

T-CLASS™ TPA*S4 COMMERCIAL SERIES UNITS

The TPA*S4 is a HFC-410A commercial split-system heat pump. The series is designed for use with expansion valves (TXV). All TPA*S4 units utilize scroll compressors.

TPA*S4 series units are available in 3, 3.5, 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 matchups.

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.

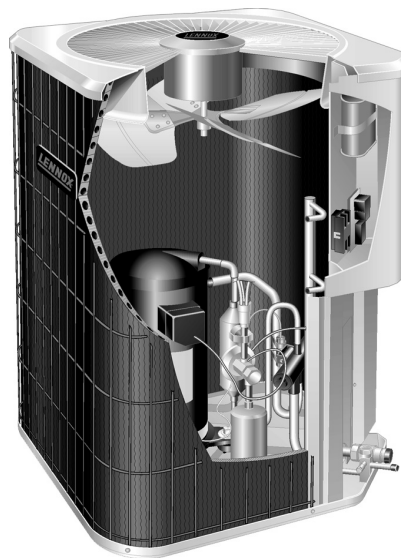


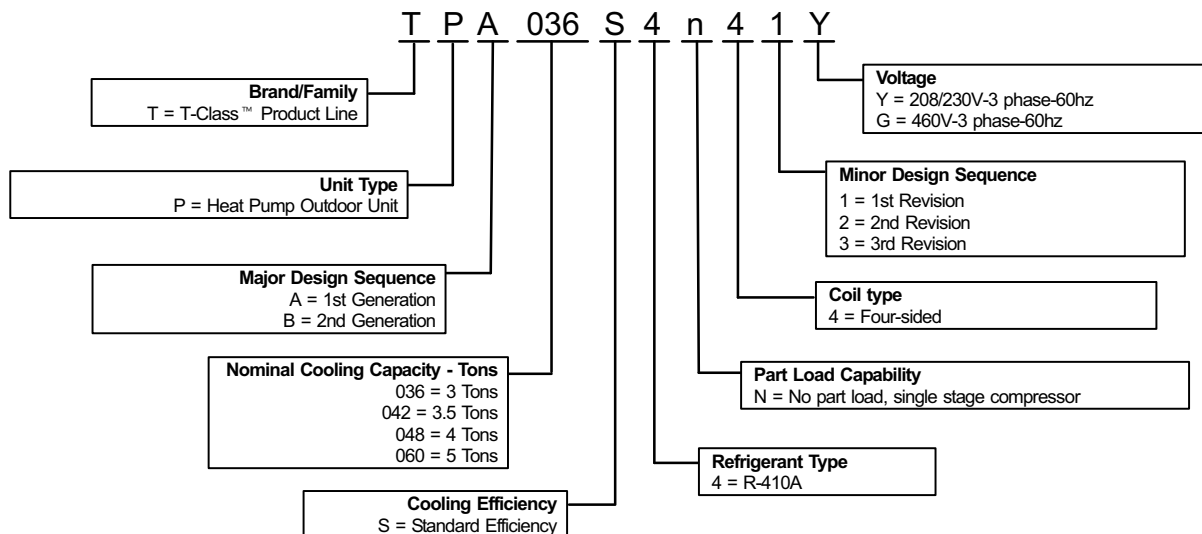
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⚠ WARNING
 Improper installation, adjustment, alteration, service or maintenance can cause personal injury, loss of life, or damage to property.
 Installation and service must be performed by a licensed professional installer (or equivalent) or a service agency.

⚠ IMPORTANT
 This unit must be matched with an indoor coil as specified in Lennox' Engineering Handbook. Coils previously charged with HCFC-22 must be flushed.

MODEL NUMBER IDENTIFICATION



SPECIFICATIONS

General Data		Model No.	TPA036S4	TPA042S4	TPA048S4	TPA060S4
	Nominal Tonnage		3	3.5	4	5
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
¹ Refrigerant	HFC-410A charge furnished		8 lbs. 12 oz.	10 lbs. 10 oz.	13 lbs. 2 oz.	15 lbs. 3 oz.
Outdoor Coil	Net face area	Outer coil	15.21	18.66	21.11	29.09
		sq. ft.				
		Inner coil	14.50	17.95	20.31	28.16
		Tube diameter	5/16	5/16	5/16	5/16
		Number of rows	2	2	2	2
	Fins per inch		22	22	22	22
Outdoor Fan	Diameter - in. - No. of Blades		18 - 4	22 - 4	22 - 4	22 - 4
		Motor hp	208/230V - 1/5 460V - 1/6	1/3	1/3	1/4
		Cfm	2450	3890	3890	3830
		Rpm	1100	1080	1085	830
		Watts	190	400	375	330
Shipping Data - lbs. 1 package			180	220	250	255

ELECTRICAL DATA

Line voltage data - 60 hz - 3ph		208/230V	460V	208/230V	460V	208/230V	460V	208/230V	460V
² Maximum overcurrent protection (amps)		20	15	30	15	30	15	35	15
³ Minimum circuit ampacity		14.2	7.8	18.6	8.3	18.8	8.6	21.3	10.7
Compressor	Rated Load Amps	10.4	5.8	13.5	6.0	13.7	6.2	15.6	7.8
	Locked Rotor Amps	88	38	88	44	83.1	41	110	52
	Power Factor	.85	.84	.83	.81	.90	.92	.90	.91
Outdoor Fan Motor	Full Load Amps	1.1	.55	1.7	1.0	1.7	1.0	1.7	1.0
	Locked Rotor Amps	1.9	1.1	4.1	2.2	4.1	2.2	3.1	2.3

OPTIONAL ACCESSORIES - must be ordered extra

	Model No.	TPA036S4	TPA042S4	TPA048S4	TPA060S4
Compressor Low Ambient Cut-Off	45F08	•	•	•	•
Compressor Sound Cover	69J03	•	•	•	•
Freezestat	3/8 in. tubing	93G35	•	•	•
	5/8 in. tubing	50A93	•	•	•
Hail Guards	92M89	•			
	92M90		•	•	
	12W21		•		
	92M94				•
⁴ Low Ambient Kit	54M89	•	•	•	•
Low Ambient Control Option (down to 30°F)		See table below	See table below	See table below	See table below
Mild Weather Kit	33M07	•	•	•	•
Monitor Kit - Service Light	76F53	•	•	•	•
Mounting Base	69J06	•			
	69J07		•	•	•
Outdoor Thermostat Kit	Thermostat 56A87	•	•	•	•
	Mtg. Box 31461	•	•	•	•
Refrigerant Line Sets	L15-65-30, L15-65-40, or L15-65-50	•	•	•	
	Field Fabricate				•
Time Delay Relay Kit	58M51	•	•	•	•
Unit Stand-Off Kit	94J45	•	•	•	•

NOTE - Extremes of operating range are plus 10% and minus 5% of line voltage.

¹ Refrigerant charge sufficient for 15 ft. length of refrigerant lines.

² HACR type circuit breaker or fuse.

³ Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

⁴ Freezestat is recommended with Low Ambient Kit.

LOW AMBIENT CONTROL Option (Down to 0°F)

Order one each: Speed Control Kit, Weatherproof Kit, Outdoor Fan Motor and Capacitor

	Model No.	TPA036S2	TPA048S2	TPA060S2
Speed Control Kit	X5867	•	•	•
Weatherproof Kit	56N41	•	•	•
Outdoor Fan Motor	1/2 HP - 230V	69H75	•	•
	460V	69H76	•	•
Capacitor	with mounting bracket	53H06	•	•

⚠ IMPORTANT

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

⚠ CAUTION

Physical contact with metal edges and corners while applying excessive force or rapid motion can result in personal injury. Be aware of, and use caution when working near these areas during installation or while servicing this equipment.

I - UNIT COMPONENTS

Unit components are illustrated in figure 1.

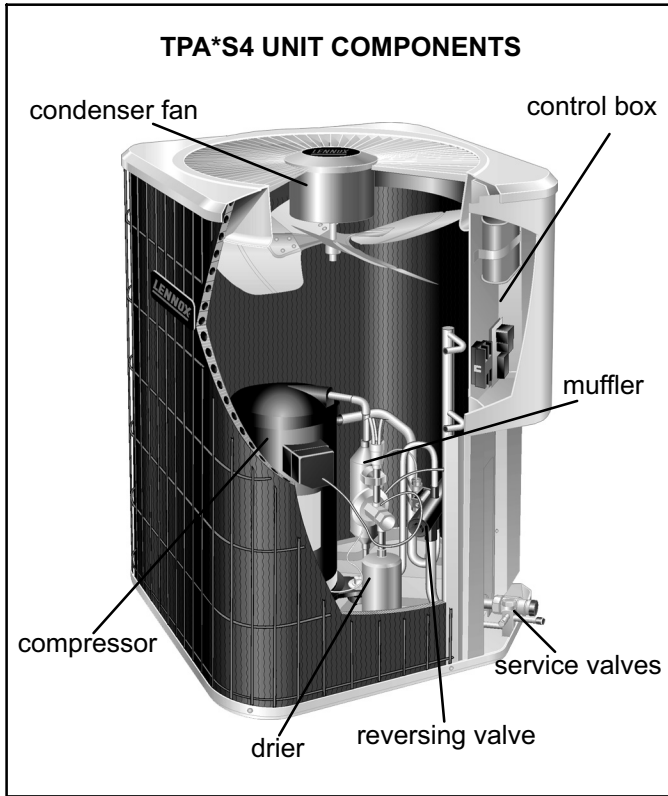


FIGURE 1

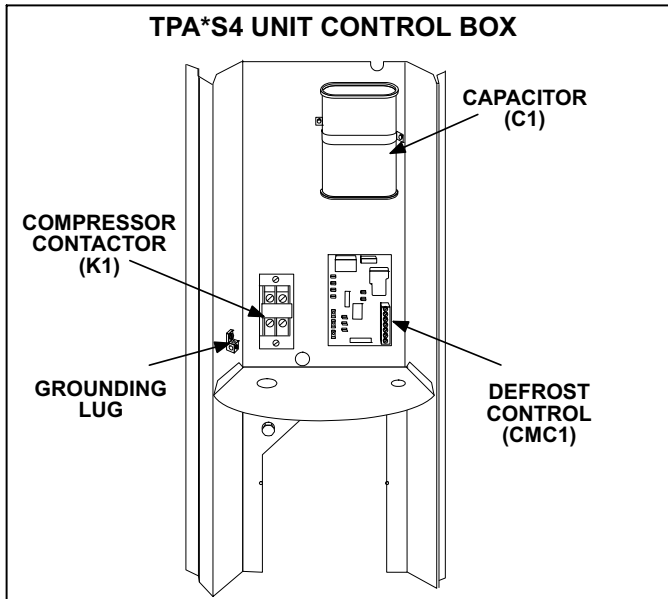


FIGURE 2

⚠ 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.

A - Control Box (Figure 2)

TPA*S4 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.

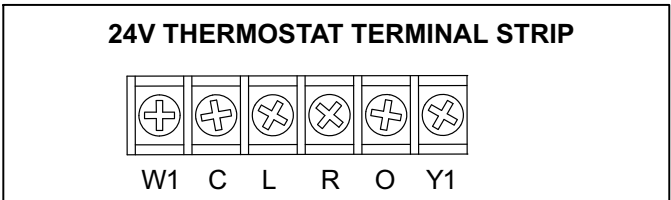


FIGURE 3

1 - Compressor Contactor K1

The compressor is energized by a contactor located in the control box. See figure 2. Three-pole contactors are used in TPA*S4 series units. K1 is energized through the control board by the indoor thermostat terminal Y1 (24V) when thermostat demand is present.

2 - Capacitor C1

All units use single-phase PSC outdoor fan motors which require a run capacitor. Ratings for capacitor will be on fan motor nameplate. C1 aids in the start up of outdoor fan B4.

3 - Defrost System

The TPA036S4 defrost system includes two components: a defrost thermostat and a defrost control.

Defrost Thermostat

The defrost thermostat is located on the liquid line between the check/expansion valve and the distributor. When defrost thermostat senses 42°F (5.5°C) or cooler, the thermostat contacts close and send a signal to the defrost control board to start the defrost timing. It also terminates defrost when the liquid line warms up to 70°F (21°C).

Defrost Control

The defrost control board includes the combined functions of a time/temperature defrost control, defrost relay, diagnostic LEDs and terminal strip for field wiring connections. See figure 4.

The control provides automatic switching from normal heating operation to defrost mode and back. During compressor cycle (call for defrost), the control accumulates compressor run times at 30-, 60-, or 90-minute field-adjustable intervals. If the defrost thermostat is closed when the selected compressor run time interval ends, the defrost relay is energized and defrost begins.

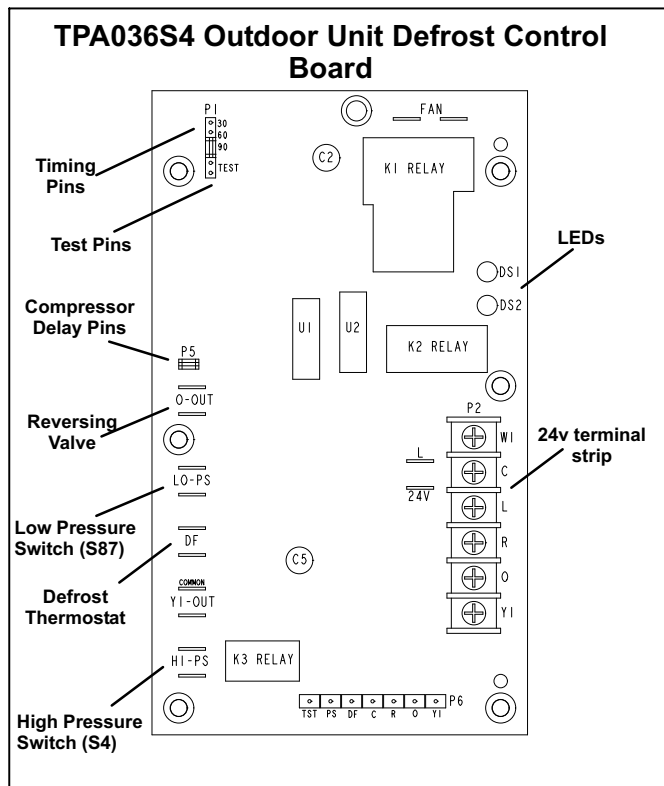


FIGURE 4

Defrost Control Timing Pins

Each timing pin selection provides a different accumulated compressor run time period for one defrost cycle. This time period must occur before a defrost cycle is initiated. The defrost interval can be adjusted to 30 (T1), 60 (T2), or 90 (T3) minutes (see figure 4). The defrost timing jumper is factory-installed to provide a 90-minute defrost interval. If the timing selector jumper is not in place, the control defaults to a 90-minute defrost interval. The maximum defrost period is 14 minutes and cannot be adjusted.

A TEST option is provided for troubleshooting. **The TEST mode may be started any time the unit is in the heating mode and the defrost thermostat is closed or jumpered.** If the jumper is in the TEST position at

power-up, the control will ignore the test pins. When the jumper is placed across the TEST pins for two seconds, the control will enter the defrost mode. If the jumper is removed before an additional 5-second period has elapsed (7 seconds total), the unit will remain in defrost mode until the defrost thermostat opens or 14 minutes have passed. If the jumper is not removed until after the additional 5-second period has elapsed, the defrost will terminate and the test option will not function again until the jumper is removed and re-applied.

Compressor Delay

The defrost board has a field-selectable function to reduce occasional sounds that may occur while the unit is cycling in and out of the defrost mode. The compressor will be cycled off for 30 seconds going in and out of the defrost mode when the compressor delay jumper is removed.

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

Time Delay

The timed-off delay is five minutes long. The delay helps to protect the compressor from short-cycling in case the power to the unit is interrupted or a pressure switch opens. The delay is bypassed by placing the timer select jumper across the TEST pins for 0.5 seconds.

Pressure Switch Circuit

The defrost control incorporates two pressure switch circuits. The optional high pressure switch (S4) connects to the board's HI PS terminals. The board also includes connections for an optional low pressure, or loss-of-charge-pressure, switch (S87). See figure 4 for switch terminal location.

During a single demand cycle, the defrost control will lock out the unit after the fifth time that the circuit is interrupted by any pressure switch wired to the control board. In addition, the diagnostic LEDs will indicate a locked-out pressure switch after the fifth occurrence of an open pressure switch (see Table 1). The unit will remain locked out until power to the board is interrupted, then re-established or until the jumper is applied to the TEST pins for 0.5 seconds.

NOTE — The defrost control board ignores input from the low-pressure switch terminals as follows:

- during the TEST mode,
- during the defrost cycle,
- during the 90-second start-up period,
- and for the first 90 seconds each time the reversing valve switches heat/cool modes. **If the TEST pins are jumpered and the 5-minute delay is being bypassed, the LO PS terminal signal is not ignored during the 90-second start-up period.**

Diagnostic LEDs

The defrost board uses two LEDs for diagnostics. The LEDs flash a specific sequence according to the condition.

TABLE 1

Defrost Control Board Diagnostic LED		
Mode	Green LED (DS2)	Red LED (DS1)
No power to control	OFF	OFF
Normal operation / power to control	Simultaneous Slow FLASH	
Anti-short cycle lock-out	Alternating Slow FLASH	
Low pressure switch fault (Optional)	OFF	Slow FLASH
Low pressure switch lockout (Optional)	OFF	ON
High pressure switch fault (Optional)	Slow FLASH	OFF
High pressure switch lockout (Optional)	ON	OFF

B - Compressor

All TPA*S4 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 5. 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 6 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 7). One scroll remains stationary, while the other is allowed to "orbit" (figure 8). Note that the orbiting scroll does not rotate or turn but merely orbits the stationary scroll.

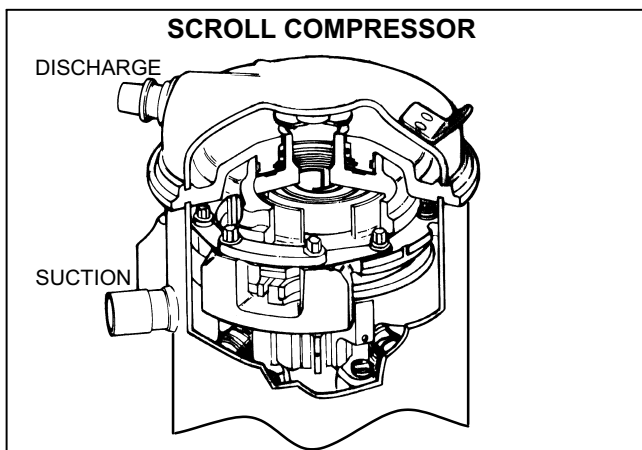


FIGURE 5

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

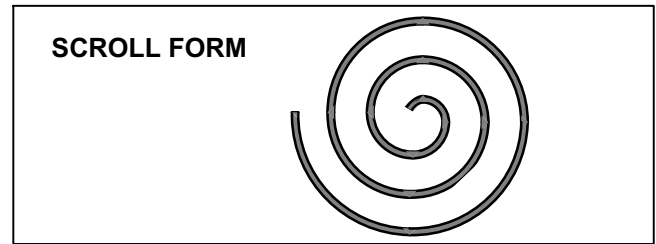


FIGURE 6

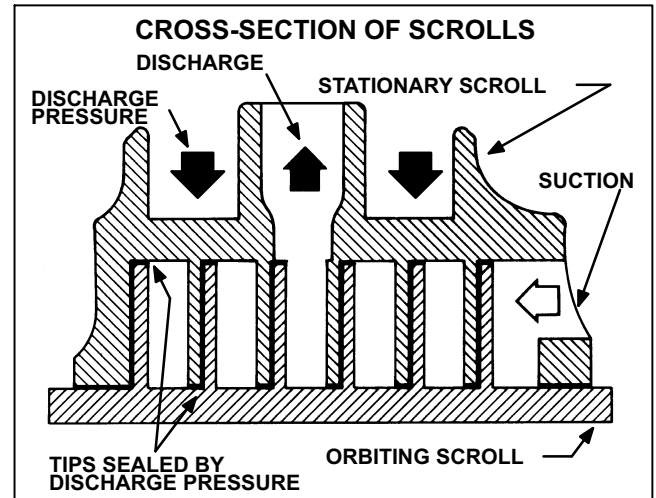


FIGURE 7

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 8 - 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 8 - 2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 8 - 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 7). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 7). During a single orbit, several pockets of gas are compressed simultaneously providing smooth continuous compression.

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.

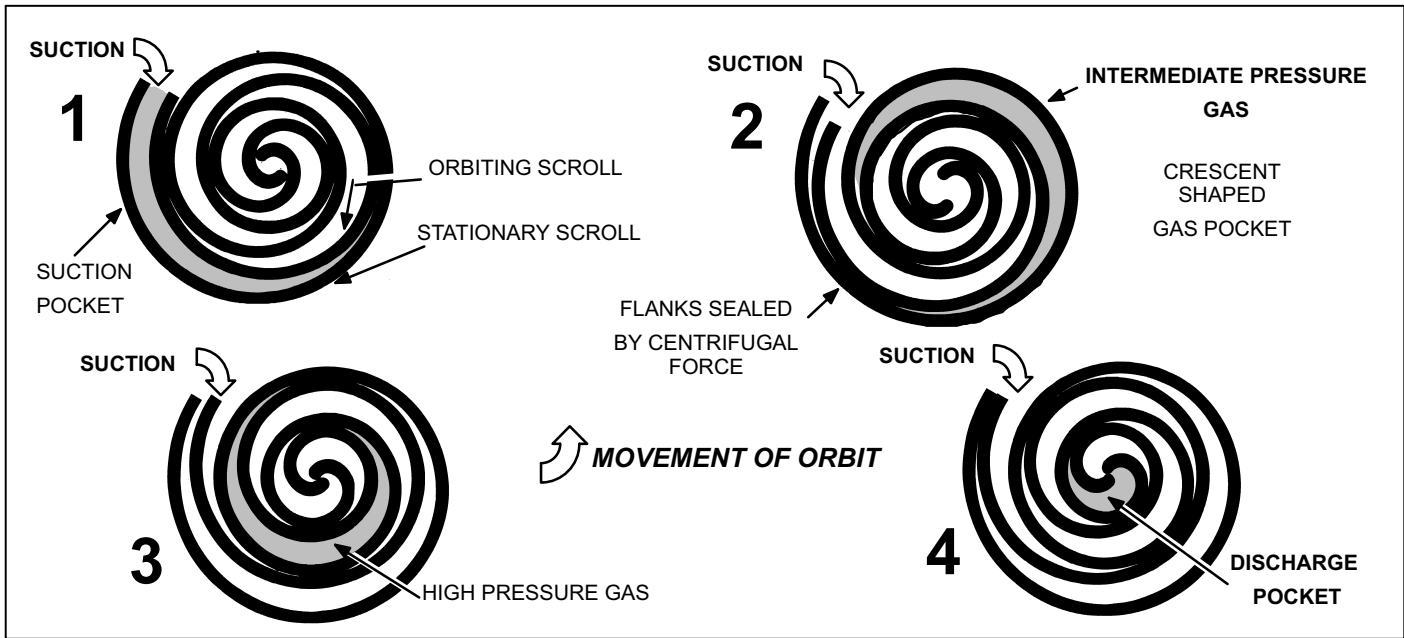


FIGURE 8

⚠ DANGER

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

C - Outdoor Fan Motor B4

All units use single-phase PSC fan motors. 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 TPA*S4s. Access to the condenser fan motor on all units is gained by removing the seven screws securing the fan assembly. See figure 9. The outdoor fan motor is removed from the fan guard by removing the four nuts found on the top panel. If outdoor fan motor must be replaced, align fan hub flush with motor shaft. Drip loops should be used in wiring when servicing motor.

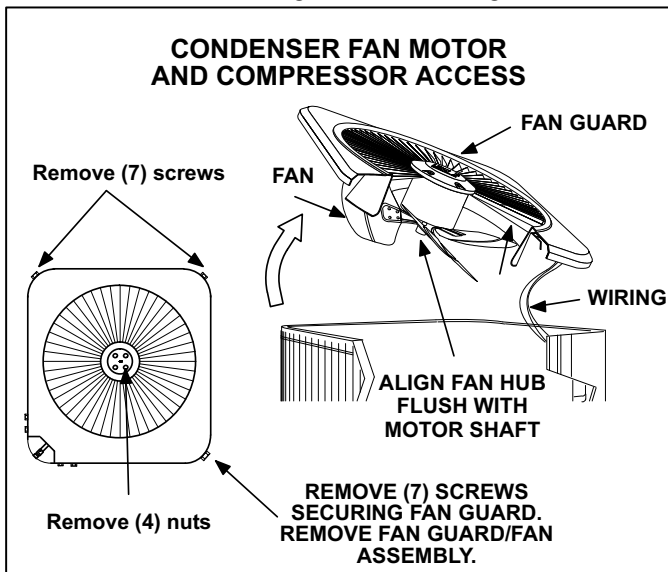


FIGURE 9

D - Reversing Valve L1 and Solenoid

A refrigerant reversing valve with electro-mechanical 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 9.

E - Crankcase Heater HR1 and Optional Thermostat S40

Crankcase heater HR1 prevents liquid from accumulating in the compressor. HR1 is controlled by crankcase heater thermostat S40, located on the liquid line. When liquid line temperature drops below 50° F, S40 closes energizing HR1. S40 opens when liquid line temperature reaches 70°.

F - High Pressure Switch S4

S4 is a manual re-set switch located on the liquid line. When liquid line pressure rises above the factory setting of 590 ± 10 psi, the switch opens and shuts off the compressor.

G - Low Pressure Switch S87

S87 is an auto-reset low pressure switch located on the suction line. The switch shuts of the compressor when suction pressure drops below the factory setting. The switch is ignored during the first 90 seconds of compressor start up, during defrost operation, 90 seconds after defrost operation and during test mode. The switch is factory set to open at 25 ± 5 psig and close at 40 ± 5 psig. These settings are not adjustable.

II - REFRIGERANT SYSTEM

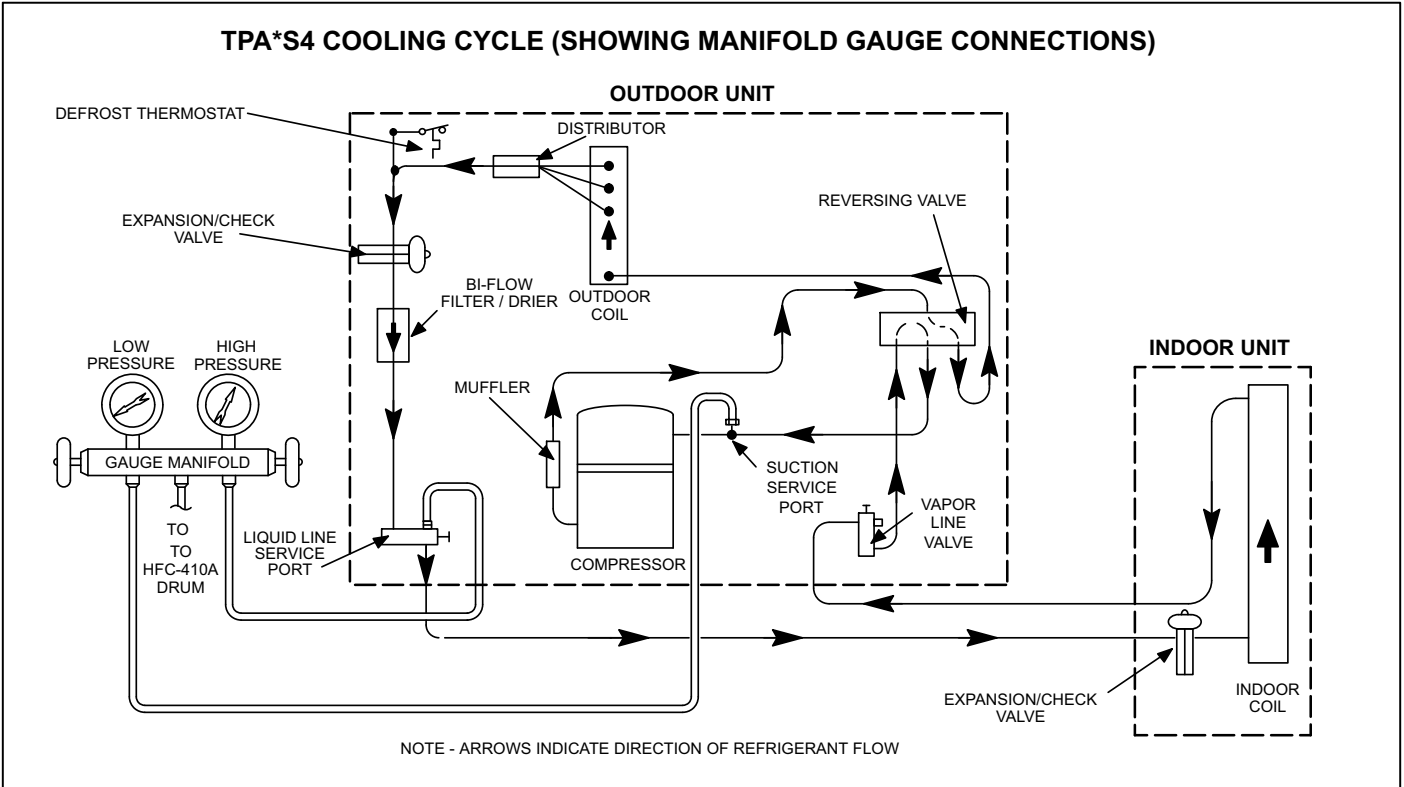


FIGURE 10

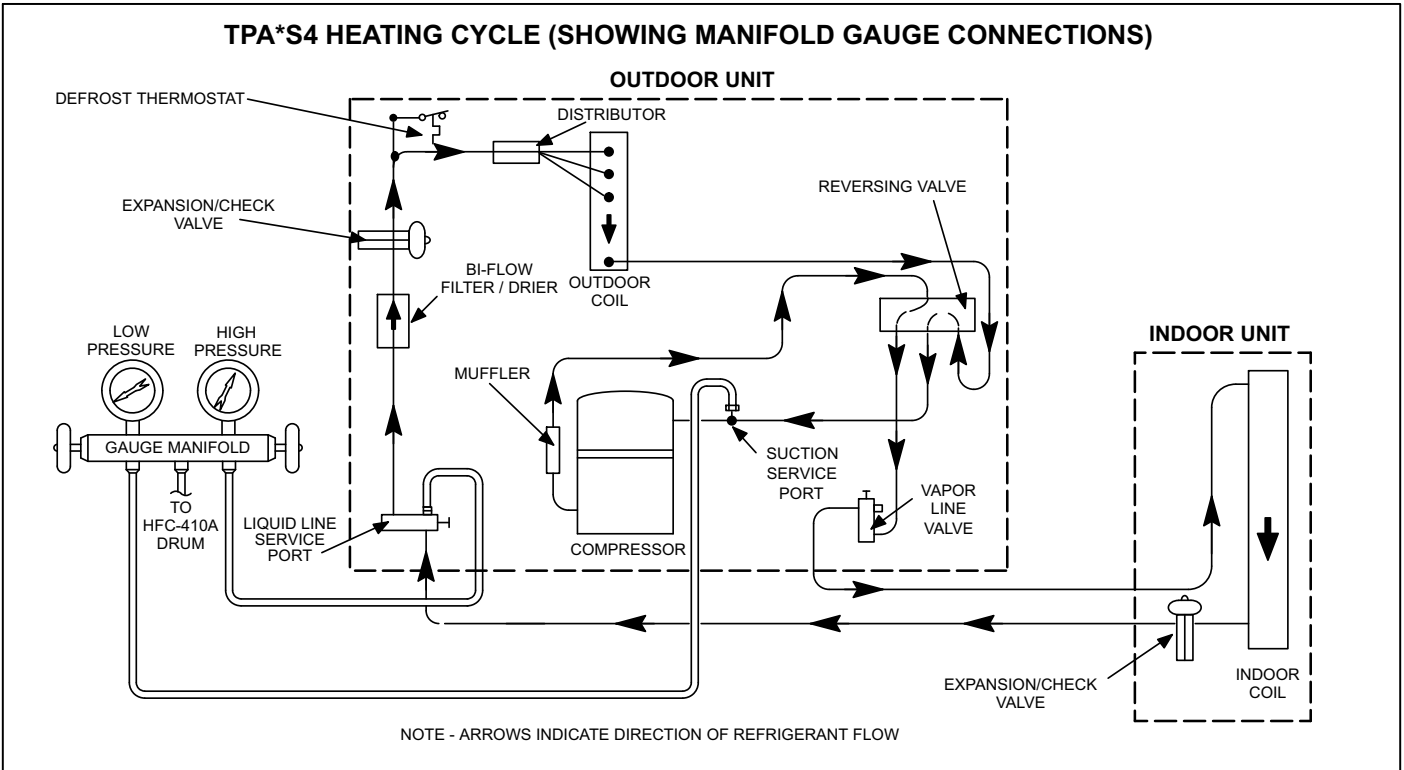


FIGURE 11

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 2.

TABLE 2

Refrigerant Line Sets					
Model	Field Connections		Recommended Line Set		
	Liquid Line	Vapor Line	Liquid Line	Vapor Line	L15 Line Sets
-036 -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 12 and 13) 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.

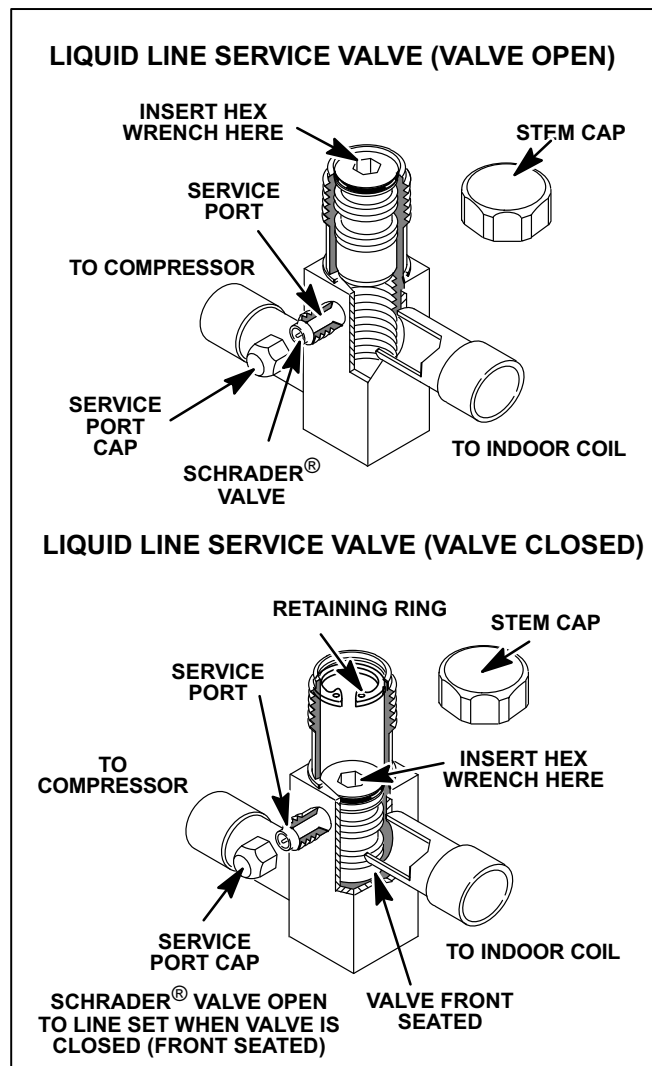


FIGURE 12

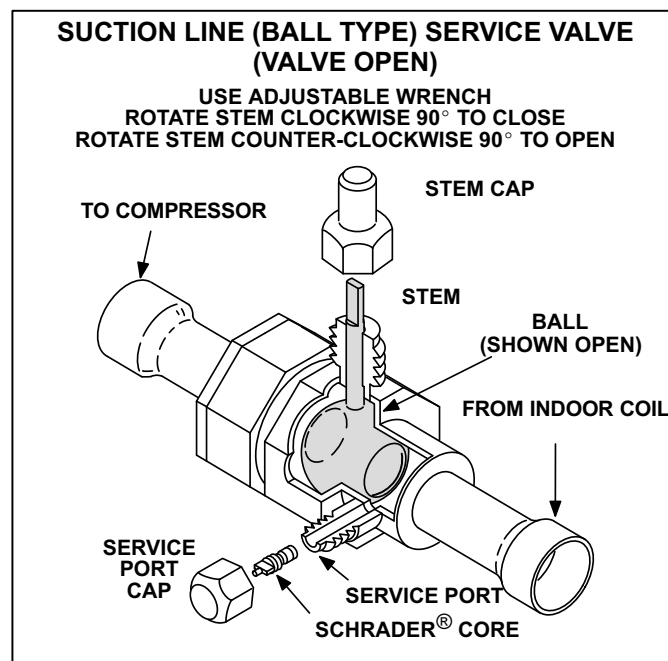


FIGURE 13

Vapor Line (Ball Type) Service Valve 5 ton unit only

A ball-type full service valve is used on TPA060S4N4xY units only. Valves are not re-buildable. If a valve has failed it must be replaced. A ball valve is illustrated in figure 13.

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.

III - CHARGING

A - Pumping Down System

⚠ CAUTION

Deep vacuum operation (operating compressor at 0 psig or lower) can cause internal fuseite 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.

B - 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 HCFC-22 (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.

C - 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.

D - Charging — TPA*S4N41Y through TPA*S4N42Y

The outdoor unit should be charged during warm weather. However, applications arise in which charging must occur in the colder months. *The method of charging is determined by the unit's refrigerant metering device and the outdoor ambient temperature.*

Measure the liquid line temperature and the outdoor ambient temperature as outlined below:

- 1.. Close manifold gauge set valves. Connect the manifold gauge set to the service valves.
 - low pressure gauge to *vapor* valve service port
 - high pressure gauge to *liquid* valve service port
- 2.. Connect the center manifold hose to an upright cylinder of HFC-410A.
- 3.. Set the room thermostat to call for heat. This will create the necessary load for properly charging the system in the cooling cycle.
- 4.. Use a digital thermometer to record the outdoor ambient temperature.
- 5.. When the heating demand has been satisfied, switch the thermostat to cooling mode with a set point of 68°F (20°C). When pressures have stabilized, use a digital thermometer to record the liquid line temperature.
- 6.. The outdoor temperature will determine which charging method to use. Proceed with the appropriate charging procedure.

Charge using the Weigh-In Method - Outdoor Temperature < 65°F (18°C)

If the system is void of refrigerant, or if the outdoor ambient temperature is cool, first, locate and repair any leaks and then weigh in the refrigerant charge into the unit.

- 1.. Recover the refrigerant from the unit.
- 2.. Conduct leak check; evacuate as previously outlined.
- 3.. Weigh in the unit nameplate charge. If weighing facilities are not available or if charging the unit during warm weather, use one of the following procedures.

Charge using the Subcooling Method - Outdoor Temperature < 65°F (18°C)

When the outdoor ambient temperature is below 65°F (18°C), use the subcooling method to charge the unit. It may be necessary to restrict the air flow through the outdoor coil to achieve pressures in the 200-250 psig (1379-1724 kPa) range. These higher pressures are necessary for checking the charge. Block equal sections of air intake panels and move obstructions sideways until the liquid pressure is in the 200-250 psig (1379-1724 kPa) range. See figure 14.

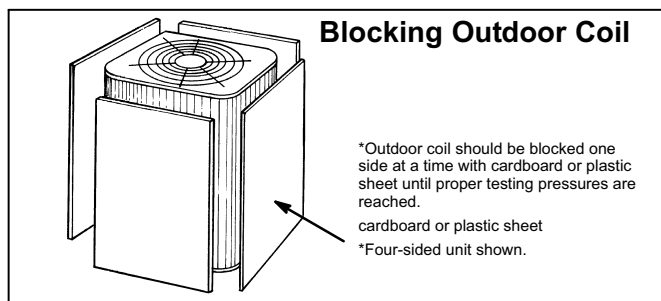


FIGURE 14

- 1.. With the manifold gauge hose still on the liquid service port and the unit's pressure stabilized, use a digital thermometer to record the liquid line temperature.
- 2.. At the same time, record the liquid line pressure reading.
- 3.. Use a temperature/pressure chart for HFC-410A to determine the saturation temperature for the liquid line pressure reading.
- 4.. Subtract the liquid line temperature from the saturation temperature (according to the chart) to determine subcooling.
- 5.. Compare the subcooling value results with those in table 3. If subcooling is greater than shown, recover some refrigerant. If subcooling is less than shown, add some refrigerant.

TABLE 3

TPA*S4N41Y through TPA*S4N42Y				
TPA036S4 Subcooling Values for Charging				
	— ° Saturation Temperature — ° Liquid Line Temperature = ° Subcooling Value			
Model	-036	-042	-048	-060
°F (°C)*	8 (4.4)	6 (3.3)	11 (6.1)	11 (6.1)
*F: +/-1.0°; C: +/-0.5°				

Charge using the Approach Method - Outdoor Temperature ≥ 65°F (18°C)

The following procedure is intended as a general guide and is for use on expansion valve systems only. For best results, indoor temperature should be 70°F (21°C) to 80°F (26°C). Monitor system pressures while charging.

- 1.. Record outdoor ambient temperature using a digital thermometer.
- 2.. Attach high pressure gauge set and operate unit for several minutes to allow system pressures to stabilize.
- 3.. Compare stabilized pressures with those provided in table 4, "Normal Operating Pressures." Pressures higher than those listed indicate that the system is overcharged. Pressures lower than those listed indicate that the system is undercharged. Verify adjusted charge using the approach method.

⚠ IMPORTANT

Use table 4 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.

- 4.. Use the same digital thermometer used to check outdoor ambient temperature to check liquid line temperature. Verify the unit charge using the approach method.
- 5.. The difference between the ambient and liquid temperatures should match the approach values given in table 5. If the values do not agree with the those in table 5, add refrigerant to lower the approach temperature or recover refrigerant from the system to increase the approach temperature.

TABLE 4

TPA*S4N41Y through TPA*S4N42Y				
Normal Operating Pressures¹				
MODEL	TPA036S4N4 1	TPA042S4N4 1	TPA048S4N4 1	TPA060S4N4 1
°F(°C) ²	Liquid/Vapor	Liquid/Vapor	Liquid/Vapor	Liquid/Vapor
Cooling Pressures³				
65 (18)	260 / 136	231 / 135	246 / 134	256 / 116
75 (24)	303 / 140	267 / 138	286 / 136	298 / 123
85 (29)	348 / 143	314 / 140	330 / 138	345 / 131
95 (35)	398 / 145	367 / 143	379 / 140	395 / 135
105 (41)	452 / 148	414 / 146	432 / 143	450 / 138
115 (45)	512 / 151	473 / 148	492 / 146	512 / 141
Heating Pressures³				
60 (15)	350 / 131	360 / 135	361 / 130	370 / 127
50 (10)	331 / 107	340 / 110	334 / 100	350 / 102
40 (4)	314 / 88	324 / 91	302 / 92	331 / 81
30 (-1)	290 / 74	307 / 73	300 / 73	309 / 62
20 (-7)	283 / 58	298 / 61	286 / 60	300 / 56

1 These are most-popular-match-up pressures. Indoor match up, indoor air quality, and indoor load cause pressures to vary.
 2 Temperature of the air entering the outdoor coil.
 3 Liquid ±10 and Vapor ±5 psig.

TABLE 5

TPA*S4N41Y through TPA*S4N42Y				
TPA036S4 Approach Values for Charging				
____ ° Liquid Line Temperature — ____ ° Outdoor Temperature = ____ ° Approach Temperature				
Model	-036	-042	-048	-060
°F (°C)*	13 (7.2)	9 (5)	6 (3.3)	9 (5)

NOTE - For best results, use the same electronic thermometer to check both outdoor-ambient and liquid-line temperatures.
 *F: +/-1.0°; C: +/-0.5°

D - Charging — TPA*S4N43Y

This system is charged with HFC-410A refrigerant which operates at much higher pressures than HCFC-22. The recommended check expansion valve is approved for use with HFC-410A. Do not replace it with a valve that is designed to be used with HCFC-22. This unit is NOT approved for use with coils that include metering orifices or capillary tubes.

The unit is factory-charged with the amount of HFC-410A refrigerant indicated on the unit rating plate. This charge is based on a matching indoor coil and outdoor coil with a 15 foot (4.6 m) line set. **For varying line set lengths and for various indoor unit matchups, the refrigerant charge must be adjusted per tables 6 (Page 14) and 8 (Page 15).** A blank space is provided on the unit rating plate to list the actual field charge.

⚠ IMPORTANT

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

Check Indoor Airflow before Charging

⚠ IMPORTANT

CHECK AIRFLOW BEFORE CHARGING!

NOTE - Be sure that filters and indoor and outdoor coils are clean before testing.

Temp. of air entering indoor coil °F	DT														
	80	78	76	74	72	70	68	66	64	62	60	58	56	54	52
80	24	24	23	23	22	22	22	20	19	18	17	16	15		
78	23	23	22	22	21	21	20	19	18	17	16	15	14		
76	22	22	21	21	20	19	18	17	16	15	14	13	12		
74	21	21	20	19	19	18	17	16	15	14	13	12	11		
72	20	20	19	18	17	17	16	15	14	13	12	11	10		
70	19	19	18	18	17	17	16	15	14	13	12	11	10		
	Wet-bulb °F	57	58	59	60	61	62	63	64	65	66	67	68	69	70

Step 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).

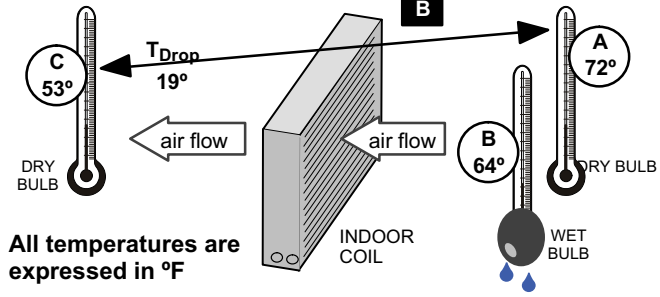
Step 2. Find temperature drop across coil—Measure the coil's dry bulb entering and leaving air temperatures (A and C). Temperature Drop Formula: $(T_{Drop}) = A \text{ minus } C$.

Step 3. Determine if fan needs adjustment—If the difference between the measured T_{Drop} and the desired DT ($T_{Drop} - DT$) is within $\pm 3^\circ$, no adjustment is needed. See examples: 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 $\pm 3^\circ$ range) no change
62°	10	-	15	=	-5	Decrease the airflow

Step 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 $\pm 3^\circ$.



All temperatures are expressed in °F

Figure 15. Checking Indoor Airflow over Evaporator Coil using Delta-T (DT) Chart

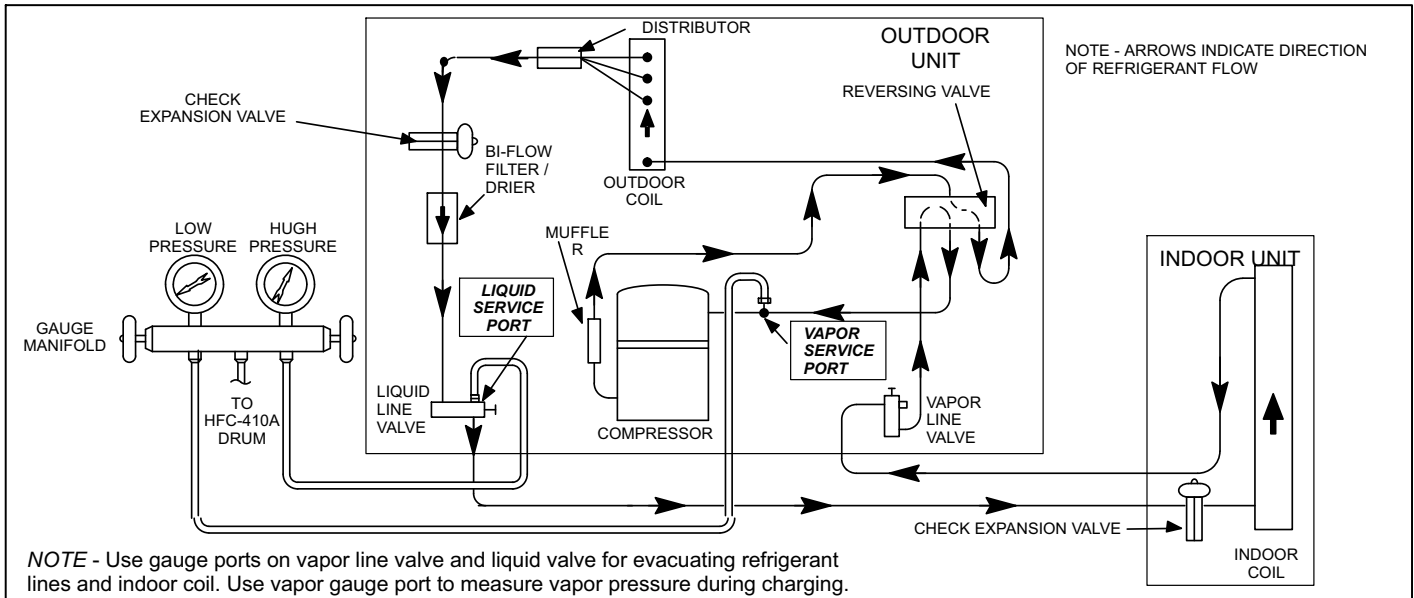


Figure 16. TPA*S4N43Y Cooling Cycle (Showing Gauge Manifold Connections)

Cooling mode indoor airflow check

Check airflow using the Delta-T (DT) process (figure 15).

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:

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

Setup for Charging

Connect the manifold gauge set to the unit's service ports (see figure 16):

- low pressure gauge to **vapor service port**
- high pressure gauge to **liquid service port**

Close manifold gauge set valves. Connect the center manifold hose to an upright cylinder of HFC-410A.

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 nameplate	+	Adjust amt. for variation in line set length (table 6)	+	Additional charge specified per indoor unit matchup (table 8)	=	Total charge
_____		_____		_____		_____

Table 7. Normal Operating Pressures - Liquid ± 10 and Vapor ± 5 PSIG*

⚠ IMPORTANT					
Use table 4 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.					
TPA*S4N43Y					
Mode	°F (°C)**	TPA036S4	TPA036S4	TPA036S4	TPA036S4
		Liquid / Vapor	Liquid / Vapor	Liquid / Vapor	Liquid / Vapor
Cooling	65 (18)	260 / 136	231 / 135	246 / 134	256 / 116
	75 (24)	303 / 140	267 / 138	286 / 136	298 / 123
	85 (29)	348 / 143	314 / 140	330 / 138	345 / 131
	95 (35)	398 / 145	367 / 143	379 / 140	395 / 135
	105 (41)	452 / 148	414 / 146	432 / 143	450 / 138
	115 (45)	512 / 151	473 / 148	492 / 146	512 / 141
Heating	60 (15)	350 / 131	366 / 129	348 / 119	379 / 127
	50(10)	331 / 111	348 / 110	334 / 105	361 / 109
	40 (4)	314 / 91	333 / 91	312 / 84	341 / 89
	30 (-1)	303 / 74	317 / 70	300 / 73	323 / 71
	20 (-7)	290 / 62	298 / 58	286 / 60	310 / 60

*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.

Weigh-in Charging Method

Weigh-in:

- 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 matchup amount per table 8. (If weighing facilities are not available, use the subcooling method.)

Table 6. 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.	

Subcooling Charging Method

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 8 lists all the Lennox recommended indoor unit matchups along with the charge levels for the various sizes of outdoor units.

Table 8. Adding Charge per Indoor Unit Matchup using Subcooling Method



Use cooling mode
60°F (15°C) –
Use heating mode

1. Check the airflow (figure 15, Page 13) 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 4, (Table 4 is a general guide. Expect minor pressures 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 68°F (20°C). 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 77°F (25°C). When pressures have stabilized, continue with step 6..
6. Read the liquid line temperature; record in the LIQ° space.
7. Read the liquid line pressure; then find its corresponding temperature in the temperature/ pressure table 13 and record it in the SAT° space.
8. Subtract LIQ° temp. from SAT° temp. to determine subcooling; record it in SC° space.
9. Compare SC° results with table below, being sure to note any additional charge for line set and/or matchup.
10. If subcooling value is greater than shown in table, remove refrigerant; if less than shown, add refrigerant.
11. If refrigerant is added or removed, repeat steps 5. through 10. to verify charge.

SAT° _____
LIQ° – _____
SC° = _____

D - Indoor Unit Matchups — TPA*S4N43Y

Table 9. TPA036S4N43Y

INDOOR MATCHUPS	Target Subcooling		*Add charge	
	Heat (±5°F)	Cool (±1°F)	lb	oz
CBX26UH-036	17	10	2	7
CBX27UH-036-230	10	5	2	7
CBX27UH-042-230	10	10	2	13
CBX32M-036, -042	10	5	2	7
CBX32MV-036-230	10	5	2	7
CBX40UHV-036	10	5	2	7
CH33-31A, -31B	10	5	2	8
CH33-36B	10	5	0	0
CH33-36C	10	5	0	5
CH33-42	10	5	2	8
CH33-44/48B	10	5	2	10
CH33-48C	10	5	2	10
CR33-30/36	25	5	0	6
CR33-48	25	5	2	8
CR33-50/60	10	5	2	10
CX34-36B	10	5	0	1
CX34-38 SN# 6007 and after	5	5	2	7
CX34-38 before SN# 6007	10	5	2	7
CX34-42B	10	5	0	1
CX34-44/48B	10	5	2	7

Table 10. TPA042S4N43Y

INDOOR MATCHUPS	Target Subcooling		*Add charge	
	Heat (±5°F)	Cool (±1°F)	lb	oz
CBX26UH-042	26	5	1	1
CBX26UH-048	10	12	4	5
CBX27UH-042-230	10	6	4	5
CBX27UH-048-230	10	6	4	5
CBX32M-036, -042	15	5	0	0
CBX32MV-036	15	5	0	0
CBX32MV-048-230	10	6	4	5
CBX40UHV-036	15	5	0	0
CBX40UHV-042, -048	10	6	4	5
CH33-43C, -48C	10	6	1	1
CH33-49C, -50/60C	10	6	4	5
CH33-60D	10	6	2	6
CR33-48	32	5	0	5
CR33-50/60	32	9	2	6
CR33-60	32	9	2	6
CX34-43C	10	6	1	1
CX34-49	10	6	3	7
CX34-50/60C	10	6	1	1

Table 11. TPA048S4N43Y

INDOOR MATCHUPS	Target Subcooling		*Add charge	
	Heat (±5°F)	Cool (±1°F)	lb	oz
CBX26UH-048	9	11	1	7
CBX26UH-060	24	18	2	7
CBX27UH-048-230	11	11	1	3
CBX27UH-060-230	24	18	2	7
CBX32M-048	11	11	1	3
CBX32M-060	11	11	1	3
CBX32MV-048	11	11	1	3
CBX32MV-060-230	11	11	1	3
CBX40UHV-048	11	11	1	3
CBX40UHV-060	11	11	1	3
CH33-43C	18	7	0	0
CH33-49C, -50/60C	11	11	1	3
CH33-60D	11	11	0	9
CH33-62D	11	11	1	10
CR33-50/60	25	7	0	9
CR33-60	25	7	0	9
CX34-49	11	11	1	1
CX34-60D	11	11	0	9

Table 12. TPA060S4N43Y

INDOOR MATCHUPS	Target Subcooling		*Add charge	
	Heat (±5°F)	Cool (±1°F)	lb	oz
CBX26UH-060	10	11	1	7
CBX27UH-060-230	10	9	0	13
CBX32MV-060	10	9	0	0
CBX32MV-068	10	9	0	9
CBX40UHV-060	10	9	0	0
CH33-60D	10	9	0	0
CH33-62D	10	9	0	11
CX34-62D	10	9	0	6

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

IV - MAINTENANCE

At the beginning of each heating or cooling season, the system should be cleaned as follows:

A - Outdoor Unit

- 1 - Clean and inspect condenser coil. (Coil may be flushed with a water hose).

NOTE - Make sure all power is disconnected before flushing coil with water.

- 2 - Visually inspect all connecting lines, joints and coils for evidence of oil leaks.

NOTE-Outdoor fan motors are permanently lubricated.

B - Indoor Coil

- 1 - Clean coil if necessary.

Table 13. 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	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
-2	45.6	34	105	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
4	53.6	39	115.8	74	214	109	360
5	55	40	118	75	217.4	110	365
6	56.4	41	120.3	76	220.9	111	370
7	57.9	42	122.6	77	224.4	112	375.1
8	59.3	43	125	78	228	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	116	396
12	65.4	47	134.6	82	242.7	117	401.3
13	67	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	121	423.2
17	73.5	52	147.4	87	262	122	428.8
18	75.2	53	150.1	88	266	123	434.5
19	77	54	152.8	89	270	124	440.2
20	78.7	55	155.5	90	274.1	125	445.9

- 2 - Check connecting lines and coil for evidence of oil leaks.

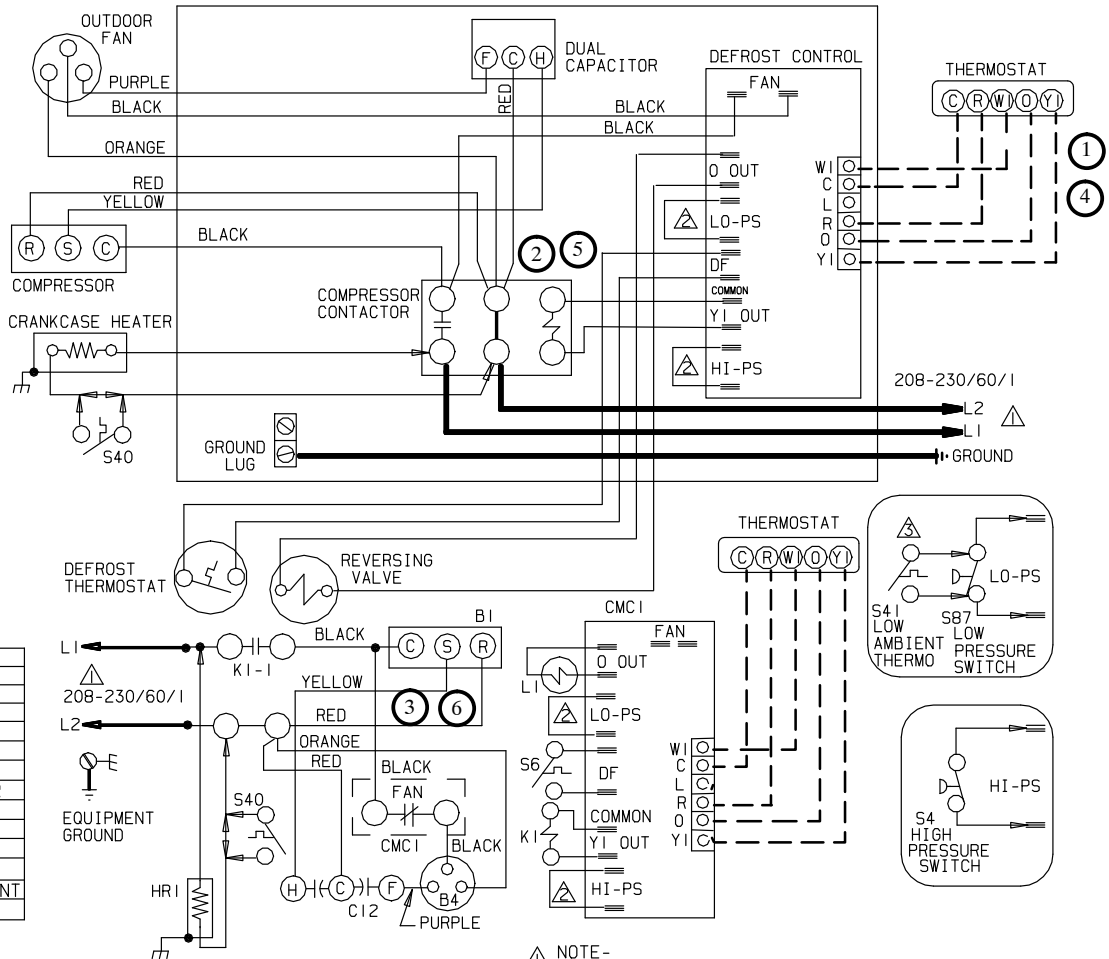
- 3 - Check condensate line and clean if necessary.

C - Indoor Unit

- 1 - Clean or change filters.
- 2 - Bearings are pre-lubricated and need no further oiling.
- 3 - Check all wiring for loose connections.
- 4 - Check for correct voltage at unit.
- 5 - Check amp-draw on blower motor.

V - WIRING DIAGRAM AND SEQUENCE OF OPERATION

TPA*S4 230 VOLT UNIT DIAGRAM



KEY	DESCRIPTION
	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

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

- NOTE -
FOR USE WITH COPPER CONDUCTORS ONLY. REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVER-CURRENT PROTECTION SIZE.
- △ CONNECTION MUST BE JUMPED WHEN OPTIONAL SWITCH IS NOT USED
 - △ S41 TO BE MOUNTED IN CONTROL BOX AND WIRED IN PARALLEL WITH LOW PRESSURE SWITCH

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- Assuming high pressure switch S4 and low pressure switch S87 are closed, 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:

During heating operation when outdoor coil temperature drops below 35°F (2°C) or 42°F (5.5°C) defrost switch (thermostat) S6 closes.

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.

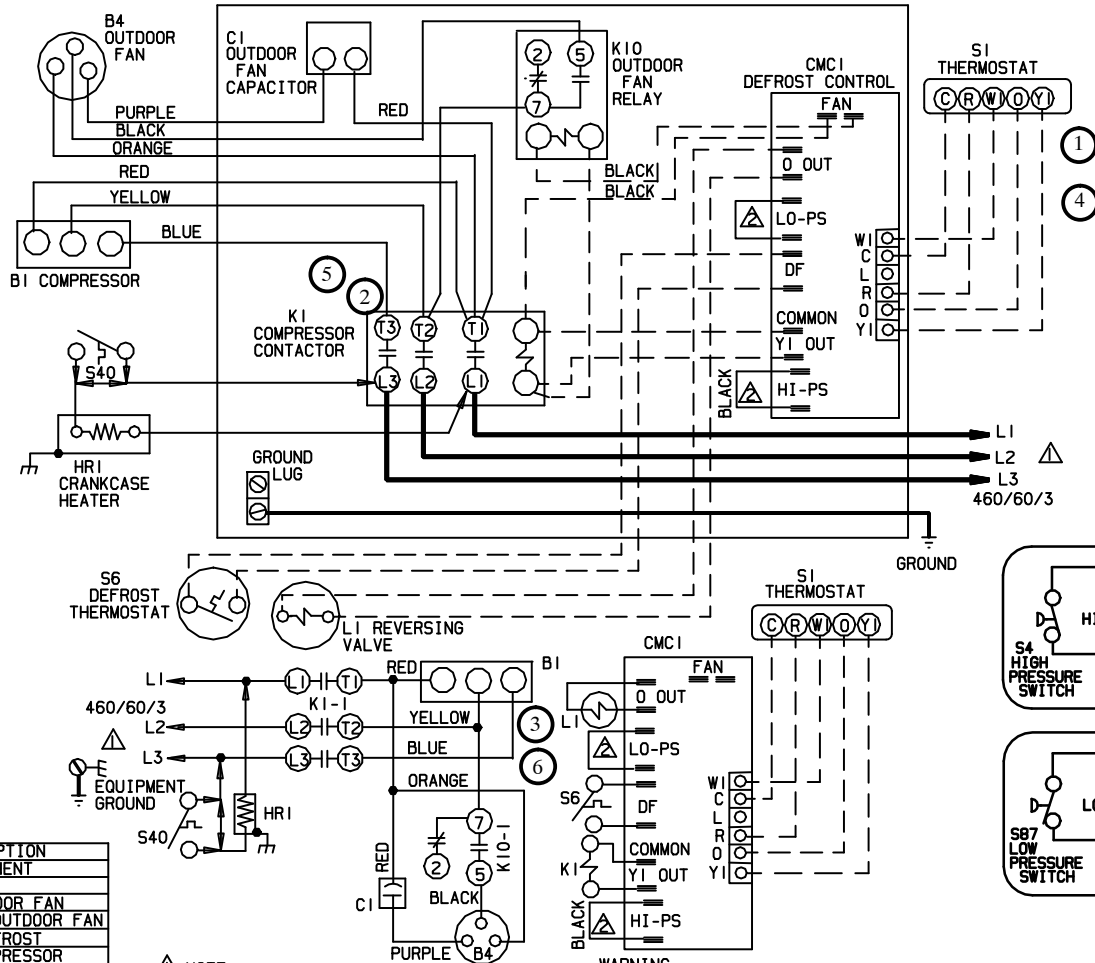
During defrost CMC1 energizes the reversing valve and W1 on the terminal strip (operating indoor unit on the first stage heat mode), while de-energizing outdoor fan motor B4.

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

When CMC1 resets, the reversing valve and W1 on the terminal strip are de-energized, while the outdoor fan motor B4 is energized.

When CMC1 resets, the reversing valve and W1 on the terminal strip are de-energized, while the outdoor fan motor B4 is energized.

TPA*S4 460 VOLT UNIT DIAGRAM



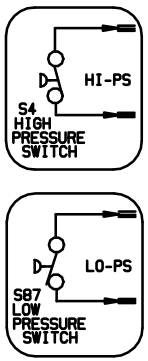
KEY	DESCRIPTION
B1	COMPRESSOR
B4	MOTOR-OUTDOOR FAN
C1	CAPACITOR-OUTDOOR FAN
CMC1	CONTROL-DEFROST
HR1	HEATER-CRANKCASE
K1	CONTACTOR-COMPRESSOR
K10	RELAY-OUTDOOR FAN
L1	VALVE-REVERSING
S4	SWITCH-LIMIT, HI PRESS
S6	SWITCH-DEFROST
S40	THERMOSTAT-CRANKCASE
S87	SWITCH-LOW PRESS

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

CONNECTION MUST BE JUMPED WHEN OPTIONAL SWITCH IS NOT USED

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

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



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- Assuming high pressure switch S4 and low pressure switch S87 are closed, 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:

During heating operation when outdoor coil temperature drops below 35°F (2°C) or 42°F (5.5°C) defrost switch (thermostat) S6 closes.

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.

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.

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

When CMC1 resets, the reversing valve and W1 on the terminal strip are de-energized, while the outdoor fan motor B4 is energized.

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1005	Supersedes
New Form No.	
535, 039W	

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