoor unit controls.

COOLING:

Internal thermostat wiring energizes terminal O by cooling mode selection, energizing the reversing valve L1.

1 - Demand initiates at Y1 in the thermostat.

2 - 24VAC energizes compressor contactor K1.

3 - K1-1 N.O. closes, energizing compressor (B1) and outdoor fan motor (B4).

END OF COOLING DEMAND:

4 - Demand is satisfied. Terminal Y1 is de-energized.

5 - Compressor contactor K1 is de-energized.

6 - K1-1 opens and compressor (B1) and outdoor fan motor (B4) are de-energized and stop immediately.

FIRST STAGE HEAT:

Internal thermostat wiring de-energizes terminal O by heating mode selection, de-energizing the reversing valve L1.

See steps 1, 2 and 3.

End of FIRST STAGE HEAT:

See steps 4, 5 and 6.

DEFROST MODE:

7 - During heating operation when outdoor coil temperature drops below 42°(5.5°C)defrost switch (thermostat) S6 closes.

8 - Defrost control CMC1 begins timing. If defrost thermostat (S6) remains closed at the end of the 30,60 or 90 minute period, defrost relay energizes and defrost begins.

9 - During defrost CMC1 energizes the reversing valve and W1 on the terminal strip (operating indoor unit on the first stage heat mode), while de-energizing outdoor fan motor B4.

10 - Defrost continues 14 ± 1 minutes or until thermostat switch (S6) opens. When defrost thermostat opens, defrost control timer loses power and resets.