S−CLASS™ SPB*H4 Commercial Heat Pump

The SPB*H4 is a high efficiency commercial split-system heat pump unit, which features a two stage scroll compressor and HFC-410A refrigerant. SPB*H4 units are available in 3, 4 and 5 ton capacities. The series designed for use with an indoor unit with an expansion valve approved for HFC-410A. This manual is divided into sections which discuss the major components, refrigerant system, charging procedure, maintenance and operation sequence.

⚠ 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.

⚠ 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.

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

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MODEL NUMBER IDENTIFICATION

S P B 036 H 4 S 4 5 Y

Brand/Family
S = 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
048 = 4 Tons
060 = 5 Tons

Cooling Efficiency
H = High Efficiency

Refrigerant Type
4 = HFC-410A

Part Load Capability
S = Part load capabilities with multi-stage operation

Coil type
4 = Four-sided

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

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

SPECIFICATIONS — SPBXXXH4S41Y and SPBXXXH4S42Y

		SPB036H4	SPB048H4	SPB060H4
General Data	**Model No.**	**SPB036H4**	**SPB048H4**	**SPB060H4**
	Nominal Tonnage	3	4	5
Connections (sweat)	Liquid line (o.d.) - in.	3/8	3/8	3/8
	Vapor line (o.d.) - in.	7/8	1-1/8	1-1/8
Refrigerant	[1] HFC-410A charge furnished	12 lb. 8 oz.	15 lb. 7 oz.	13 lb. 8 oz.
Outdoor Coil	Net face area - sq. ft. Outer coil	18.67	24.5	24.93
	Inner coil	18.00	23.64	24.14
	Tube diameter - in.	5/16	5/16	5/16
	No. of rows	2	2	2
	Fins per inch	22	22	22
Outdoor Fan	Diameter - in.	22	22	26
	No. of blades	4	4	3
	Motor hp	1/6	1/4	1/3
	Cfm	3150	3980	4380
	Rpm	844	836	850
	Watts	215	305	280
Shipping Data - lbs. 1 pkg.		252	294	331

ELECTRICAL DATA

		SPB036H4	SPB048H4	SPB060H4
	Line voltage data - 60hz	208/230V-3ph	208/230V-3ph	208/230V-3ph
	[2] Maximum overcurrent protection (amps)	25	30	40
	[3] Minimum circuit ampacity	15.04	18.53	23.83
Compressor	Rated load amps	11.15	13.46	17.62
	Locked rotor amps	58	88	135
	Power factor	0.99	0.99	0.99
Outdoor Coil Fan Motor	Full load amps	1.1	1.7	1.8
	Locked rotor amps	2.1	3.1	2.9

SPECIFICATIONS — SPBXXXH4S43Y and SPBXXXH4S44Y

General Data	**Model No.**	**SPB036H4**	**SPB048H4**	**SPB060H4**
	Nominal Tonnage	3	4	5
Connections (sweat)	Liquid line (o.d.) - in.	3/8	3/8	3/8
	Vapor line (o.d.) - in.	7/8	1-1/8	1-1/8
Refrigerant	[1] HFC-410A charge furnished	10 lb. 4 oz.	15 lb. 7 oz.	11 lb. 7 oz.
Outdoor Coil	Net face area - sq. ft. Outer coil	18.67	24.5	24.93
	Inner coil	18.00	23.64	24.14
	Tube diameter - in.	5/16	5/16	5/16
	No. of rows	2	2	2
	Fins per inch	22	22	22
Outdoor Fan	Diameter - in.	22	22	26
	No. of blades	4	4	3
	Motor hp	1/6	1/4	1/3
	Cfm	3150	3980	4380
	Rpm	844	836	850
	Watts	215	305	280
Shipping Data - lbs. 1 pkg.		252	294	331

ELECTRICAL DATA

	Line voltage data - 60hz	208/230V-3ph	208/230V-3ph	208/230V-3ph
	[2] Maximum overcurrent protection (amps)	25	30	40
	[3] Minimum circuit ampacity	15.04	18.53	23.83
Compressor	Rated load amps	11.15	13.46	17.62
	Locked rotor amps	58	88	135
	Power factor	0.99	0.99	0.99
Outdoor Coil Fan Motor	Full load amps	1.1	1.7	1.8
	Locked rotor amps	2.1	3.1	2.9

SPECIFICATIONS — SPBXXXH4S45Y

		SPB036H4	SPB048H4	SPB060H4
General Data	**Model No.**	**SPB036H4**	**SPB048H4**	**SPB060H4**
	Nominal Tonnage	3	4	5
Connections (sweat)	Liquid line (o.d.) - in.	3/8	3/8	3/8
	Vapor line (o.d.) - in.	7/8	1-1/8	1-1/8
Refrigerant	[1] HFC-410A charge furnished	10 lb. 9 oz.	11 lb. 12 oz.	12 lb. 15 oz.
Outdoor Coil	Net face area - sq. ft. Outer coil	21.0	22.17	29.09
	Inner coil	20.27	21.51	28.16
	Tube diameter - in.	5/16	5/16	5/16
	No. of rows	2	2	2
	Fins per inch	22	22	22
Outdoor Fan	Diameter - in.	22	26	26
	No. of blades	4	3	3
	Motor hp	1/4	1/3	1/3
	Cfm	3900	4100	4350
	Rpm	830	855	820
	Watts	2195	265	195
Shipping Data - lbs. 1 pkg.		273	294	353
ELECTRICAL DATA				
	Line voltage data - 60hz	208/230V-3ph	208/230V-3ph	208/230V-3ph
	[2] Maximum overcurrent protection (amps)	25	30	40
	[3] Minimum circuit ampacity	15.6	18.6	24.8
Compressor	Rated load amps	11.15	13.46	17.62
	Locked rotor amps	58	88	135
	Power factor	0.99	0.99	0.99
Outdoor Coil Fan Motor	Full load amps	1.7	1.8	2.8

⚠ WARNING

Warranty will be voided if covered equipment is removed from original installation site. Warranty will not cover damage or defect resulting from: Flood, wind, lightning, or installation and operation in a corrosive atmosphere (chlorine, fluorine, salt, recycled waste water, urine, fertilizers, or other damaging chemicals).

⚠ 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 non-compliance.

⚠ IMPORTANT

This unit must be matched with an indoor coil as specified in Lennox SPB036H4 Engineering Handbook. Coils previously charged with HCFC-22 must be flushed.

⚠ 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.

I - UNIT INFORMATION

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. A misapplied system will cause erratic operation and can result in early compressor failure.

⚠ CAUTION

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

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

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

Remove the louvered panels as follows:

1. Remove 2 screws, allowing the panel to swing open slightly (see figure 1).
2. **Hold the panel firmly throughout this procedure.** Rotate bottom corner of panel away from hinge corner post until lower 3 tabs clear the slots (see figure 1, Detail B).
3. Move panel down until lip of upper tab clears the top slot in corner post (see figure 1, Detail A).

Position and Install Panel — Position the panel almost parallel with the unit (figure 1, Detail D) with the “screw side” as close to the unit as possible. Then, in a continuous motion:

- Slightly rotate and guide the lip of top tab inward (figure 1, Details A and C); then upward into the top slot of the hinge corner post.
- Rotate panel to vertical to fully engage all tabs.
- Holding the panel’s hinged side firmly in place, close the right-hand side of the panel, aligning the screw holes.

When panel is correctly positioned and aligned, insert the screws and tighten.

Removing/Installing Louvered Panels

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

Panel shown slightly rotated to allow top tab to exit (or enter) top slot for removing (or installing) panel.

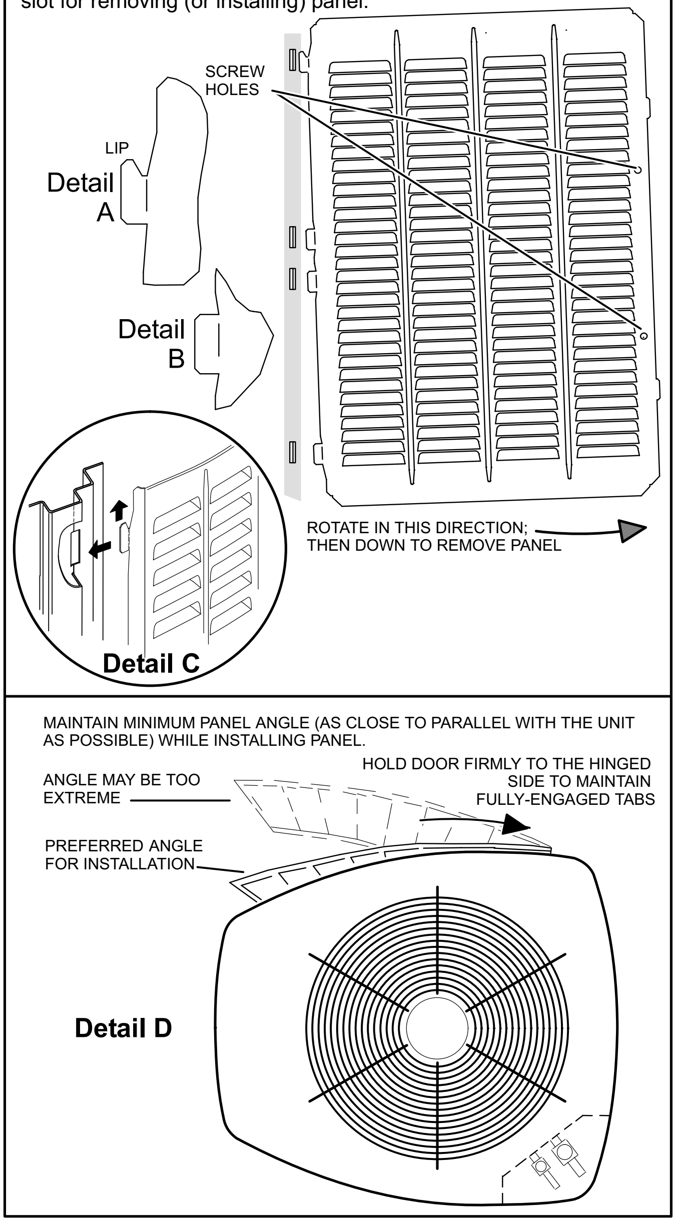


FIGURE 1

II - UNIT COMPONENTS

Unit components are illustrated in figure 2.

SPB*H4 UNIT COMPONENTS

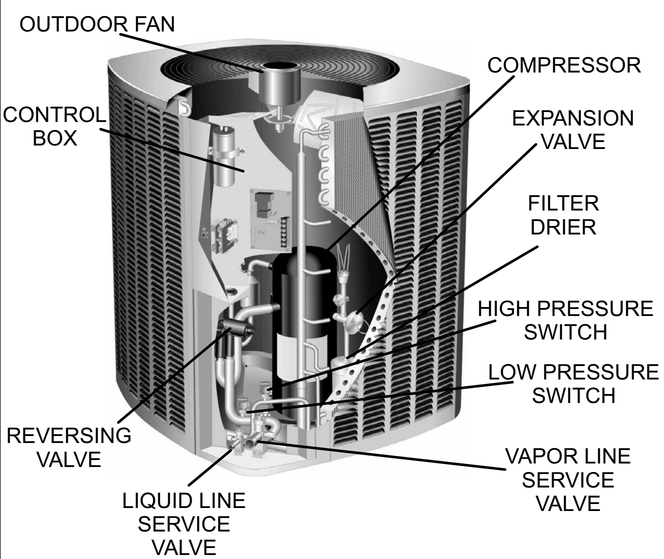


FIGURE 2

A - Control Box (Figure 3)

SPB*H4 units are not equipped with a 24V transformer. All 24 VAC controls are powered by the indoor unit. Refer to wiring diagram.

UNIT CONTROL BOX

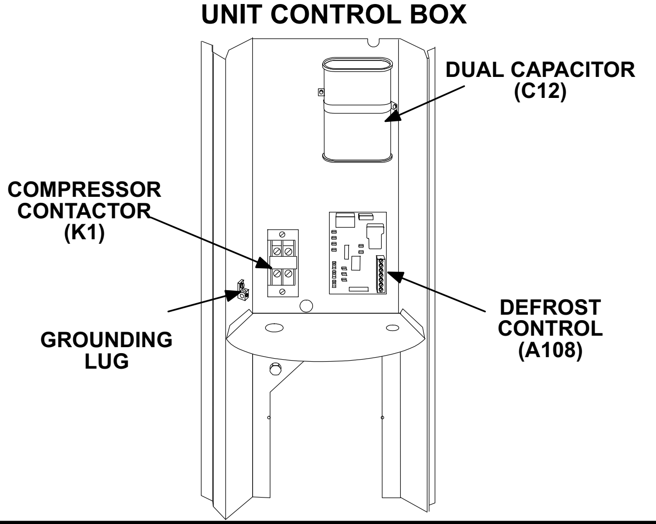


FIGURE 3

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 4.

24V THERMOSTAT TERMINAL STRIP

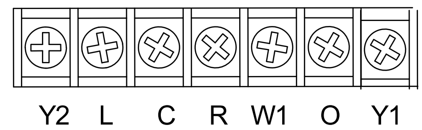


FIGURE 4

1 - Compressor Contactor K1

The compressor is energized by a contactor located in the control box. See figure 3. Three-pole contactors are used in all SPB*H4 series units. K1 is energized through the defrost control board by the indoor thermostat demand.

⚠ 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.

2 - Dual Capacitor C12

The compressor and fan in SPB*H4 series units use permanent split capacitor motors. The capacitor is located inside the unit control box (see figure 3). 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. See side of capacitor for ratings.

3 - Defrost Control

The demand defrost controller 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 5.

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.

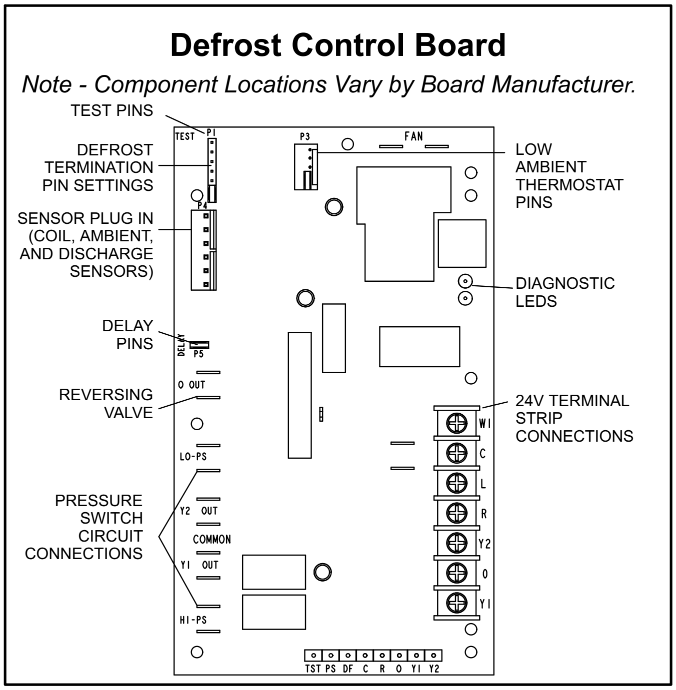


FIGURE 5

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 Board 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.

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 board will cycle off the compressor, and the strike counter in the board will count one strike.

5-Strike Lockout Feature

The internal control logic of the board 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 board through a field-replaceable harness assembly that plugs into the board. Through the sensors, the board detects outdoor ambient, coil, and discharge temperature fault conditions. As the detected temperature changes, the resistance across the sensor changes. Sensor resistance values can be checked by ohming across pins shown in table 1. The graph in figure 6 shows sensor temperature to resistance range.

NOTE - When checking the ohms across a sensor, be aware that a sensor showing a resistance value that is not within the range shown in table 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 need to be replaced.

TABLE 1

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

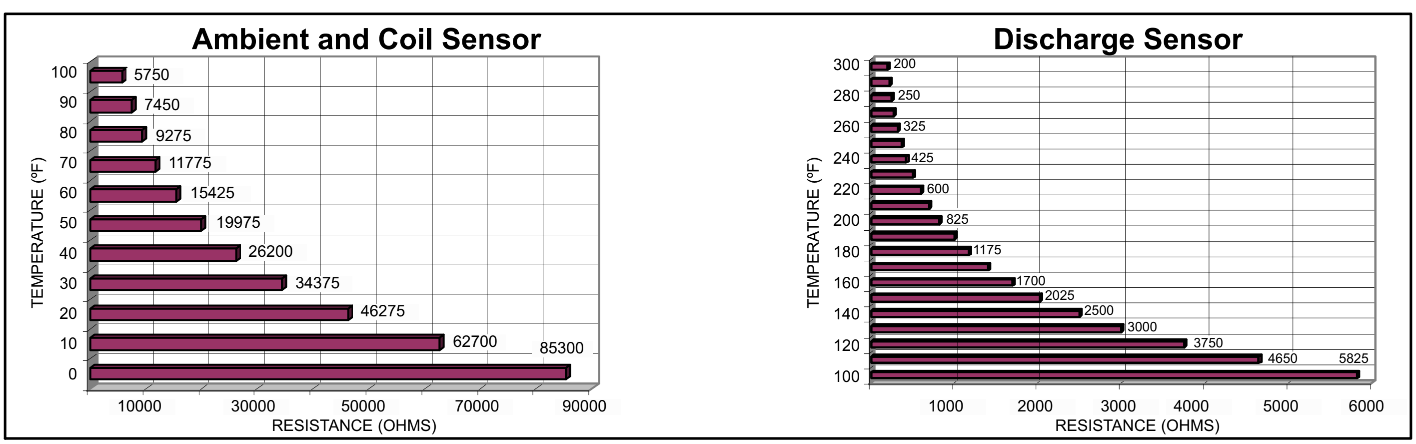


FIGURE 6

Sensor Locations

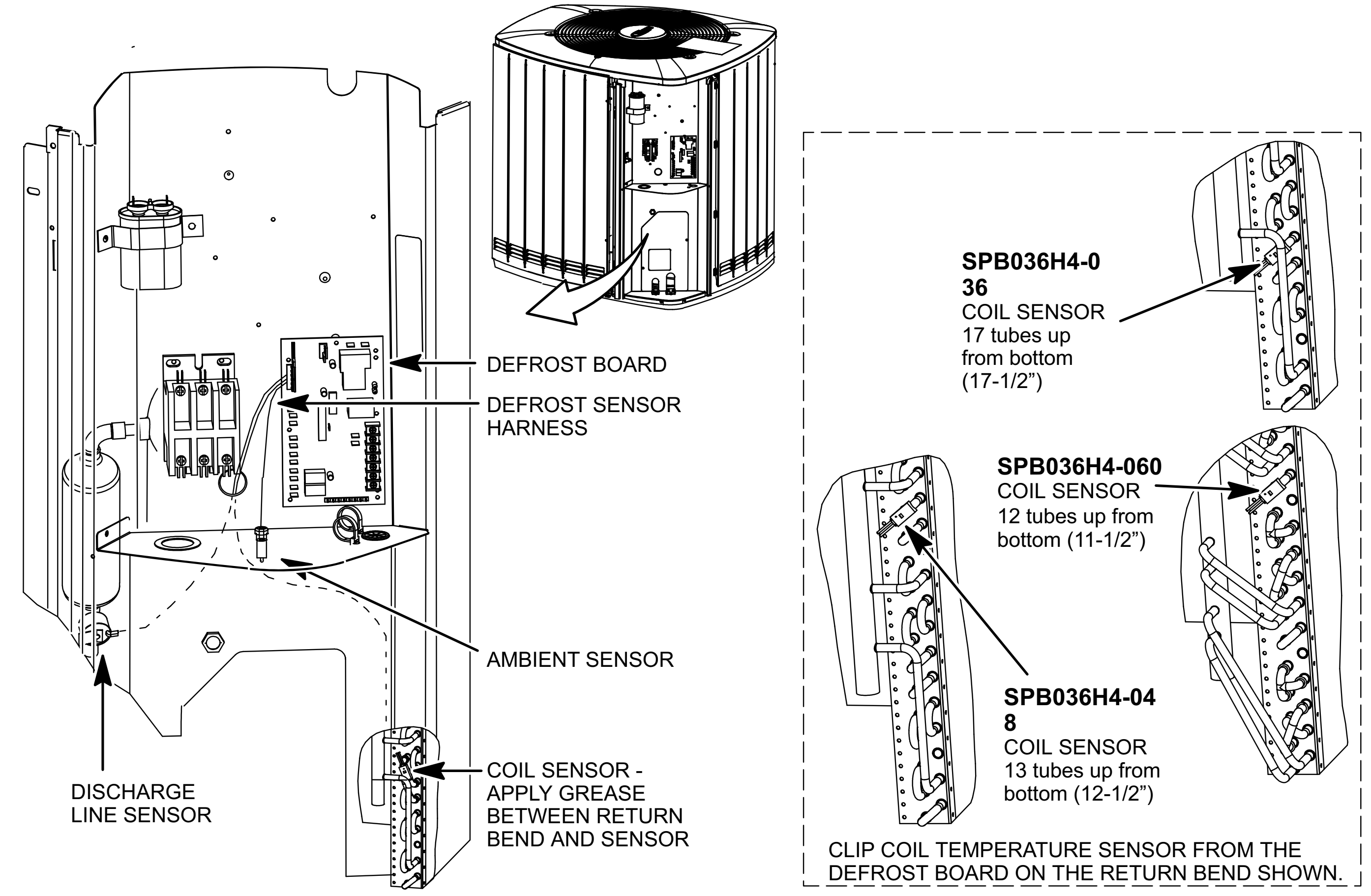


FIGURE 7

Ambient Sensor — The ambient sensor (shown in detail A, figure 7) considers outdoor temperatures below -35°F (-37°C) or above 120°F (48°C) as a problem. If the ambient sensor is detected as being open, shorted or out of the temperature range of the sensor, the board will not perform demand defrost operation. The board 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.

Coil Sensor — The coil temperature sensor (shown in detail B, figure 7) considers outdoor temperatures below -35°F (-37°C) or above 120°F (48°C) as a problem. 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.

Discharge Line Sensor — If the discharge line temperature (shown in figure 7) exceeds a temperature of 300°F (148°C) during compressor operation, the board will de-energize the compressor contactor output (and the defrost output, if active). The compressor will remain off until the discharge temperature has dropped below 225°F (107°C) and the 5-minute anti-short cycle delay has been satisfied. This sensor has two fault and lockout codes:

4. If the board recognizes five high discharge line temperature faults during a single (Y1) compressor demand, it reverts to a lockout mode and displays the appropriate code. This code detects shorted sensor or high discharge temperatures. (Code on board is "Discharge Line Temperature Fault and Lockout").
5. If the board recognizes five temperature sensor range faults during a single (Y1) compressor demand, it reverts to a lockout mode and displays the appropriate code. The board detects open sensor or out-of-temperature sensor range. This fault is detected by allowing the unit to run for 90 seconds before checking sensor resistance. If the sensor resistance is not within range after 90 seconds, the board will count one fault. After 5 faults, the board will lockout. (Code on board is "Discharge Sensor Fault and Lockout").

The discharge line sensor, which covers a range of 150°F (65°C) to 350°F (176°C), is designed to mount on a ½" refrigerant discharge line.

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.

Second-Stage Operation — If the board receives a call for second-stage compressor operation “Y2” in heating or cooling mode and the first-stage compressor output is active, the second-stage compressor solenoid output will be energized.

If first-stage compressor output is active in heating mode and the outdoor ambient temperature is below the selected compressor lock-in temperature, the second-stage compressor solenoid output will be energized without the “Y2” room thermostat input. If the jumper is not connected to one of the temperature selection pins on P3 (40, 45, 50, 55°F), the default lock-in temperature of 40°F (4.5°C) will be used.

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

Defrost Temperature Termination Shunt (Jumper) Pins — The defrost board 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 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. 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 the TEST pins are jumpered.

Operational Description

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

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

Calibration of the board 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 board initiates a defrost cycle based on either frost detection or time.

- **Frost Detection** — If the compressor runs longer than 34 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 board 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 34 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 board fails to calibrate, another defrost cycle will be initiated after 45 minutes (90 minutes -1 to -4 boards) 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 board 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 34 minutes of run time.

Test Mode — When Y1 is energized and 24V power is being applied to the board, 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 board **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). Board timings are reduced, the low-pressure switch and loss of charge detection fault is ignored and the board will clear any active lockout condition.

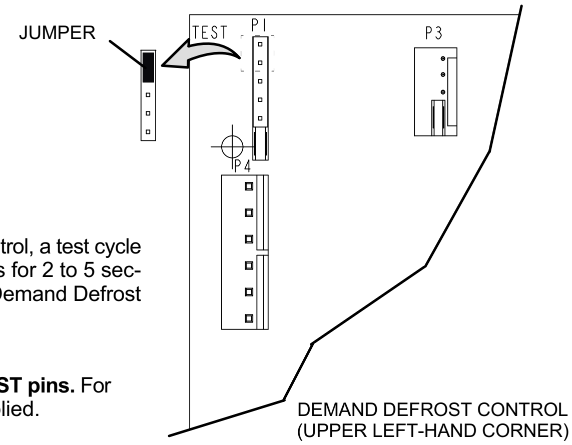
Each test pin shorting will result in one test event. For each “TEST” the shunt (jumper) must be removed for at least 1 second and reapplied. Refer to flow chart (figure 8) for “TEST” operation.

NOTE — The Y1 input must be active (ON) and the “O” room thermostat terminal into board must be inactive.

Defrost Board Diagnostics

See table 2 to determine defrost board 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 fault 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 8

TABLE 2

Defrost Control Board Diagnostic LEDs

DS2 Green	DS1 Red	Condition/Code	Possible Cause(s)	Solution
OFF	OFF	Power problem	No power (24V) to board terminals R and 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. Board 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. Board will not perform demand or time/temperature defrost operation. (System will still heat or cool).	
ON	ON	Circuit Board Failure	Indicates that board has internal component failure. Cycle 24 volt power to board. If code does not clear, replace board.	
FAULT and 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 and 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***		
SLOW Flash	ON	Discharge Line Temperature Fault	This code detects shorted sensor or high discharge temperatures. If the discharge line temperature exceeds a temperature of 300ºF (148ºC) during compressor operation, the board will de-energize the compressor contactor output (and the defrost output if active). The compressor will remain off until the discharge temperature has dropped below 225ºF (107ºC).	
FAST Flash	ON	Discharge Line Temperature ***LOCKOUT***		
OFF	Fast Flash	Discharge Sensor Fault	The board detects open sensor or out of temperature sensor range. This fault is detected by allowing the unit to run for 90 seconds before checking sensor resistance. If the sensor resistance is not within range after 90 seconds, the board will count one fault. After 5 faults, the board will lockout.	
Fast Flash	OFF	Discharge Sensor ***LOCKOUT***		

B - Two-Stage Scroll Compressor (B1)

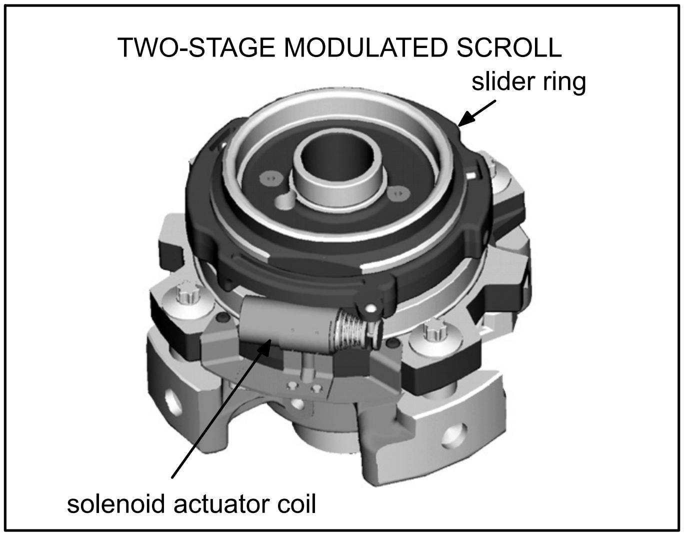


FIGURE 9

The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 1.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 10 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 11). One scroll remains stationary, while the other is allowed to “orbit” (figure 12). Note that the orbiting scroll does not rotate or turn but merely “orbits” the stationary scroll.

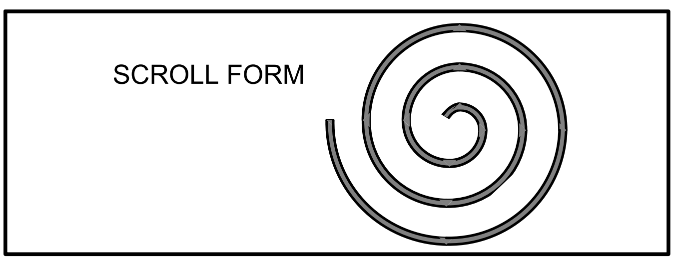


FIGURE 10

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 4 - 1). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 4 - 2). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 4 -3). When the compressed gas reaches the center, it is discharged vertically into a chamber and discharge port in the top of the compressor (figure9). The discharge pressure forcing down on the top scroll helps seal off the upper and lower edges (tips) of the scrolls (figure 11). During a single orbit, several pockets of gas are compressed simultaneously providing smooth continuous compression.

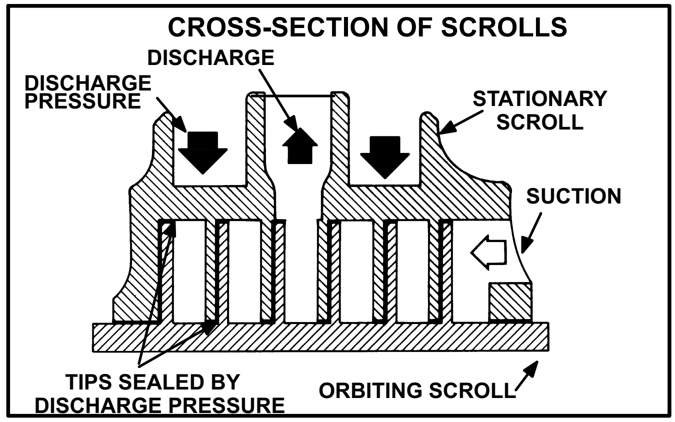


FIGURE 11

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.

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. This type of damage can be detected and will result in denial of warranty claims. The scroll compressor can be used to pump down refrigerant as long as the pressure is not reduced below 7 psig.

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

The scroll compressors in all SPB*H4 model units are designed for use with HFC-410A refrigerant and operation at high pressures. Compressors are shipped from the factory with 3MA (32MMMA) P.O.E. oil. See electrical section in this manual for compressor specifications.

TWO-STAGE OPERATION

The two-stage scroll compressor operates like any standard scroll compressor with the exception the two-stage compressor modulates between first stage (low capacity approximately 67%) and second stage (high capacity). Modulation occurs when gas is bypassed through bypass ports (figure 13 bypass ports open) in the first suction pocket. This bypassing of gas allows the compressor to operate on first stage (low capacity) if thermostat demand allows. Indoor thermostat setting will determine first or second stage operation. The compressor will operate on first-stage until demand is satisfied or the indoor temperature reaches the thermostat set point calling for second-stage.

Second-stage (high capacity) is achieved by blocking the bypass ports (figure 13 bypass ports closed) with a slider ring. The slider ring begins in the open position and is controlled by a **24VDC** internal solenoid. On a Y2 call the internal solenoid closes the slider ring, blocking the bypass ports and bringing the compressor to high capacity. Two-stage modulation can occur during a single thermostat demand as the motor runs continuously while the compressor modulates from first-stage to second- stage.

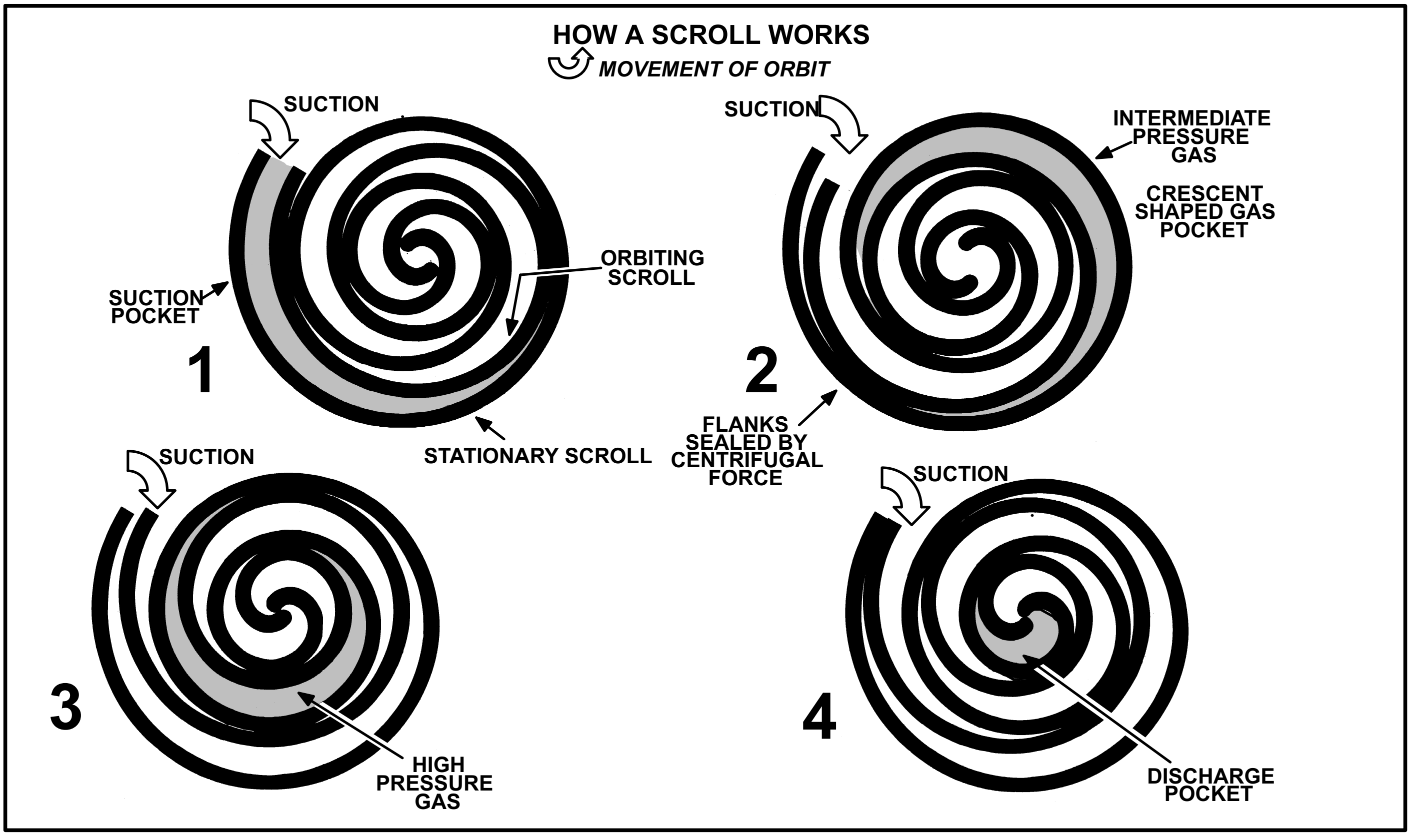


FIGURE 12

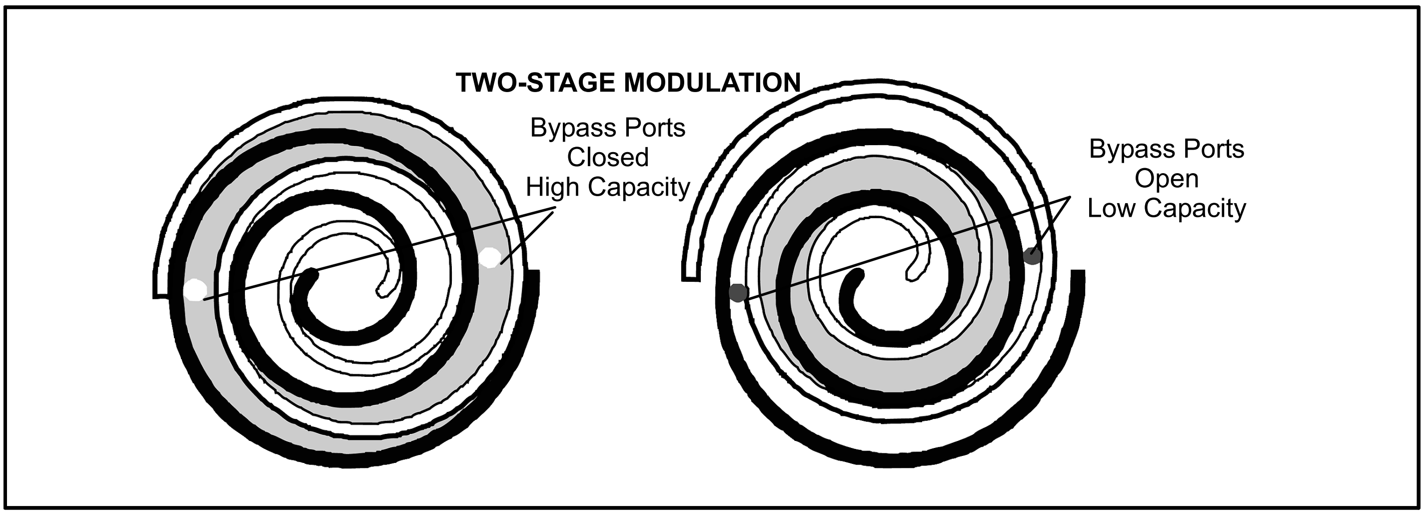


FIGURE 13

INTERNAL SOLENOID (L34)

The internal unloader solenoid controls the two-stage operation of the compressor by shifting a slide ring mechanism to open two by-pass ports in the first compression pocket of the scrolls in the compressor. The internal solenoid is activated by a **24 volt direct current solenoid coil.** The coil power requires 20VAC. The internal wires from the solenoid in the compressor are routed to a 2 pin fusite connection on the side of the compressor shell. The external electrical connection is made to the compressor with a molded plug assembly. This plug contains a full wave rectifier that converts 24 volt AC into 24 volt DC power to power the unloader solenoid. Refer to unit diagram for internal circuitry view of plug.

If it is suspect the unloader is not operating properly, check the following

⚠ IMPORTANT

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

STEP 1 Confirm low to high capacity compressor operation

Tools required

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

Procedure

1. Turn main power ”OFF” to outdoor unit.
2. Adjust room thermostat set point above (heating operation on heat pump) or below (cooling operation) the room temperature 5ºF.
3. Remove control access panel. Install refrigeration gauges on unit. Attach the amp meter to the common (black wire) wire of the compressor harness. Attach thermometer to discharge line as close as possible to the compressor.
4. Turn toggle switch ”OFF” and install switch in series with Y2 wire from room thermostat.
5. Cycle main power ”ON.”
6. Allow pressures and temperatures to stabilize before taking any measured reading (may take up to 10 minutes).

NOTE — Block outdoor coil to maintain a minimum of 375 psig during testing).

7. Record all of the readings for the Y1 demand on table 3.
8. Close switch to energize Y2 demand.
9. Allow pressures and temperatures to stabilize before taking any measured reading (this may take up to 10 minutes).
10. Record all of the readings of Y2 demand on table 3.

NOTE — On new installations or installations that have shut down for an extended period of time, if the compressor does not cycle from low stage to high stage on the first attempt, it may be necessary to recycle the compressor back down to low stage and back up to high stage a few times in order to get the bypass seals to properly seat

Compare Y1 readings with Y2 readings in table 3. Some readings should be higher, lower or the same. If the readings follow what table 3 specifies, the compressor is operating and shifting to high capacity as designed. If the readings do not follow what table 3 specifies, continue to step 2 to determine if problem is with external solenoid plug power.

TABLE 3

Unit Readings	Compressor Operation		
	Y1 - 1st-Stage	Expected Results	Y2 - 2nd-Stage
Compressor			
Voltage		Same	
Amperage		Higher	
Condenser Fan motor			
Amperage		Same or Higher	
Temperature			
Ambient		Same	
Outdoor Coil Discharge Air		Higher in Cooling Lower in Heating	
Compressor Discharge Line		Higher	
Indoor Return Air		Same	
Indoor Coil Discharge Air		Lower in Cooling Higher in Heating	
Pressures			
Suction (Vapor)		Lower	
Liquid		Higher	

STEP 2 Confirm DC voltage output on compressor solenoid plug

A - Compressor solenoid plug **WITH** built in full wave-rectifier (LSOM I) that converts 24 volt AC into 24 volt DC power. See Table 1 for units equipped with the LSOM I.

1. Shut power off to outdoor unit.
2. Supply 24 volts AC control voltage to the wire ends of the full wave rectifier plug. Listen for a “click” as the solenoid is energized. See figure 14.

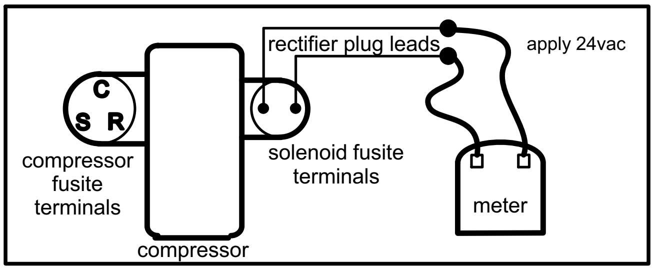


FIGURE 14

3. Unplug the full wave rectifier plug from the fusite connection on the compressor.
4. Turn the low voltage power back onto the unit. Supply 24VAC to the wires of the full wave rectifier plug. Set volt meter to DC volts and measure the DC voltage at the female connector end of the full wave rectifier plug. The DC voltage reading should be 1.5 to 3 volts lower than the input voltage to the plug wire leads. (EX: Input voltage is 24VAC output voltage is 22VDC).
   See figure 15.

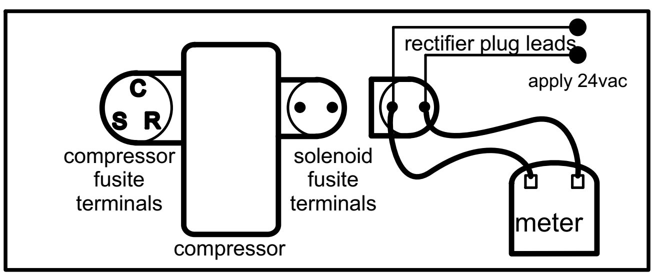


FIGURE 15

If the above checks verify that the solenoid plug is providing power to cycle into high capacity operation, continue to step 3 to determine if problem is with solenoid coil in compressor

STEP 3 Confirm internal unloader solenoid has proper resistance

1. Shut all power off to unit (main and low voltage)
2. Unplug the molded plug from the compressor solenoid 2-pin fusite.
3. Using a volt meter set on the 200 ohm scale

Replace the Compressor under these conditions:

Bad Solenoid

a. Measure the resistance at the 2-pin fusite. The resistance should be 32 to 60 ohms depending on compressor temperature. If no resist ancereplace compressor.

b. Measure the resistance from each fusite pin to ground. There should **not be** continuity to ground. If solenoid coil is grounded, replace compressor.

Good Solenoid

a. Seals not shifting, replace compressor
b. Slider ring not shifting, replace compressor.

C - Outdoor Fan Motor

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.

ELECTRICAL DATA tables in this manual show specifications for condenser fans used in SPB*H4’s.

Access to the condenser fan motor on all units is gained by removing the four screws securing the fan assembly. See figure 16. The grill fan assembly can be removed from the cabinet as one piece. See figure 17. The condenser fan motor is removed from the fan guard by removing the four nuts found on top of the grill. See figure 17 if condenser fan motor replacement is necessary.

⚠ DANGER

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

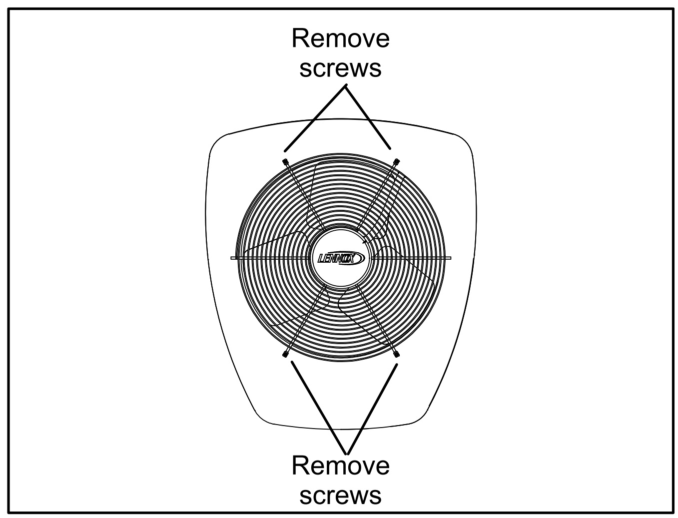


FIGURE 16

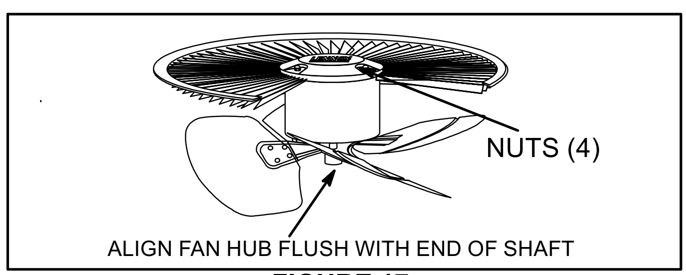


FIGURE 17

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. It is not repairable. If the reversing valve has failed, it must be replaced.

E - Crankcase Heater (HR1) and Thermostat (S40)

The compressor in the unit is equipped with a 70 watt, belly band type crankcase heater. HR1 prevents liquid from accumulating in the compressor. HR1 is controlled by a thermostat located on the liquid line. When liquid line temperature drops below 50° F the thermostat closes energizing HR1. The thermostat will open, de-energizing HR1 once liquid line temperature reaches 70° F .

F - Drier

A filter drier designed for all SPB*H4 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 4 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 IV - sub section B - ”Evacuating the System” when replacing the drier.

G - High/Low Pressure Switch

⚠ IMPORTANT

Pressure switch settings for HFC-410A refrigerant will be significantly higher than units with HCFC-22.

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 ± 15 psi.

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 ± 5 psi. The switch automatically resets when suction line pressure rises above 40 ± 5 psi. Under certain conditions the low pressure switch is ignored. See *Pressure Switch Circuit* in the Defrost Control description.

TABLE 4

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	Sporlan One Shot - TA-1	

III - REFRIGERANT SYSTEM

Refer to figure 18 and 19 for refrigerant flow in the heating and cooling modes. The reversing valve is energized during cooling demand and during defrost.

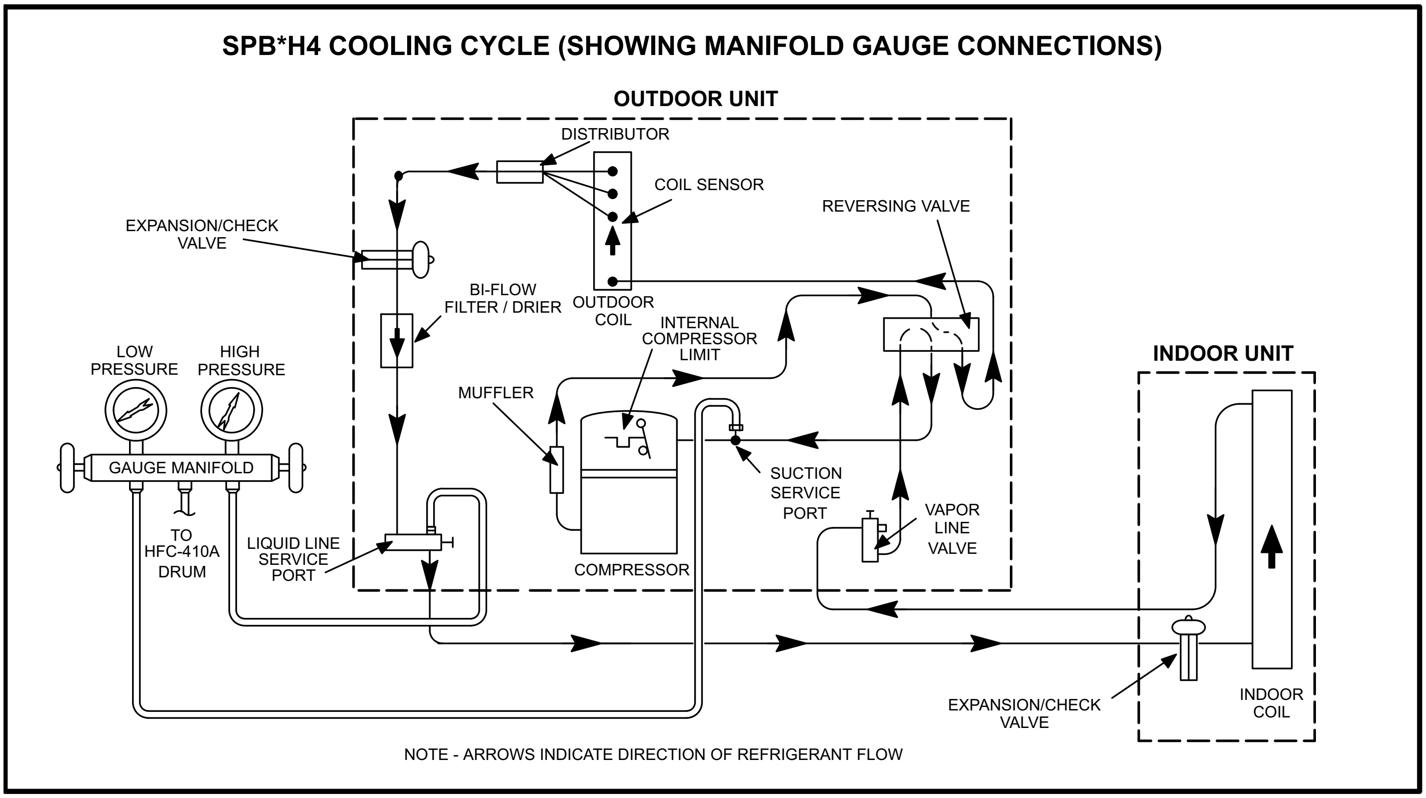


FIGURE 18

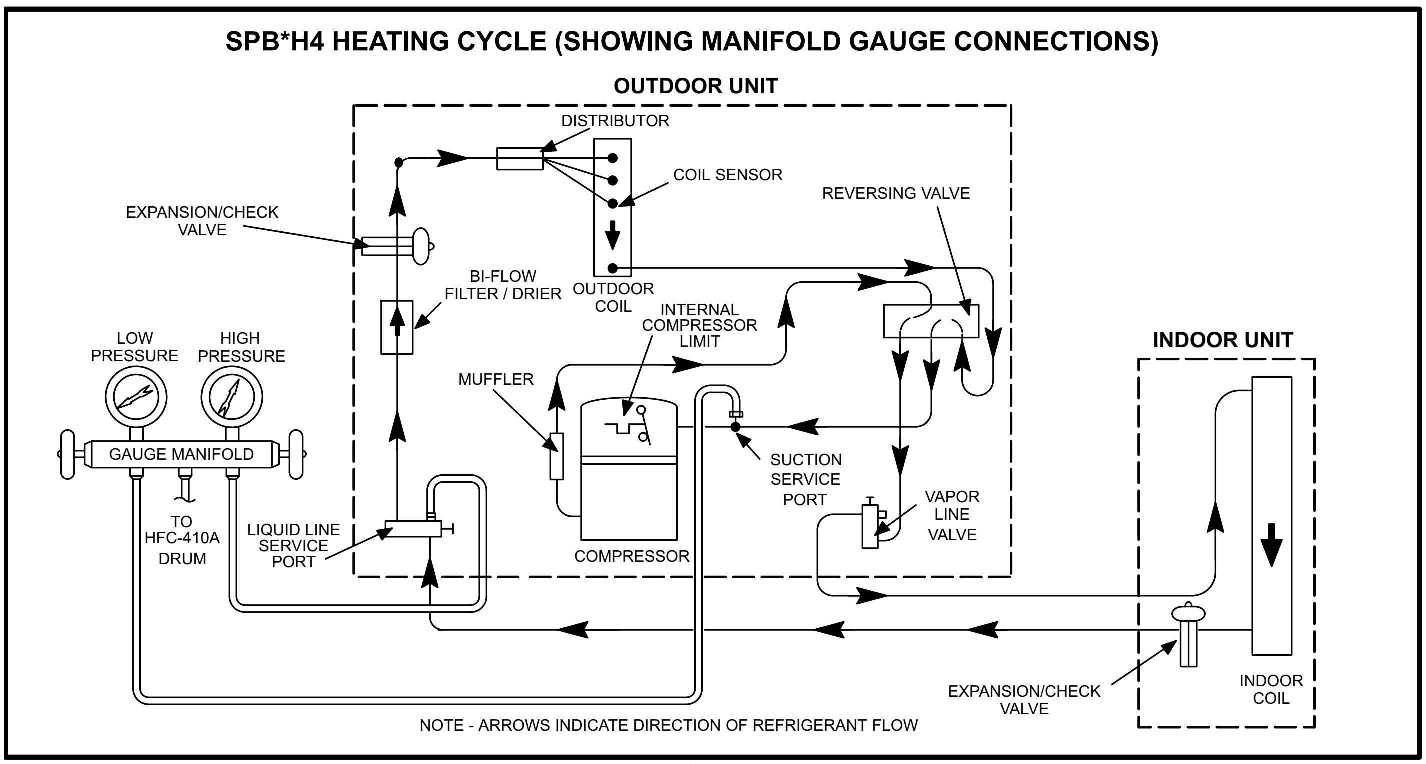


FIGURE 19

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 1.

TABLE 1

Unit	Liquid Line	Suction Line	L15 Line Sets
-036, -048	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)	Field Fabricated

B - Service Valves

⚠ IMPORTANT

Only use Allen wrenches of sufficient hardness (50Rc - Rockwell Harness Scale min). Fully insert the wrench into the valve stem recess. Service valve stems are factory torqued (from 9 ft lbs for small valves, to 25 ft lbs for large valves) to prevent refrigerant loss during shipping and handling. Using an Allen wrench rated at less than 50Rc risks rounding or breaking off the wrench, or stripping the valve stem recess.

Service valves (figures 20 and 21) and gauge ports are accessible from the outside of the unit. Use the service ports for leak testing, evacuating, charging and checking charge.

Each valve is equipped with a service port which has a factory-installed Schrader valve. A service port cap protects the Schrader valve from contamination and serves as the primary leak seal.

To Access Schrader Port:

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

To Open Service Valve:

1 - Remove the stem cap with an adjustable wrench.
2 - Use a service wrench with a hex-head extension to back the stem out counterclockwise as far as it will go.

NOTE — Use a 3/16” hex head extension for 3/8” line sizes or a 5/16” extension for large line sizes.

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

To Close Service Valve:

1 - Remove the stem cap with an adjustable wrench.
2 - Use a service wrench with a hex-head extension to turn the stem clockwise to seat the valve. Tighten the stem firmly.

NOTE — Use a 3/16” hex head extension for 3/8” line sizes or a 5/16” extension for large line sizes.

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

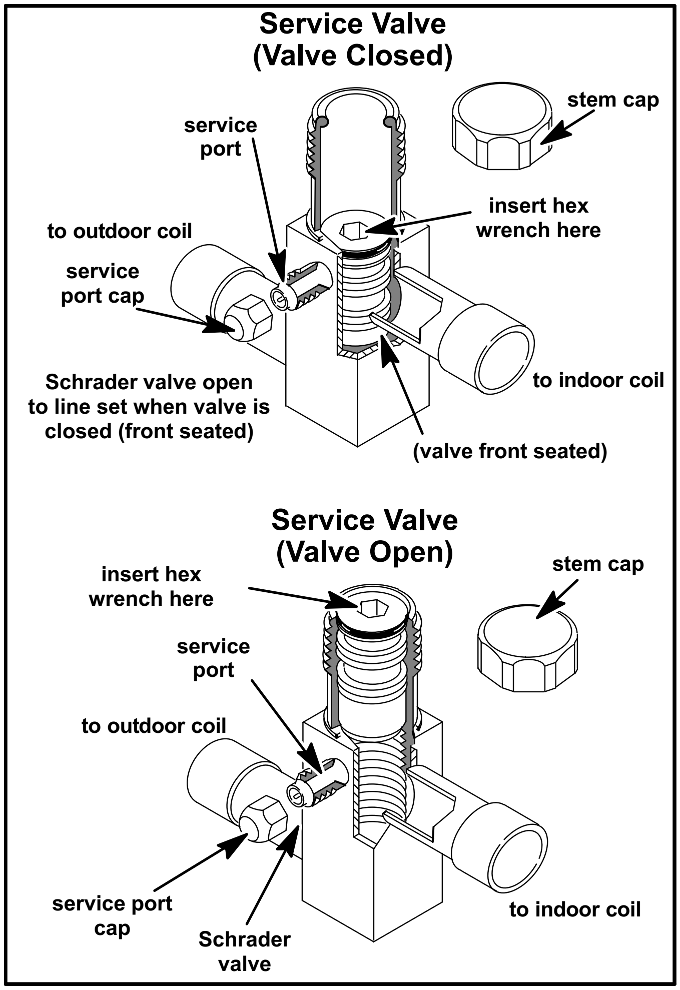


FIGURE 20

Vapor Line Ball Valve – 4 and 5 Ton Only

Vapor line service valves function the same way as the other valves, the difference is in the construction. If a valve has failed, you must replace it. A ball valve is illustrated in figure 21.

The ball valve is equipped with a service port with a factory-installed Schrader valve. A service port cap protects the Schrader valve from contamination and assures a leak-free seal.

Ball Valve (Valve Open)

Use Adjustable Wrench
To open: rotate Stem Clockwise 90°.
To close: rotate Stem Counter-clockwise 90°.

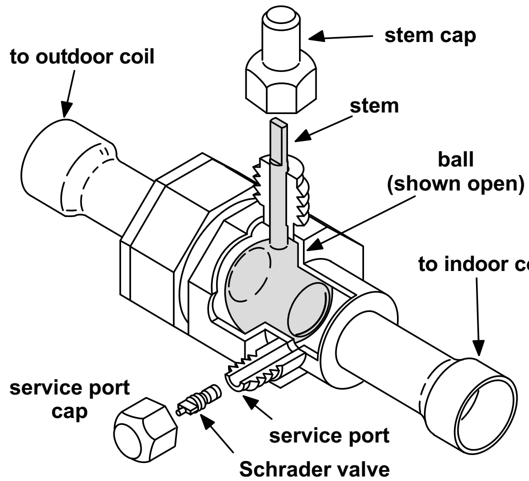


FIGURE 21

IV - CHARGING

A - Leak Testing

After the line set has been connected to the indoor and outdoor units, check the line set connections and indoor unit for leaks.

IMPORTANT

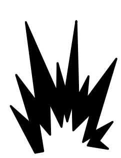
Leak detector must be capable of sensing HFC refrigerant.

WARNING

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

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

WARNING



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

WARNING

Fire, Explosion and Personal Safety Hazard.

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

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

Using an Electronic Leak Detector or Halide

1 - Connect a cylinder of HFC-410A to the center port of the manifold gauge set.

2 - With both manifold valves closed, open the valve on the HFC-410A cylinder (vapor only).

3 - Open the high pressure side of the manifold to allow the HFC-410A into the line set and indoor unit. Weigh in a trace amount of HFC-410A. [A trace amount is a maximum of 2 ounces (57 g) or 3 pounds (31 kPa) pressure.] Close the valve on the R-410A cylinder and the valve on the high pressure side of the manifold gauge set. Disconnect the HFC-410A cylinder.

4 - Connect a cylinder of nitrogen with a pressure regulating valve to the center port of the manifold gauge set.

5 - Connect the manifold gauge set high pressure hose to the vapor valve service port. *(Normally, the high pressure hose is connected to the liquid line port; however, connecting it to the vapor port better protects the manifold gauge set from high pressure damage.)*

6 - Adjust the nitrogen pressure to 150 psig (1034 kPa). Open the valve on the high side of the manifold gauge set which will pressurize line set and indoor unit.

7 - After a few minutes, open a refrigerant port to ensure the refrigerant you added is adequate to be detected. (Amounts of refrigerant will vary with line lengths.) Check all joints for leaks. Purge nitrogen and HFC-410A mixture. Correct any leaks and recheck.

B - Evacuating the System

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

NOTE — This evacuation process is adequate for a new installation with clean and dry lines. If excessive moisture is present, the evacuation process may be required more than once.

IMPORTANT

Use a thermocouple or thermistor electronic vacuum gauge that is calibrated in microns. Use an instrument that reads from 50 microns to at least 10,000 microns.

1 - Connect manifold gauge set to the service valve ports :
- low pressure gauge to *vapor* line service valve
- high pressure gauge to *liquid* line service valve

2 - Connect micron gauge.

3 - Connect the vacuum pump (with vacuum gauge) to the center port of the manifold gauge set.

4 - Open both manifold valves and start the vacuum pump.

5 - Evacuate the line set and indoor unit to an **absolute pressure** of 23,000 microns (29.01 inches of mercury). During the early stages of evacuation, it is desirable to close the manifold gauge valve at least once to determine if there is a rapid rise in **absolute pressure**. A rapid rise in pressure indicates a relatively large leak. If this occurs, repeat the leak testing procedure.

NOTE — The term ***absolute pressure*** *means the total actual pressure within a given volume or system, above the absolute zero of pressure. Absolute pressure in a vacuum is equal to atmospheric pressure minus vacuum pressure.*

6 - When the absolute pressure reaches 23,000 microns (29.01 inches of mercury), close the manifold gauge valves, turn off the vacuum pump and disconnect the manifold gauge center port hose from vacuum pump. Attach the manifold center port hose to a nitrogen cylinder with pressure regulator set to 150 psig (1034 kPa) and purge the hose. Open the manifold gauge valves to break the vacuum in the line set and indoor unit. Close the manifold gauge valves.

CAUTION

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

7 - Shut off the nitrogen cylinder and remove the manifold gauge hose from the cylinder. Open the manifold gauge valves to release the nitrogen from the line set and indoor unit.

8 - Reconnect the manifold gauge to the vacuum pump, turn the pump on, and continue to evacuate the line set and indoor unit until the absolute pressure does not rise above 500 microns (29.9 inches of mercury) within a 20-minute period after shutting off the vacuum pump and closing the manifold gauge valves.

9 - When the absolute pressure requirement above has been met, disconnect the manifold hose from the vacuum pump and connect it to an upright cylinder of HFC-410A refrigerant. Open the manifold gauge valves to break the vacuum from 1 to 2 psig positive pressure in the line set and indoor unit. Close manifold gauge valves and shut off theHFC-410A cylinder and remove the manifold gauge set.

C - Charging — SSB*H4S41Y through SSB*H4S43Y

Charge Using the Weigh-in Method—*Outdoor Temperature < 65ºF (18ºC)*

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 ≤ 65ºF (18ºC)*

When the outdoor ambient temperature is below 65°F (18°C), use the subcooling method to charge the unit. If necessary, restrict the air flow through the outdoor coil to achieve pressures in the 325-375 psig (2240-2585 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 325-375 psig (2240-2585 kPa) range. See figure 22.

Blocking Outdoor Coil

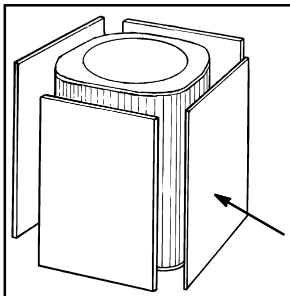


FIGURE 22

1. With the manifold gauge hose still on the liquid service port and the unit operating stably, use a digital thermometer to check the liquid line temperature and record in table 2.
2. At the same time, record the liquid line pressure reading.
3. Use a temperature/pressure chart for HFC-410A (table 9) to determine the saturation temperature for the liquid line pressure reading; record in table 2.
4. Subtract the liquid line temperature from the saturation temperature (according to the chart) to determine the subcooling value.
5. Compare the subcooling value with those in table 2. If subcooling value is greater than shown, recover some refrigerant; if less, add some refrigerant.

TABLE 2

SPB036H4 Subcooling Values for Charging Second Stage (High-Capacity)			
SSB*H4S41Y through SSB*H4S43Y			
____° Saturation Temperature — ____° Liquid Line Temperature = ____° Subcooling Value			
Model	**SPB036H4S41**	**SPB048H4S41**	**SPB060H4S41**
°F (°C)*	7 (3.9)	9 (5)	8 (4.4)
*F: +/-1.0°; C: +/-0.5°			

Charge Using the Approach Method—*Outdoor Temperature ≥ 65ºF (18ºC)*

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. Check the outdoor ambient temperature using a digital thermometer and record in table 3.
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 tables 4 and 5, “Normal Operating Pressures.” 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. Pressures higher than those listed indicate that the system is overcharged. Pressures lower than those listed indicate that the system is undercharged. Continue to check adjusted charge using approach values.
4. Use the same digital thermometer used to check outdoor ambient temperature to check liquid line temperature and record in table 3. Verify the unit charge using the approach method. The difference between the ambient and liquid temperatures should match values given in table 3. Add refrigerant to lower the approach temperature and remove it to increase the approach temperature. Loss of charge results in low capacity and efficiency.
5. If the values do not agree with those in table 3, add refrigerant to lower the approach temperature or recover refrigerant from the system to increase the approach temperature.

TABLE 3

SPB036H4 Approach Values for Charging Second Stage (High-Capacity)			
SSB*H4S41Y through SSB*H4S43Y			
____° Liquid Line Temperature — ____° Outdoor Temperature = ____° Approach Temperature			
Model	SPB036H4S41	SPB048H4S41	SPB060H4S41
°F (°C)*	9 (5)	8 (4.4)	8 (4.4)
*F: +/-1.0°; C: +/-0.5°			

TABLE 4

Normal Operating Pressures - Cooling[1]						
SSB*H4S41Y through SSB*H4S43Y						
Model	SPB036H4S41		SPB048H4S41		SPB060H4S41	
°F (°C)[2]	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
First Stage (Low Capacity) Pressure[3]						
65 (18.3)	225	144	235	144	225	138
75 (23.9)	261	147	268	145	264	141
85 (29.4)	302	149	310	147	305	142
95 (35.0)	349	151	356	148	352	146
105 (40.6)	397	153	407	150	405	148
115 (46.1)	461	157	466	152	459	150
Second Stage (High Capacity) Pressure[3]						
65 (18.3)	239	139	244	140	241	134
75 (23.9)	278	141	283	141	280	136
85 (29.4)	322	143	326	144	324	137
95 (35.0)	367	146	374	147	373	138
105 (40.6)	426	148	427	148	425	142
115 (46.1)	489	151	491	151	486	146

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

Normal Operating Pressures - Heating[1]						
SSB*H4S41Y through SSB*H4S43Y						
Model	SPB036H4S41		SPB048H4S41		SPB060H4S41	
°F (°C)[2]	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
First Stage (Low Capacity) Pressure[3]						
40 (4.4)	328	98	369	75	351	63
50 (10)	333	118	366	114	335	92
Second Stage (High Capacity) Pressure[3]						
20 (-7.0)	296	62	311	58	308	59
30 (-1.0)	309	75	334	72	323	70
40 (4.4)	322	92	354	89	318	69
50 (10)	336	113	381	108	329	82

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.

C - Charging — SSB*H4S44Y

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.

COOLING MODE INDOOR AIRFLOW CHECK

Check airflow using the Delta-T (DT) process using the illustration in figure 23.

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:

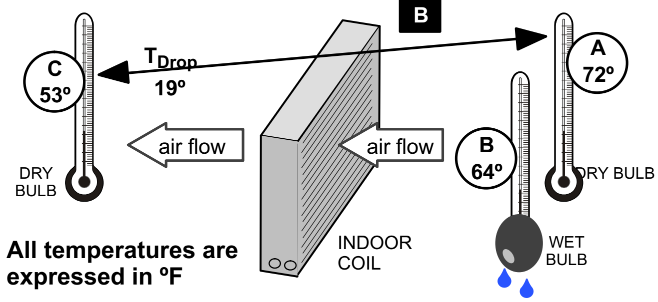
$$\text{CFM} = \frac{\text{Amps x Volts x 3.41}}{\text{1.08 x Temperature rise (F)}}$$

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 nameplate		Adjust amount. for variation in line set length listed on table in figure 24.		Additional charge specified per indoor unit match-up listed in tables 6 through 8.		Total charge
________	±	______________	+	____________	=	______

Temp. of air entering indoor coil ºF (Dry-bulb)	DT													
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**



All temperatures are expressed in ºF

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** 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$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 $\pm$3º range) no change*
62º	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$3º.

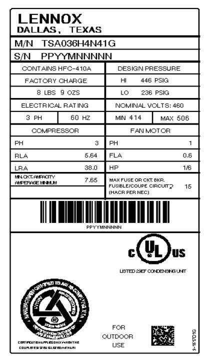
Figure 23. Checking Indoor Airflow over Evaporator Coil using Delta-T Chart

WEIGH IN

Refrigerant Charge per Line Set Length

Liquid Line Set Diameter	Ounces per 5 feet (g per 1.5 m) adjust from 15 feet (4.6 m) line set*
3/8" (9.5 mm)	3 ounce per 5' (85 g per 1.5 m)

*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.*

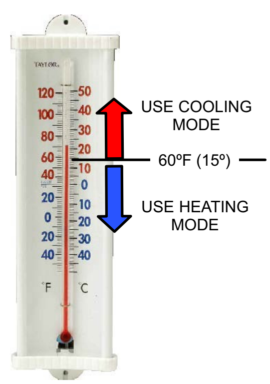


1. Check Liquid and suction line pressures
2. Compare unit pressures with tables 4 and 10, *Normal Operating Pressures*.
3. Conduct leak check; evacuate as previously outlined.
4. Weigh in the unit nameplate charge plus any charge required for line set differences over feet.

This nameplate is for illustration purposes only. Go to actual nameplate on outdoor unit for charge information.

Figure 24. Using HFC-410A Weigh In Method

SUBCOOLING



SATº ________

LIQº – ________

SCº = ________

1 Check the airflow as illustrated in figure 23 to be sure the indoor airflow is as required. (Make any air flow adjustments before continuing with the following procedure.)

2 Measure outdoor ambient temperature; determine whether to use **cooling mode** or **heating mode** to check charge.

3 Connect gauge set.

4 Check liquid and vapor line pressures. Compare pressures with either heat or cooling mode normal operating pressures in tables 4 and 10 (second stage - high capacity),

NOTE - The reference table is a general guide. Expect minor pressure variations. Significant differences may mean improper charge or other system problem.

5 Set thermostat for heat/cool demand, depending on mode being used:

Using cooling mode—When the outdoor ambient temperature is 60°F (15°C) and above. Target subcooling values (second stage - high capacity) in tables 4 are based on 70 to 80°F (21-27°C) indoor return air temperature; if necessary, operate heating to reach that temperature range; then set thermostat to cooling mode setpoint to 68ºF (20ºC) which should call for second stage (high capacity) cooling. When pressures have stabilized, continue with step 6.

Using heating mode—When the outdoor ambient temperature is below 60°F (15°C). Target subcooling values (second stage - high capacity) in tables 4 and 10 are based on 65-75°F (18-24°C) indoor return air temperature; if necessary, operate cooling to reach that temperature range; then set thermostat to heating mode setpoint to 77ºF (25ºC) which should call for second stage (high capacity) heating. When pressures have stabilized, continue with step 6.

6 Read the liquid line temperature; record in the LIQº space.

7 Read the liquid line pressure; then find its corresponding temperature in the temperature/ pressure chart listed in table 15 and record it in the SATº space.

8 Subtract LIQº temperature from SATº temperature to determine subcooling; record it in SCº space.

9 Compare SCº results with tables 6 through 8, being sure to note any additional charge for line set and/or match-up.

10 If subcooling value is greater than shown in tables 6 through 8 for the applicable unit, remove refrigerant; if less than shown, add refrigerant.

11 If refrigerant is added or removed, repeat steps 4 through 10 to verify charge.

12 Disconnect gauge set and re-install both the liquid and suction service valve caps.

Figure 25. Using HFC-410A Subcooling Method — Second Stage (High Capacity)

Indoor Unit Matchups — SSB*H4S44Y

Table 6. – SSB024H4S44Y

INDOOR MATCHUP	HEAT PUMP	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	**Add charge lb	**Add charge oz
	SPB036H4–036			lb	oz
CH23–51		17	7	0	13
CH23–65		12	8	1	10
CBX26UH–030		25	8	1	14
CBX26UH–036		25	8	1	14
CB27UH-036		17	8	2	4
CB27UH-042		17	8	2	4
CB30U–31		17	6	0	0
CB30U–41/46		17	8	2	4
CBX32M–030		17	6	0	0
CBX32M–036		17	8	2	4
CBX32MV–024/030		17	6	0	0
CBX32MV–036		17	8	2	4
C33–44C		17	8	1	14
CH33–42B–2F		17	7	0	13
CH33–44/48B–2F		12	8	1	8
CH33–48C–2F		10	8	1	6
CH33–43B		9	10	1	6
CH33–49C		9	10	1	6
CR33–48B/C–F		25	8	2	0
CR33–50/60C–F		25	9	0	14
CX34–38A/B–6F *Serial No# before 6007K*		31	7	1	5
CX34–38A/B–6F *Serial No# 6007K and after*		10	8	1	12
CX34–43B/C–6F		10	8	1	6
CX34–60D		9	9	0	14

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

Table 7. SSB036H4S44Y

INDOOR MATCHUP	HEAT PUMP	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	**Add charge lb	**Add charge oz
	SPB036H4–048			lb	oz
CH23–68		15	13	0	7
CB27UH-048		17	7	0	0
CB27UH-060		17	7	0	0
CB30U–51, –65		17	7	0	0
CBX32M–048, –060		17	7	0	0
CBX32MV–048, –060		17	7	0	0
CBX32MV–068		16	10	0	3
CH33–60D–2F		18	4	0	2
CH33–62D–2F		15	10	0	4
CR33–60		40	4	0	2
CX34–60D–6F		18	4	0	2
CX34–62D–6F		16	8	0	2

Table 8. SSB060H4S44Y

INDOOR MATCHUP	HEAT PUMP	Target Subcooling Heat (±5ºF)	Target Subcooling Cool (±1ºF)	**Add charge lb	**Add charge oz
	SPB036H4SPB036H4–060			lb	oz
CH23–68		13	14	3	3
CH23–65		18	2	0	0
CBX26UH–060		13	14	3	5
CB27UH-060		13	10	2	1
CBX32M–060		13	10	2	1
CBX32MV–060		13	10	2	1
CBX32MV–068		13	12	2	9
CH33–60D–2F		15	6	1	3
CH33–62D–2F		13	12	2	10
CR33–50/60C–F		30	6	1	3
CR33–60D–F		30	6	1	3
CX34–49C–6F		13	9	1	14
CX34–60D–6F		15	6	1	3
CX34–62C–6F		13	11	2	6
CX34–62D–6F		13	11	2	5

Table 9. HFC-410A Normal Operating Pressures - Cooling[1]

SSB*H4S44Y								
SPB036 H4	**-024**		**-036**		**-048**		**-060**	
°F (°C)[2]	**Liq**	**Vap**	**Liq**	**Vap**	**Liq**	**Vap**	**Liq**	**Vap**
First Stage (Low Capacity) Pressure[3]								
65 (18.3)	232	146	225	144	235	144	225	138
75 (23.9)	264	148	261	147	268	145	264	141
85 (29.4)	307	149	302	149	310	147	305	142
95 (35.0)	353	151	349	151	356	148	352	146
105 (40.6)	403	153	397	153	407	150	405	148
115 (46.1)	460	155	461	157	466	152	459	150
Second Stage (High Capacity) Pressure[3]								
65 (18.3)	240	143	239	139	244	140	241	134
75 (23.9)	279	145	278	141	283	141	280	136
85 (29.4)	322	147	322	143	326	144	324	137
95 (35.0)	371	149	367	146	374	147	373	138
105 (40.6)	423	151	426	148	427	148	425	142
115 (46.1)	485	154	489	151	491	151	486	146

Table 10. HFC-410A Normal Operating Pressures - Heating[1]

SSB*H4S44Y								
XP16	**-024**		**-036**		**-048**		**-060**	
°F (°C)[2]	**Liq**	**Vap**	**Liq**	**Vap**	**Liq**	**Vap**	**Liq**	**Vap**
First Stage (Low Capacity) Pressure[3]								
40 (4.4)	314	88	304	89	324	92	341	89
50 (10)	333	116	318	116	354	115	365	113
Second Stage (High Capacity) Pressure[3]								
20 (-7.0)	286	59	289	63	306	61	318	59
30 (-1.0)	303	74	303	77	322	70	335	73
40 (4.4)	321	89	314	88	345	92	348	86
50 (10)	346	109	333	110	370	110	369	107

1 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.

[1]*Use tables 9 and 10 to perform maintenance checks; it is not a procedure for charging the system. Minor variations in these pressures may be due to differences in installations. Significant deviations could mean that the system is not properly charged or that a problem exists with some component in the system.*

Indoor Unit Matchups — SSB*H4S45Y

Table 11. SPB036H4S45Y

Indoor Unit Match-up	Heating +5ºF	Cooling +1ºF	*Add Charge	
	Subcooling		lbs.	oz.
CBX26UH-036	50	5	0	0
CBX27UH-036-230	22	7	0	9
CBX27UH-042-230	24	11	3	0
CBX32M-036	22	7	0	9
CBX32MV-036	22	7	0	9
CBX32MV-048	24	11	3	0
CBX40UHV-030	22	7	0	9
CBX40UHV-036	22	7	0	9
CBX40UHV-042	24	11	3	0
CBX40UHV-048	24	11	3	0
CH33-43B	13	10	2	7
CH33-48C	37	11	2	11
CH33-43C	37	11	2	11
CR33-48B/C	49	7	0	9
CX34-43B/C	29	9	2	11
CX34-50/60C	29	9	2	11

Table 12. SPB048H4S45Y

Indoor Unit Match-up	Heating +5ºF	Cooling +1ºF	*Add Charge	
	Subcooling		lbs.	oz.
CBX26UH-048-230	10	8	1	4
CBX27UH-048-230	19	9	1	4
CBX27UH-060-230	13	14	3	3
CBX32M-048	19	9	1	4
CBX32M-060	14	9	1	11
CBX32MV-048	19	9	1	4
CBX32MV-060	14	9	1	11
CBX32MV-068	9	8	1	11
CBX40UHV-048	19	9	1	4
CBX40UHV-060	14	9	1	11
CH23-68	24	10	1	12
CH33-49C	19	9	2	5
CH33-50/60C	19	9	2	5
CH33-60D	13	8	0	0
CH33-62D	11	9	1	4
CR33-50/60C	15	7	0	10
CR33-60D	15	7	0	10
CX34-60D	14	8	1	0
CX34-62D	9	9	1	6
CX34-62C	8	9	1	9

Table 13. SPB060H4S45Y

Indoor Unit Match-up	Subcooling		lbs.	oz.
CBX26UH-060	20	9	4	13
CBX27UH-060-230	10	6	2	3
CBX32M-060	17	6	1	12
CBX32MV-060	17	6	1	12
CBX32MV-068	15	7	2	1
CBX40UHV-060	17	6	1	12
CH33-50/60C	33	8	1	0
CH33-62D	15	7	1	4
CH23-68	37	9	2	10
CR33-50/60C	24	7	0	0
CR33-60D	24	7	0	0
CX34-62C	21	9	2	16
CX34-62D	13	7	1	4

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

Table 14. Normal Operating Pressures* SPB*H4S45Y

[1]Use tables to perform maintenance checks; it is not a procedure for charging the system. Minor variations in these pressures may be due to differences in installations. Significant deviations could mean that the system is not properly charged or that a problem exists with some component in the system.

Normal Operating Pressures - Cooling						
SPB* H4	-036		-048		-060	
°F (°C)**	Liq	Vap	Liq	Vap	Liq	Vap
First Stage (Low Capacity) Pressure						
65 (18.3)	220	141	224	143	230	137
75 (23.9)	254	144	259	143	267	139
85 (29.4)	295	148	302	147	311	141
95 (35.0)	340	150	346	149	357	144
105 (40.6)	389	153	396	152	398	147
115 (46.1)	444	156	450	155	453	149
Second Stage (High Capacity) Pressure						
65 (18.3)	232	129	238	138	232	131
75 (23.9)	269	136	278	140	276	133
85 (29.4)	312	140	321	142	320	136
95 (35.0)	346	142	372	144	367	138
105 (40.6)	409	145	424	147	421	141
115 (46.1)	465	148	481	149	479	144
Normal Operating Pressures - Heating						
First Stage (Low Capacity) Pressure						
50 (10)	350	115	336	114	385	108
60 (15.5)	372	136	363	135	414	126
Second Stage (High Capacity) Pressure						
20 (-7.0)	321	61	289	57	332	59
30 (-1.0)	347	74	294	69	349	67
40 (4.4)	367	90	321	80	361	75
50 (10)	387	110	341	110	383	85
60 (15.5)	395	131	361	128	425	122

* Typical pressures only, expressed in psig (liquid +/- 10 and vapor+/- 5 psig); indoor match up, indoor air quality, and indoor load will cause the pressures to vary. These operating pressures are also listed on the unit charging sticker (580005-01) located on the access panel.

** *Temperature of air entering outdoor coil.*

Table 15. HFC-410A Temp. (°F) - Pressure (Psig)

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

V - SERVICE AND RECOVERY

WARNING

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

IMPORTANT

Use recovery machine rated for HFC-410A refrigerant.

If the SPB*H4 system must be opened for any kind of service, such as compressor or drier replacement, you must take extra precautions to prevent moisture from entering the system. The following steps will help to minimize the amount of moisture that enters the system during recovery of HFC-410A.

1 - Use a regulator-equipped nitrogen cylinder to break the system vacuum. Do not exceed 5 psi. The dry nitrogen will fill the system, and will help purge any moisture.

2 - Remove the faulty component and quickly seal the system (using tape or some other means) to prevent additional moisture from entering the system.

3 - Do not remove the tape until you are ready to install new component. Quickly install the replacement component.
4 - Evacuate the system to remove any moisture and other non-condensables.

*The SPB*H4 system MUST be checked for moisture any time the sealed system is opened.*

Any moisture not absorbed by the polyol ester oil can be removed by triple evacuation. Moisture that has been absorbed by the compressor oil can be removed by replacing the drier.

IMPORTANT

Evacuation of system only will not remove moisture from oil. Drier must be replaced to eliminate moisture from POE oil.

VI - MAINTENANCE

In order to maintain the warranty on this equipment, the SPB*H4 system must be serviced annually and a record of service maintained. The following should be checked between annual maintenance:

A - Outdoor Unit

1 - Clean and inspect the outdoor coil. The coil may be flushed with a water hose. Ensure the power is turned off before you clean the coil.
2 - Condenser fan motor is pre-lubricated and sealed. No further lubrication is needed.
3 - Visually inspect connecting lines and coils for evidence of oil leaks.
4 - Check wiring for loose connections.
5 - Check for correct voltage at unit (unit operating).
6 - Check amp-draw condenser fan motor.
Unit nameplate _________ Actual ____________ .

NOTE — If owner complains of insufficient cooling, the unit should be gauged and refrigerant charge checked. Refer to section on refrigerant charging in this instruction.

1 - Clean and inspect condenser coil. (Coil may be flushed with a water hose after disconnecting power).
2 - Visually inspect all connecting lines, joints and coils for evidence of oil leaks.

B - Indoor Coil

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

C - Indoor Unit

1 - Clean or change filters.
2 - Adjust blower speed for cooling. Measure the pressure drop over the coil to determine the correct blower CFM. Refer to the unit information service manual for pressure drop tables and procedure.
3 - *Belt Drive Blowers* - Check belt for wear and proper tension.
4 - Check all wiring for loose connections
5 - Check for correct voltage at unit (blower operating).
6 - Check amp-draw on blower motor
Unit nameplate_________ Actual ____________.

VII - BRAZING

Before brazing remove access panels and any piping panels to avoid burning off paint. Be aware of any components ie, service valves, reversing valve, pressure switches that may be damaged due to brazing heat.

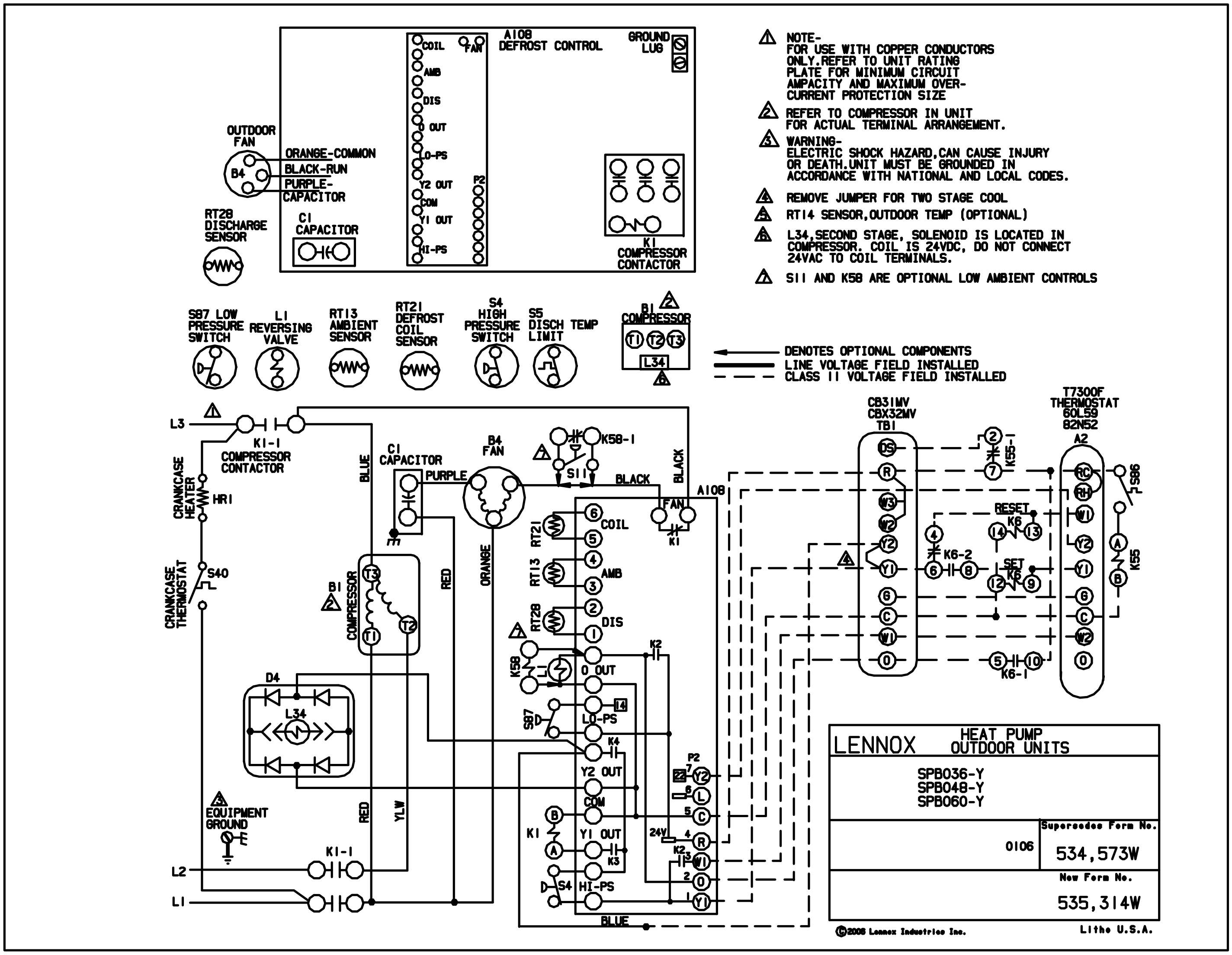
When making line set connections, use 1 to 2 psig dry nitrogen to purge the refrigerant piping. This will help to prevent oxidation into the system.

WARNING

Danger of explosion: Can cause equipment damage, injury or death. When using a high pressure gas such as dry nitrogen to pressurize a refrigeration or air conditioning system, use a regulator that can control the pressure down to 1 or 2 psig (6.9 to 13.8 kPa).

1 - .Cut ends of copper square (free from nicks or dents). Debur the ends. The pipe must remain round, do not pinch end of line.
2 - Wrap wet rag around any components that may be damaged.
3 - Use silver alloy brazing rods (5 or 6 percent minimum silver alloy for copper to copper brazing or 45 percent silver alloy for copper to brass or copper to steel brazing) which are rated for use with HCFC-22 and HFC-410A refrigerant.
4 - After brazing quench the joints with a wet rag to prevent possible heat damage to any components.

VIII - WIRING DIAGRAM AND SEQUENCE OF OPERATION



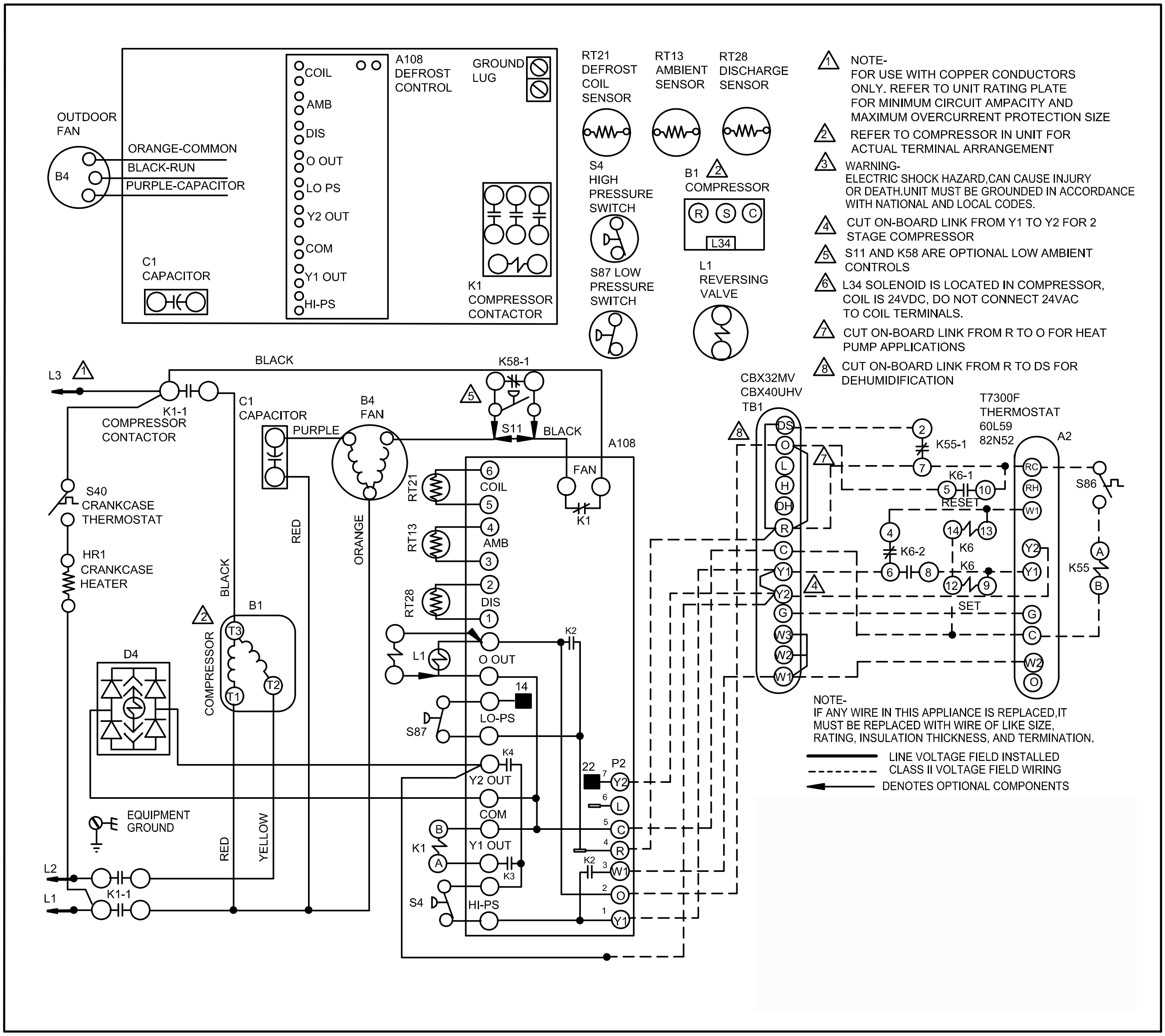


Figure 26. Unit Wiring Diagram (-036 and -048 Sizes) — SPB*H4S45Y

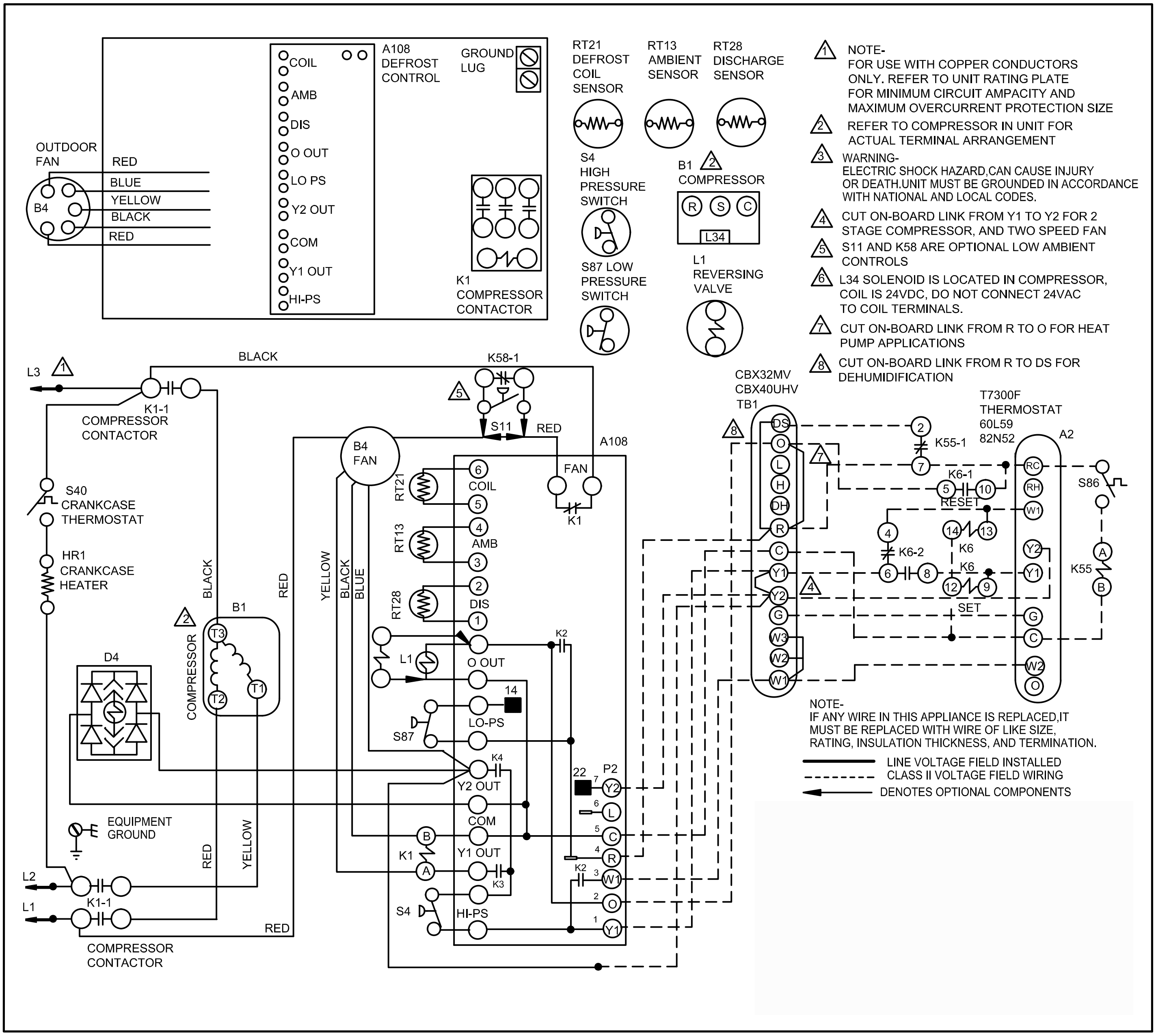


Figure 27. Unit Wiring Diagram (-060 Size Only) — SPB*H4S45Y

Sequence of Operation

Cooling

A – First Stage Low Capacity

Transformer from indoor unit supplies 24VAC power to the thermostat and outdoor unit controls.

1- Internal wiring energizes terminal O by cooling mode selection, energizing the reversing valve. Cooling demand initiates at Y1 in the thermostat.

2 - The defrost board checks for open low or high-pressure switches and proper coil, ambient and discharge sensor readings. If checks show no issues, the defrost board sends 24 volts through Y1 OUT signal to the K1 compressor contactor coil.

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

4- Solenoid L34 is NOT energized. The slider ring remains open limiting compressor to low capacity.

B – Second Stage High Capacity

5- Second stage thermostat demand goes through Y2 on the defrost board and energizes rectifier plug D4. D4 converts the AC voltage to DC voltage and energizes L34 unloader solenoid. L34 then closes the slider ring, allowing the compressor to operate at high capacity.

Heating

A – Low Capacity

1- Internal wiring de-energizes terminal O by heating mode selection, de-energizing the reversing valve. Heating demand initiates at Y1 in the thermostat.

2 - The defrost board checks for open low or high-pressure switches and proper coil, ambient and discharge sensor readings. If checks show no issues, the defrost board sends 24 volts through Y1 OUT signal to the K1 compressor contactor coil.

3- K1-1 closes, energizing the compressor and outdoor fan motor.

4- Solenoid L34 is NOT energized. The slider ring remains open limiting compressor to low capacity.

B – High Capacity (Ambient temperature <u>above</u> defrost board Y2 lock-in temperature)

1- Room thermostat in heating mode. Room thermostat outputs Y1 and Y2 (if applicable to that room thermostat) signal to the defrost board in the heat pump and to the indoor unit.

2- The defrost board checks for open low or high-pressure switches and proper coil, ambient and discharge sensor readings. If checks show no issues, the defrost board sends 24 volts through Y1 OUT signal to the K1 compressor contactor coil.

3 - The defrost board sends 24 volts through Y2 OUT to the L34 compressor solenoid plug. The 2- wire compressor solenoid plug converts the 24volt AC outputs to a 24volt DC signal input to the L34 internal high capacity solenoid valve in the compressor.

4 - K1-1 closes, energizing the compressor and outdoor fan motor through the normally closed fan relay contacts on the defrost board. The compressor runs high capacity.

B – High Capacity (Ambient temperature <u>below</u> defrost board Y2 lock-in temperature)

1 - Room thermostat in heating mode. Room thermostat outputs Y1 signal to the defrost board in the heat pump and to the indoor unit.

2 - The defrost board checks for open low or high-pressure switches and proper coil, ambient and discharge sensor readings. If checks show no issues, the defrost board sends 24 volts through Y1 OUT signal to the K1 compressor contactor coil.

3 - The defrost board **<u>Y2 locks in</u>** sends 24 volts through Y2 OUT to the L34 compressor solenoid plug. The plug converts the 24volt AC outputs to a 24volt DC signal input to the L34 internal high capacity solenoid valve in the compressor.

4 - K1-1 closes, energizing the compressor and outdoor fan motor through the normally closed fan relay contacts on the defrost board. The compressor runs on high capacity.

Defrost Mode

When a defrost cycle is initiated, the control energizes the reversing valve solenoid and turns off the condenser fan. The control will also put 24VAC on the “W1” (auxiliary heat) line. The unit will stay in this mode until either the coil sensor temperature is above the selected termination temperature, the defrost time of 14 minutes has been completed, or the room thermostat demand cycle has been satisfied. (If the temperature select shunt is not installed, the default termination temperature will be 90°F.) If the room thermostat demand cycle terminates the cycle, the defrost cycle will be held until the next room thermostat demand cycle. If the coil sensor temperature is still below the selected termination temperature, the control will continue the defrost cycle until the cycle is terminated in one of the methods mentioned above. If a defrost is terminated by time and the coil temperature did not remain above 35°F (2°C) for 4 minutes the control will go to the 34-minute Time/Temperature mode.