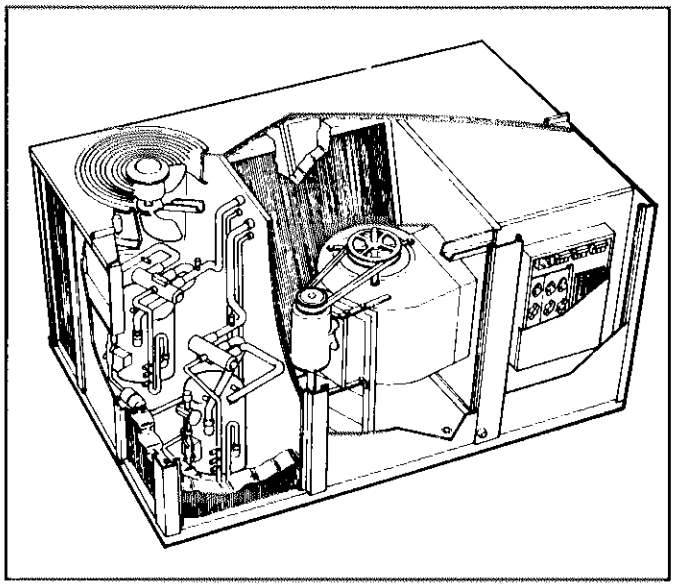
CHP16 SERIES
15 TON UNITS

CHP16 series units in the 15 ton cooling size were introduced in the spring of 1990. The units are packaged commercial heat pumps with two compressors providing two-stage dx cooling and heating. Supplemental electric heat sections install inside the cabinet and are available in 15kW through 75kW input sizes. Electric heat operates in single or multiple stages depending on kW input size. Units are designed for rooftop or side of building installation with either bottom or horizontal discharge and return air.

For commercial applications, the CHP16 is designed to accept any of several different thermostat control systems with minimum field wiring. Control options such as economizer, warm up kit, Honeywell W973 control or Honeywell W7400 control connect to the unit with jack–plugs. When "plugged in" the controls become an integral part of the unit wiring. Units are also equipped with a low voltage terminal strip to facilitate thermostat field wiring.

All specifications in this manual are subject to change.



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CHP16–1853
SPECIFICATIONS

Model No.			CHP16–1853
*ARI Standard 340 Ratings	Cooling Ratings	Cooling Capacity (Btuh)	178,000
		Total unit watts	20,000
		EER (Btuh/Watts)	8.9
		Integrated Part Load Value	9.4
	High Temperature Heating Ratings	Total Capacity (Btuh)	178,000
		Total unit watts	18,000
		C.O.P.	2.9
	Low Temperature Heating Ratings	Total Capacity (Btuh)	96,000
		Total unit watts	14,070
		C.O.P.	2.0
Refrigerant (R–22) charge – Two Stages			16 lbs. 2 oz. per circuit
Evaporator Blower and Drive Selection	Blower wheel nominal diameter x width (in.)		18 X 18
	Factory Installed Drives•	Nominal motor horsepower	3
		Maximum usable horsepower	3.45
		Voltage and Phase	208/230/460v/575v–3ph
		RPM range	610–780
	Optional Factory Installed Drives•	Nominal motor horsepower	5
		Maximum usable horsepower	5.75
		Voltage and Phase	208/230/460v/575v–3ph
		RPM range	770–980
Indoor Coil	Net face area (sq. ft.)		16.0
	Tube diameter (in.) & Number of rows		3/8 – 3
	Fins per inch		13
Outdoor Coil	Net face area (sq. ft.)		30.5
	Tube diameter (in.) & Number of rows		3/8 – 3
	Fins per inch		20
Outdoor Fan(s)	Diameter (in.) & Number of blades		(2) 26 – 4
	Air volume (cfm)		12,000 Total
	Motor horsepower		(2) 1
	Motor watts		2200 Total
Condensate drain size mpt (in.)			1
No. and size of filters (in.)			(4) 24 x 24 x 2
Electrical characteristics			208/230 to 460 volt — 60 hertz — 3 phase
Optional Electric Heat	Model No.		ECH16-185
	kW Input Range		15-30-45-60-75
Optional Roof Mounting Frame			RMF16–185
Optional Economizer Dampers with Gravity Exhaust No. and size of filters (in.)			REMD16M–185 (2) 25 x 25 x 1
Optional Power Exhaust Fans (Downflow Only)	Model No.		PED16–185
	Diameter (in.) and No. of blades		16 — 5
	Total air volume (cfm)		4200
	Motor horsepower		(2) 1/4
	Watts input (total)		500
Optional Horizontal Supply and Return Air Kit			LB–55756BD
Optional Outdoor Air Dampers No. and size of filters (in.)			OAD16–185 (1) 25 x 27 x 1
Optional Ceiling Supply and Return Air Diffusers		Step–down	RTD11–185
		Flush	FD11–185
		Transition	SRT16–185
Optional Automatic OAD16 Damper Kit			35G21
Optional Commercial Controls			Refer to Commercial Controls in Accessory Section of this Manual

*Rated in accordance with ARI Standard 360 and DOE; 95°F outdoor air temperature and 80°F db/67°F wb entering evaporator air.

•Using total air volume and system static pressure requirements determine from blower performance tables rpm and bhp required. Maximum usable hp of motors furnished by Lennox are shown. If motors of comparable hp are used be sure to keep within the service factor limitations outlined on the motor nameplate.

ELECTRICAL DATA

Model No.			CHP16–1853			
Line Voltage Data - 60Hz. – 1ph			208/230V		460V	
Compressors 2	Rated load amps	each	27.1		14.2	
		total	54.2		28.4	
	Locked Rotor Amps	each	183		91.1	
		total	366		182.2	
Outdoor Fan Motors (2)	Full load amps (total)		9.6		4.8	
	Locked rotor amps (total)		24.0		12.0	
Indoor Blower Motor	Horsepower		3	5	3	5
	Full load amps (total)		10.6	16.7	4.8	7.6
	Locked rotor amps (total)		58.0	91.0	26.8	45.6
Optional Power Exhaust Fans	(No.) Horsepower		(2) – 1/4		(2) – 1/4	
	Full load amps (total)		2.8		1.4	
	Locked rotor amps (total)		6.5		3.3	
•Recommended Maximum Fuse Size (Amps)	Less Power Exhaust		100	100	50	60
	With Power Exhaust		100	100	50	50
Unit Power Factor	Less Power Exhaust		.84	.84	.84	.84
	With Power Exhaust		.84	.84	.84	.84
*Minimum Circuit Ampacity	Less Power Exhaust		81.2	87.2	42.6	45.6
	With Power Exhaust		84.0	90.0	44.0	47.0

•Where current does not exceed 60 amps, HACR circuit breaker may be used in place of fuse.
NOTE – Extremes of operating range are plus and minus 10% of line voltage.
*Refer to National Electrical Code manual to determine wire, fuse and disconnect size requirements.

ACCESSORY AIR RESISTANCE

Unit Model No.	Air Volume (cfm)	Total Resistance (inches water gauge)					
		Wet Evaporator Coil	REMD16M Economizer	RTD11 Diffuser			FD11 Diffuser
				2 Ends Open	1 Side 2 Ends Open	All Ends & Sides Open	
CHP16–1853	5000	.07	.11	.51	.44	.39	.27
	5200	.08	.12	.56	.48	.42	.30
	5400	.09	.13	.61	.52	.45	.33
	5600	.10	.14	.66	.56	.48	.36
	5800	.11	.15	.71	.59	.51	.39
	6000	.12	.16	.76	.63	.55	.42
	6200	.13	.17	.80	.68	.59	.46
	6400	.14	.18	.86	.72	.63	.50
	6600	.15	.20	.92	.77	.67	.54
	6800	.16	.22	.99	.83	.72	.58
	7000	.17	.23	1.03	.87	.76	.62
	7200	.18	.24	1.09	.92	.80	.66
	7400	.19	.25	1.15	.97	.84	.70
	7600	.20	.26	1.21	1.02	.88	.74

TABLE 1
BLOWER DATA
CHP16-1853 BLOWER PERFORMANCE

Air Volume cfm	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge											
	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.30	1.50
	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP
5000	540 1.50	570 1.60	600 1.70	640 1.80	660 1.95	690 2.20	720 2.25	740 2.40	765 2.60	785 2.75	830 3.00	870 3.20
5200	555 1.60	580 1.70	615 1.80	650 2.10	670 2.20	700 2.30	730 2.40	750 2.50	775 2.75	795 2.80	840 3.20	880 3.50
5400	570 1.70	590 1.85	630 2.00	660 2.25	690 2.30	710 2.40	740 2.50	760 2.70	785 2.80	810 3.00	850 3.30	890 3.75
5600	580 1.75	615 2.05	640 2.25	670 2.30	700 2.45	725 2.35	750 2.70	775 2.85	795 3.00	820 3.20	860 3.50	905 3.95
5800	600 2.00	630 2.25	655 2.35	685 2.50	715 2.65	740 2.75	765 2.90	785 3.10	805 3.25	820 3.35	870 3.70	915 4.20
6000	615 2.20	640 2.35	670 2.60	695 2.65	725 2.80	750 2.95	775 3.15	795 3.30	820 3.50	840 3.65	880 4.05	925 4.45
6200	630 2.40	660 2.60	685 2.75	715 2.90	740 3.00	765 3.20	785 3.40	810 3.60	830 3.80	850 3.90	895 4.30	935 4.75
6400	645 2.55	670 2.75	700 2.90	725 3.05	750 3.20	775 3.40	800 3.70	820 3.75	845 4.00	860 4.25	905 4.60	940 5.00
6600	660 2.80	690 2.95	715 3.15	740 3.25	765 3.40	790 3.65	810 3.90	835 4.10	850 4.20	875 4.50	915 4.80	955 5.30
6800	670 3.00	705 3.25	730 3.40	760 3.55	780 3.75	800 3.95	825 4.15	845 4.40	865 4.50	890 4.90	930 5.20	965 5.60
7000	695 3.30	720 3.45	745 3.60	770 3.75	790 4.00	815 4.20	840 4.50	860 4.65	880 4.90	900 5.05	950 5.60	- - - - - - - -
7200	710 3.55	740 3.70	760 3.85	785 4.15	810 4.40	830 4.55	850 4.70	870 4.95	895 5.30	915 5.65	- - - - - - - -	- - - - - - - -
7400	730 3.75	750 3.90	775 4.10	800 4.40	820 4.60	840 4.70	860 5.00	880 5.25	900 5.40	925 5.70	- - - - - - - -	- - - - - - - -
7600	740 3.90	765 4.40	785 4.35	810 4.60	830 4.70	850 4.95	870 5.15	890 5.40	920 5.60	- - - - - - - -	- - - - - - - -	- - - - - - - -

NOTE — All data is measured external to the unit with the air filters in place.

TABLE 2
CHP16-1853 BLOWER PERFORMANCE
with electric heat

Air Volume cfm	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge											
	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.30	1.50
	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP	RPM BHP
5000	590 1.50	620 1.70	650 1.85	675 2.00	705 2.20	730 2.35	755 2.50	780 2.75	805 2.90	830 3.10	885 3.35	925 3.60
5600	640 2.10	670 2.30	695 2.45	725 2.70	750 2.80	775 2.95	795 3.10	825 3.30	850 3.55	875 3.75	920 4.10	965 4.50
5800	660 2.30	685 2.60	715 2.70	740 2.85	765 2.95	790 3.20	815 3.40	840 3.60	865 3.80	890 4.00	935 4.30	975 4.60
6000	675 2.50	705 2.80	735 2.90	760 3.10	780 3.30	805 3.45	830 3.65	855 3.90	880 4.15	900 4.25	945 4.70	995 5.10
6200	695 2.75	725 3.00	750 3.20	775 3.35	795 3.45	820 3.60	845 3.90	870 4.20	890 4.30	915 4.50	960 4.90	1000 5.30
6400	715 3.10	745 3.30	770 3.50	790 3.70	815 3.90	840 4.00	860 4.20	875 4.30	905 4.80	825 4.75	970 5.20	1010 5.70
6600	740 3.35	760 3.55	785 3.75	810 3.85	830 4.10	855 4.30	875 4.50	900 4.70	920 4.85	945 5.00	985 5.25	- - - - - - - -
6800	760 3.60	780 3.80	800 4.00	825 4.15	845 4.25	870 4.60	890 4.75	915 4.95	935 5.10	950 5.25	- - - - - - - -	- - - - - - - -
7000	775 3.90	800 4.10	820 4.30	840 4.50	865 4.80	885 4.90	910 5.10	925 5.25	950 5.50	970 5.75	- - - - - - - -	- - - - - - - -
7200	795 4.25	820 4.35	835 4.50	855 4.75	880 5.00	900 5.20	920 5.30	940 5.50	960 5.75	- - - - - - - -	- - - - - - - -	- - - - - - - -
7500	825 4.60	840 4.90	860 5.10	885 5.30	905 5.50	920 5.60	- - - - - - - -	- - - - - - - -	- - - - - - - -	- - - - - - - -	- - - - - - - -	- - - - - - - -

NOTE — All data is measured external to the unit with the air filters in place.

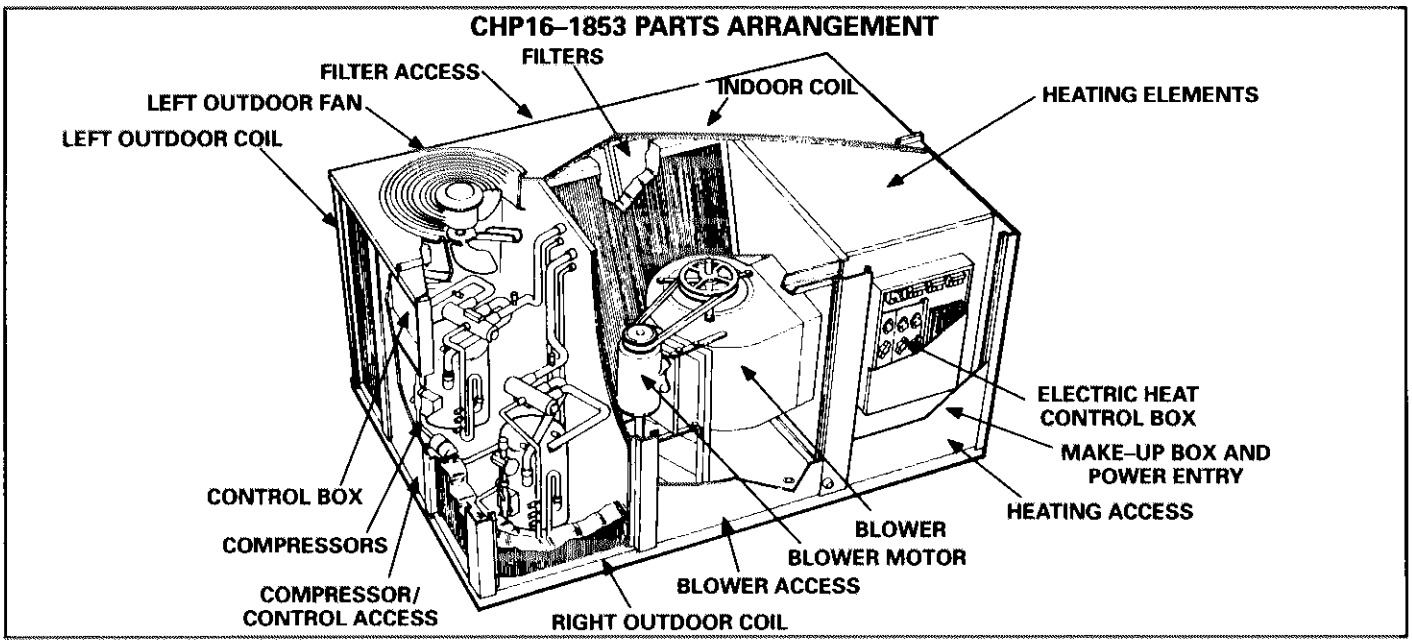


FIGURE 1

I–APPLICATION

CHP16 15 ton units are available in a single cabinet size (refer to the Engineering Handbook for more specific application data). All units are factory equipped with the hardware required for installing Lennox' optional thermostat control systems. Lennox' optional thermostat control systems are the same controls, harnesses, and harness plugs used in all previously released CHP16 commercial units. For example, a Honeywell W973 control will plug in to a CHP16–1853 as easily as it will plug in to a CHP16–411 (and no field wiring is required for either).

II–UNIT COMPONENTS

An overview of CHP16–1853 unit components is shown in figure 1.

A–Lifting Brackets

Each unit is equipped with factory installed lifting brackets as shown in figure 2. Brackets are used for lifting the unit during installation or when servicing. Lifting lugs can be removed from the unit and reused. If unit must be lifted for service, use only lifting brackets to lift unit.

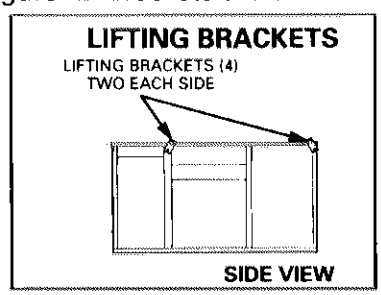


FIGURE 2

B–Control Box Components

CHP16 control box is shown in figure 4. The control box is located in the upper portion of the compressor compartment behind the compressor compartment access panel. After the access panel is removed, a hinged door with magnetic latch provides access to control components.

1–Power Distribution Terminal Block TB13

All CHP16 units use a power distribution terminal block located in the control box to provide a line voltage connection between the control box components and the power entry area in the heating compartment. Line voltage cables connect TB13 with the unit terminal block TB2 located in the heating compartment.

2–Transformer T1

CHP16-1853 series units use two line voltage to 24VAC transformers installed in the control box. Transformer T1 supplies power to all control circuits in the unit (except the reversing valves and the heating section). Transformer T1 is rated at 70VA. 208/230 (P) voltage transformers use two primary voltage taps as shown in figure 3.

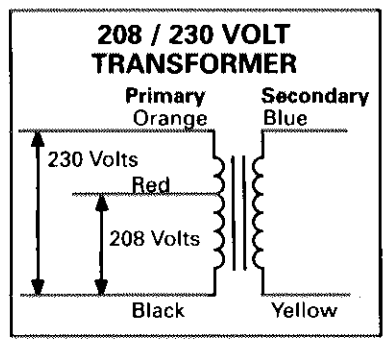


FIGURE 3

CHP16–1853 UNIT CONTROL BOX

KEY NUMBER	COMPONENT
A11	Pilot Relay Board
F1	Control Fuse Transformer T1
F16	Unit Fuses
F18	Control Fuse Transformer T18
CMC1	1st Stage Defrost Control
CMC2	2nd Stage Defrost Control
T1	Control Transformer
T18	Control Transformer
K3	Blower Contactor
K4	1st Stage Defrost Relay
K5	2nd Stage Defrost Relay
K6	Latch Relay
K8	Transfer Relay
K2	2nd Stage Compressor Contactor
K68	1st Stage Outdoor Fan Contactor
K10	2nd Stage Outdoor Fan Contactor
K1	1st Stage Compressor Contactor
S3	Compressor Monitor
S6	1st Stage Defrost Pressure Switch
S9	2nd Stage Defrost Pressure Switch

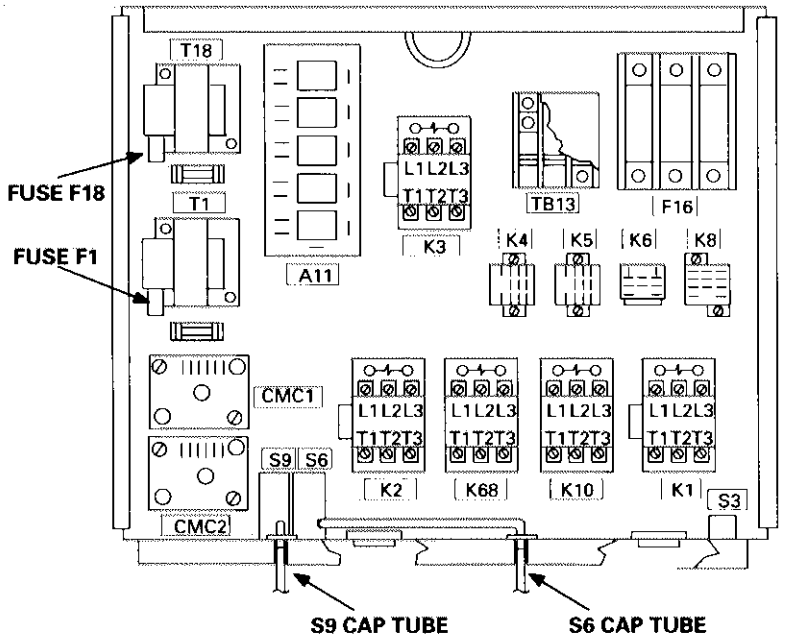


FIGURE 4

3–Transformer T18

The reversing valves are powered by transformer T18. Transformer T18 is identical to T1 (rated 70VA).

4–Unit Line Voltage Fuses F16

Line voltage fuses F16 are used to provide overcurrent protection to all line voltage components in the unit (except compressors and crankcase heaters). Fuses are rated at 35A in 208/230V units and 30A in all others.

5–Transformer Fuse F1

Transformer T1 is equipped with an integral fuse (F1) connected in series with the blue secondary voltage wire. The fuse may be accessed outside the transformer and is rated 3.5A.

6–Transformer Fuse F18

Fuse F18 is identical to F1 and is located inside T18.

7–Contactor K1

Contactor K1 is used to energize the first stage compressor (B1) in response to first stage heating or cooling demand. All units use three-pole-double-break contactors with a 24VAC coil for three-phase operation. K1 is also equipped with a set of auxiliary contacts mounted on the side of the contactor. The auxiliary switch is responsible for energizing first stage outdoor fan contactor K10.

NOTE–Contactor K1 is energized by the thermostat control system. Depending on the control system installed, the contactors may or may not be immediately energized upon demand. Refer to the operation sequence for the control system installed.

8–Contactor K2

Contactor K2 is used to energize the second stage compressor (B2) in response to second stage heating or cooling demand. All units use three-pole-double-break contactors with a 24VAC coil for three-phase operation. K2 is also equipped with a set of auxiliary contacts mounted on the side of the contactor. The auxiliary switch is responsible for energizing second stage outdoor fan contactor K68.

9–Outdoor Fan Contactor K10

Contactor K10 is used to energize the first stage outdoor fan (B4) in response to first stage demand. Outdoor fan motor B4 is energized with the first stage compressor upon receiving a heating or cooling demand. Outdoor fans operate independently. K10 is a three-pole-double-break contactor with a 24VAC coil.

10–Outdoor Fan Contactor K68

Contactor K68 is used to energize second stage outdoor fan (B5) in response to second stage demand. Outdoor fan motor B5 is energized with the second stage compressor upon receiving a heating or cooling

demand. Outdoor fans operate independently. K68 is a three-pole-double-break contactor with 24VAC coil.

11–Indoor Blower Contactor K3

Contactor K3 is used to energize the indoor blower motor in response to blower demand. In cooling mode K3 is energized by pilot relay K46 in response to heating, cooling or constant fan demand. When second stage heating demand is present K3 is energized by relay K9 (in the electric heat section). K3 is a three-pole-double-break contactor with a 24VAC coil. K3 is also equipped with a set of auxiliary contacts mounted on the side of the contactor. The auxiliary switch is responsible for powering the (optional) economizer control circuit when K3 is energized.

12–Pilot Relay Board A11

WARNING – DO NOT REMOVE OR BYPASS THE PILOT RELAY BOARD. CONTROL DAMAGE OR FAILURE COULD RESULT.

A11 is a pilot relay board (figure 5) used in all CHA16–1853 units. Pilot relays are used in 24VAC control circuits to limit voltage drop caused by a long run of thermostat wire. The relays on the circuit board are added electrically in between the thermostat (or thermostat control system) and the contactors in the unit. The relays draw much less current from the transformer than the unit contactors. When a long run of thermostat wire is used from the unit to the thermostat and back to energize unit contactors, the current drawn by the contactors could potentially cause voltage drop resulting in contactor chattering. The pilot relays are added between the thermostat and the contactors (refer to unit wiring diagram) to electrically isolate the contactor coils from the thermostat wire thereby minimizing the potential for voltage drop at the contactors.

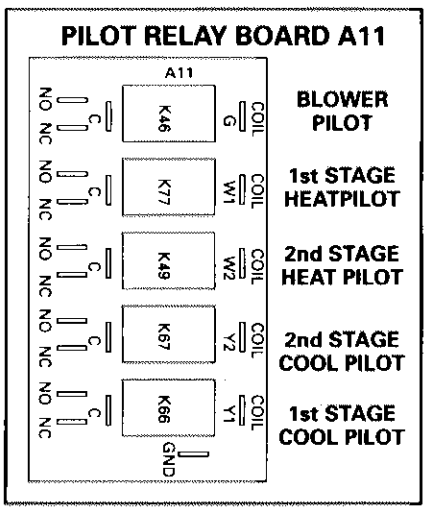


FIGURE 5

13–Defrost Control CMC1 & CMC2

The CMC defrost control (figure 6) is a solid state control manufactured by Hamilton Standard. The control provides automatic switching from normal heating operation to defrost mode and back. Two defrost controls are used in the CHP16-1853. Both operate independently. The CMC1 controls defrost in the first stage refrigeration circuit and the CMC2 controls defrost in the second stage refrigeration circuit. Each control provides 14 minute defrost periods at 30, 60 or 90 minute field changeable intervals. Each control monitors thermostat demand and "holds" the timer in place between thermostat demand. A set of diagnostic pins are also provided for troubleshooting the respective refrigeration circuit.

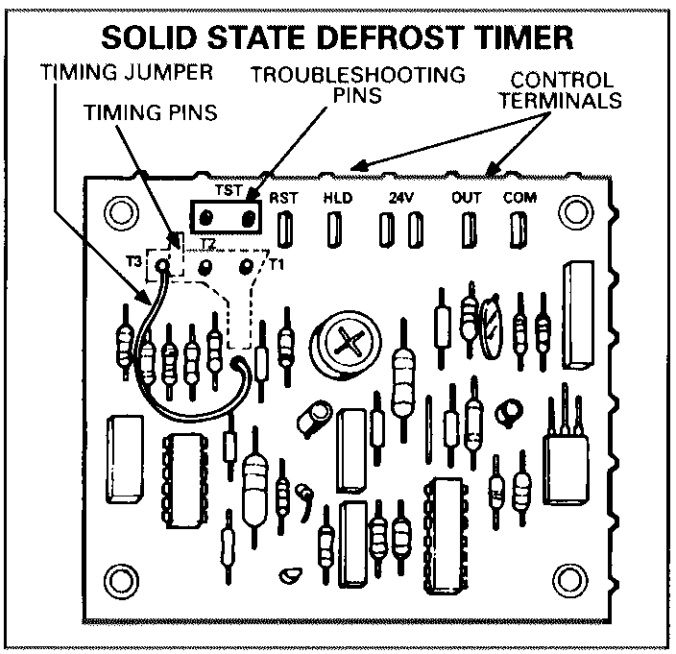


FIGURE 6

The control contains a solid state timer which switches an external defrost relay through 1/4" male spades mounted on the control's circuit board. The control energizes the defrost relay at regular timed intervals. But, in the CHP16-1853, a normally open defrost switch (S6 and S9) is placed in series with the defrost relay coil. This causes the defrost control to initiate defrost only when needed (when S6 or S9 is closed) at the end of the timed interval.

When the indoor thermostat closes (call for heat or cool), the defrost timer initiates a 30, 60 or 90 minute (depending on how the control is preset) timing sequence. At the end of the timing sequence, the control attempts to energize the defrost relay. If the defrost pressure switch is closed when the timing sequence ends, the defrost relay is energized and defrost begins.

Defrost Control Components

a– Timing Pins 30(T1), 60(T2), 90(T3)

Each of these pins provides a different timed interval between defrosts. A jumper connects the pins to circuit board pin W1. Table 3 shows the timings of each pin. The defrost interval can be field changed to 30, 60 or 90 minutes. The defrost period (14 minutes) cannot be changed. To change the interval between defrosts, simply remove the jumper from the pin it is connected to and reconnect the jumper to one of the other available pins (see figure 7).

b– Timing Jumper

The timing jumper is a factory installed jumper on the circuit board used to connect pin W1 to one of the three timing pins. The jumper may be connected to any one of the timing pins but must never be connected to either of the "TST" pins. See Caution.

CAUTION – DO NOT CONNECT TIMING JUMPER TO EITHER "TST" PIN. "TST" PINS ARE USED ONLY DURING A TEST AND MUST NOT CONNECT WITH ANY OF THE TIMING PINS. CONTROL DAMAGE WILL RESULT.

TABLE 3

DEFROST CONTROL CMC TIMINGS	INTERVAL BETWEEN DEFROSTS WITH JUMPER CONNECTED TO:			DEFROST TIME
	30 (T1)	60 (T2)	90 (T3)	
NORMAL OPERATION	30 ± 3 MIN.	60 ± 6 MIN.	90 ± 9 MIN.	14 ± 1.4 MIN.
"TST" PINS JUMPERED TOGETHER	7 ± 0.7 SEC.	14 ± 1.4 SEC.	21 ± 2.1 SEC.	3.3 ± 0.3 SEC.

c– "24V" Terminal

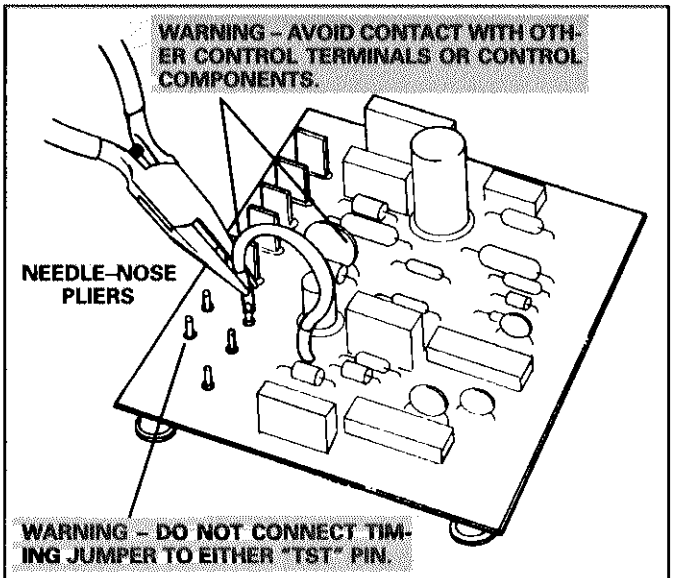
Terminal "24V" receives 24VAC from the control transformer. This terminal powers the control's internal timer and relays. Terminal "24V" must be powered at all times in order to provide "HOLD" between thermostat demands.

d– "COM" Terminal

Terminal "COM" provides 24VAC common.

e– "HLD" Terminal

Terminal "HLD" holds the internal timer in place between thermostat demands and allows the unit to continue timing upon resumption of thermostat demand. When thermostat demand is present, the control is allowed to count down to the next defrost. Terminal "HLD" is connected directly to thermostat demand.



TO CHANGE CONTROL TIMINGS:

1– Turn off all power to the unit to avoid damaging the circuit board.
2– Grasp wire connector firmly with needle nose pliers as shown.
3– *Gently* pull connector from pin.
4– Select new timing pin. DO NOT SELECT A "TST" PIN.
5– Gently push connector onto desired pin (see Table 3 for timings). Connector is seated when pin snaps.
6– Turn on power to unit.

FIGURE 7

TO PLACE CONTROL IN TEST MODE:

1– Turn off all power to avoid damaging the circuit board.
2– Make sure all control terminals are connected as shown on unit wiring diagram before attempting to place control in test mode. See NOTE below.

NOTE – Control will not go into test mode when disconnected from unit. Unit load must be applied to control terminals before the control will go into test mode.

3– Connect jumper to "TST" pins as shown.
4– Turn indoor thermostat to heat mode and adjust to highest temperature setting.
5– Turn on power to unit.
6– See Table 3 for control timings in "TST" mode.
7– Be sure to turn off power and remove jumper when test is complete. Turn on power and re–adjust thermostat.

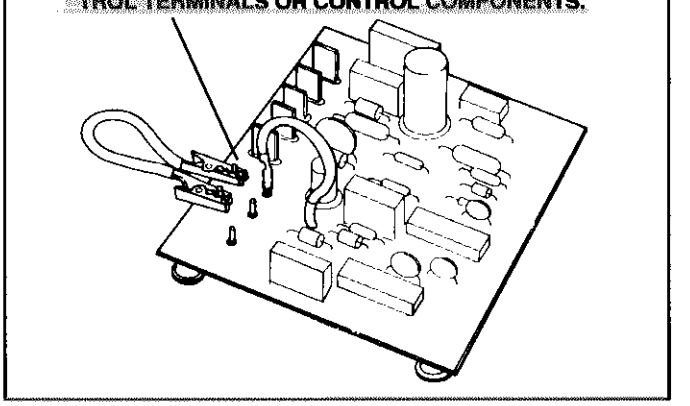


FIGURE 8

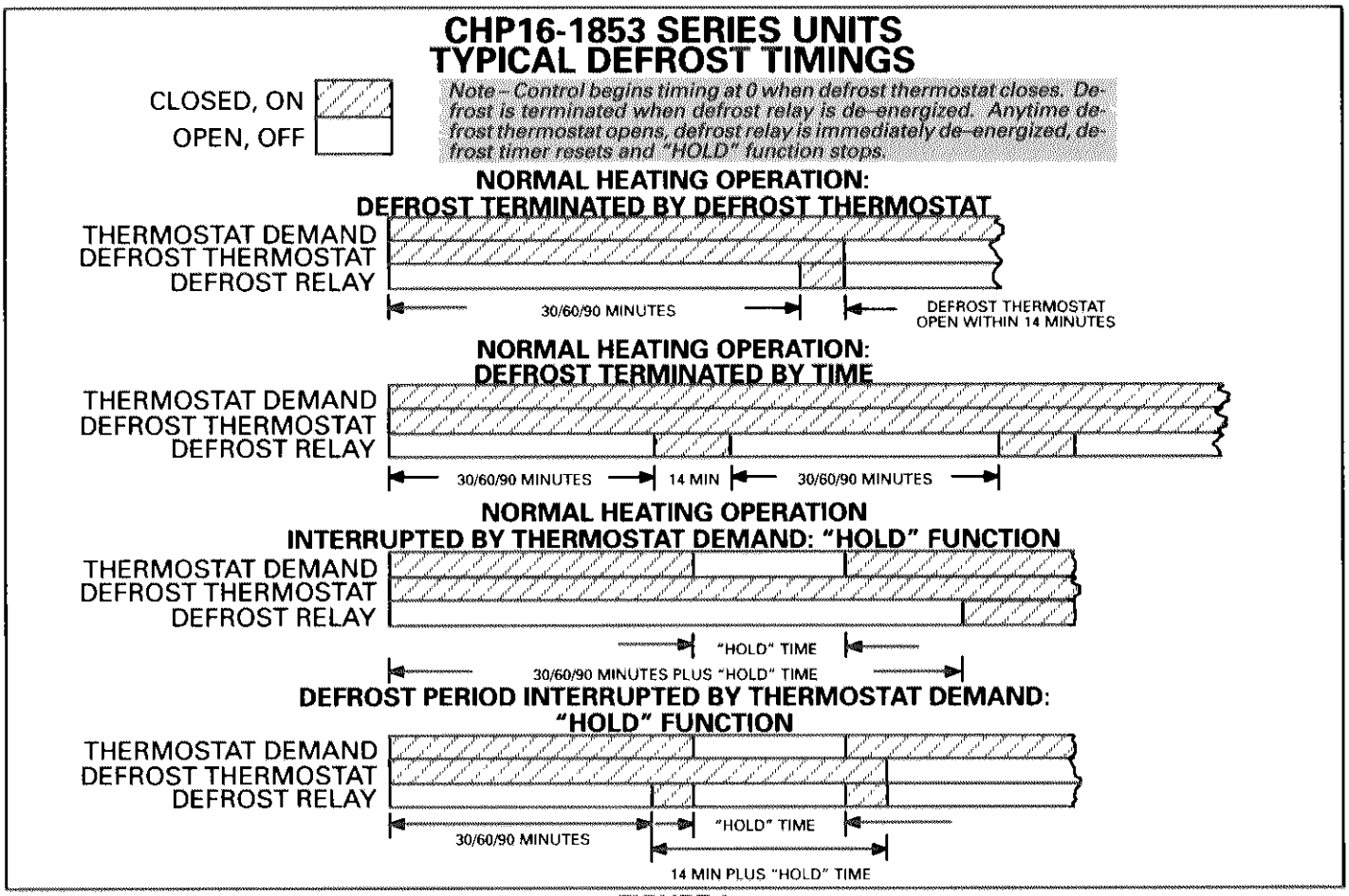


FIGURE 9

f– "OUT" Terminal

Terminal "OUT" controls defrost when connected to one side of the defrost relay coil. An internal relay connected to terminal "OUT" closes to allow external defrost relay to energize and initiate defrost. At the end of the defrost period, the internal relay connected to terminal "OUT" opens to de–energize the external defrost relay.

g– "RST" Terminal

Terminal "RST" resets the internal timer when power is removed and begins timer operation when power is returned. Terminal "RST" is connected to terminal "COM" through a set of normally closed defrost relay contacts. When the defrost relay contacts open terminal "RST" loses power (the path through "RST" is disrupted) and the internal timer is reset. The control resumes timing when the defrost relay contacts close.

h– "TST" Pins

Each board is equipped with a set of test pins for use in troubleshooting the unit. When jumpered together, these pins reduce the control timing to about 1/256 original time (see table 3 and figure 8).

IMPORTANT – CONTROL WILL BEGIN TEST MODE ONLY IF NORMAL LOAD IS APPLIED TO CONTROL TERMINALS. DO NO ATTEMPT TO OPERATE OR TEST CONTROL OUT OF UNIT.

A defrost period can last up to 14 minutes and can be terminated two ways. If the defrost thermostat does not open within 14 minutes after defrost begins, the timer will de–energize the defrost relay and the unit will resume normal operation. If the defrost thermostat opens during the 14 minute defrost period, the defrost relay is de–energized and the unit resumes normal operation. Refer to figure 9.

14–Defrost Relay K4 (First Stage)

Defrost relay K4 controls defrost in the first stage refrigeration circuit. K4 is controlled by defrost control CMC1 and defrost pressure switch S6. When K4 is energized defrost is initiated. When contacts K4-1 open, CMC1 internal timer is reset to zero. When K4-2 opens, outdoor fan contactor K10 is de-energized (outdoor

fan stops during defrost). And, when K4-3 closes, reversing valve L1 is energized, placing the first stage refrigeration circuit in cooling mode.

First stage defrost is terminated when K4 is de-energized. K4 can be de-energized two ways. When 14 minutes has elapsed, the path through terminal out will be disrupted causing relay K4 to de-energize. Defrost can also be terminated if defrost pressure switch S6 opens during defrost.

15–Defrost Relay K5 (Second Stage)

Defrost relay K5 controls defrost in the second stage refrigeration circuit. K4 is controlled by defrost control CMC2 and defrost pressure switch S9. When K5 is energized defrost is initiated. When contacts K5-1 open, CMC2 internal timer is reset to zero. When K5-2 opens, outdoor fan contactor K68 is de-energized (outdoor fan stops during defrost). And, when K4-3 closes, reversing valve L2 is energized, placing the second stage refrigeration circuit in cooling mode.

Second stage defrost is terminated when K5 is de-energized. K5 can be de-energized two ways. When 14 minutes has elapsed, the path through terminal out will be disrupted causing relay K5 to de-energize. Defrost can also be terminated if defrost pressure switch S9 opens during defrost.

16–Latch Relay K6

CHP16 series units are plumbed so that the unit is in cooling mode when the reversing valves are energized. Latch relay K6 controls operation of the reversing valves and is controlled (indirectly) by the indoor thermostat. The combined operation of latch relay K6 and transfer relay K8 allow the CHP16-1853 to use a conventional heat/cool thermostat as opposed to a heat pump thermostat.

A latch relay (figure10) is a special type of relay with two coils; a "SET" coil and a "RESET" coil. When 24VAC is applied to the "SET" coil, the normally open contacts close and the normally closed contacts open. When power is removed from the "SET" coil, nothing happens; the N.O. contacts remain closed and the N.C. contacts remain open. The contacts do not return to their normal position until the "RESET" coil is energized. Once the contacts are reset, they remain in their normal position when power is removed.

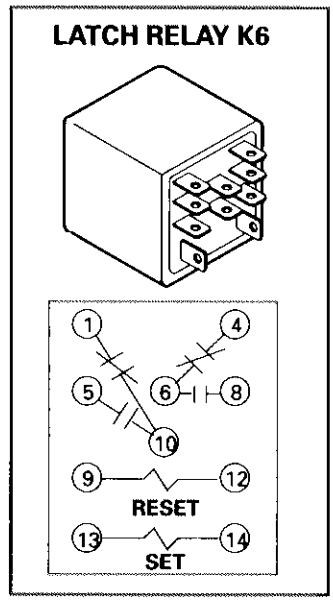


FIGURE 10

CHP16-1853 series units use a DPDT latch relay. Each set of normally open contacts is connected in series with a reversing valve. When the "SET" coil is energized, the normally open contacts close to energize the reversing valves (thereby placing the unit in the cooling mode). When power is removed from the "SET" coil (such as when thermostat demand is satisfied), the normally open contacts remain closed, the reversing valves remain energized and the unit remains in the cooling mode.

When a heating demand is initiated, the "RESET" coil is energized. The normally open contacts open and the reversing valves are de-energized (thereby placing the unit in the heating mode). When heat demand is satisfied and power to the "RESET" coil is removed, the normally open contacts remain open, the normally closed contacts remain closed and the unit remains in the heating mode.

17–Transfer Relay K8

Transfer relay K8 switches the unit from cooling mode to heating mode. Relay K8 routes thermostat demand to the appropriate contactors and defrost controls depending on whether the unit is in cooling or heating mode. The combined operation of latch relay K6 and transfer relay K8 allow the CHP16-1853 to use a conventional heat/cool thermostat as opposed to a heat pump thermostat.

During cooling mode, compressor contactor coils, outdoor fan contactor coils and defrost controls receive power (thermostat demand) from pilot relays K66-1 (first stage) and K67-1 (second stage). During a heating demand transfer relay K8 is energized. When K8 is energized, power routing is switched so that the compressor contactor coils, the outdoor fan contactor coils and the defrost controls receive power (thermostat demand) directly from control transformer T1.

18–Low Ambient Lockout Switch (Compressor Monitor) S3

All CHP16 units are equipped with a single compressor monitor located in the unit control box. The compressor monitor is a SPST bimetal thermostat which opens on a temperature drop. It is connected inline with the 24VAC compressor control circuits. When outdoor temperature drops below 40°F the compressor monitor opens to electrically disconnect all compressors. When the compressors are disconnected, cooling demand is handled by optional REMD16M economizer (if installed) and heating demand is handled by optional electric heat (if installed). The monitor automatically resets when outdoor temperature rises above 50°F.

NOTE–Compressor monitor must be disconnected if optional low ambient kit is used.

19–Defrost Pressure Switches S6

Defrost pressure switch S6 is located in the control box and is connected by cap tube to the first stage outdoor coil vapor line. The switch monitors the outdoor coil vapor line pressure to determine when defrost is needed. When the outdoor vapor line drops below 45±10 psig the switch closes. If S6 is closed when CMC1 checks for defrost, defrost relay K4 energizes to begin first stage defrost cycle. First stage defrost continues until S6 opens or until 14 minutes has elapsed.

20–Defrost Pressure Switch S9

Defrost pressure switch S9 is located in the control box and is connected by cap tube to the first stage outdoor coil vapor line. It is identical to S6. If S9 is closed when CMC2 checks for defrost, defrost relay K5 energizes to begin second stage defrost cycle. second stage defrost continues until S9 opens or until 14 minutes have elapsed.

What keeps the unit from defrosting while in the cooling mode?

Defrost cannot be initiated as long as the defrost pressure switches remain open. When the unit is in heating mode, the outdoor coil vapor line is connected directly to compressor suction. The vapor line pressures are in a range that allows the defrost pressure switches to cycle freely. When the unit is in cooling mode, the vapor line is connected to compressor discharge. The vapor line pressures are in a range that forces the defrost pressure switches to remain open.

C–Refrigeration Components

Summary of Features

The CHP16–1853 uses two independent refrigeration circuits (figure 11) consisting of two compressors, outdoor coils and indoor coils. Two draw–through type outdoor fans draw air across the outdoor coils independently controlled by thermostat demand. A single belt drive blower draws air across both indoor coils during all unit operation. Cooling may be supplemented by field-installed economizer and heating may also be supplemented by field-installed electric heat. The indoor coils are slab type and are stacked as shown in figure 12. Each coil is independently plumbed. Each indoor coil uses a non–adjustable externally equalized 7.5 ton expansion valve as the primary (cooling mode) expansion device. Likewise, each outdoor coil uses a non–adjustable externally equalized 7.5 ton (heating mode) expansion valve. A check valve is connected in parallel with each of the expansion valves for reverse refrigerant flow. Each indoor coil is also equipped with enhanced fins and rifled tubing. The two outdoor coils are also independently plumbed. The first stage compressor uses an independent circuit in the right outdoor coil (figure 11), and the second stage compressor uses an independent circuit in the left outdoor coil. Each compressor is protected by a high pressure switch and loss of charge switch. Additional protection is provided by factory installed low ambient thermostat (unit control box) and freezestats (on each indoor coil). Each refrigeration circuit is equipped with a thermometer well for charging.

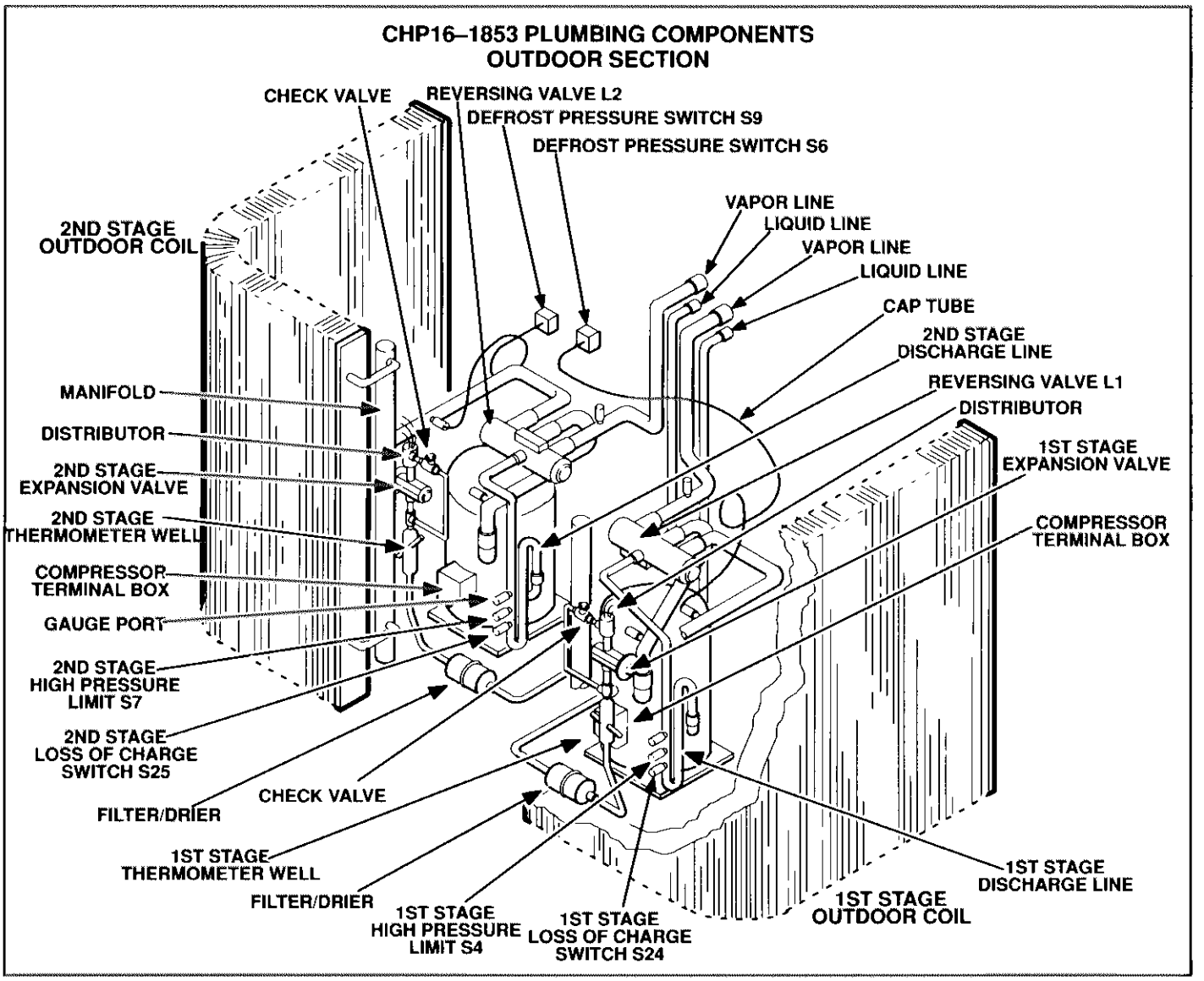


FIGURE 11

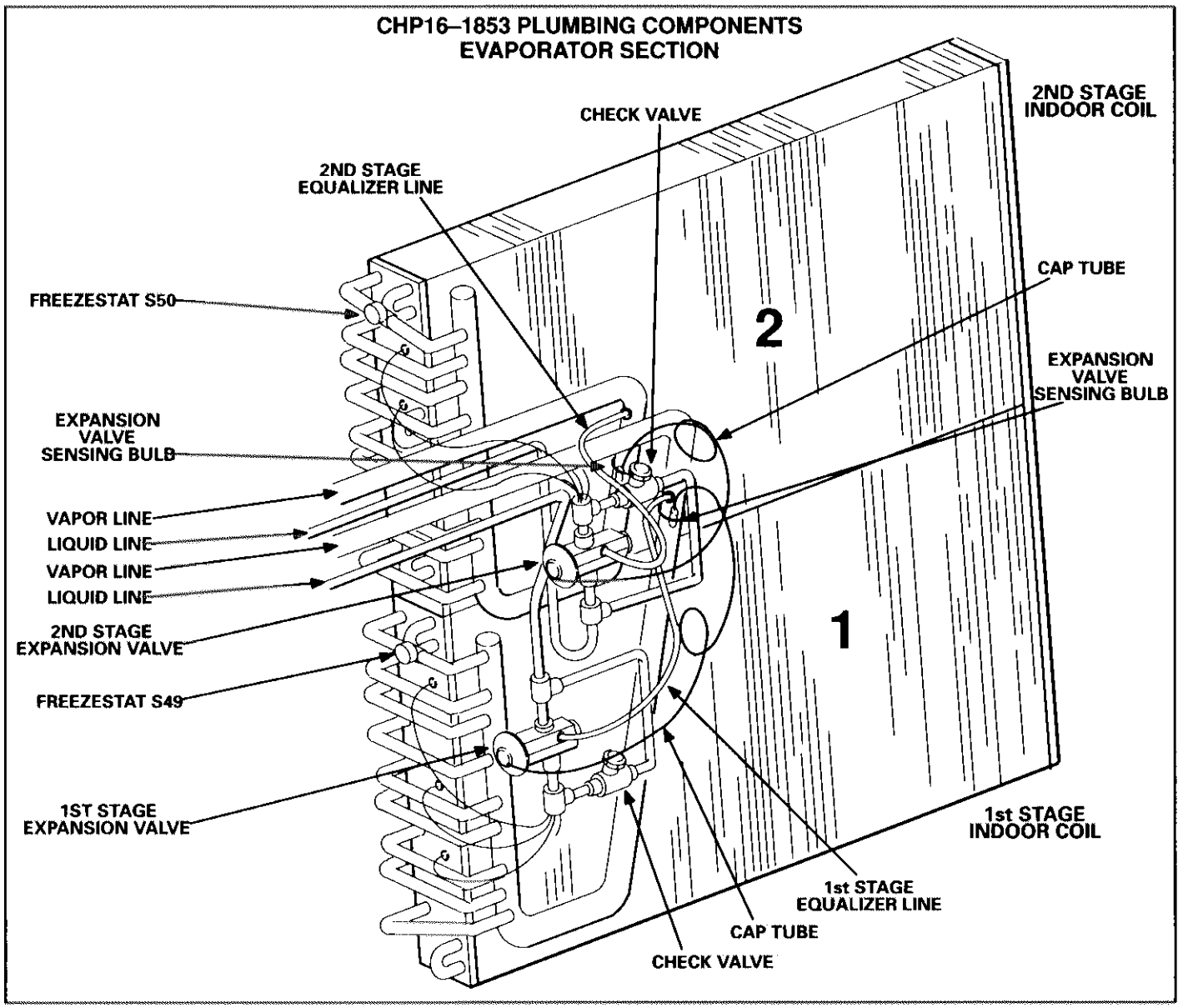


FIGURE 12

TABLE 4

CHP16 SERIES UNITS – COMPRESSOR SPECIFICATIONS								
Unit	Voltage/ Phase	Compressor Manufacturer	Locked Rotor Amps	Rated Load Amps	Oil Charge Fl. Oz.	Viscosity	Oil Type	Crankcase Heater
CHP16–1853-1	208/230V/3	Tecumseh	185	25.1	65	**	**	None
CHP16–1853-1	460V/3	Tecumseh	89	14.2				
CHP16–1853-1	575V/3	Tecumseh	79	11.2				
CHP16–1853-2	208/230V/3	Copeland	183	27.1	128	150	*	70 watt Insertion Type Self–Regulating
CHP16–1853-2	460V/3	Copeland	91	14.2				
CHP16–1853-2	575V/3	Copeland	73	11.2				

*Texaco Capella WF–32 or Suniso 3GS or White Oil M/M Sontex 200–LT
**Not Specified

1–Compressors B1 and B2

Table 4 shows the specifications of compressors used in all units. Compressor B1 operates during all cooling and heating demand. Compressor B2 operates only during second stage cooling and during first and second stage heating demand. All compressors are protected by internal overload protection circuitry.

CHP16-1853-1 units are equipped with a Tecumseh SF compressor and CHP16-1853-2 units are equipped with a Copeland BR compressor. The Tecumseh compressor is a "high side shell" compressor. Certain precautions should be taken when servicing these compressors. See Caution below.

CAUTION – Tecumseh SF compressors are "high side shell" compressors. The compressor shell is internally exposed to discharge temperatrure and pressure. Compressor shell will be hot during and just after operation.

WARNING – WHEN NITROGEN LEAK TESTING A UNIT EQUIPPED WITH TECUMSEH SF COMPRESSOR, DO NOT ALLOW TEST PRESSURE TO EXCEED 300psi.

NOTE–Refer to wiring diagram section B10 for specific unit operation.

WARNING – COMPRESSOR MUST BE GROUNDED. DO NOT OPERATE WITHOUT PROTECTIVE COVER OVER TERMINALS. DISCONNECT POWER BEFORE REMOVING PROTECTIVE COVER. FAILURE TO FOLLOW THESE PRECAUTIONS COULD CAUSE ELECTRICAL SHOCK RESULTING IN INJURY OR DEATH.

WARNING – UNITS EQUIPPED WITH COPELAND BR COMPRESSORS ARE EQUIPPED WITH CRANKCASE HEATERS. THE HEATERS MUST BE ENERGIZED FOR 24 HOURS BEFORE ATTEMPTING TO START COMPRESSORS. SET THERMOSTAT SO THERE IS NO COMPRESSOR DEMAND BEFORE CLOSING DISCONNECT SWITCH. ATTEMPTING TO START COMPRESSORS DURING THE 24 HOUR WARM-UP PERIOD COULD RESULT IN DAMAGED OR FAILED COMPRESSORS.

2–Crankcase Heaters HR1 and HR2

CAUTION – Crankcase heaters (if equipped) are self-regulating and are connected to line voltage at all times (not switched by unit circuitry).

CHP16–1853 units may be equipped with Copeland BR or Tecumseh SF compressors. Copeland BR compressors are equipped with 70 watt self–regulating insertion type crankcase heaters. Heater HR1 is installed in compressor B1, heater HR2 is installed in compressor B2 and heater HR5 is installed in compressor B13.

Tecumseh SF compressors are not equipped with crankcase heaters.

3–High Pressure Limit S4 and S7

The high pressure limit is a manually reset SPST N.C. switch which opens on a pressure rise. All CHP16-1853 units are equipped with this limit. The switch is located in the compressor discharge line and is wired in series with the compressor and outdoor fan contactors. S4 is wired in series with first stage contactors K1 and K10. S7 is wired in series with the second stage contactors K2 and K68. When discharge pressure rises above 410±10 psig (indicating a problem in the system) the switch opens and the respective compressor and outdoor fan are de–energized (the economizer can continue to operate.) After the problem has been found and corrected, the switch can be reset by pushing in the reset button.

4–Loss of Charge Switch S24 and S25

The loss of charge switch is an auto-reset SPST N.C. switch which opens on a pressure drop (almost complete loss of charge). All CHP16-1853 units are equipped with this switch. The switch is located in the compressor discharge line next to the high pressure switch and is wired in series with the high pressure switch and compressor and outdoor fan contactors. S24 is wired in series with the first stage contactors K1 and K10. S25 is wired in series with the second stage contactors K2 and K68. When discharge pressure drops below 25±5 psig (indicating a loss of charge in the system) the switch opens and the compressor is de–energized. The switch automatically resets when refrigerant is added and pressure in the discharge line rises above 55±5 psig.

5–Outdoor Fans B4 and B5

The specifications table on page 3 in this manual shows the specifications of outdoor fans used in CHP16–1853 units. The outdoor fans are energized independently upon receiving heating or cooling thermostat demand. Outdoor fan B4 draws air across the first stage outdoor coil during all cooling and heating demand. Outdoor fan B5 draws air across the second

stage outdoor coil during second stage cooling demand and during all heating demand. Both outdoor fans in the CHP16–1853 (all voltages) three–phase motors which do not require a run capacitor.

6–Reversing Valves L1 and L2

Two refrigerant reversing valves, each with electromechanical solenoids, are used to reverse refrigerant flow during unit operation. The reversing valves are connected in the vapor lines of each refrigerant circuit. Reversing valve L1 is connected in the first stage circuit and L2 is connectd in the second stage circuit. The reversing valves are energized during cooling demand and during defrost.

7–Thermometer Well (Figure 13)

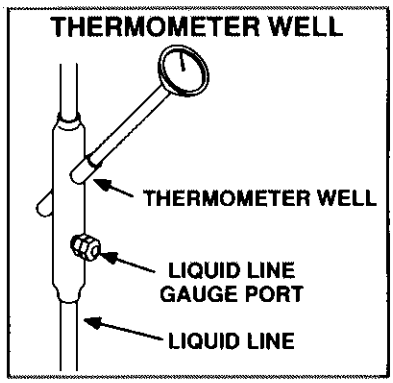


FIGURE 13

All units are factory equipped with thermometer wells in each refrigeration circuit for charging the unit. The wells are used to accurately measure the temperature of the liquid line. The temperature measured is then used to calculate the approach or subcooling temperature. Approach and subcooling temperatures are compared to tables printed in the charging section of this manual to determine the correct charge. The thermometer wells are equipped with a gauge port for connection of a high pressure gauge.

To accurately measure the temperature of the liquid line, the well should be filled with a light mineral oil before using. This will ensure good heat transfer to the thermometer.

8–Expansion Valves

The CHP16-1853 uses four externally equalized 7.5 ton expansion valves. Each valve is located in the liquid line adjacent to a refrigerant coil (one valve on each indoor coil and one valve on each outdoor coil). A liquid line and check valve connected in parallel with each expansion valve allows for reverse refrigerant flow. Expansion valve control is provided by a superheat sensing bulb which is connected by cap tube to the expansion valve. The sensing bulb is strapped to the vapor line where it exits the coil. As the bulb senses too little superheat, the expansion valve throttles closed and restricts refrigerant flow through the coil. When too much superheat is sensed, the expansion valve throttles open and allows more refrigerant flow through the coil.

All expansion valves are equipped with an internal check valve to prevent refrigerant from flowing backward through the valve when refrigerant flow is reversed.

9–Check Valves

A separate liquid line connected in parallel with each expansion valve allows for refrigerant flow around the valve when flow is reversed (relative to the valve). A check valve is supplied in each of the parallel liquid lines to prevent refrigerant from bypassing the valve when refrigerant flow is forward (relative to the valve).

10–Filter/Drier

A combination filter/drier is located in the liquid line of each refrigerant circuit.

D–Blower and Heating Compartment Components

1–Freezestats S49, S50

Each indoor coil is equipped with a low temperature limit located on the indoor vapor line. S49 is located on the first stage coil and S50 is located on the second stage coil. Each freezestat is wired in series with its respective compressor and outdoor fan contactor coil. Each freezestat is a SPST auto–reset limit which opens at 29°F ± 3°F on a temperature drop and closes at 58°F ± 4°F on a temperature rise. To prevent indoor coil icing, the freezestats open during compressor operation to temporarily disable the respective compressor until the coil warms sufficiently to melt any accumulated frost.

If the freezestats are tripping frequently due to coil icing, check the unit charge, airflow and filters before allowing unit back in operation. Make sure to eliminate all conditions which might promote indoor coil ice buildup.

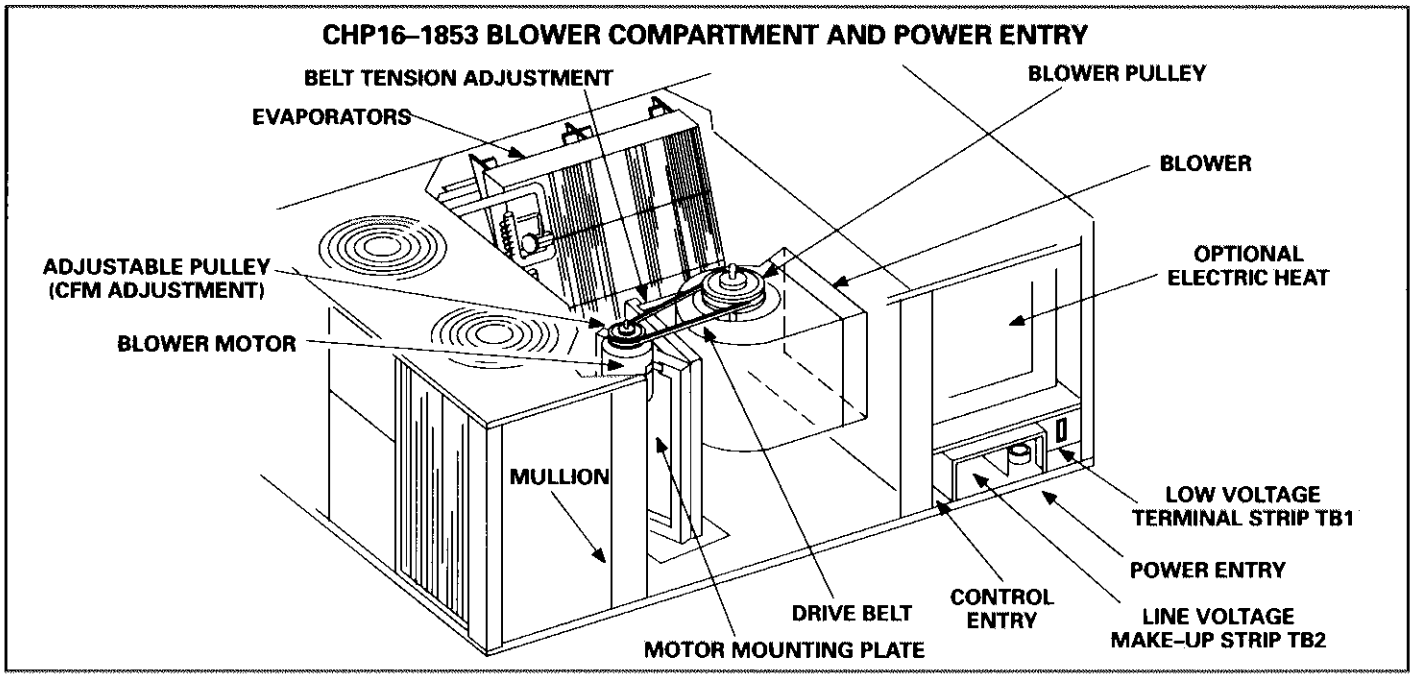


FIGURE 14

2–Indoor Blower Motor B3

All units use three-phase single-speed blower motors. CFM adjustments are made by adjusting the motor pulley. Blower motor ratings are shown in table 5.

TABLE 5

BLOWER MOTOR				
Unit	Volts	Phase	HP	FLA
CHP16–1853	208/230	3	3	10.6
CHP16–1853	208/230	3	5	16.7
CHP16–1853	460	3	3	4.8
CHP16–1853	460	3	5	7.6
CHP16–1853	575	3	3	3.9
CHP16–1853	575	3	5	6.1

3–Line Voltage Make–Up Strip TB2

Line voltage terminal strip TB2 (figure 14) is provided in all CHP16–1853 units to provide a means for connection of all line voltage wiring. Knock–outs provided in the base pan of the unit cabinet allow for passage of wires into conduit and roof mounting frame.

4–Low Voltage Terminal Strip TB1

All CHP16–1853 units are equipped with a low voltage terminal strip TB1 located in the heating compartment (figure 14). Most low voltage (thermostat) electrical connections can be made to this terminal strip. Knock–outs provided in the base pan of the unit cabinet allow for passage of wires into conduit and roof mounting frame. Special instructions are provided where needed for low voltage connections that cannot be made to the terminal strip. A detail drawing of TB1 is also shown in figure 15.

TB1 uses spring crimp type retainers for securing wires. A small slot screwdriver must be used to depress the spring in order to insert or remove a wire (see figure 15). Strip wire no more than 1/4".

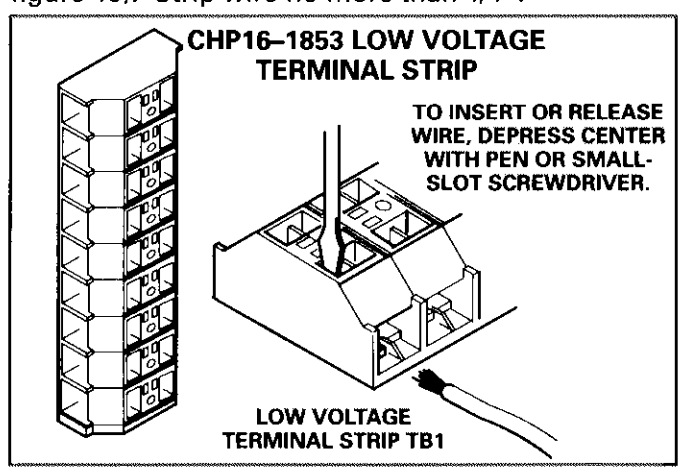


FIGURE 15

III–ELECTRICAL CONNECTIONS

Refer to startup directions and refer closely to the unit wiring diagram when servicing. See unit nameplate for minimum circuit ampacity and maximum fuse size. 208/460/575 volt units are factory wired with red wire connected to control transformer primary. 230 volt units are field wired with orange wire connected to control transformer primary.

IV–PLACEMENT AND INSTALLATION

Make sure the unit is installed in accordance with the installation instructions and all applicable codes. See accessories section for conditions requiring use of optional roof mounting frame (RMF16).

V–STARTUP – OPERATION

A–Preliminary and Seasonal Checks

1– Make sure the unit is installed in accordance with the installation instructions and applicable codes.

2– Inspect all electrical wiring, both field and factory installed for loose connections. Tighten as required. Refer to unit diagram located on inside of unit control box cover.

3– Check to ensure that refrigerant lines are in good condition and do not rub against the cabinet or other refrigerant lines.

4– Check voltage at disconnect. Voltage must be within the range listed on nameplate. If not, consult the power company and have voltage condition corrected before starting the unit.

5– Recheck voltage and amp draw with unit running. If power is not within range listed on unit nameplate, stop unit and consult power company. Refer to unit nameplate for correct running amps.

6– Inspect and adjust blower belt (see section VII–C–Blower Belt Adjustment).

B–Cooling Startup

NOTE–The following is a generalized procedure and does not apply to all thermostat control systems. Electronic and ramping thermostat control systems may operate differently. Refer to the operation sequence section of this manual for more information.

WARNING – Crankcase heaters (used in CHP16-1853-2 units) must be energized for 24 hours before attempting to start compressors. Set thermostat so there is no compressor demand before closing disconnect switch. Attempting to start compressors during the 24 hour warm-up period could result in damaged or failed compressors.

1– Set fan switch to AUTO or ON and move the system selection switch to COOL. Adjust the thermostat to a setting far enough below room temperature to bring on both compressors. Compressors will start and cycle on demand from the thermostat (allowing for unit and thermostat time delays).

2– Each refrigerant circuit is charged with R–22 refrigerant. See unit rating plate for correct charge.

3– Refer to Cooling Operation and Adjustment section for proper method of checking charge.

C–Heating Startup

1– Set the fan switch to AUTO or ON and move the system selection switch to HEAT. Adjust the thermostat setting above room temperature.

2– The heat pump provides two stages of heat operation. The initial heating demand energizes both compressors. Further demand will bring on supplemental electric heaters, if used.

3– The independent refrigeration systems allow either compressor circuit to complete a defrost cycle without affecting heating performance of the other circuit.

D–Safety or Emergency Shutdown

Turn off power to the unit at the disconnect.

VI–COOLING SYSTEM SERVICE CHECKS

The unit is factory charged and requires no adjustment; however, charge should be checked periodically (before each heating and cooling season) using the approach method. The approach method compares actual liquid temperature with the outdoor ambient temperature. Thermometer wells have been provided to allow accurate liquid temperature measurement.

NOTE–Indoor temperature should be between 70°F (21°C) and 80°F (27°C) and the outdoor ambient must be above 60° F (16°C).

A–Gauge Manifold Attachment

Service gauge ports are identified in figure 11. Attach high pressure line to liquid line port on thermometer well and low pressure line to suction line service port.

NOTE–When unit is properly charged (whether by approach, superheat or subcooling method) liquid line pressures should approximate those in table 7.

B–Charging

Charging must be done in cooling mode.

If the system is void of refrigerant, the recommended and most accurate method of charging is to weigh refrigerant into the unit according to the amount shown on the unit nameplate and in the specifications table. If weighing facilities are not available or if the unit is just low on charge, use the following procedures:

WARNING-DO NOT EXCEED NAMEPLATE CHARGE UNDER ANY CONDITIONS.

1- This method uses a thermometer inserted in the thermometer wells to check liquid line temperature. *Make sure thermometer wells are filled with oil before checking.*

2- Attach gauge manifolds and insert thermometers in wells.

3- *IMPORTANT - Block compressor access opening with access panel so air does not by-pass coils.*

4- Operate unit (both compressors) for at least five minutes to stabilize pressures. If ambient temperature is below 60°F, it is necessary to raise the liquid pressure to 200 to 250 psig. To accomplish this, block the outdoor coil from top to bottom evenly from both ends, then proceed with step 5.

5- Approach Temperature = Liquid temperature minus ambient temperature. (For best results use same thermometer for both readings).
Approach temperature should match values on the unit label (table 6). An approach temperature greater than value shown indicates an undercharge. An approach temperature less than value shown indicates an overcharge.

TABLE 6

APPROACH TEMPERATURE	
UNIT	LIQUID TEMP. MINUS AMBIENT TEMP.
CHP16-1853	12°F + 1°F

6- When unit is properly charged, the system pressure should approximate pressure given in the Normal Operating Pressure Table (table 7).

TABLE 7

CHP16-1853 NORMAL OPERATING PRESSURES			
Mode	Outdoor Entering Air Temperature	Each Stage	
		Liq. + 10 PSIG	Suct. + 5 PSIG
Heating	17°F	179	31
Heating	47°F	225	52
Cooling	75°F	185	69
Cooling	85°F	217	72
Cooling	95°F	250	74
Cooling	105°F	295	80

NOTE - Table 7 is a general guide for performing maintenance checks. When unit is properly charged line pressures should approximate those in table 7. Table 7 is not a procedure for charging the system. Minor variations in pressures may be expected due to differences in installations or conditions such as indoor air volume, humidity and load. Significant deviations could mean that the system is not properly charged or that a problem exists with some component. Used prudently, table 7 could serve as a useful service guide.

VII-INDOOR BLOWER OPERATION / ADJUSTMENT

A-Blower Operation

NOTE-The following is a generalized procedure and does not apply to all control systems.

1- Blower operation is dependent on the thermostat control system option that has been installed in the CHP16. Refer to the operation sequence for the control system installed for detailed descriptions of blower operation.

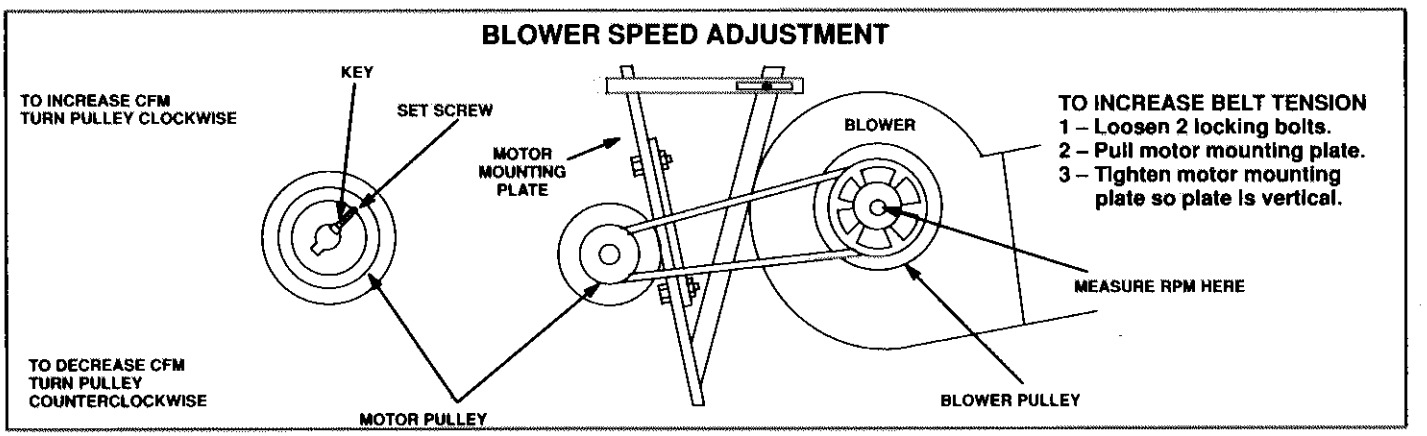


FIGURE 16

2- Generally, blower operation is set at the thermostat subbase fan switch. With the fan switch in the "ON" position, the blower operates continuously. With the fan switch in the "AUTO" position, the blower cycles with demand (or, with some control systems, runs continuously while the heating or cooling circuits cycle).

3- In most cases, the blower and entire unit will be off when the system switch is "OFF". The only exception is immediately after a heating demand until the blower control (which is controlled by the heating section of the unit) switches off.

B-Determining Unit CFM

1- The following measurements must be made with a dry indoor coil. Run the blower without the cooling demand. Air filters must be in place when measurements are taken.

2- Measure static pressure external to the unit (from supply to return).

To Measure Discharge Static Pressure:

a- Locate taps as shown in figure 17.

b- Punch a 1/4" diameter hole. Insert manometer hose flush with the inside edge of hole or insulation. Seal around the hole with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. Connect the other end of the manometer to the return duct as above.

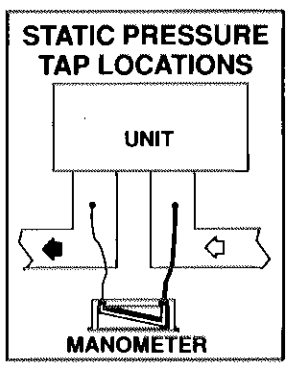


FIGURE 17

c- With only the blower motor running, observe manometer reading.

d- Seal around the hole when finished.

3- Measure blower wheel RPM (figure 16).

4- Refer to unit nameplate to determine the blower motor horse power.

5- Referring to tables 1 and 2, use the static pressure and RPM readings to determine unit CFM.

6- The CFM can be adjusted at the motor pulley (see section C-Blower Belt Adjustment).

Determining Unit CFM (Alternative Method):

Air volume may also be determined by measuring pressure drop across the indoor coil.

1- Remove lifting lug bolt located on the blower side of unit above condensate drain. Use an awl or screw driver to open a hole in the insulation.

2- Insert the negative or low pressure hose of draft gauge 1 inch past the insulation.

3- Remove filter access panel and insert other hose through hole provided on the left rear panel above filter and connect to positive or high pressure side of draft gauge.

4- Turn on blower and compare draft gauge reading to table 8. Use gauge reading to determine CFM.

5- Adjust blower speed as required (see section C-Blower Belt Adjustment).

TABLE 8

DRAFT GAUGE READINGS		
AIR VOLUME (CFM)	DRY COIL IN. WATER	*WET COIL IN. WATER
5200	.16 - .17	.26 – .27
5600	.18 - .19	.29 – .31
6000	.20 - .22	.32 – .35
6400	.23 - .25	.37 – .40
6800	.26 - .27	.41 – .43
7200	.27 - .28	.44 – .45
7400	.27 - .29	.43 – .46

NOTE–These are pressure drops across the indoor coil and not total system resistance.

* All cooling stages must be in operation.

C-Blower Belt Adjustment

Maximum life and wear can be obtained from belts only if proper pulley alignment and belt tension are maintained.

Important–Tension new belt after 24–48 hours of operation. This will allow belts to stretch and seat in grooves. To increase belt tension, loosen 2 locking bolts and pull mounting plate. Tighten motor mounting plate in vertical position.

Adjusting Unit CFM:

To change CFM:

1- Remove the blower belt.

2- Loosen the set screws on motor pulley and remove key as shown in figure 16.

3- Turn pulley clockwise to increase CFM and counterclockwise to decrease CFM. One half turn changes blower speed approximately 20 RPM.

NOTE–The pulley is factory set at 3 turns open.

4- Replace the key and tighten the set screw. Replace and tighten the blower belt.

VIII–MAINTENANCE

CAUTION – TURN OFF GAS AND ELECTRICAL POWER TO THE UNIT BEFORE PERFORMING ANY MAINTENANCE OR SERVICE OPERATION ON THE UNIT. REMEMBER TO FOLLOW LIGHTING INSTRUCTIONS ATTACHED TO THE UNIT WHEN PUTTING THE UNIT BACK IN OPERATION.

BE CAREFUL WHEN SERVICING UNIT TO AVOID ACCIDENTAL CONTACT WITH SHARP METALLIC EDGES WHICH MAY CAUSE INJURY.

A–Indoor Coil

CAUTION–Disconnect power before cleaning.

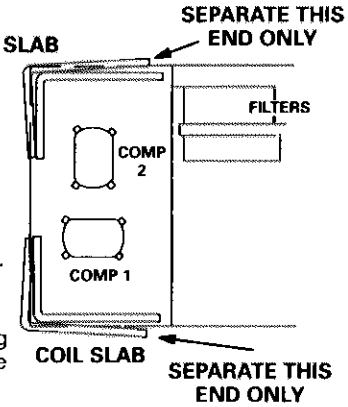
Inspect and clean coil at beginning of each cooling and heating season. Clean using mild detergent or commercial coil cleanser. Check condensate drain pan and line, if necessary. Flush coil and condensate drain with water taking care not to get insulation, filters or return air ducts wet. Check connecting lines and coil for evidence of oil leaks.

B–Outdoor Coil

Clean outdoor coil annually with detergent or commercial coil cleaner and inspect monthly during the cooling season.

SLAB COIL CLEANING PROCEDURE

1– Remove unit top panel.
2– Remove mullion holding coil.
3– Remove clips connecting coil slabs and separate slabs 3"–4" (76 mm–102 mm).
4– Clean coils with detergent or commercial coil cleaner.
5– Rinse thoroughly with water and reassemble.
6– Visually inspect connecting lines and coils for evidence of refrigerant leaks.



CAUTION - Handle coils gently to prevent damage to return bends. Inspect control box end of each condenser coil after unit has been cleaned and re-assembled. Look for refrigerant leaks caused by cracks in return bends or solder joints.

FIGURE 18

CAUTION–Disconnect power before cleaning.

Outdoor coils are made of individual coil slabs. Dirt and debris may become trapped between the slabs. To clean between slabs, carefully separate coil slabs and wash them thoroughly. See figure 18.

NOTE–If owner complains of insufficient cooling, the unit should be gauged and refrigerant charge checked. Refer to Gauge Manifold Attachment, Checking Charge and Charging sections in this manual.

C–Lubrication

All motors used in CHP16–1853 units are prelubricated; no further lubrication is required.

D–Supply Air Blower Wheel

Annually inspect supply air blower wheel for accumulated dirt or dust. Turn off power before attempting to remove access panel or to clean blower wheel.

E–Filters (Figure 19)

CHP16 unit is equipped with four pleated 2" throw–away type filters. Permanent 1" foam filters are acceptable replacements. Filters should be checked monthly (or more frequently in severe use) and cleaned or replaced regularly. If permanent foam filters are used as a replacement, they should be checked and cleaned periodically with warm water and a mild detergent. Once dry, filters should be sprayed with filter handicoater before reinstallation. Filter handicoater is R.P. Products coating no. 418 and is available as Lennox part no. P-8-5069. Take note of the "AIR FLOW DIRECTION" marking on the filter frame when re–installing.

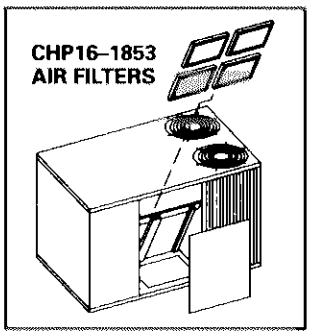


FIGURE 19

NOTE–Filters must be U.L.C. certified or equivalent for use in Canada.

F–Electrical

1– Check all wiring for loose connections.
2– Check for correct voltage at unit (unit operating).
3– Check amp–draw on both condenser fan motor and blower motor.
Fan Motor Rating Plate ____ Actual ____
Indoor Blower Motor Rating Plate____ Actual____

IX–OPTIONAL ECH16 ELECTRIC HEAT

A–Matchups and Ratings

Table 9 shows all possible CHP16 to ECH16 matchups. Also shown in the tables are ECH16 electrical ratings.

B–Electric Heat Components

ECH16 parts arrangement is shown in figures 20 and 21. All ECH16 units consist of electric heating elements exposed directly to the airstream. Multiple-stage elements are sequenced on and off by time-delays in response to thermostat demand.

1–Contactor K15

Contactor K15 is a 3-pole double-break contactor located in the control box. All ECH16-185 electric heat units are equipped with K15. K15 is equipped with a 24VAC coil which is energized when pilot relay K9 closes. When K15 is energized, the heating elements (first stage heating elements if equipped with multi-stage heater) are energized.

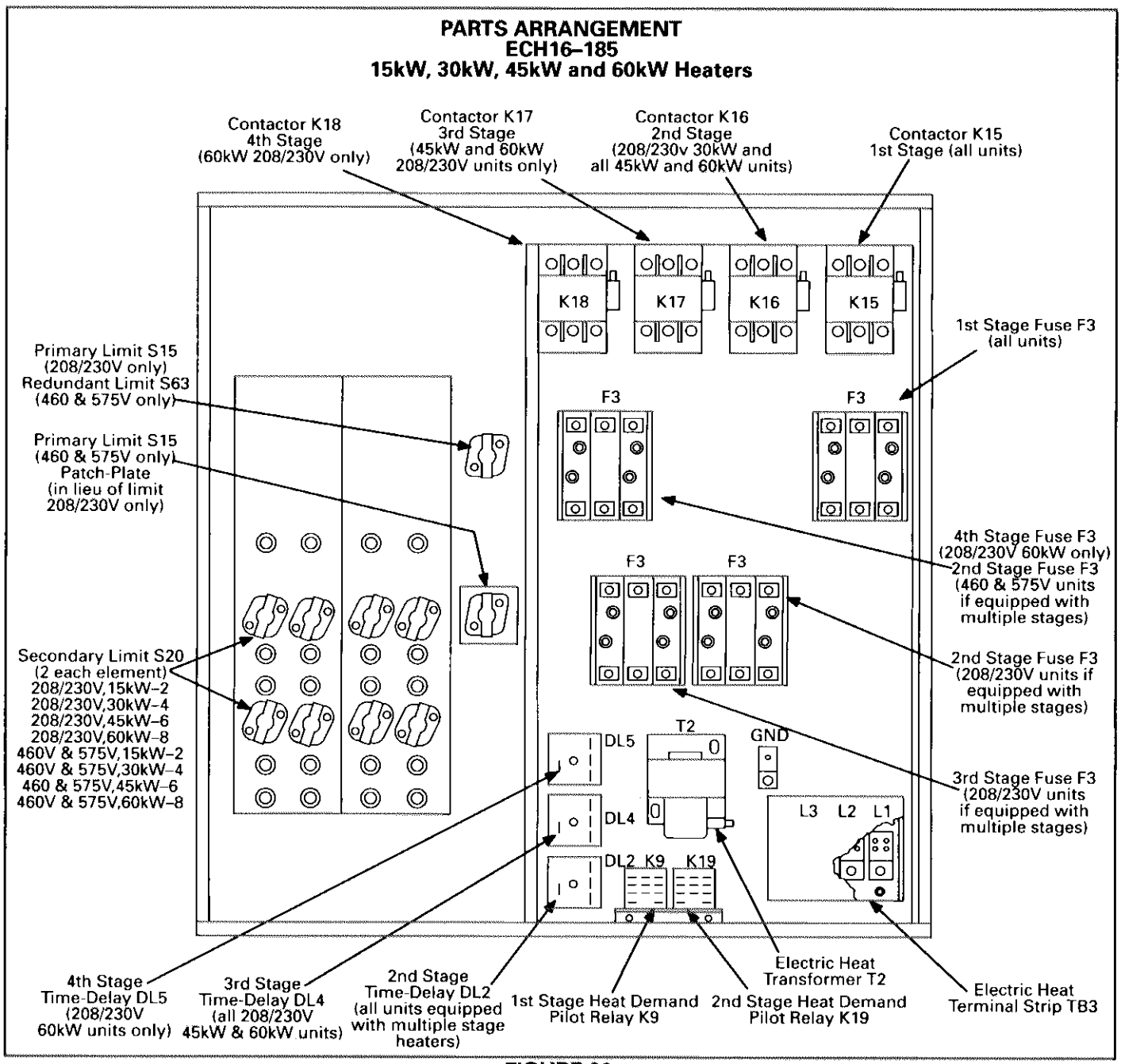


FIGURE 20

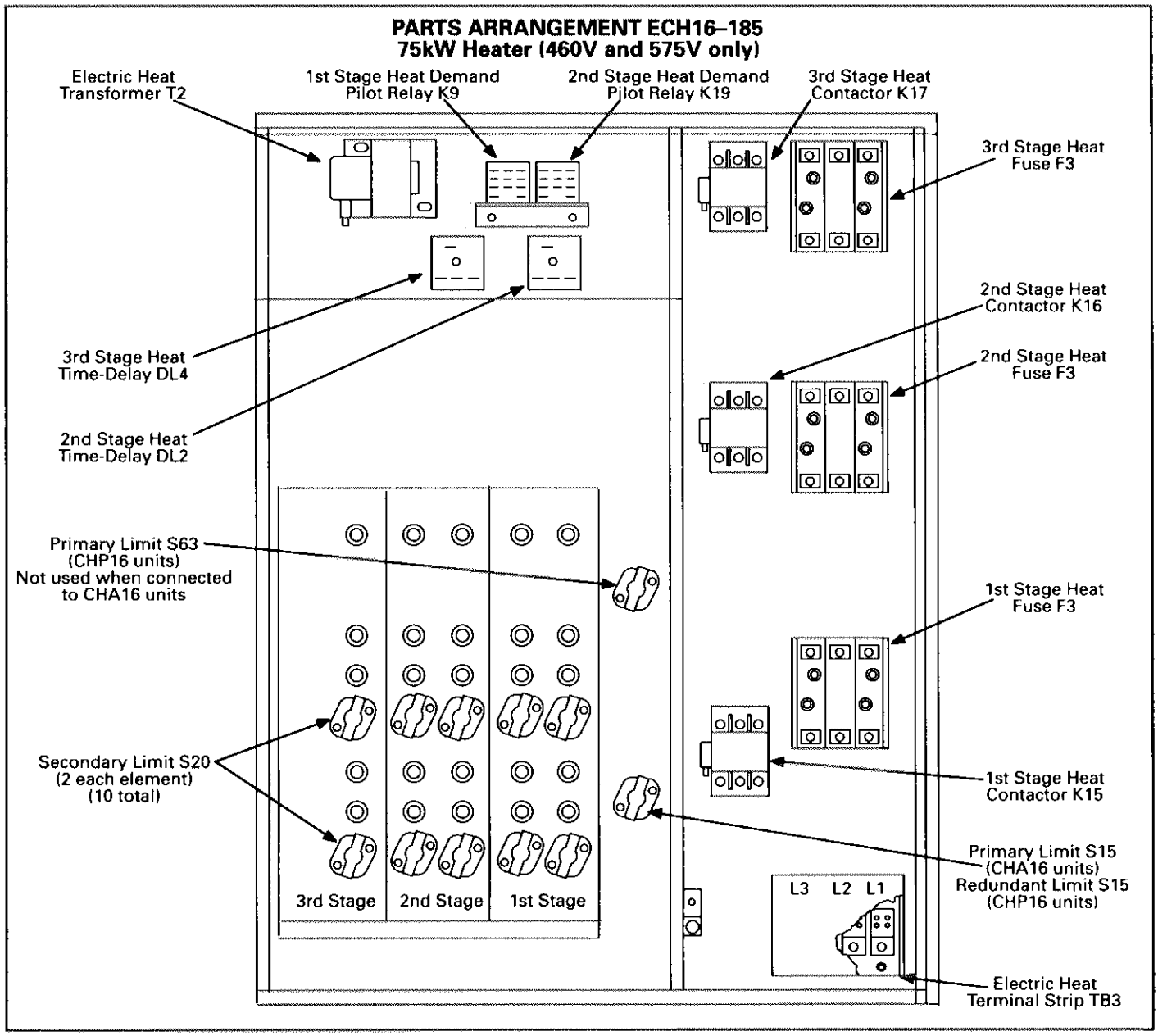


FIGURE 21

2–Contactor K16

Contactor K16 is also a 3-pole double-break contactor located in the control box. All ECH16-185 electric heat units which are equipped with multiple stages of heat are equipped with K16. K16 is equipped with a 24VAC coil which is energized after time delay DL2 closes. When K16 is energized, the second-stage heating elements are energized.

3–Contactor K17

Contactor K17 is also a 3-pole double-break contactor located in the control box. All ECH16-185 electric heat units which have three stages of heat are equipped with K17. K17 has a 24VAC coil which is energized after time delays DL2 and DL4 close in sequence. When K17 is energized, the third-stage heating elements are energized.

4–Contactor K18

Contactor K18 is also a 3-pole double-break contactor located in the control box. Only ECH16-185–60 208/230V electric heat unit (which is equipped with four stages of heat) has K18. K18 is has a 24VAC coil which is energized after time delays DL2, DL4 and DL5 close in sequence. When K18 is energized, fourth-stage heating elements are energized.

CHP16–1853 OPTIONAL ELECTRIC HEAT DATA (TABLE 9)

Electric Heat Unit Model No.	No. of Steps & phase	Volts Input	kw Input	Btuh Input	*Total Unit & Electric Heat Minimum Circuit Ampacity	
					3 HP	5 HP
ECH16–185–15	1 step 3 phase	208	11.3	38,600	120.0	126.0
		220	12.6	43,000	126.0	132.0
		230	13.5	46,100		
		240	15.0	51,200		
	1 step 3 phase	440	12.6	43,000	67.0	69.0
		460	13.8	46,100		
		480	15.0	51,200		
	1 step 3 phase	550	12.6	43,000	54.0	56.0
		575	13.8	47,100		
		600	15.0	51,200		
ECH16–185–30	♦2 steps 3 phase	208	22.5	76,800	159.0	165.0
		220	25.2	86,000	171.0	177.0
		230	27.5	93,900		
		240	30.0	102,400		
	1 step 3 phase	440	25.2	86,000	90.0	92.0
		460	27.5	93,900		
		480	30.0	102,400		
	1 step 3 phase	550	25.2	86,000	72.0	74.0
		575	27.5	93,900		
		600	30.0	102,400		
ECH16–185–45	♦3 steps 3 phase	208	33.8	115,300	198.0	204.0
		220	37.8	129,000	216.0	222.0
		230	41.3	141,000		
		240	45.0	153,600		
	♦2 steps 3 phase	440	37.8	129,000	112.0	114.0
		460	41.3	141,000		
		480	45.0	153,600		
	♦2 steps 3 phase	550	37.8	129,000	90.0	92.0
		575	41.3	141,000		
		600	45.0	153,600		
ECH16–185–60	♦4 steps 3 phase	208	45.0	153,800	237.0	250.0
		220	50.4	172,000	261.0	267.0
		230	55.1	188,100		
		240	60.0	204,800		
	♦2 steps 3 phase	440	50.4	172,000	135.0	137.0
		460	55.1	188,100		
		480	60.0	204,800		
	♦2 steps 3 phase	550	50.4	172,000	108.0	110.0
		575	55.1	188,100		
		600	60.0	204,800		
ECH16–185–75	♦3 steps 3 phase	440	63.0	215,000	157.0	159.0
		460	68.9	235,000		
		480	75.0	255,900		
	♦3 steps 3 phase	550	63.0	215,000	126.0	128.0
		575	68.9	235,000		
		600	75.0	255,900		

♦When used with two stage control.
*Refer to National Electrical Code manual to determine wire, fuse and disconnect size requirements. Use wires suitable for at least 167°F.
NOTE–Fuse block ordered extra. Factory installed heaters will have the fuse block factory installed. Fuse block is field installed in field installed heaters. See specifications.

5–Relay K9

Relay K9 is a three-pole double-throw pilot relay intended to electrically isolate the CHP16 and ECH16 24VAC circuits. The coil of relay K9 is connected to first-stage heating demand from the CHP16. When K9 is energized, three sets of contacts switch. When K9-1 switches, the indoor blower is energized. When K9-2 closes, second stage electric heat is enabled (but not energized until second stage demand is received from the thermostat). When K9-3 closes, contactor K15 is energized.

6–Relay K19

Relay K19 is a single-pole double-throw pilot relay also intended to electrically isolate the CHP16 24VAC circuits from the ECH16 24VAC circuits. The coil of relay K19 is connected to second stage heating demand from the CHP16. When K19 is energized, a single set of contacts switch. When K19-1 closes, second stage electric heat is energized.

7–Time Delay DL2

Time delay DL2 is factory installed in all multiple-stage electric heat units. DL2 allows staging by providing a timed-interval between the first and second heating elements. The delay control is a single-pole single-throw 24VAC relay with normally open contacts. When the relay coil is energized, the contacts are delayed 30 seconds (±20%) before closing. When the relay coil is de-energized, the contacts are delayed 1 second (+20%) before opening.

DL2 is energized with first stage thermostat demand in 60kW 208/230V electric heat units. In all other multiple-stage electric heat units, DL2 is energized only after receiving a second stage thermostat demand.

8–Time Delay DL4

Time delay DL4 is identical to DL2. It is factory installed in all multiple-stage electric heat units with at least three stages of electric heat. DL4 allows staging by providing a timed interval between the second and third heating elements. The delay control is a single-pole single-throw 24VAC relay with normally open contacts. When the relay coil is energized, the contacts are delayed 30 seconds (±20%) before closing. When the relay coil is de-energized, the contacts are delayed 1 second (±20%) before opening.

DL4 is energized with second stage thermostat demand in 60kW 208/230V electric heat units. In all other multiple-stage electric heat units, DL4 is energized only after time delay DL2 closes.

9–Time-Delay DL5

Time delay DL5 is only used in 60kW 208/230V electric heat units. The delay is identical to DL2 and DL4. DL5 allows four stages of heat by providing a timed-interval between the third and fourth heating elements. The delay control is a single-pole single-throw 24VAC relay with normally open contacts. When the relay coil is energized, the contacts are delayed 30 seconds (±20%) before closing. When the relay coil is de-energized, the contacts are delayed 1 second (±20%) before opening.

DL5 is energized only after time delay DL4 closes.

10–High Temperature Limit S15 (Primary)

S15 is the primary high temperature limit. It is located in the electric heat unit immediately downstream from the heating elements. S15 is a single-pole single-throw normally closed thermostat wired in series with the first stage contactor coil. The thermostat actuates at temperatures shown in table 10. The temperature differential is factory set and is not adjustable.

TABLE 10

S15 SPST AUTO-RESET HIGH TEMPERATURE LIMIT		
Electric Heat Units	**Open on Rise**	**Close On Fall**
208/230V Units	130°F ± 5°F	90°F ± 6°F
460 & 575V Units	125°F + 5°F	95°F + 6°F

When S15 opens, indicating a problem in the system, contactor K15 is de-energized. When K15 is de-energized, first stage and all subsequent stages of heat are de-energized. Since the indoor blower is controlled by thermostat demand (K9 remains energized), the indoor blower will continue to operate.

11–High Temperature Limit S63(Redundant)

S63 is a redundant (primary) temperature limit factory equipped in 460 & 575V units. The redundant limit is operable only when connected to CHP16 units and does not function when connected to CHA16 units.

12–High Temperature Limit S20 (Secondary)

Each heating element assembly is electrically connected to two high temperature limits S20 (refer to wiring diagrams in back of this manual). Each limit is connected in series with one leg of the three-

phase element assembly. The third leg of each assembly is not equipped with a limit. Three-phase operating characteristics allow one of the other two limits to protect the third leg.

Each S20 limit is physically located adjacent to the element it is protecting. S20 is a single-pole single-throw normally closed thermostat. The thermostat actuates at 185°F ± 8°F on a temperature rise and cannot be reset. Once tripped, it must be replaced.

13–Fuse F3

F3 is a current limiting fuse connected in series with each leg of each stage of electric heat (each stage of electric heat uses three fuses). Fuses used in ECH16-185 series units are shown in table 11.

TABLE 11

ECH16-185 ELECTRIC HEAT FUSE RATINGS				
Unit	Fuse F3 1st Stage (3 Fuses)	Fuse F3 2nd Stage (3 Fuses)	Fuse F3 3rd Stage (3 Fuses)	Fuse F3 4th Stage (3 Fuses)
ECH16-185-15 208/230V	60 Amp 250V	—	—	—
ECH16-185-15 460 & 575V	30 Amp 600V	—	—	—
ECH16-185-30 208/230V	60 Amp 250V	60 Amp 250V	—	—
ECH16-185-30 460 & 575V	60 Amp 600V	—	—	—
ECH16-185-45 208/230V	60 Amp 250V	60 Amp 250V	60 Amp 250V	—
ECH16-185-45 460 & 575V	60 Amp 600V	30 Amp 600V	—	—
ECH16-185-60 208/230V	60 Amp 250V	60 Amp 250V	60 Amp 250V	60 Amp 250V
ECH16-185-60 460 & 575V	60 Amp 600V	60 Amp 600V	—	—
ECH16-185-75 460 & 575V	60 Amp 600V	60 Amp 600V	30 Amp 600V	—

14–Terminal Strip TB3

Electric heat line voltage connections are made to terminal strip TB3 located in the lower right corner of the control box. CHP16 unit electrical connections are also made here.

15–Transformer T2

T2 is a line voltage to 24VAC transformer located in the electric heat control box. The transformer provides 24VAC power to all ECH16 controls (contactor coils and time delays). Pilot relays (K9 and K19) plug-in to the CHP16 to provide 24V circuit isolation.

The transformer is rated as shown in table 12.

TABLE 12

TRANSFORMER RATINGS			
Electric Heat Unit	Primary	Secondary	Internal Fuse
All 208/230V	Red Tap-208V Orange Tap-230V Black Tap-Common	50VA Blue Tap-24VAC Yellow Tap-Common	2.5A
All 460V	Red Tap-440V Black Tap-Common	48VA Blue Tap-24VAC Yellow Tap-Common	2.5A
15kW, 30kW 45kW, 60kW 575V	Red Tap-550V Black Tap-Common	50VA Blue Tap-24VAC Yellow Tap-Common	2.5A
75kW 575V	Red Tap-575V Black Tap-Common	70VA Blue Tap-24VAC Yellow Tap-Common	3.5A

16–Heating Elements

ECH16-185 heating elements are composed of helix wound nichrome bare heating elements which are exposed directly to the airstream. Heating elements are energized directly by contactors in the ECH16 control box. Once energized, heat transfer is instantaneous. Overtemperature protection is provided by primary and secondary high temperature limits. Overcurrent protection is provided by fuses.

Each stage of electric heat consists of three elements connected in a three-phase arrangement. Elements in 208/230V units are connected in a "Delta" arrangement. Elements in 460 and 575V units are connected in "Wye" arrangement.

Each stage is energized independently by a three-pole double-break contactor and is protected by safety limits. Heating elements used in ECH16 series units are listed in table 13.

TABLE 13

Unit	Total Watts	Number of Elements/ Arrangement
ECH16-15-Y	15000 @ 240V	3 / Delta
ECH16-15-G	15000 @ 460V	3 / Wye
ECH16-15-J	15000 @ 575V	3 / Wye
ECH16-30-Y	30000 @ 240V	6 / Delta
ECH16-30-G	30000 @ 460V	6 / Wye
ECH16-30-J	30000 @ 575V	6 / Wye
ECH16-45-Y	45000 @ 240V	9 / Delta
ECH16-45-G	45000 @ 460V	9 / Wye
ECH16-45-J	45000 @ 575V	9 / Wye
ECH16-60-Y	60000 @ 240V	12 / Delta
ECH16-60-G	60000 @ 460V	12 / Wye
ECH16-60-J	60000 @ 575V	12 / Wye
ECH16-75-G	75000 @ 460V	15 / Wye
ECH16-75-J	75000 @ 575V	15 / Wye

X–ACCESSORIES

This section describes the application of most of the optional accessories which can be connected to the CHP16. Some of the accessories (for example, the Warm Up Control Kit) are described in the operation sequence section of this manual.

A–RMF16 Mounting Frame

When installing a CHP16 unit on a combustible surface for downflow discharge applications, the Lennox RMF16 roof mounting (figure 22) frame is required. Otherwise, the RMF16 is recommended but not required. The CHP16, if not mounted on a flat (roof) surface, MUST be supported under all edges and under the middle of unit to prevent sagging. The CHP16 MUST be mounted level within 1/16" per linear foot in any direction.

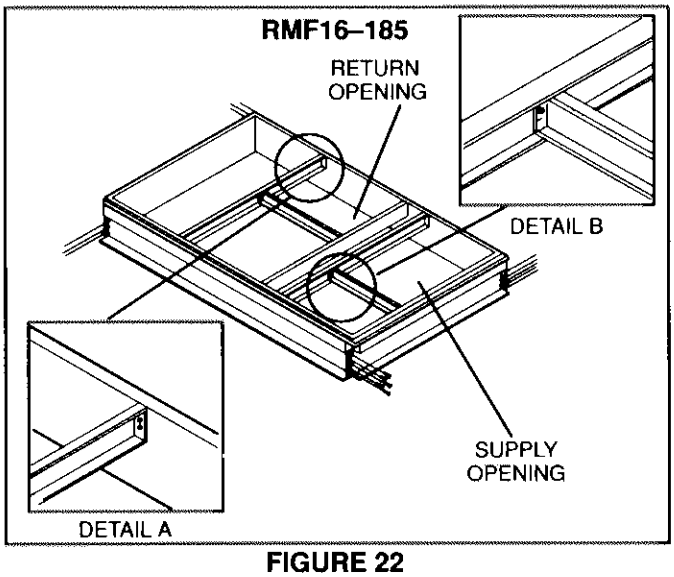


FIGURE 22

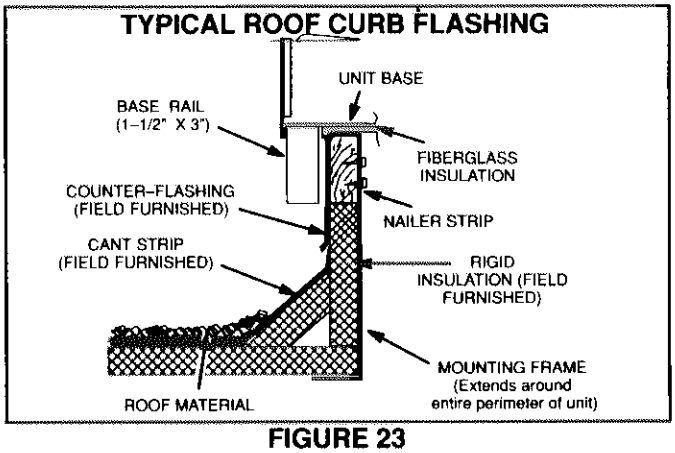


FIGURE 23

The assembled RMF16 mounting frame is shown in figure 22. Refer to the RMF16 installation instructions for details of proper assembly and mounting. The roof mounting frame MUST be squared to the roof before mounting. Plenum system MUST be installed before the unit is set on the mounting frame. Typical roof curbing and flashing is shown in figure 23. Refer to the RMF16 installation instructions for proper plenum construction and attachment.

B–Economizer

1–Application

REMD16M–185 economizer can be applied directly to CHP16–1853 units. Economizer consists of damper assembly installed in unit, enthalpy control assembly installed in filter access area of unit and gravity exhaust damper assembly installed in economizer.

Optional PED16–185,–300 power exhaust damper may be added to the economizer to provide forced air exchange during economizer operation. The PED16 installs between the economizer and the gravity exhaust damper assembly.

2–REMD16M Economizer

The REMD16M economizer (figure 24) is designed for use with downflow CHP16–1853 units. The economizer opens a set of dampers to allow 0 to 100 percent outdoor air to be used for cooling when outdoor humidity and temperature are acceptable. Damper position continually adjusts to outdoor conditions. Additional (second stage) cooling demand is directed to the compressor while the dampers remain open. If outdoor air becomes unacceptable, the outdoor air dampers close to a predetermined minimum position while the compressor cooling circuit cycles as needed.

Refer to the REMD16M–185 installation instructions for specific installation details. Refer to the operation sequence (in back of this manual) for detailed economizer operation. Operation sequence flowcharts also describe how the economizer interacts with the CHP16 and the control system being used.

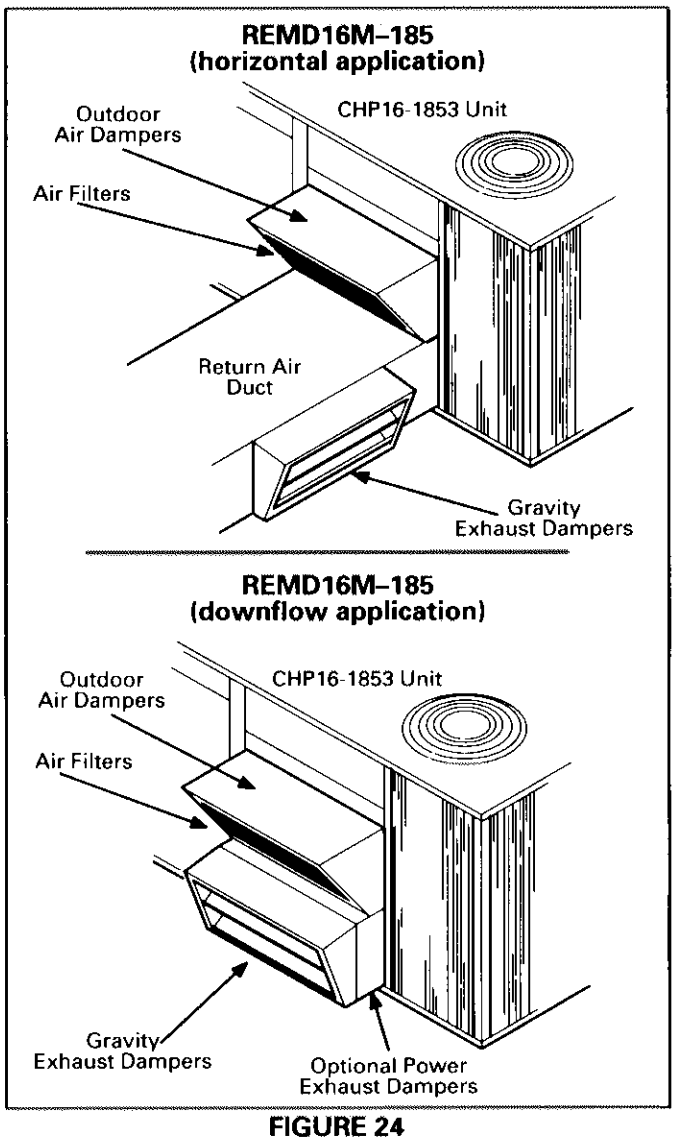


FIGURE 24

3–Economizer Operation

a–Enthalpy Control: Setpoint Control

The key to economizer operation is the enthalpy control. The enthalpy control senses total heat content of outside air (temperature plus humidity) and uses that information to control the amount of outside air brought into the system. When the enthalpy of outside air drops below the control setpoint and cooling demand is present, the control actuates a motor which in turn adjusts outdoor dampers to meet cooling demand. With outdoor air dampers open, the indoor blower draws in outdoor air for cooling and first stage compressor is disabled. When heat content rises above the setpoint, the control deactivates and the dampers close to the preset minimum position. First stage compressor is switched to handle all first stage cooling.

Two types of adjustment may be made at the control. The first is the control setpoint. The setpoint determines the temperature and humidity conditions at which the outdoor air dampers will open and close. The recommended setpoint is "A." If the economizer is allowing air which is too warm or too humid into the system, the control may be changed to a lower setpoint (B,C or D). Refer to enthalpy chart figure 25.

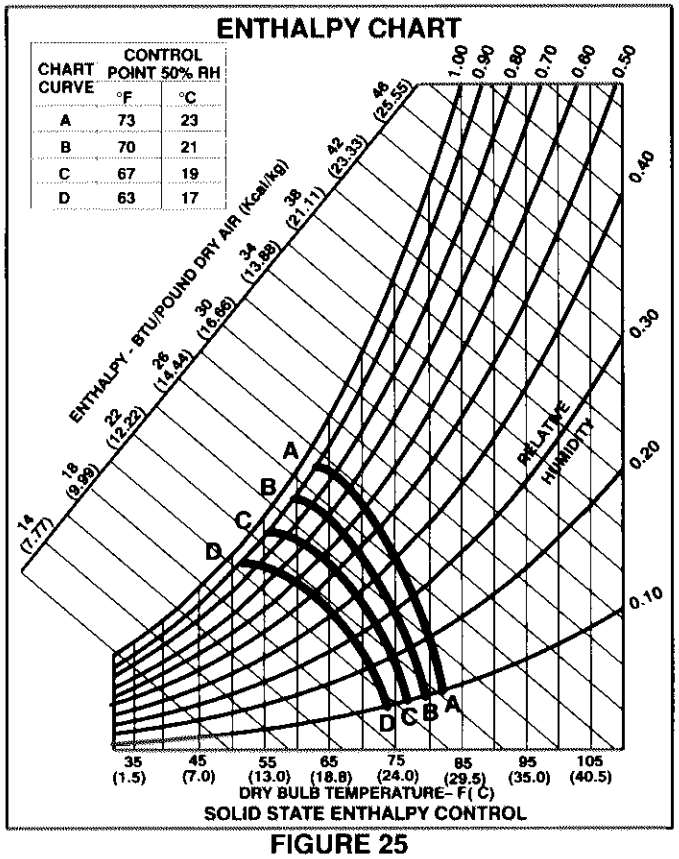


FIGURE 25

Example:

If the enthalpy control is set at setpoint "A" as shown in figure 25, the following situation could occur. A cooling demand when the outside air is at 75° and 20 percent humidity would drive the economizer outdoor air dampers open to utilize outdoor air for cooling. The compressor cooling circuit would be disabled. However, if the outdoor air should change to 70°F (a drop in temperature) and 70 percent humidity (a dramatic rise in humidity), the "total heat content" of the outdoor air would

rise above the enthalpy control setpoint and de-activate the damper motor to the preset minimum position. If cooling demand is still present when the total heat of the outside air rises above the control setpoint, cooling demand is routed from the economizer to the compressor cooling circuit.

b–Minimum Positioner

The second type of adjustment which may be made at the control is the minimum position of the outdoor damper blades. Each economizer has a minimum positioner switch (potentiometer) which allows the outdoor dampers to be adjusted to a preset minimum position. This allows a preset amount of air exchange at all times during blower operation. When unit operation stops, the dampers drive closed. The potentiometer is located on the enthalpy control face.

c–Enthalpy Sensor

The enthalpy sensor is located on the outside portion of the outdoor damper blades (as shown in figure 26). The sensor monitors the total heat content of the outdoor air (temperature plus humidity) and sends the information to the enthalpy control. The enthalpy control uses the information to determine if outdoor air can be used for cooling.

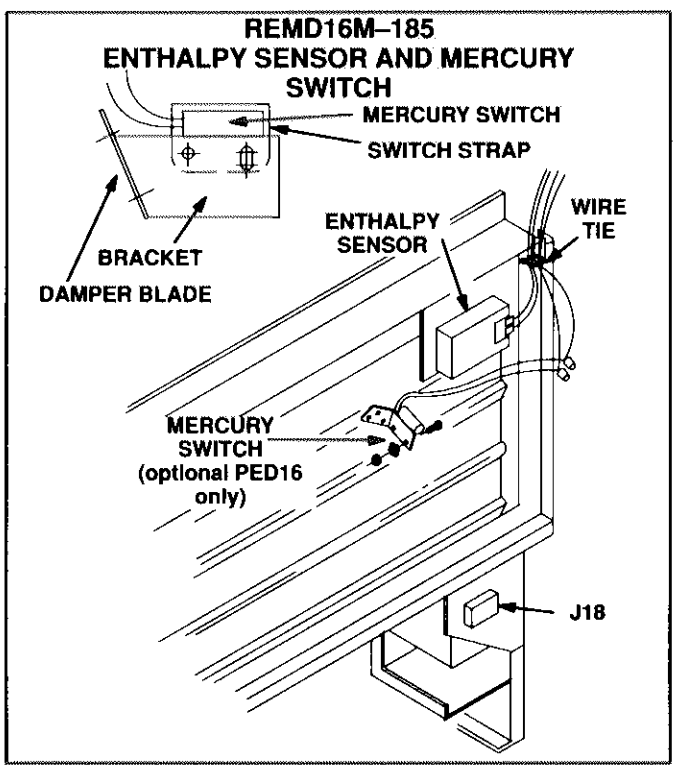


FIGURE 26

d–Mixed Air Sensor

The sensor measures the resultant temperature of the mixed air downstream of the evaporator coil. The mixed air temperature is measured in the heating compartment (figure 27). The mixed air temperature is used by the enthalpy control when outdoor dampers are open to help determine outdoor air damper position. The economizer is factory equipped with a single mixed air sensor which fits through a factory supplied hole in the panel dividing unit return and supply air (see figure 27).

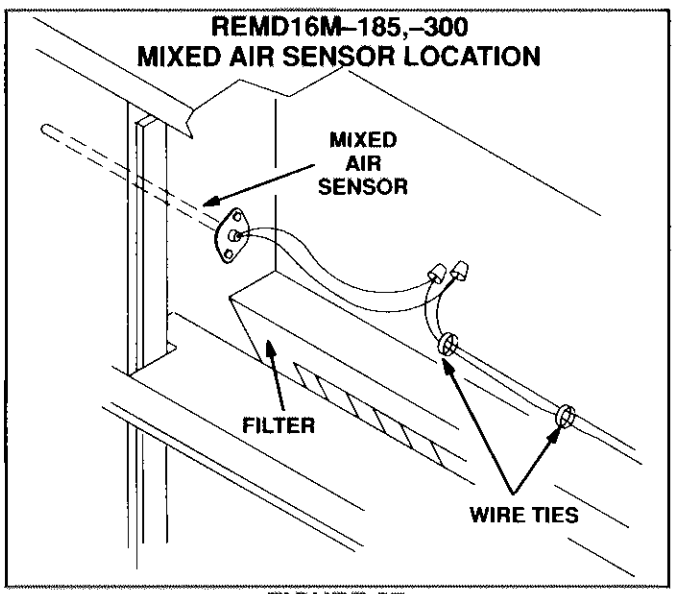


FIGURE 27

e–Wiring, Installation, Maintenance

The economizer uses harness plugs to connect to the CHP16 unit harness connector located in the filter access compartment. Unlike smaller 16 series economizers which are unitary in construction (all one piece), the REMD16M–185 economizer has a control relay kit (consists of enthalpy control and relays) installed separately in the unit filter access section. The damper section (consists of dampers and damper motor) is installed separately in the return air section. Figure 28 shows enthalpy control installation and wiring. Figures 29 and 30 show REMD16M installation. Although harness connectors are used to connect the CHP16 to the economizer, the economizer electrically connects to the CHP16 differently depending on which control system has been installed. The different electrical connections are made in relay kits and controls located in the filter access area of the unit.

All connections (except for enthalpy sensor and mixed air sensor) are made with quick-connect type harness connectors. For specific details of economizer wiring and operation, refer to the sequence of operation section of this manual.

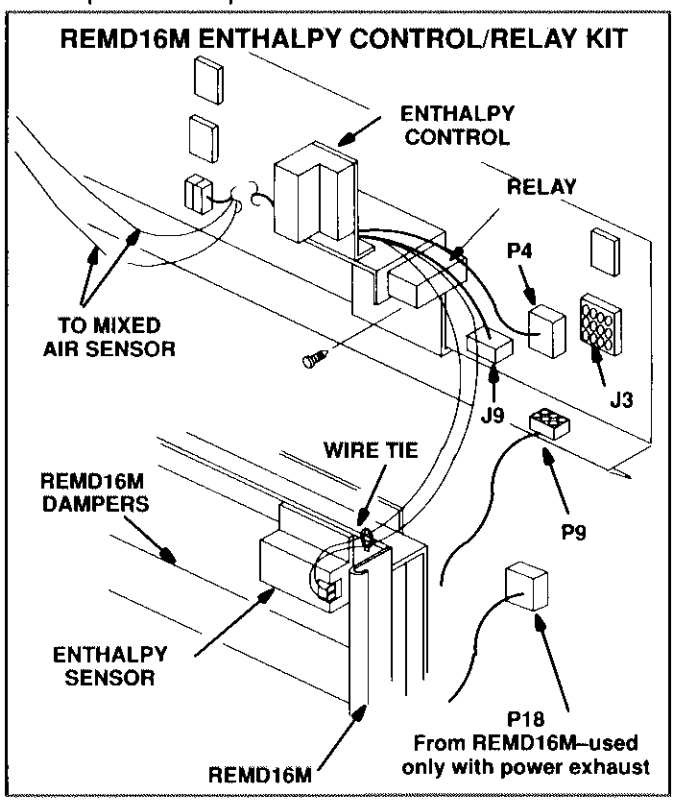


FIGURE 28

Figures 29 and 30 show how an REMD16M is installed in a CHP16 cabinet. For detailed installation and maintenance instructions, refer to the REMD16M–185 installation instructions.

f–Modulating Damper Motor Check

The following procedure checks only the damper motor. For detailed economizer checkout procedure refer to Lennox' Solid State Economizer Checkout And Troubleshooting Guide.

1– Disconnect power. Turn thermostat to OFF position (occupied mode).

2– Install jumper across contactor K3–2 terminals (see unit diagram) in unit control box. Install jumper across enthalpy control terminals T and T1. See figure 31 for terminal location.

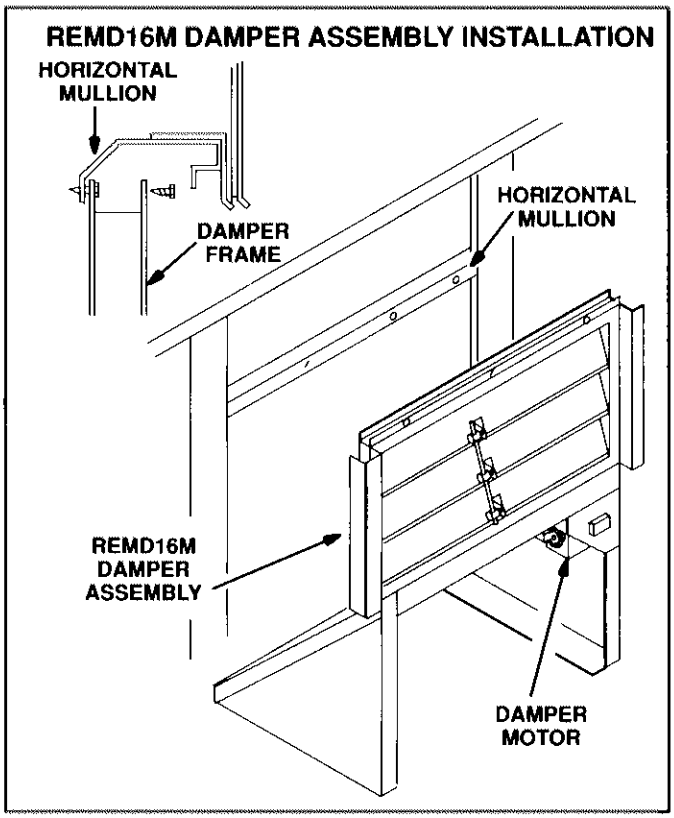


FIGURE 29

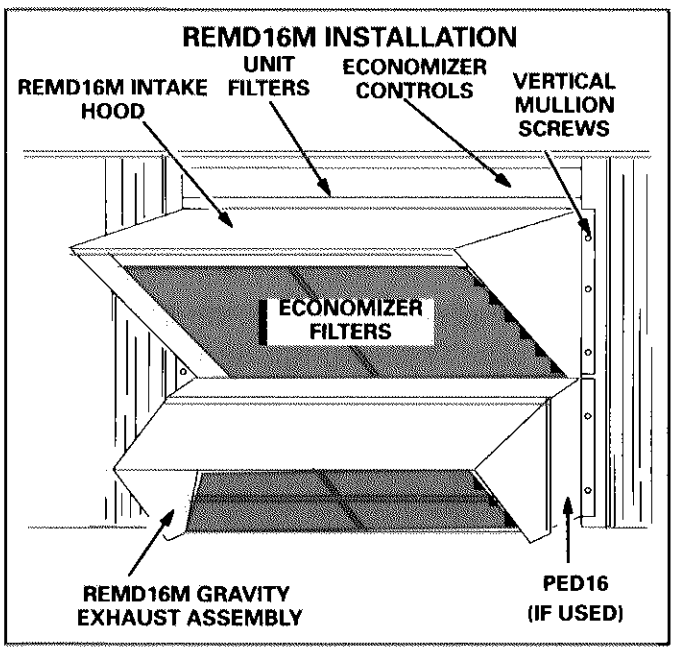


FIGURE 30

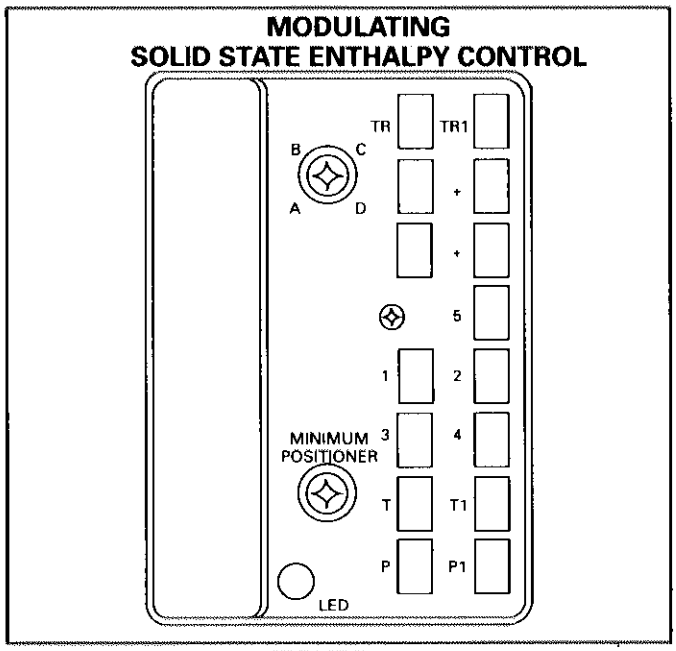


FIGURE 31

3–Restore power to unit. Outdoor damper should drive to fully open position (60 to 90 sec. required for full travel). Observe travel for proper damper operation.

4–Disconnect power to unit. Outdoor damper should spring return to closed position.

5–Remove T and T1 jumper then restore power to unit. Outdoor damper should drive to minimum position. Adjust minimum damper position pot located on control. See figure 31.

6–Disconnect power to unit and remove jumper on blower relay terminals 6–9. Replace all panels. Restore power to unit.

g–Warm Up Kit

An optional warm up kit may be added to the REMD16M economizer (except CHP16 units using a Honeywell W7400 Control System). The warm up kit holds the dampers closed during night setback and morning warm up. When the first thermostat demand of the day is satisfied, the warm up kit opens the outdoor dampers to minimum position. The warm up kit installs in the CHP16 filter access section. The kit plugs into the unit wiring harness inline between the unit and the economizer. For detailed wiring and operation, refer to the sequence of operation section of this manual.

If a W973 system is used, the relay kit holds the outdoor dampers closed during setback. If an electromechanical thermostat system is used, the relay holds the outdoor dampers closed during setback, de–energizes the indoor thermostat and energizes the setback thermostat.

h–PED16 Power Exhaust Damper

Optional PED16 power exhaust fans (figure 30) are used in conjunction with REMD16M economizer to provide forced exhaust of return air. PED16 consists of two fans (figure 33) which install in the return air portion of the economizer and a relay control kit which installs in the unit filter section.

TABLE 14

POWER EXHAUST FAN PERFORMANCE	
Air Volume (cfm) Exhausted	Return Air System Static Pressure (inches Water Gauge)
4200	0
3800	.05
3500	.10
3200	.15
2700	.20
2200	.25

The PED16 is operated by the relay control kit (figure 32). A mercury switch located on the damper blades senses economizer operation. As the damper blades open (figure 26) the mercury switch closes and energizes a relay in the control kit. When the relay is energized a set of normally open contacts close and the PED16 exhaust fans are energized.

PED16 fan motors use unit line voltage except in 575V units. 575V units use 460V fan motors. A 575V to 460V transformer and fuse are provided in the PED16 control kit to provide stepped–down voltage to the fan motors.

The PED16 control kit (figure 32) and the economizer enthalpy control (figure 28) are designed to be located in the same area of the unit filter section simultaneously. The enthalpy control is attached to a stand-off bracket which allows the PED16 control kit to be installed behind as shown in figure 34.

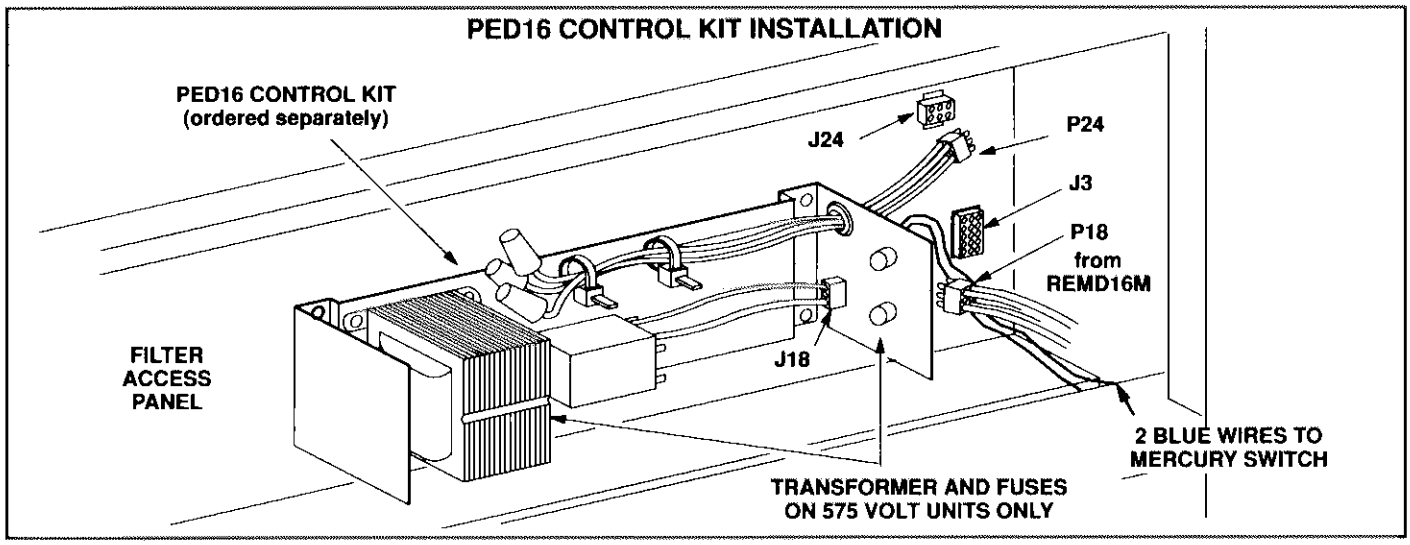


FIGURE 32

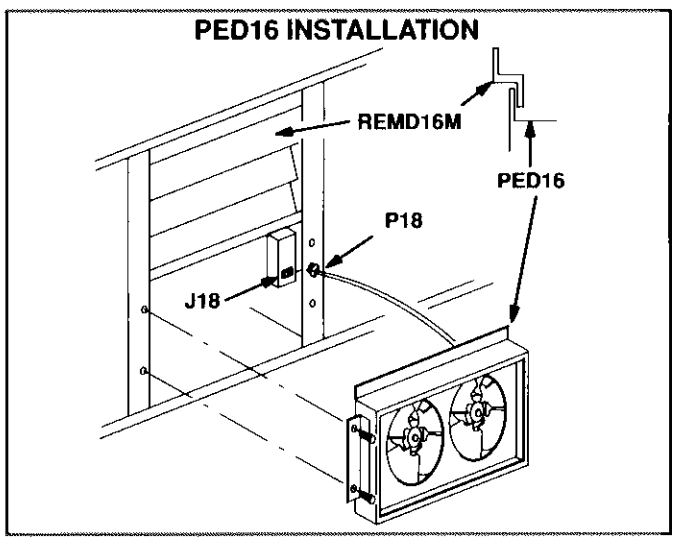


FIGURE 33

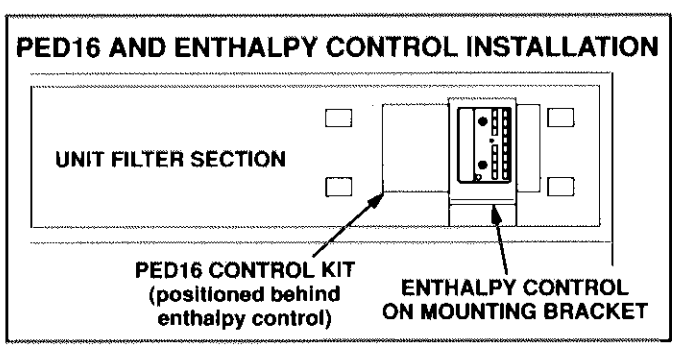


FIGURE 34

C–OAD16 Outdoor Air Damper

OAD16 outdoor air damper section (figure 35) installs in CHP16 to allow a fixed amount of outside air into the system. OAD16 consists of a set of manually operated dampers which may be adjusted and locked in place to allow up to 25 percent outside air into the system at all times. Automatic operation is available with addition of an electric spring-return three-position damper actuator. Refer to OAD16 installation instruction manual for specific installation procedure. Washable filter supplied with the OAD16 can be cleaned with water and a mild detergent. It should be sprayed with Filter Handicoater when dry prior to reinstallation. Filter Handicoater is R.P. Products coating no. 418 and is available as Lennox part No. P–8–5069.

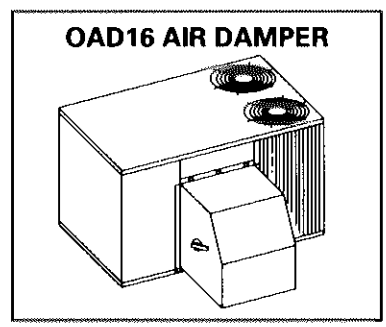


FIGURE 35

D–Transitions

Optional supply/return transition SRT16–185 is available for use with CHP16–1853 utilizing the optional RMF16 roof mounting frame. The transition must be installed in the RMF16 mounting frame before mounting the CHP16 to the frame. Refer to the manufacturer's instructions included with the transition for detailed installation procedures.

E–Supply and Return Diffusers

Optional flush mount diffuser/return FD11 and extended mount diffuser/return RTD11 are available for use with the CHP16. Refer to the manufacturer's instructions included with the transition for detailed installation procedures.

F–Cycle Control Kit

Optional cycle control kit, when applied to units with electromechanical thermostat, prevents frequent cycling caused by thermostat diddling or thermostat bulb vibration. The cycle controls require minimum on and minimum off times before compressors can be energized or de-energized. The cycle controls plugs in to the J16/P16 jackplug located in the unit filter section. No field wiring is required. The kit consists of two cycle control delays DL8 and DL9. Once installed, DL8 prevents the first stage compressors from being energized until the first stage thermostat bulb has been closed for at least 30 seconds. First stage thermostat bulb must be open for at least 240 seconds before first stage compressors can be de-energized. DL9 prevents Second stage compressors from being energized until second stage thermostat bulb has been closed for at least 60 seconds. Second stage thermostat bulb must be open for at least 240 seconds before second stage compressors can be de-energized.

NOTE-Late production CHP16 units are equipped with factory installed cycle controls.

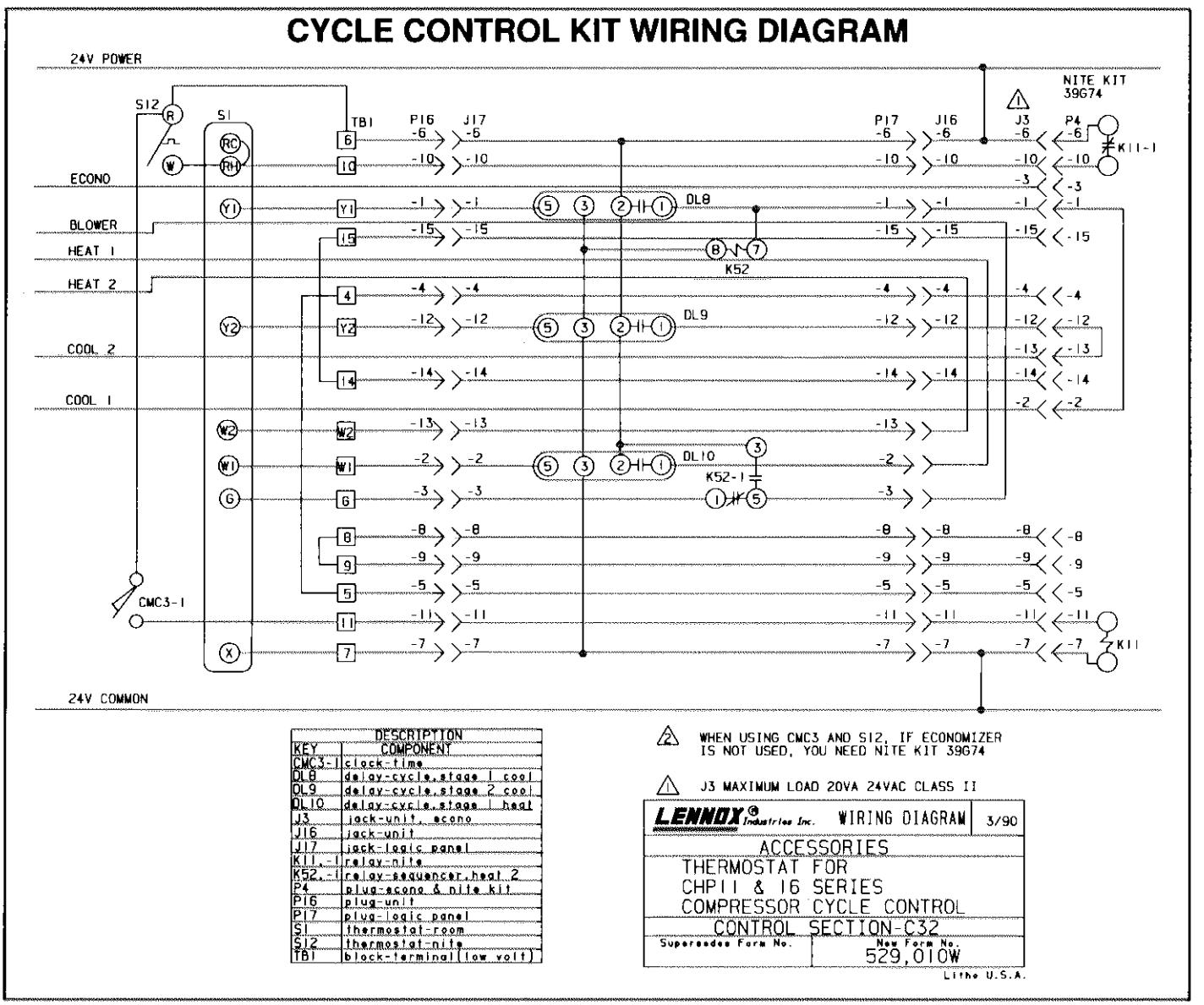


FIGURE 36

G–Timed–Off Control Kit (Figure 37)

Optional field installed timed–off controls prevent the CHP16 compressors from short cycling. CHP16–1853 requires two 40G20 timed-off control kits to complete an installation. After a thermostat demand, automatic reset timed–off controls keep compressors off for 3–7 minutes. If thermostat demand is present at the end of the 3–7 minute delay, the compressor contactors are immediately energized. If no thermostat demand is present at the end of the 3–7 minute delay, the compressor contactors will remain de–energized until thermostat demand is present and all safety controls are closed. Field wiring should be made as shown in figure 37. Be sure to disconnect power first and double check all wiring after installing controls. Refer to timed–off control installation instructions for specific installation procedures.

NOTE–Some electronic thermostats have built in timed–off delay. Field installed timed–off delay is not needed.

NOTE-Late production CHP16 units are equipped with factory installed timed off controls.

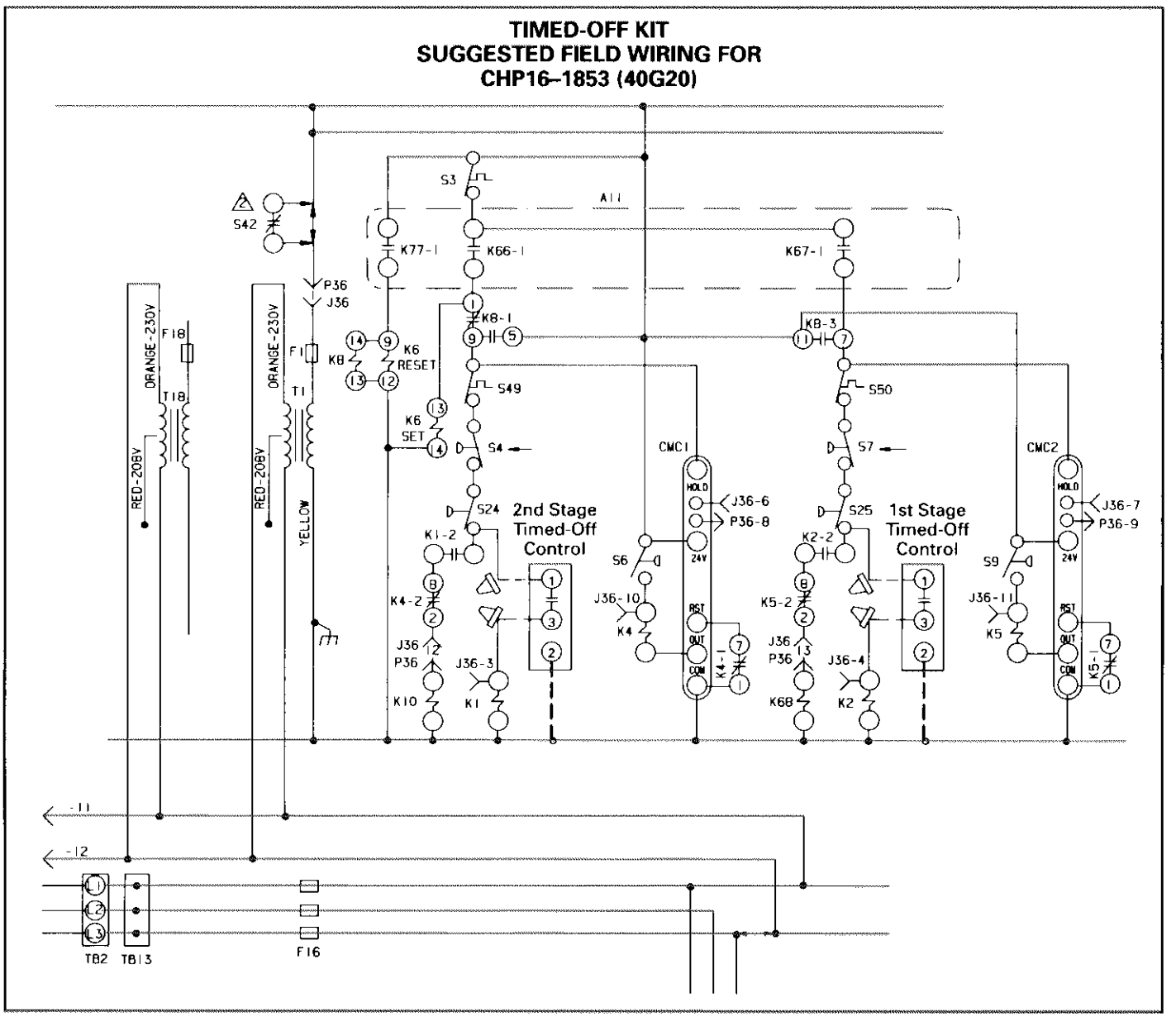


FIGURE 37

H–Low Ambient Kit

Optional low ambient kit (figure 38) allows mechanical cooling operation at low outdoor temperature. One kit is used for each refrigerant stage. Two kits are used in the CHP16-1853. The low ambient pressure switch is installed inside the compressor compartment and is wired in series with the outdoor fan contactor coil and in parallel with the normally closed contacts of the fan control relay. The low ambient control box (housing the low ambient fan control relay) is also installed in the compressor compartment. The fan control relay coil is wired in parallel with the reversing valve. Refer to the low ambient kit installation instructions for detailed installation procedures.

CAUTION–Compressor monitor (Low Ambient Lockout Switch) S3 cannot be used with optional low ambient kit. Compressor monitor MUST be disconnected before low ambient kit can be used.

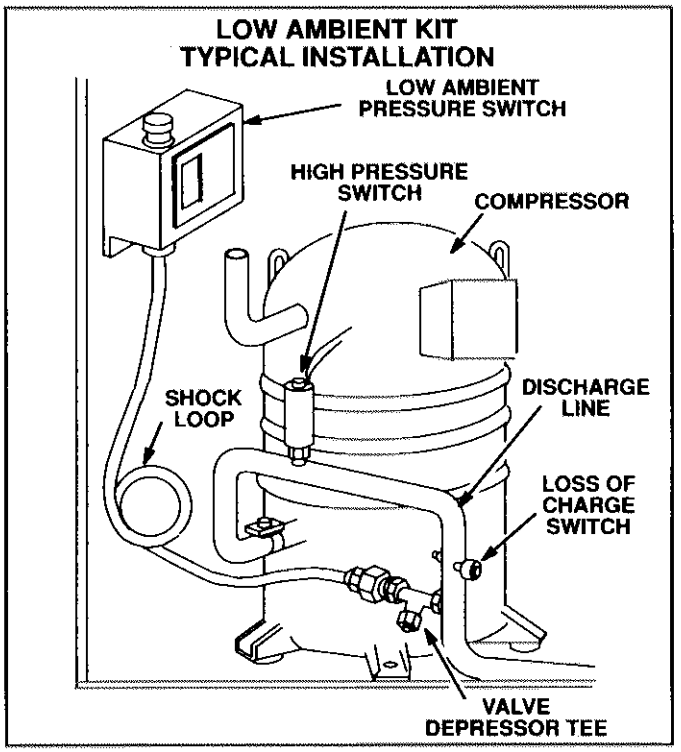


FIGURE 38

Operation:

The low ambient pressure switch monitors first stage compressor discharge pressure and cycles the condenser fan when discharge pressure drops below a predetermined setpoint. The cycling fan raises the condensing temperature thereby raising the evaporating temperature. The increased evaporating temperature reduces capacity and keeps the indoor coil temperature above freezing.

The fan control relay furnished in the kit is used to override the low ambient pressure switch when the unit is operating in heating (or defrost) mode. During cooling operation the fan control relay is energized and its normally closed contacts are open. When the fan control relay normally closed contacts are open, the low ambient pressure switch is capable of de-energizing the outdoor fan when outdoor ambient is low. During heating (or defrost) operation, the fan control relay is de-energized. The fan control relay's normally closed contacts shunt across and disable the low ambient pressure switch.

Pressure Switch Adjustment:

The low ambient pressure switch is adjustable but the adjustment knob *does not* adjust CUT–IN. CUT–IN is fixed and cannot be adjusted. The scale on the switch measures the difference in pressure between preset CUT–IN and adjustable CUT–OUT. Adjustment knob changes CUT–OUT (not shown on indicator) by adjusting the DIFFERENCE (shown on indicator) between CUT–IN and CUT–OUT.

The low ambient pressure switch is factory set to CUT–IN at 285psig with a difference of 145psig (CUT–OUT at 140psig). Adjustment should not be needed. If adjustment is needed, adjust the switch as follows:

1– Loosen knob securing screw to allow knob stop to pass over fixed stop on control (see figure 39).

DIFFERENCE (set by knob) = CUT–IN (fixed) minus CUT–OUT.

To find CUT–OUT, re–arrange the equation so that:

CUT–OUT = CUT–IN minus the DIFFERENCE.

2– Rotate the knob as needed to set the difference indicator at 145psig (1000kPa).

3– Tighten the securing screw after adjusting.

Low ambient kit field wiring is shown in figure 40.

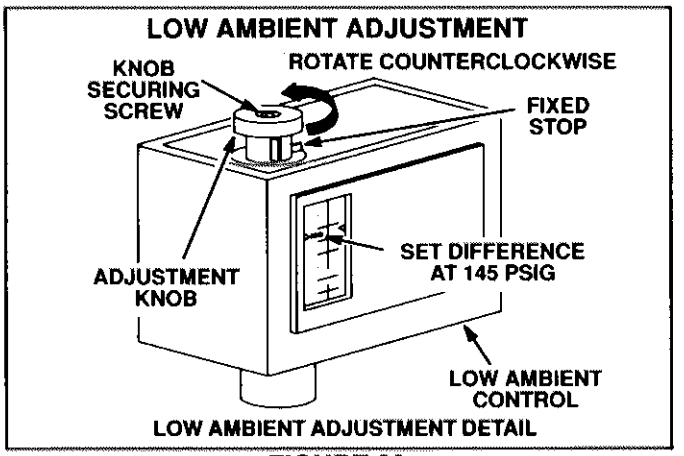


FIGURE 39

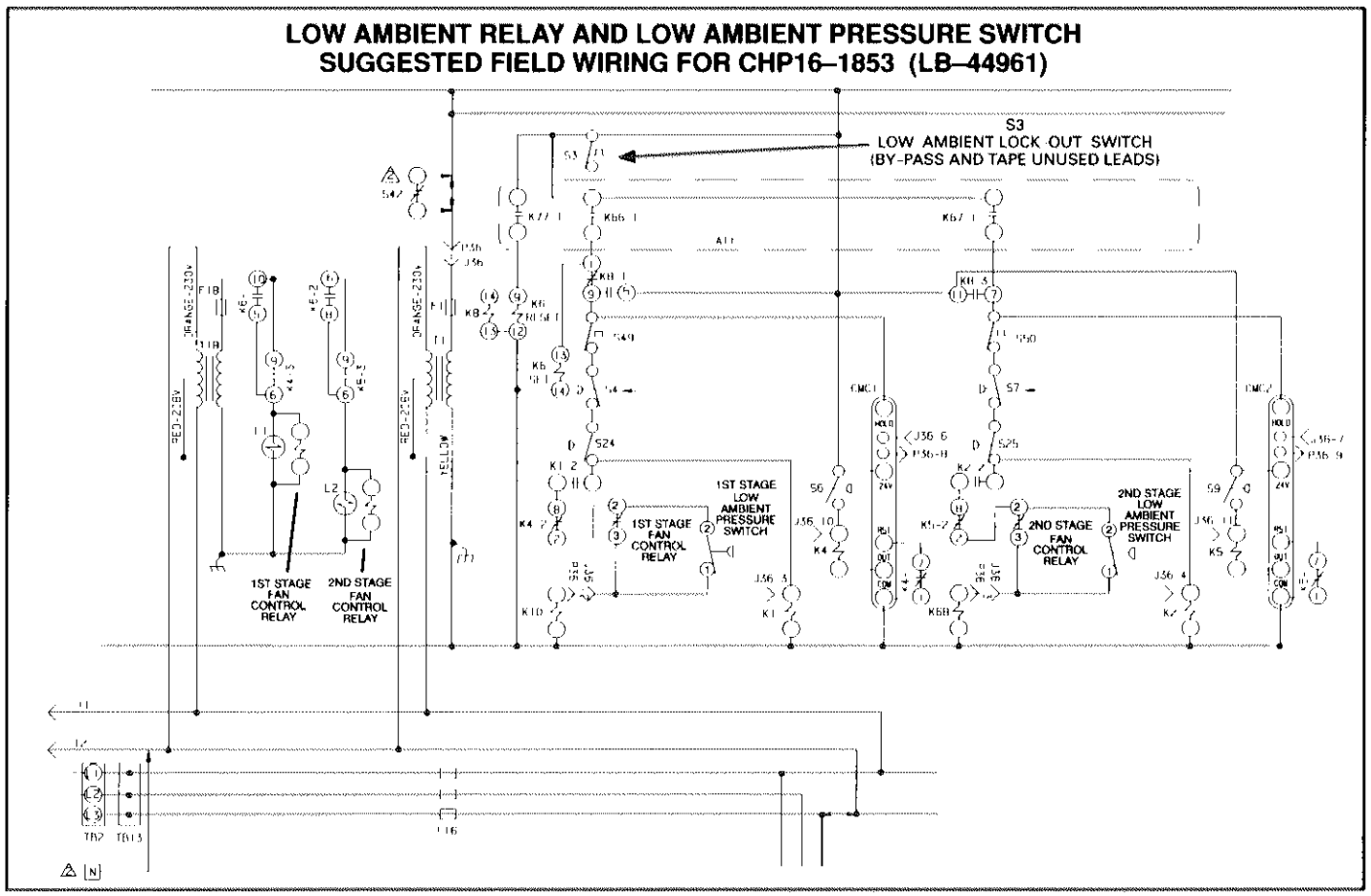


FIGURE 40

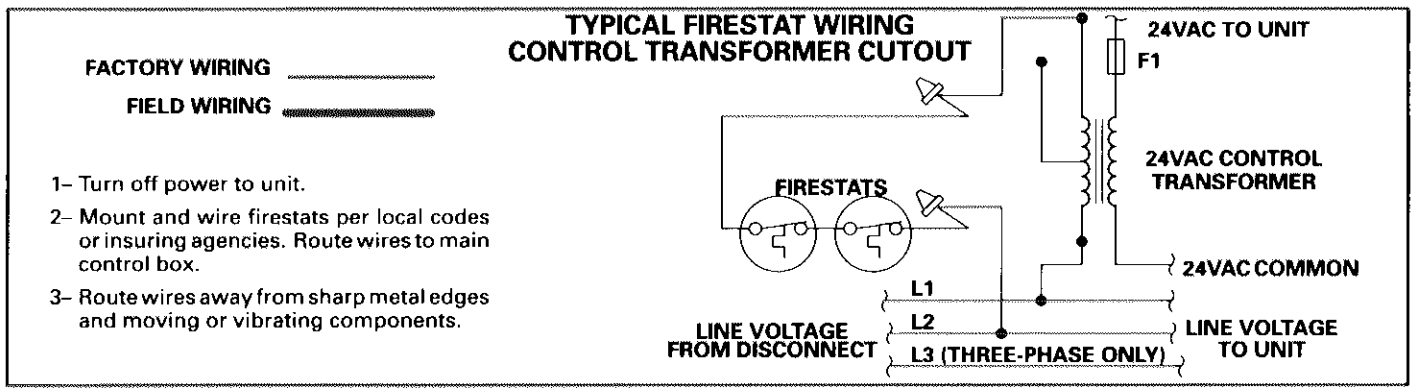


FIGURE 41

I–Firestats

Some local codes require the installation of discharge air and return air firestats to automatically shut down the unit when excessive temperature is reached . Other local codes require firestats wired to perform tasks such as energizing a blower or closing dampers. These field provided firestats MUST be mounted and wired per local codes or insuring agencies. If manual reset controls are used, they MUST be accessible.

Figures 41 and 42 show typical firestat wiring connections. Figure 41 shows firestats connected inline with transformer T1 primary. When either or both firestats open, the control circuit is de–energized, the unit shuts down and the economizer outdoor air dampers drive full closed.

Figure 42 shows firestats connected inline with the 24VAC control circuit. When either or both firestats open, the control circuit is de–energized while control transformer T1 remains energized to operate dampers, exhaust blower, etc. The unit shuts down and economizer outdoor dampers drive full closed.

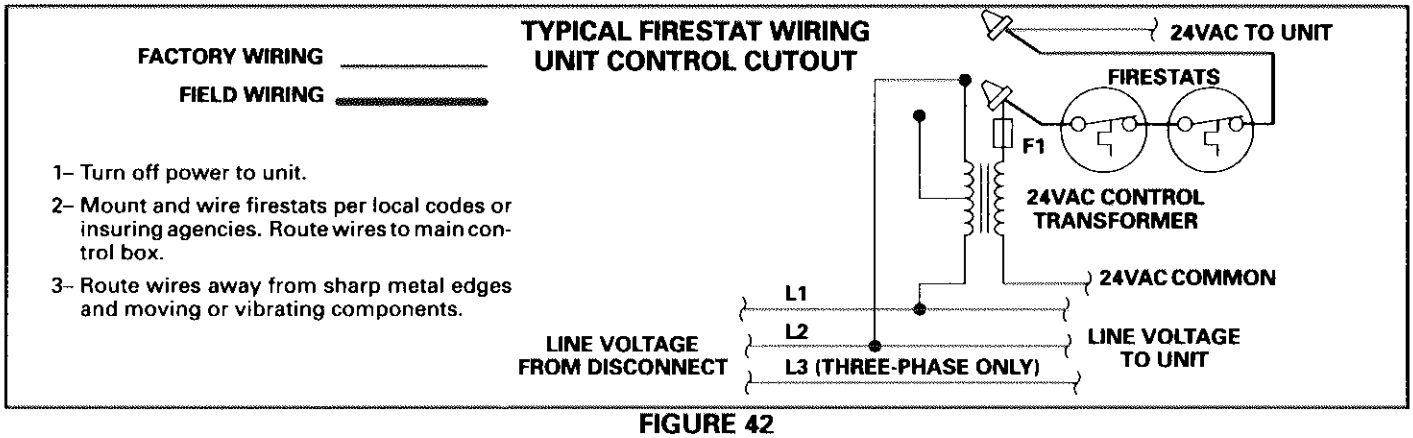


FIGURE 42

J-Status Panels SP11 and SSP11

Optional status panels allow remote monitoring of system operation. Two types of panels are available. The SP11 (figure 43) provides system readout only. The SSP11 switching status panel (figure 44) is a combination switching subbase and system readout. The SSP11 also has an "After Hours Timer" to override the unoccupied mode (night heating setback / cooling setup).

NOTE-Status panels are not applicable to all CHP16 control systems. The following section details status panel applications.

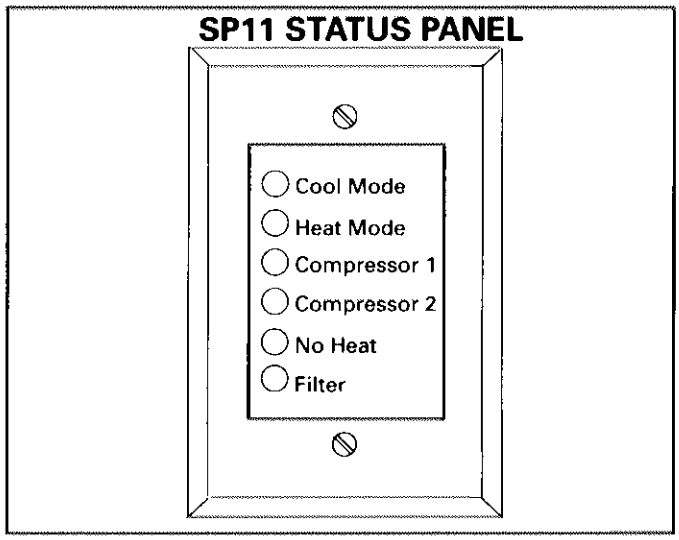


FIGURE 43

1-SP11 Application

The SP11 can be applied to all CHP16 control systems. To operate an SP11, a readout relay kit is required to interface the CHP16 to the SP11. Optional filter switch kit must be added in order to make the filter light functional.

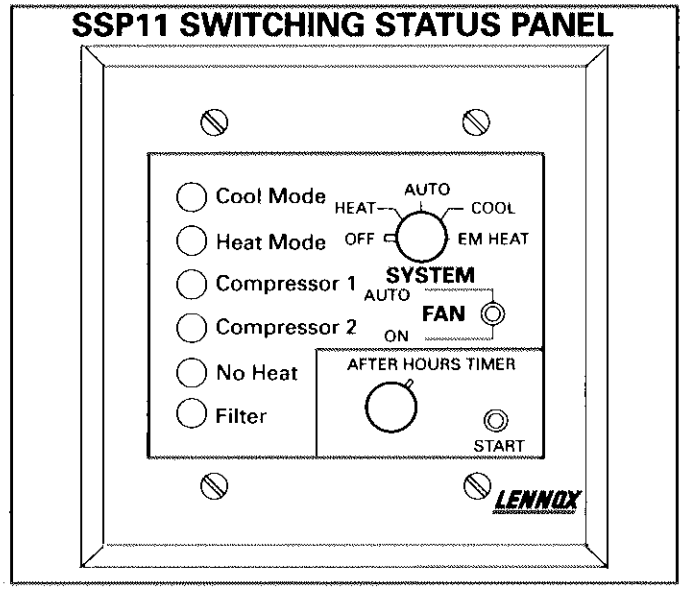


FIGURE 44

2-SSP11 Application

The SSP11 can be applied to CHP16 units using standard electromechanical thermostat or Honeywell W973 control systems only. The Prostat, W7400 and T7300 control systems provide switching features similar to the SSP11, therefore, the SSP11 is not needed. To operate an SSP11, a readout relay kit is required to interface the CHP16 to the SSP11. An SSP11 relay kit is also required (in addition to the readout relay kit) in units using an electromechanical thermostat.

Optional filter switch kit is required to make the dirty-filter light functional.

3-Indications and Functions

Both status panels are identical in function except for the switching and after hours capabilities of the SSP11.

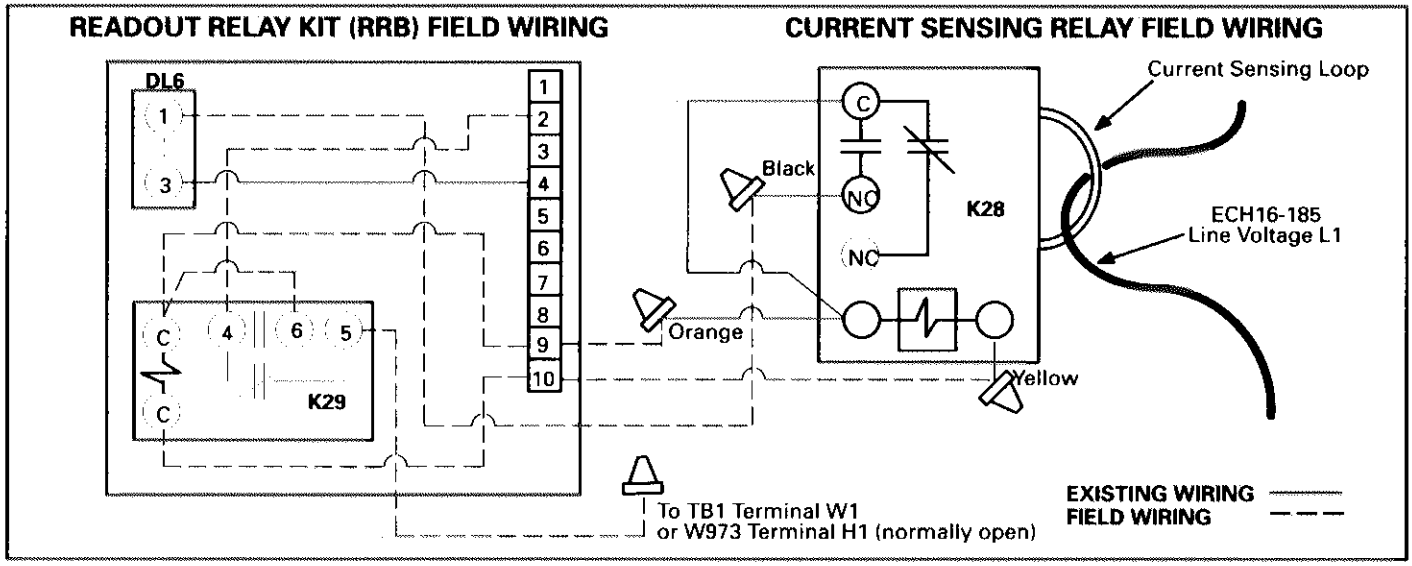


FIGURE 45

a–The "COOL MODE" LED lights green to indicate economizer "free cooling" operation when unit includes the economizer option. Otherwise, the LED indicates mechanical cooling operation.

b–The "HEAT MODE" LED lights green during normal heating operation.

c–The "COMPRESSOR 1" LED lights green when compressor 1 is running. The light turns red if a compressor safety switch opens during a compressor demand.

d–The "COMPRESSOR 2" LED lights green when compressor 3 is running. The light turns red if a compressor safety switch opens during a compressor demand.

e–The "NO HEAT" LED lights red on a loss of heat during a heating demand.

f– The "FILTER" LED lights red when optional pressure switch contacts close indicating dirty filters.

g–The "SYSTEM" switch on the SSP11 has five positions to indicate the following functions:
"OFF" – System off.
"HEAT" – System operates in heating mode only.
"AUTO" – System automatically provides heating or cooling on demand.
"COOL" – System operates in cooling mode only.
"EM HEAT" – (Emergency Heat) If placed in this position, the compressors are disabled and auxiliary electric heat is energized.

h–The "FAN" switch on the SSP11 has two positions to indicate the following functions:
"AUTO" – Blower cycles with demand.
"ON" – Blower runs continuously.

i– The "AFTER HOURS TIMER" on the SSP11 provides override of unoccupied mode operation (night heating setback / cooling setup) from 0 to 12 hours. In the occupied (day) mode, the after hours timer has no effect on unit operation.

The unit must be in the unoccupied mode (night) to activate the timer. Set the potentiometer for the number of hours desired override and push the momentary start button. The unit reverts to occupied mode operation for the set number of hours.

4–Installation and Wiring

The SP11 and SSP11 require relay kits to interface the status panel to the control system and the unit. The following sections list the operation sequence and installation procedures for the relay kits and the status panels.

a–Readout Relay Kit (RRB)

A readout relay kit (aka readout relay box – RRB) is required for all units using either the SP11 or SSP11 status panels. RRB is shown in figure 45. RRB includes relays which interface the status panels to the unit. Status panels will not operate without the RRB.

RRB Sequence of Operation:

1– Initial heating demand (W1) from the unit is routed through RRB terminal 2 to SP11 terminal 2 to light the green "HEAT" light.

2- The same heat demand is routed through RRB terminal 2 and through (RRB relay) K29 N.C. contacts to energize time delay DL6.

3- DL6 begins 60 second count before closing.

4- After current sensing relay K28 receives 24VAC power, N.O. contacts close.

5- When current is sensed, N.O. contacts open.

6- When N.O. contacts K28 open, time delay DL6 resets. When DL6 resets, the "NO HEAT" light is prevented from energizing.

7- If the current sensing relay does not sense current (indicating a problem with the electric heat or the safety circuits) before time delay DL6 finishes its 60 second count, time delay contacts close and red "NO HEAT" light is energized.

8- Other status panel lights are directly controlled by the individual unit functions.

9- Each "COMPRESSOR" light depends on two sources of voltage for green operation and one source of voltage for red operation. Each lead is tied electrically to either side of compressor number 1 high pressure cutout switch. If the high pressure switch contacts open, the green voltage side of the "COMPRESSOR" light will drop out leaving only the red "compressor" light on.

b–Current Sensing Relay

A current sensing relay is connected to the RRB in units equipped with electric heat. The current sensing relay momentarily closes its normally open contacts when power is applied to the relay coil (power is applied to the coil when first stage thermostat demand is received by CHP16 terminal strip TB1). As soon as current is sensed by the current sensing relay, the normally open contacts reopen.

When current sensing relay (normally open) contacts are closed, time delay DL6 is energized. DL6 begins a 30 second count before closing. When DL6 closes, "NO HEAT" light is energized.

Line voltage L1 passes through the current sensing loop in the current sensing redlay (figure 45). When current is sensed with first stage heating demand present, the current sensing relay's normally open contacts reopen. When the contacts reopen, time delay DL6 loses power and resets and the "NO HEAT" light is de-energized.

Status panel field wiring is shown in figures 47, 48 and 49.

c–SSP11 Relay Kit

An SSP11 relay kit is required on units using an electromechanical thermostat and an SSP11 switching status panel. The kit is used with the RRB (readout relay kit) to interface the SSP11 to the thermostat. SSP11 Relay Kit is shown in figure 46. The SSP11 relay kit must not be used on any other control system.

SSP11 Relay Kit Sequence of Operation:

1–The SSP11 relay kit contains two relays which affect unit operation.

2- Relay K20 energizes when the SSP11 is switched to "EM HEAT." Contacts K20–1 open to de–activate the green "HEAT" light. Simultaneously, the control switch routes power backward through the "HEAT" light. The "HEAT" light changes to red. Relay K20 has no other effect on unit operation.

3- Relay K21 energizes when the SSP11 "FAN" switch is in the "ON" position. Contacts K21–1 switch to allow the indoor blower to run continuously.

Switching status panel field wiring is shown in figures 50 and 51.

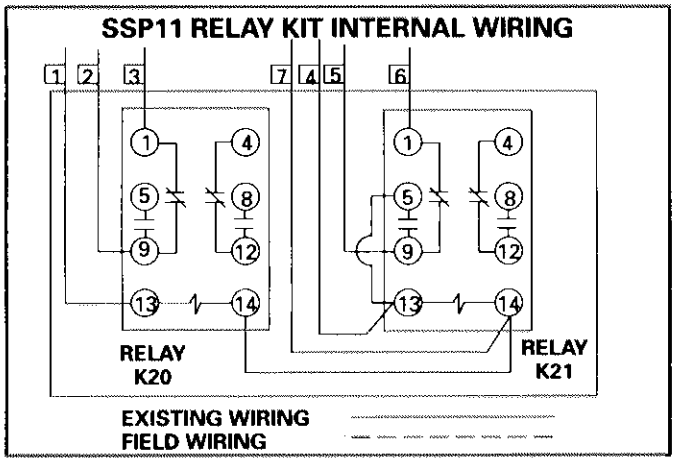
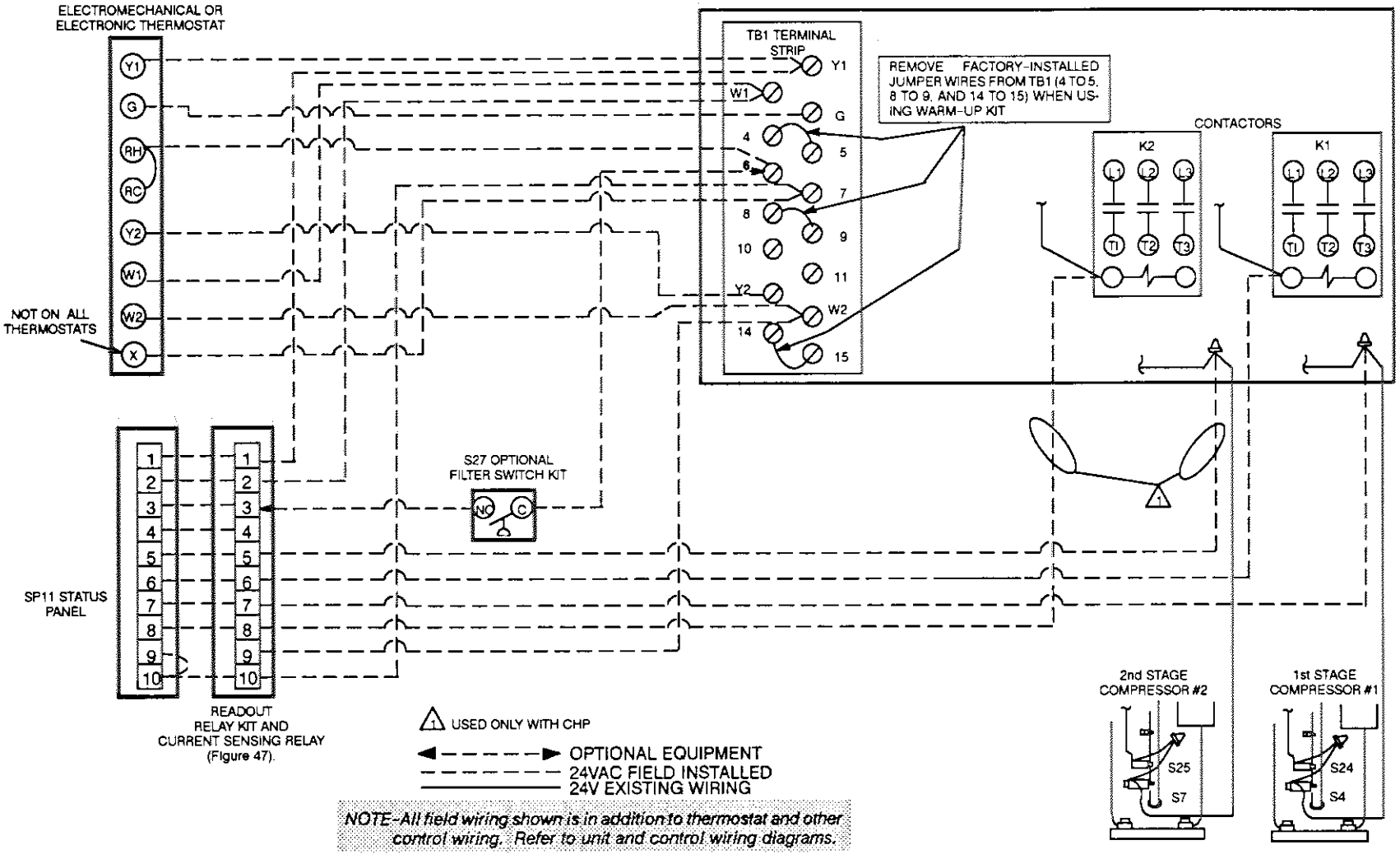


FIGURE 46

5–Filter Switch Kit

An air filter switch kit is available for use with the SP11 and SSP11. The air filter switch is activated by high negative pressure in the blower compartment caused by dirty air filters or other restrictions. When high negative pressure causes the switch to close, power is routed from terminal strip terminal TB1–6 through the switch to the red "FILTER" light in the SP11 or SSP11. See figure 52.

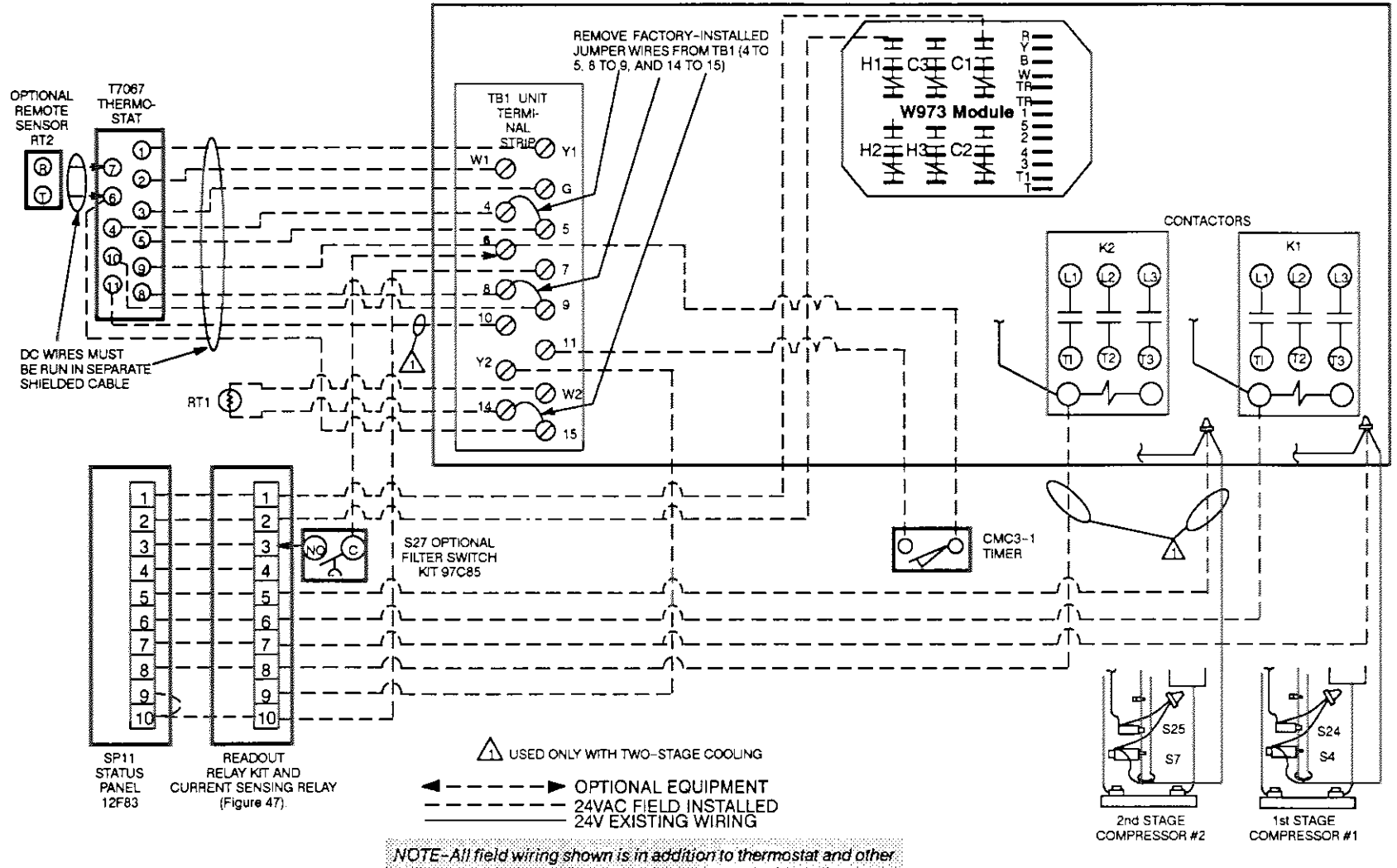
SP11 FIELD WIRING
ELECTROMECHANICAL OR
ELECTRONIC THERMOSTATS



NOTE - All field wiring shown is in addition to thermostat and other control wiring. Refer to unit and control wiring diagrams.

FIGURE 49

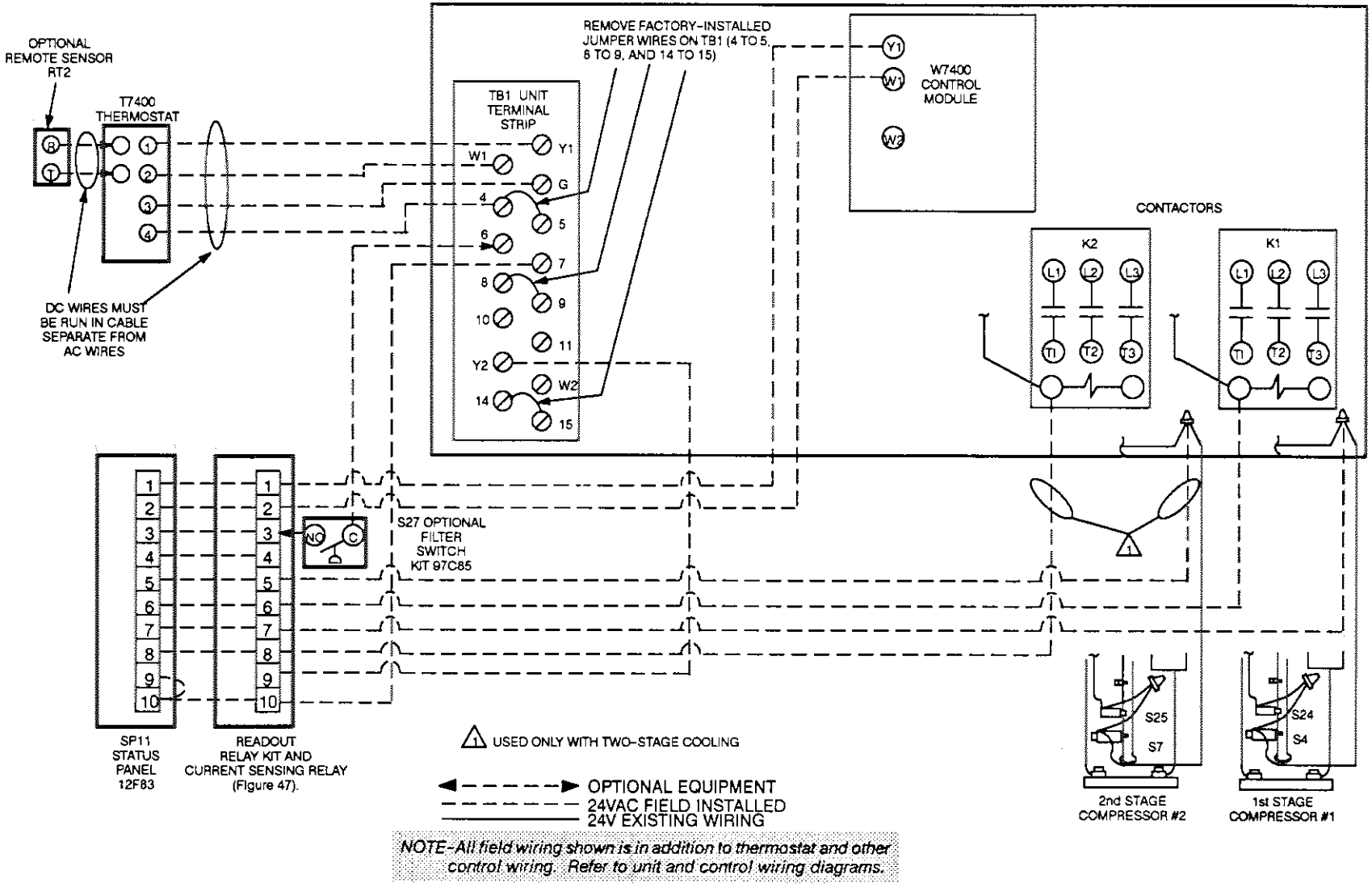
SP11 FIELD WIRING
W973 CONTROL SYSTEM



NOTE-All field wiring shown is in addition to thermostat and other control wiring. Refer to unit and control wiring diagrams.

FIGURE 50

SP11 FIELD WIRING
W7400 CONTROL SYSTEM



NOTE-All field wiring shown is in addition to thermostat and other control wiring. Refer to unit and control wiring diagrams.

FIGURE 51

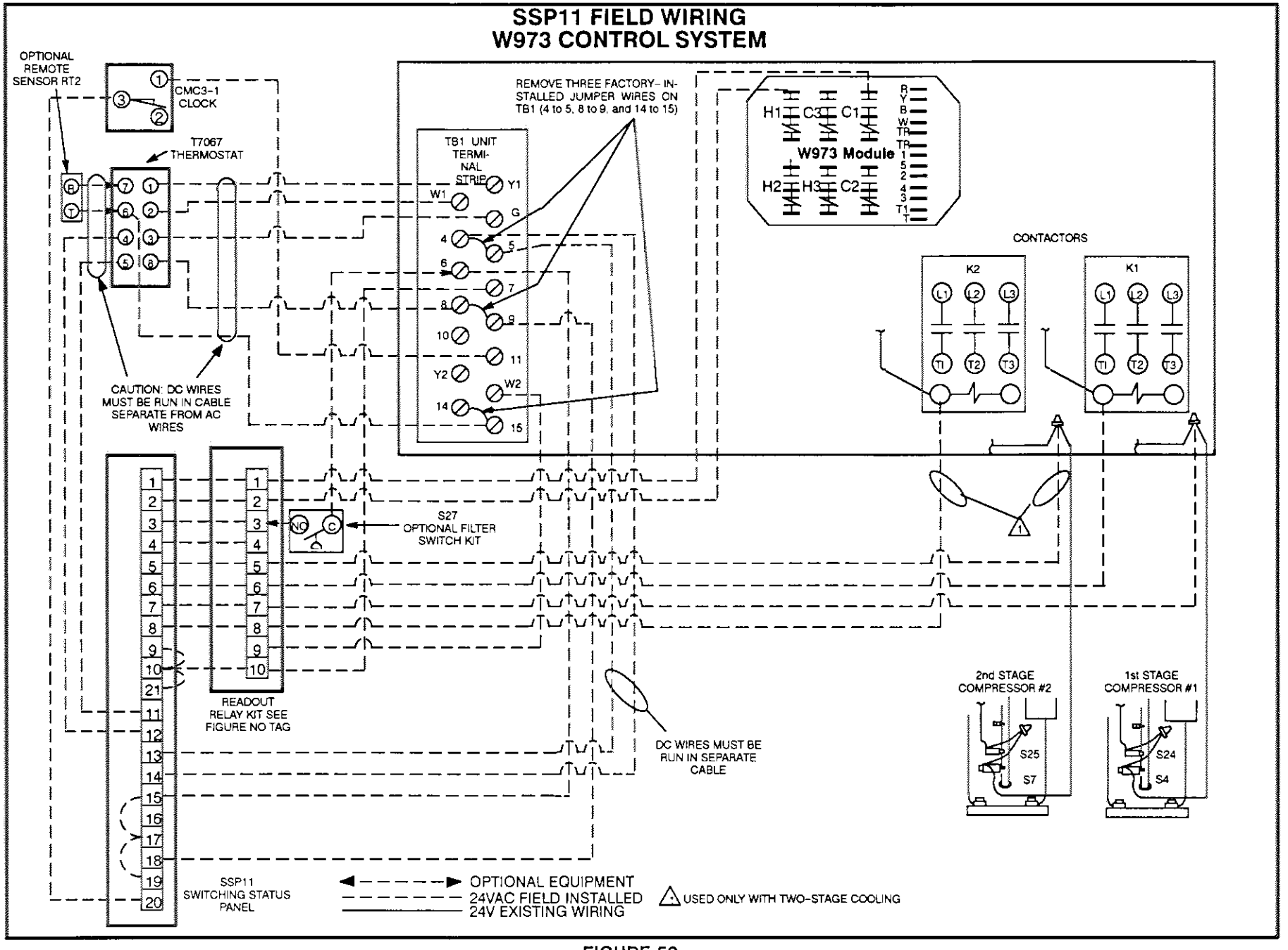

SSP11 FIELD WIRING
W973 CONTROL SYSTEM
OPTIONAL REMOTE SENSOR RT2
CMC3-1 CLOCK
T7067 THERMOSTAT
CAUTION: DC WIRES MUST BE RUN IN CABLE SEPARATE FROM AC WIRES
REMOVE THREE FACTORY- INSTALLED JUMPER WIRES ON TB1 (4 to 5, 8 to 9, and 14 to 15)
TB1 UNIT TERMINAL STRIP
W973 Module
CONTACTORS
K2
K1
S27 OPTIONAL FILTER SWITCH KIT
READOUT RELAY KIT SEE FIGURE NO TAG
DC WIRES MUST BE RUN IN SEPARATE CABLE
2nd STAGE COMPRESSOR #2
1st STAGE COMPRESSOR #1
S25
S7
S24
S4
SSP11 SWITCHING STATUS PANEL
OPTIONAL EQUIPMENT
24VAC FIELD INSTALLED
24V EXISTING WIRING
USED ONLY WITH TWO-STAGE COOLING

FIGURE 52

SSP11 FIELD WIRING ELECTROMECHANICAL AND ELECTRONIC THERMOSTATS

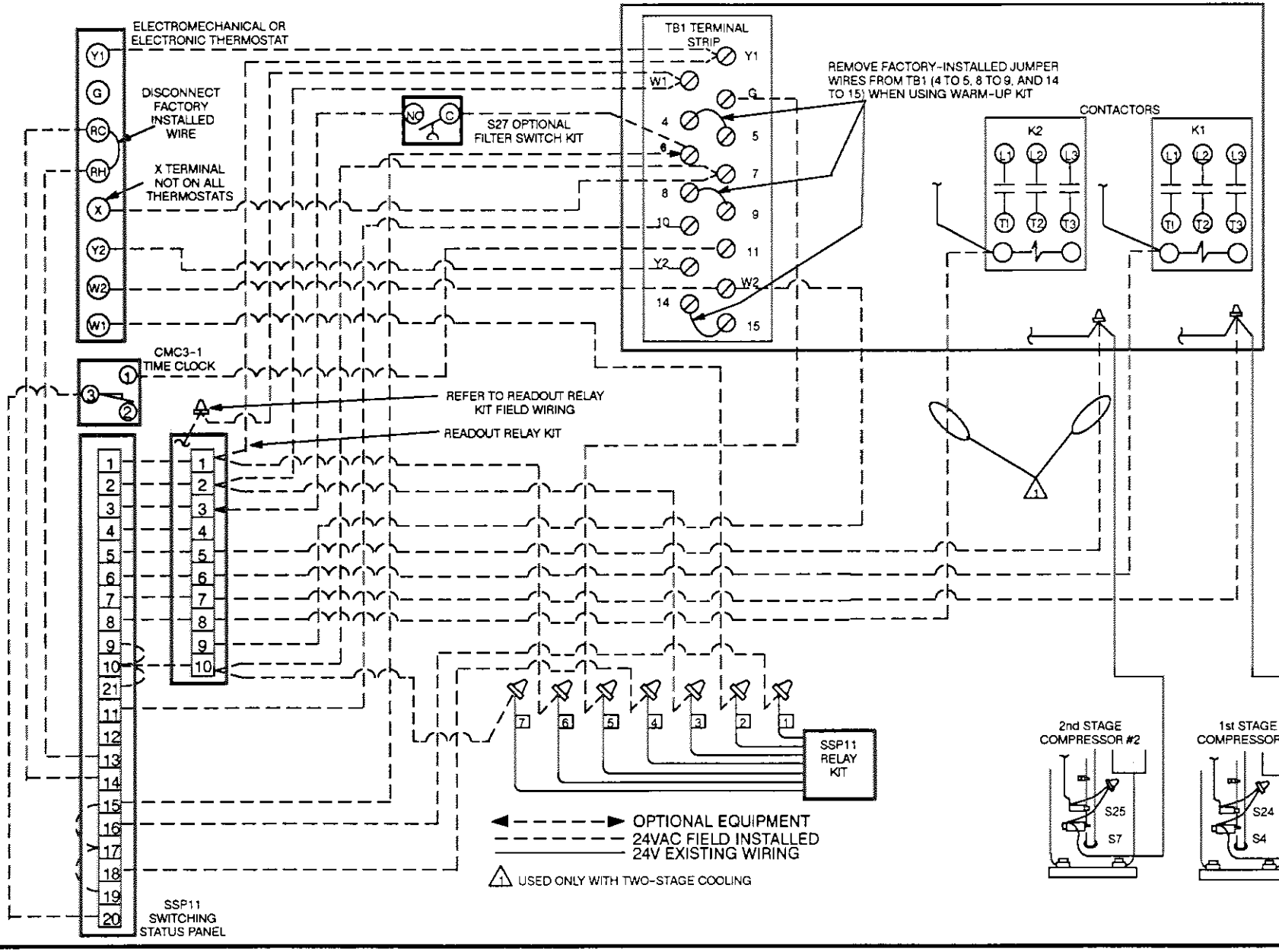


FIGURE 53

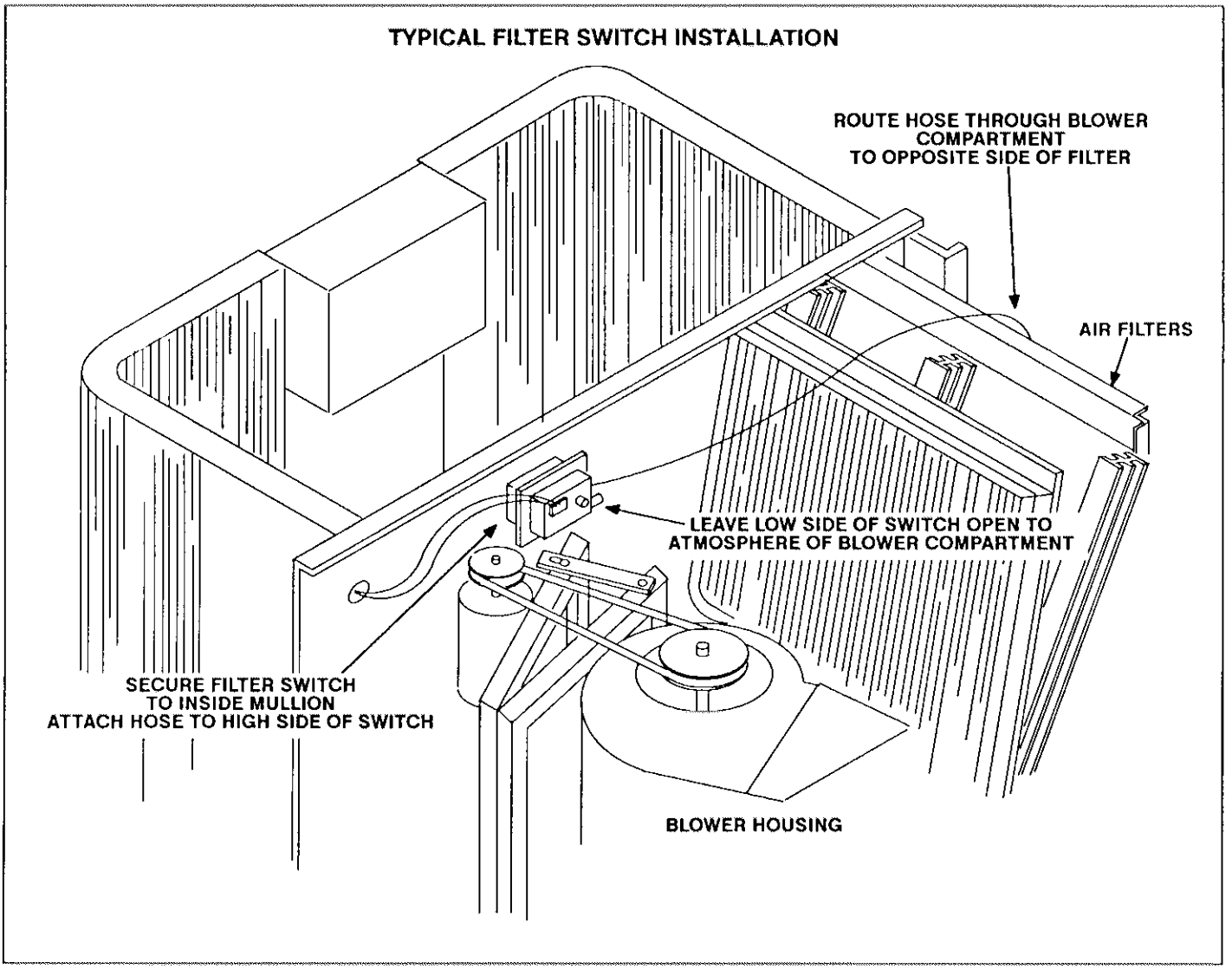

TYPICAL FILTER SWITCH INSTALLATION
ROUTE HOSE THROUGH BLOWER COMPARTMENT TO OPPOSITE SIDE OF FILTER
AIR FILTERS
LEAVE LOW SIDE OF SWITCH OPEN TO ATMOSPHERE OF BLOWER COMPARTMENT
SECURE FILTER SWITCH TO INSIDE MULLION
ATTACH HOSE TO HIGH SIDE OF SWITCH
BLOWER HOUSING

FIGURE 54

K–Commercial Controls Hardware

All CHP16–1853 units are factory equipped with the hardware required to connect and operate Lennox' commercial controls (W973, W7400, economizer, warm–up, etc...). The hardware consists of an economizer wiring harness (figure 53) and associated jackplugs. The economizer harness is a pre–wired harness which facilitates economizer, controls and/or warm–up connections.

Access to the unit filter section is gained by loosening the two quarter–turn fasteners on the access door (figure 53) with a slot screwdriver. The quarter–turn fasteners hold the access door shut with a spiral spring.

L–Optional Commercial Controls Systems

Optional "16 Series Commercial Controls" may be connected to all CHP16–1853 units. These are the same controls which are optional in all other size CHP16 commercial units. The following list describes the components used in all currently available (at time of printing) optional control system combinations. Each system is assigned a "C" number for easy reference. The "C" number identifies the control system on the wiring diagram (likewise, each CHP16 unit wiring diagram is assigned a "B" number, each heating section is assigned an "A" number and each economizer diagram is assigned a "D" number). Look for these numbers on the diagram to help you identify how the unit is setup and which control system is being used.

The control system wiring diagrams and the accompanying system "Operation Sequences" are not included in this manual. Look for the control system diagrams and the operation sequence sections in the "16 Series Control Systems" manuals printed separately.

The following section is provided to help service personnel become familiar with Lennox' Commercial Controls and the associated wiring schemes.

1– *D5 Wiring Diagram – Modulating Economizer Model Number REMD16M–185*
Downflow Modulating Economizer. Optional field installed in all CHP16 units. Sensors continuously monitor air conditions and adjust dampers accordingly. Infinite number of damper positions.

2– *Warm–Up Kit*
Warm–up kit is shown in Figure 54. Warm–up kit is an accessory to the economizer (diagram D5). The kit provides warm–up capabilities by holding outdoor air dampers closed during the first heating period after night setback. When first heating demand is satisfied, warm–up kit allows outdoor air dampers to open to minimum position.

Warm–up kit does not have its own wiring diagram. It is included in the C2, C4, C6 and C14 wiring diagrams.

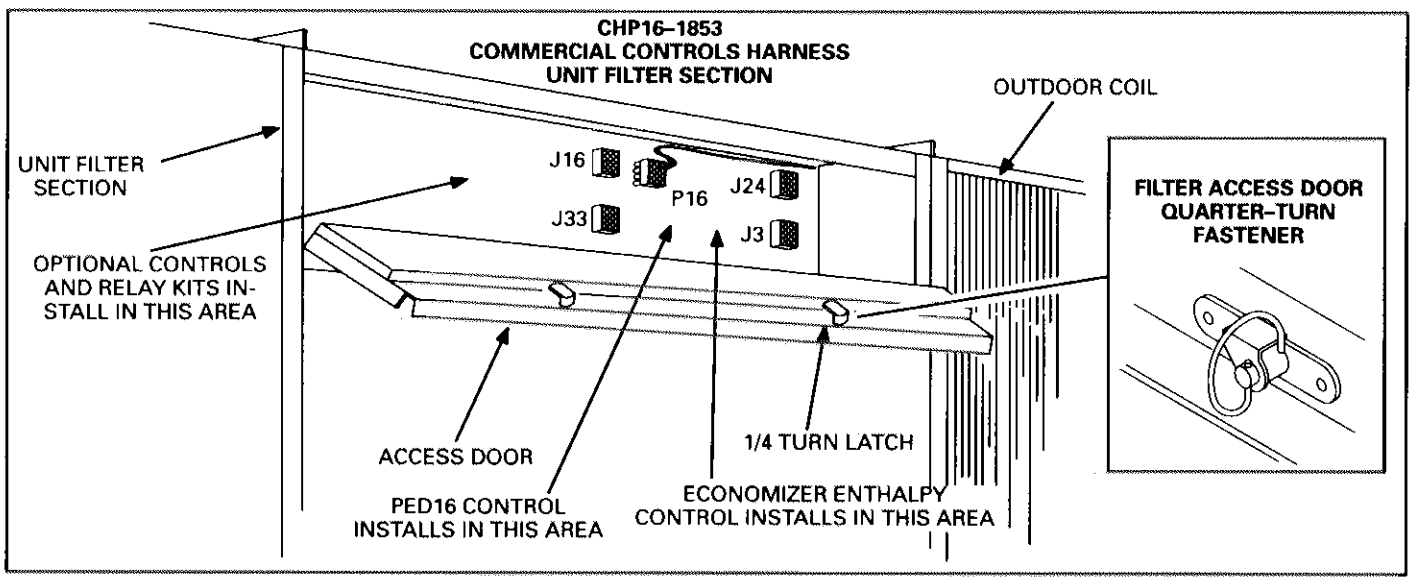


FIGURE 53

Some of the following optional thermostat control systems have built–in warm up capabilities and the warm up kit (figure 54) cannot be added due to wiring incompatibility.

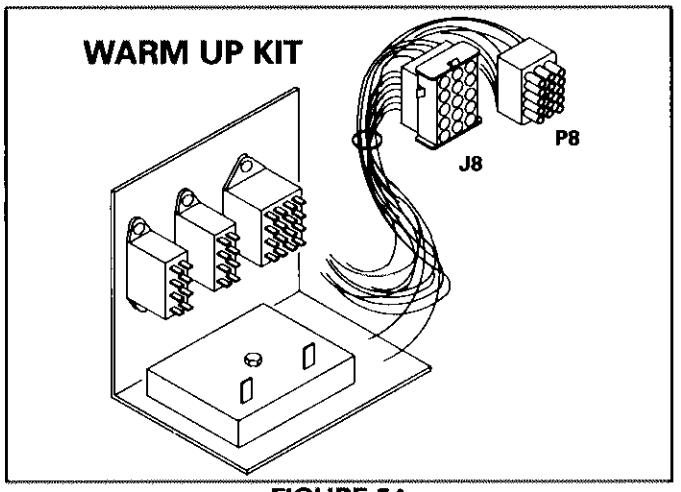


FIGURE 54

3– *C1 Wiring Diagram*
Standard 2heat/2cool thermostat for all units without economizer or warm–up.

4– *C2-1 Wiring Diagram*
Standard 2heat/2cool thermostat for all units with economizer and warm–up. CMC3–1 clock and night thermostat must be added for night setback. Night relay must also be added to economizer for night setback.

5– C11–1 *Wiring Diagram*
Standard 2heat/2cool thermostat for all units without economizer or warm–up. C11 Night Kit adds a relay facilitating night setback function (see figure 55). CMC3–1 clock and night thermostat must also be added to make setback relay functional.

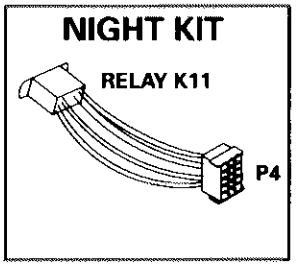


FIGURE 55

NOTE – Flexstat (C3 and C4 diagrams) was discontinued as a control system option in July 1989 and is not shown in the CHP16–1853. However, Flexstat remains a valid matchup to CHP16 units until inventories are depleted. You may find some CHP16–1853 units using it.

6– *C3 Wiring Diagram*
Flexstat L2F–N for units without economizer or warm–up. Setback is built in.

7– *C4 Wiring Diagram*
Flexstat L2F–N for units with economizer and warm–up. Setback is built in.

8– *C5 Wiring Diagram*
Prostat T5010 for units without economizer or warm–up. Setback is built in.

9– *C6 Wiring Diagram*
Prostat T5010 for units with economizer and warm–up. Setback is built in.

10– *C7–3 Wiring Diagram*
W7400 control system for units. See figure 56. Requires W7400 relay kit and economizer. Warm up and setback are built in.

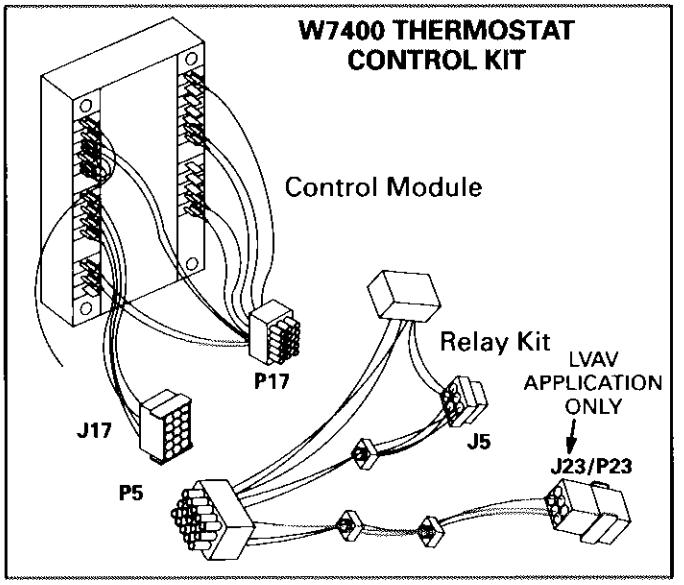


FIGURE 56

11– *C8–1 Wiring Diagram*
W973 control system for units without economizer or warm–up. See figure 57. Requires W973 relay kit. Also requires CMC3–1 clock for night setback.

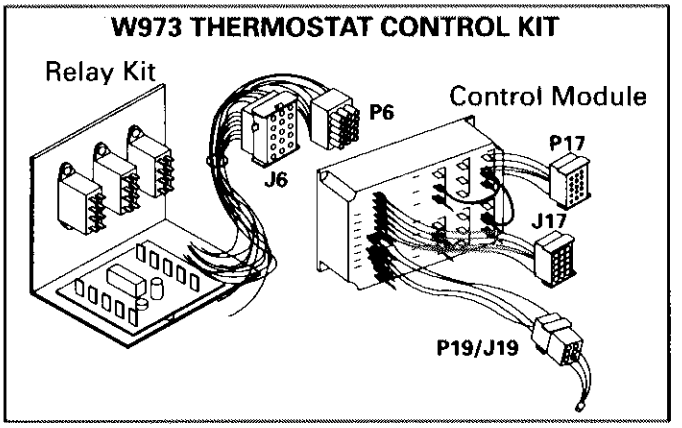


FIGURE 57

12– *C14–1 Wiring Diagram*
W973 control system for units with economizer and warm–up. Requires W973 relay kit. Also requires CMC3–1 clock and night relay for night setback.

13– *C12 Wiring Diagram*
T7300 electronic thermostat for units without economizer.

14– *C12–2 Wiring Diagram*
T7300 electronic thermostat for units with economizer. Warm–up is built in.

M–Clocks / Timers (CMC3–1)

Two optional clocks (both designated model# CMC3–1) are available for use with either the electromechanical thermostat or the Honeywell W973 control system. Both allow mechanical thermostats to "set back" during unoccupied periods. The clocks, models 202A and 702A, allow 24-hour and 7-day programmability respectively.

Other CHP16 control system options (W7400, T7300, Pro–stat, etc.) are equipped with built-in clocks for this purpose and do not need CMC3–1.

Both CMC3–1 clocks are alike except for programmability. The clocks are rated 24VAC*, 60Hz and have SPDT contacts rated at 15A and 120VAC.

**NOTE–Some clocks may be 120VAC while most are 24VAC. Be sure to check clock motor rating and wire clock according to its rating.*

Wiring connections should be made to N.O. terminal 1 and 3 (see figure 58). Refer to the sequence of operation for the control system being used (back of this manual) for correct wiring connections. Refer to the "Status Panel" section of this manual for wiring connections of clocks used with SP11 or SSP11. Refer to the manufacturer's operation and installation instructions printed inside the front cover of each clock.

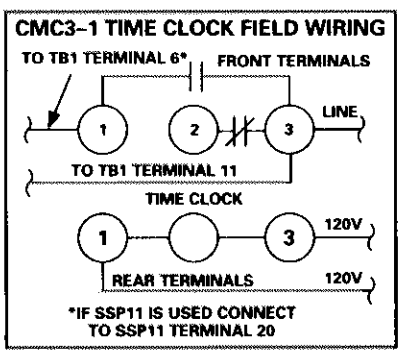


FIGURE 58

XI–COMMERCIAL CONTROLS INSTALLATION OF PLUG–IN KITS

The commercial controls harness allows optional commercial controls and economizer to "plug in" to the CHP16 so field wiring is minimized. Figure 53 shows the commercial controls harness which is located in the CHP16 filter section.

A–Night Kit

The night kit is used only with the C11 wiring diagram. It cannot be used with any other control system options or control damage will result. This system is designed for use with optional CMC3–1 time clock and night thermostat.

Optional night (setback relay) kit allows CHP16 units without REMD16M economizer to automatically "set back" the thermostat to reduce energy consumption during times when the building is not occupied. The night kit achieves this by disconnecting thermostat S1 and connecting a night thermostat during periods when the building is not occupied. The night thermostat can then be adjusted with a lower setpoint as needed for unoccupied heating.

WARNING–CONNECT ONLY RELAY KITS DESIGNED FOR THIS CONTROL SYSTEM. RELAY KITS DESIGNED FOR OTHER CONTROL SYSTEMS ARE NOT COMPATIBLE AND CONTROL DAMAGE OR FAILURE WILL RESULT. FOR EXAMPLE, DO NOT CONNECT A WARM–UP KIT TO THIS CONTROL SYSTEM.

No wiring is required (see figure 59). Jumper–plug P3 is removed and discarded. Night kit harness plug P4 connects directly into economizer harness jack J3.

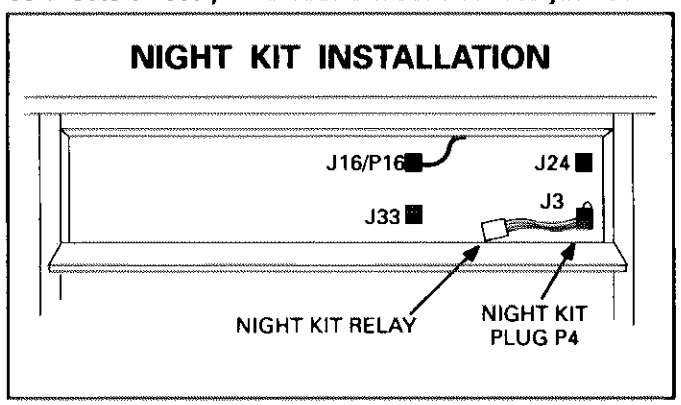


FIGURE 59

B–W7400 Control System

The W7400 is used only with the C7-3 control system option. It cannot be used with any other control system option or control damage will result.

The Honeywell W7400/T7400 control system, when applied to the CHP16, allows fully programmable operation of the unit during occupied and unoccupied periods. Morning warm–up capabilities are built in to the control system. An external warm–up kit is not needed.

1–W7400 Control

No wiring is required (see figure 60). Disconnect jack J16 from plug P16. Connect plug P17 to unit jack J16. Connect W7400 jack J17 to unit plug P16.

For basic unit operation without economizer, unit plug P3 must be connected to unit jack J3.

2–W7400 Relay Kit

An economizer may be added to the system to allow outside air for cooling. W7400 relay kit must be added to interface the control to the economizer.

WARNING–CONNECT ONLY RELAY KITS DESIGNED FOR THIS CONTROL SYSTEM. RELAY KITS DESIGNED FOR OTHER CONTROL SYSTEMS ARE NOT COMPATIBLE AND CONTROL DAMAGE OR FAILURE WILL RESULT. FOR EXAMPLE, DO NOT CONNECT A W973 RELAY KIT TO THIS CONTROL SYSTEM.

CAUTION–DO NOT CONNECT A WARM-UP KIT TO JACK J5 OF THE W7400 RELAY KIT. Warm–up kit wiring is not compatible with W7400 wiring and COMPONENT DAMAGE WILL RESULT. The W7400 system has a warm–up feature built in. A warm–up kit is not needed.

No wiring is required (see figure 61). Unit plug P3 is removed and discarded. Relay kit plug P5 connects to unit jack J3. Economizer plug P4 connects to relay kit jack J5.

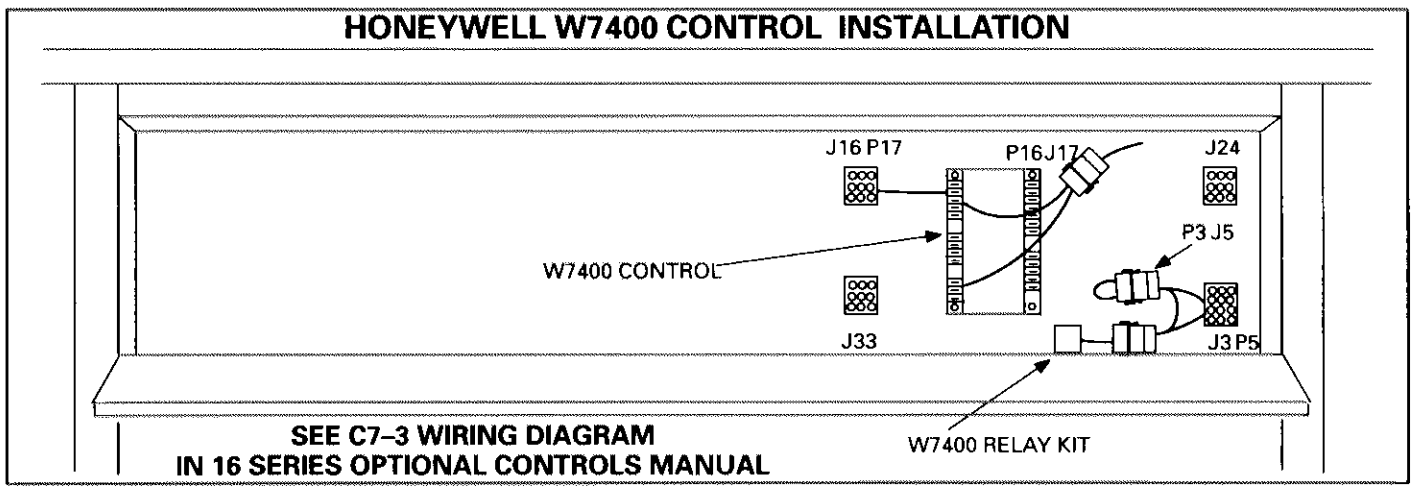


FIGURE 60

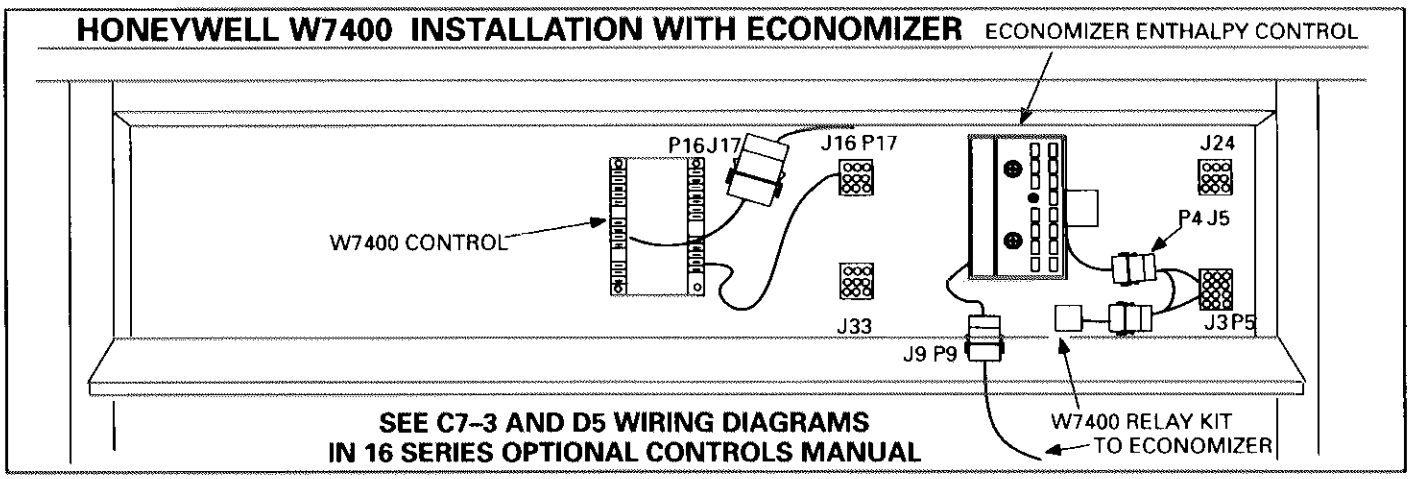


FIGURE 61

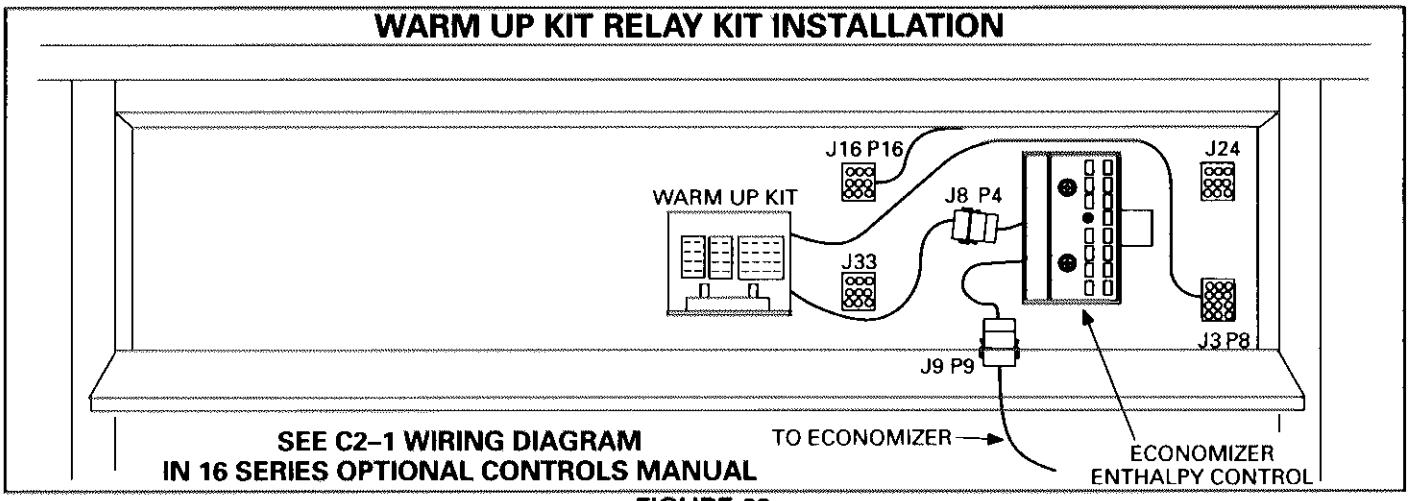


FIGURE 62

C–Warm–Up Kit

The warm–up kit is an option to the REMD16M economizer. The warm–up kit may be applied to any economizer (except units using W7400 control system or T7300 control system). If W973 control system is being used, CMC3–1 time clock must also be used. If electromechanical control system is being used, CMC3–1 time clock and night thermostat must be used.

CAUTION–DO NOT CONNECT A WARM–UP KIT TO A W7400 RELAY KIT OR TO A SYSTEM USING A T7300. Warm–up kit wiring is not compatible with these control systems and COMPONENT DAMAGE WILL RESULT. These control systems have a warm–up feature built in. A warm–up kit is not needed.

An economizer allows outside air to be used for cooling when conditions are acceptable and permits a preset amount of air exchange during all other unit operation. Warm–up kit holds outdoor air dampers full closed during first heating demand after night setback (during morning warm–up).

No wiring is required (see figure 62). The kit plugs into the unit wiring harness between the unit and economizer. Unit plug P3 is removed and discarded. Relay kit plug P8 connects to unit jack J3. Relay kit jack J8 connects to economizer plug P4.

D–W973 Control System

The W973 is used only with the C8-1 and C14-1 wiring diagrams. It cannot be used with any other control system options or control damage will result.

The Honeywell W973 control, when added to a CHP16, allows use of electronic "ramping" thermostats, discharge temperature sensors, return air temperature sensors and/or remote thermostats and transmitters. The W973 control system is designed for use with Honeywell T7067 electronic "ramping" thermostat and Q667 subbase.

An interconnecting W973 relay kit must be used to adapt the W973 to the CHP16. Optional CMC3–1 time clock must also be used for night setback capabilities. The relay kit changes the thermostat setpoints for night setback. A night thermostat is not needed.

1–W973 Control (C8 and C14 wiring diagram)

No wiring is required (see figure 63). Disconnect Jumper J16 from plug P16. Connect W973 plug P17 to unit jack J16. Connect W973 jack J17 to unit plug P16. Jumper plug J19 supplied with the W973 must be connected to plug P19 on the W973. Jumper plug J12 (also supplied with the W973) is not used with CHP16s and may be discarded.

2–W973 Relay Kit units without economizer or units with economizer and without warm–up (C8–1 and C8–3 wiring diagram)

No wiring is required (see figure 64). Disconnect unit plug P3 from unit jack J3. *Do not discard. P3 must be used if unit is not equipped with economizer.* Connect relay kit plug P6 to unit jack J3.

If unit is not equipped with economizer, connect relay kit J6 to unit plug P3. If unit is equipped with economizer, connect relay kit plug P6 to economizer jack J4.

3–W973 Relay Kit with Warm–Up units with economizer and warm–up (C14–1 wiring diagram)

No wiring is required for connection of the kits (see figure 65). However, a minimum amount of field wiring is required to pigtails provided in the warm–up kit. Field wiring is shown in the W973 Control Information Manual and on the diagram provided with the unit. Unit plug P3 is removed from the unit and discarded. Connect W973 relay kit plug P6 to unit jack J3. Connect W973 relay kit jack J6 to warm–up kit plug P8. Connect warm–up kit jack J8 to economizer plug P4.

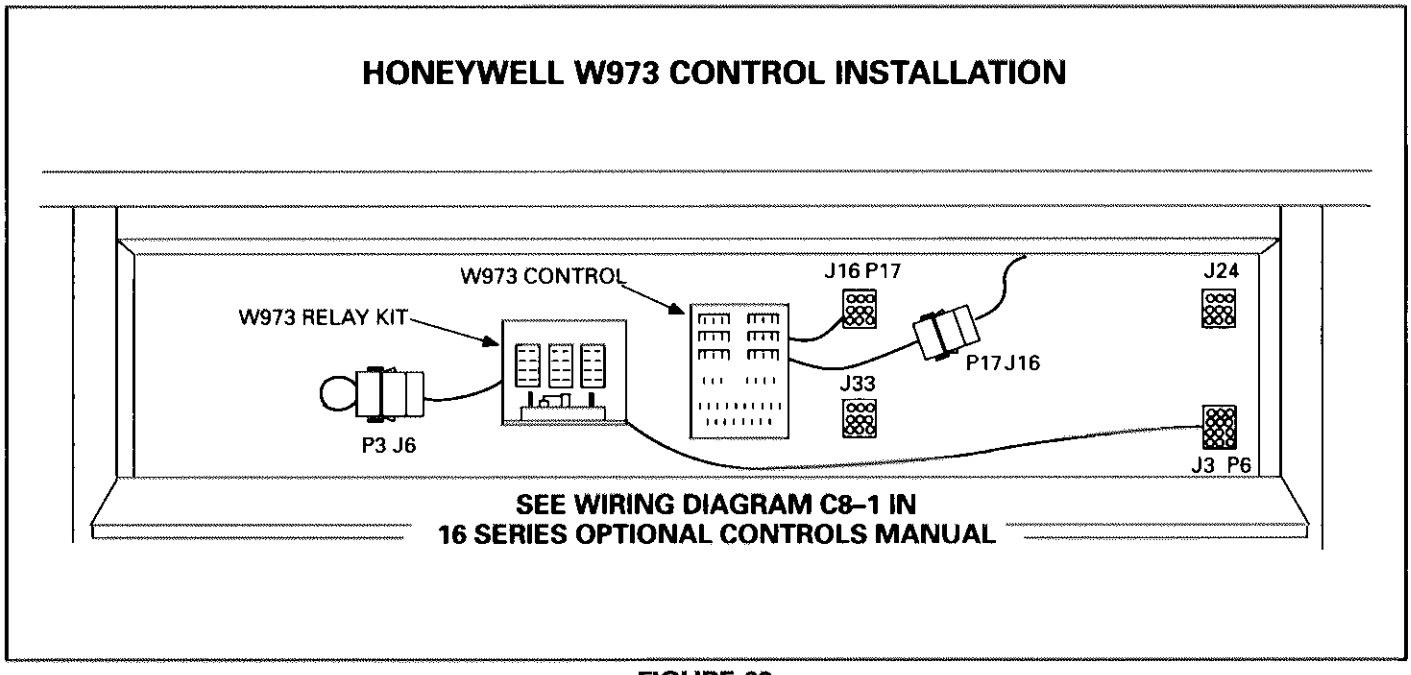


FIGURE 63

HONEYWELL W973 CONTROL INSTALLATION WITH ECONOMIZER

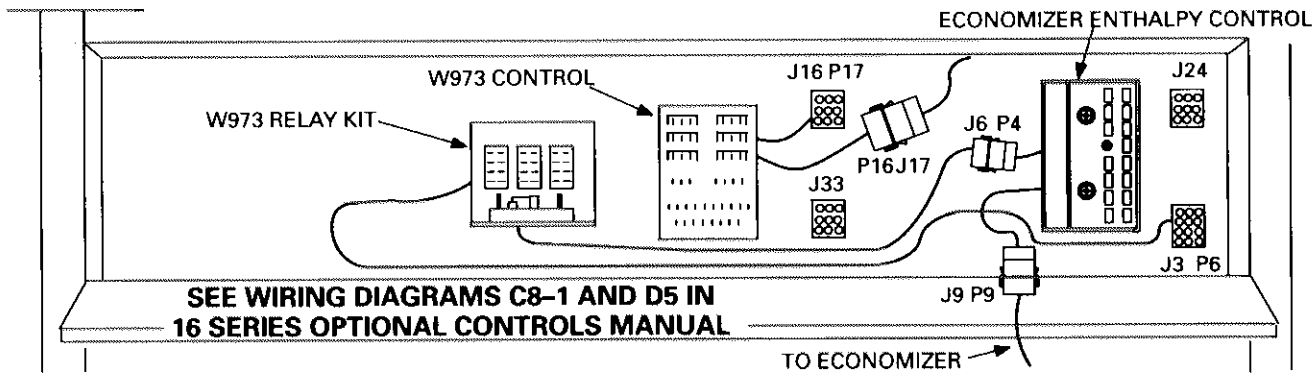


FIGURE 64

HONEYWELL W973 CONTROL INSTALLATION WITH ECONOMIZER

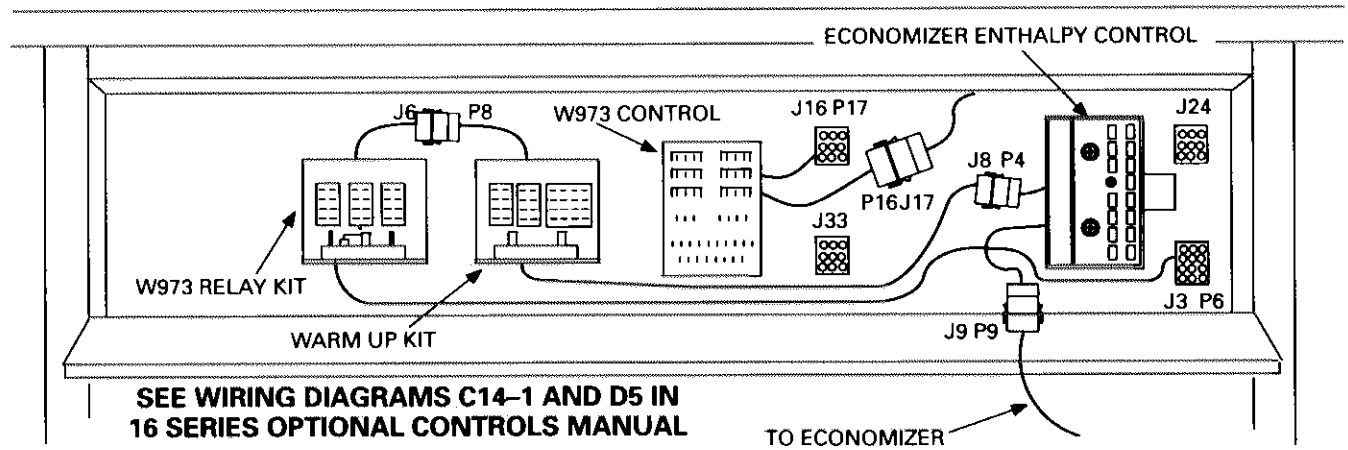


FIGURE 65

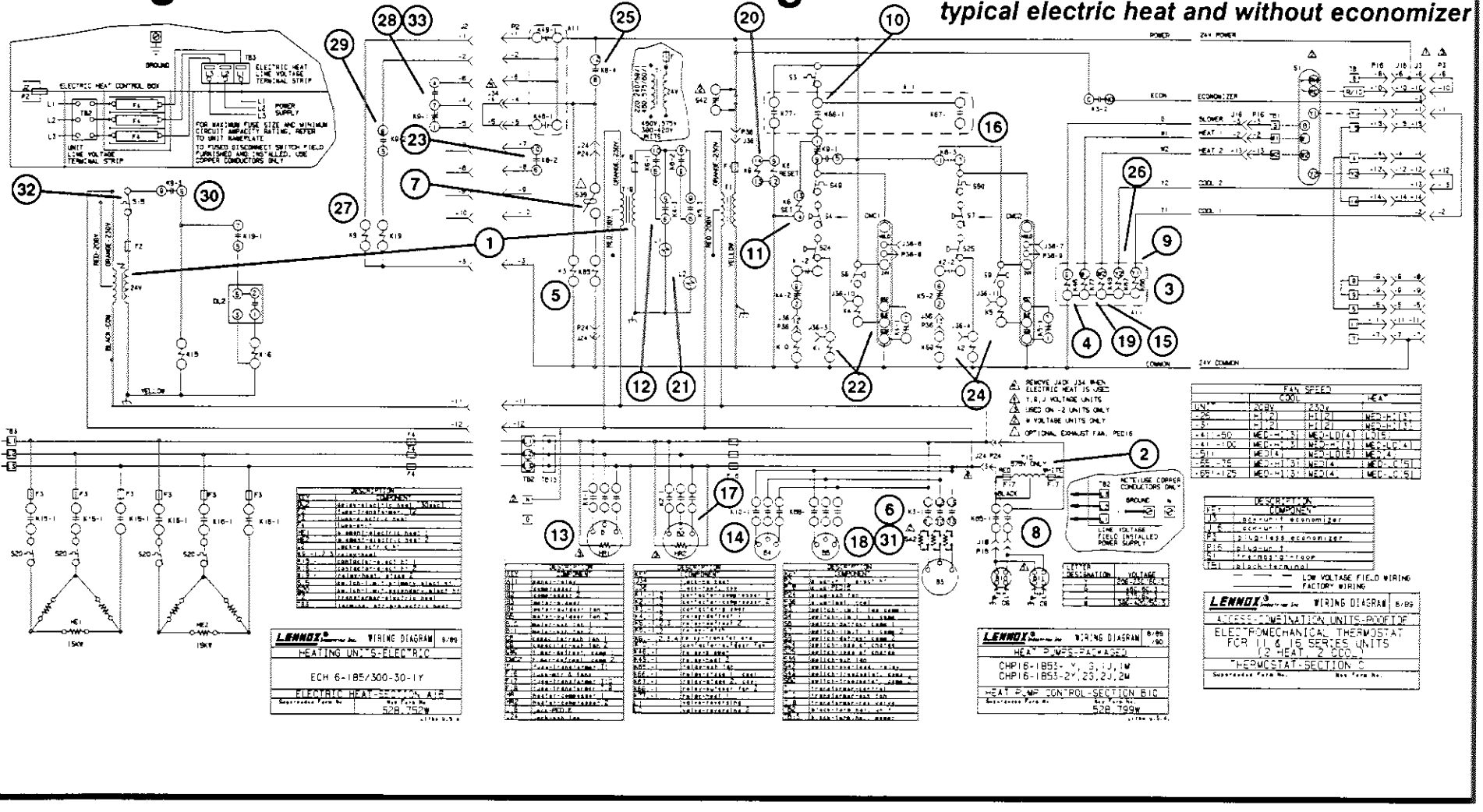
XII–WIRING DIAGRAMS AND OPERATION SEQUENCE

NOTE–THE FOLLOWING DIAGRAM AND OPERATION SEQUENCE SHOWS A BASIC UNIT (B10 and A16 DIAGRAMS) CONNECTED TO AN ELECTROMECHANICAL THERMOSTAT (C1 DIAGRAM) ONLY.

OPTIONAL "16 SERIES CONTROLS" WIRING DIAGRAMS ARE NOT PRINTED IN THIS MANUAL. LOOK FOR CONTROL SYSTEM DIAGRAMS AND OPERATION SEQUENCES IN INDIVIDUAL UNIT INFORMATION CONTROL SYSTEM MANUALS PRINTED SEPARATELY.

C1diagram with B10 and A16 diagrams

basic thermostat with CHP16-1853, with typical electric heat and without economizer



C1 DIAGRAM WITH B10 AND A16 DIAGRAMS

Electromechanical Thermostat Connected to CHP16-1853 with Typical Electric Heat Unit (and Without Economizer)

A-CHP16-1853

This flowchart is used to show the step by step sequence that takes place when thermostat demand is sent to the CHP16. The sequence describes the actions of devices in the unit which control blowers, fans, gas valves and other components in the system. The sequence is outlined by numbered steps which correspond to circled numbers on the adjacent diagram.

Operation Sequence: C1 Section B10 and A16 Sections (electromechanical thermostat wired to CHP16-1853)

Power:

1- When the unit disconnect closes, line voltage energizes both transformers T1 and T12. Transformer T1 provides 24VAC power to unit cooling and blower controls and thermostat. Transformer T2 provides 24VAC power to unit heating controls.

2- If the unit is 575V and is equipped with optional PED16 exhaust fans, line voltage simultaneously energizes transformer T10. Transformer T10 provides 460VAC power to PED16 fan motors and is switched through relay K65 (NOTE-PED16 fan motors use line voltage in all units except 575V models).

Pilot Relays:

3- All thermostat demand is switched via pilot relays located on pilot relay board A11. A11 is used to reduce voltage drop caused by long runs of thermostat wire or undersized thermostat wire.

Blower Operation:

4- Blower demand from thermostat terminal G energizes pilot relay K46. Normally open K46-1 contacts close.

5- When K46-1 closes 24VAC power is routed through N.C. K9-1 contacts to energize blower contactor K3 (and mercury exhaust switch S39 if optional PED16 is installed).

6- When K3 is energized K3-1 closes to energize blower motor B3 and K3-2 closes to energize the economizer damper motor (if economizer is installed, outdoor damper drives to minimum position).

7- Optional REMD16 and PED16 installed: As the economizer damper drives open, mercury switch S39 closes and relay K65 is energized.

8- When K65 is energized, K65-1 closes to energize both PED16 exhaust fan motors B10 and B11.

1st Stage Cooling (both compressors B1 and B2 operate separated by 30 sec. delay):

9- Cooling demand energizes Y1 and G in the thermostat. G energizes pilot relay K46. See step 5 and subsequent steps for blower operation. Y1 energizes pilot relay K66. Normally open K66 contacts contacts close.

10- When K66-1 closes, latch relay K6 "SET" coil is energized and power is routed through K8-1 N.C. contacts to energize defrost control CMC1, compressor contactor K1 and outdoor fan contactor K10. K1 can only energize if low ambient thermostat S3, high temperature limit S49, high pressure limit S4 and low pressure limit S24 are all closed.

11- When latch relay K6 "SET" coil is energized, contacts K6-1 and K6-2 close.

12- When contacts K6-1 close, reversing valve L1 is energized. When contacts K6-2 close, reversing valve L2 is energized. K6-1 and K6-2 remain closed when cooling demand stops.

13- Contactor K1-1 contacts close to energize compressor B1. Since the reversing valves are energized, the defrost pressure switches are sensing discharge pressure and are prevented from closing (thereby preventing defrost in cooling mode).

14- Contactor K10-1 contacts close to energize outdoor fan B4.

2nd Stage Cooling (compressor B13 operates in addition to compressors B1 and B2):

15- Additional cooling demand energizes Y2 in the thermostat. Y2 energizes pilot relay K67. Normally open K67 contacts close.

16- When K67-1 closes, defrost control CMC2, compressor contactor K2 and outdoor fan contactor K68 are energized. K2 can only energize if high temperature limit S50, high pressure limit S7 and low pressure limit S25 are all closed.

17- Contactor K2-1 closes to energize compressor B2. Since the reversing valves are energized, the defrost pressure switches are sensing discharge pressure and are prevented from closing (thereby preventing defrost in cooling mode).

18- Contactor K68-1 contacts close to energize outdoor fan B5.

1st Stage Heating Operation:

19- Heating demand energizes W1 in the thermostat. W1 energizes pilot relay K77. Normally open K77-1 contacts close.

20- When K77-1 closes, latch relay K6 "RESET" coil and transfer relay K8 are energized. Latch relay K6 "RESETS." Both compressors are energized during 1st stage heating demand.

21- When latch relay K6-1 opens, reversing valve L1 is de-energized. When latch relay K6-2 opens, reversing valve L2 is de-energized.

22- When K8-1 switches, defrost control CMC1, compressor copntactor K1 and outdoor fan contactor K10 are energized.

23- When K8-2 switches, ECH16 redundant high temperature limit S63 (460V and 575V only - not shown) is enabled.

24- When K8-3 switches, defrost control CMC2, compressor contactor K2 and outdoor fan contactor K68 are energized.

25- When K8-4 is energized, the indoor blower is energized (steps 5-8 repeat).

2nd Stage Heating Operation:

26- Heating demand energizes W2 in the thermostat. W2 energizes pilot relay K49. Normally open K49-1 contacts close.

27- When K49-1 closes the 1st stage heating pilot relay (K9) is energized. K9-1 normally open contacts switch closed (and normally closed contacts switch open) and K9-2 and K9-3 normally open contacts switch closed.

28- When K9-1 switches, blower contactor K3 (and mercury exhaust switch S39 if optional PED16 is installed) is energized. Since K8-4 is already closed, this is a redundant circuit to ensure indoor blower operation while electric heat is energized.

29- When K9-2 switches close, 2nd stage electric heat is enabled. 2nd stage heat contactor (K19 in this example) is immediately energized.

30- When K9-3 closes, electric heat operation begins. The operation sequence of electric heat units varies depending on size (kW input rating) and line voltage rating.

31- When K3 is energized K3-1 closes to energize blower motor B3 and K3-2 closes to energize the economizer damper motor (if economizer is installed, outdoor damper drives to minimum position).

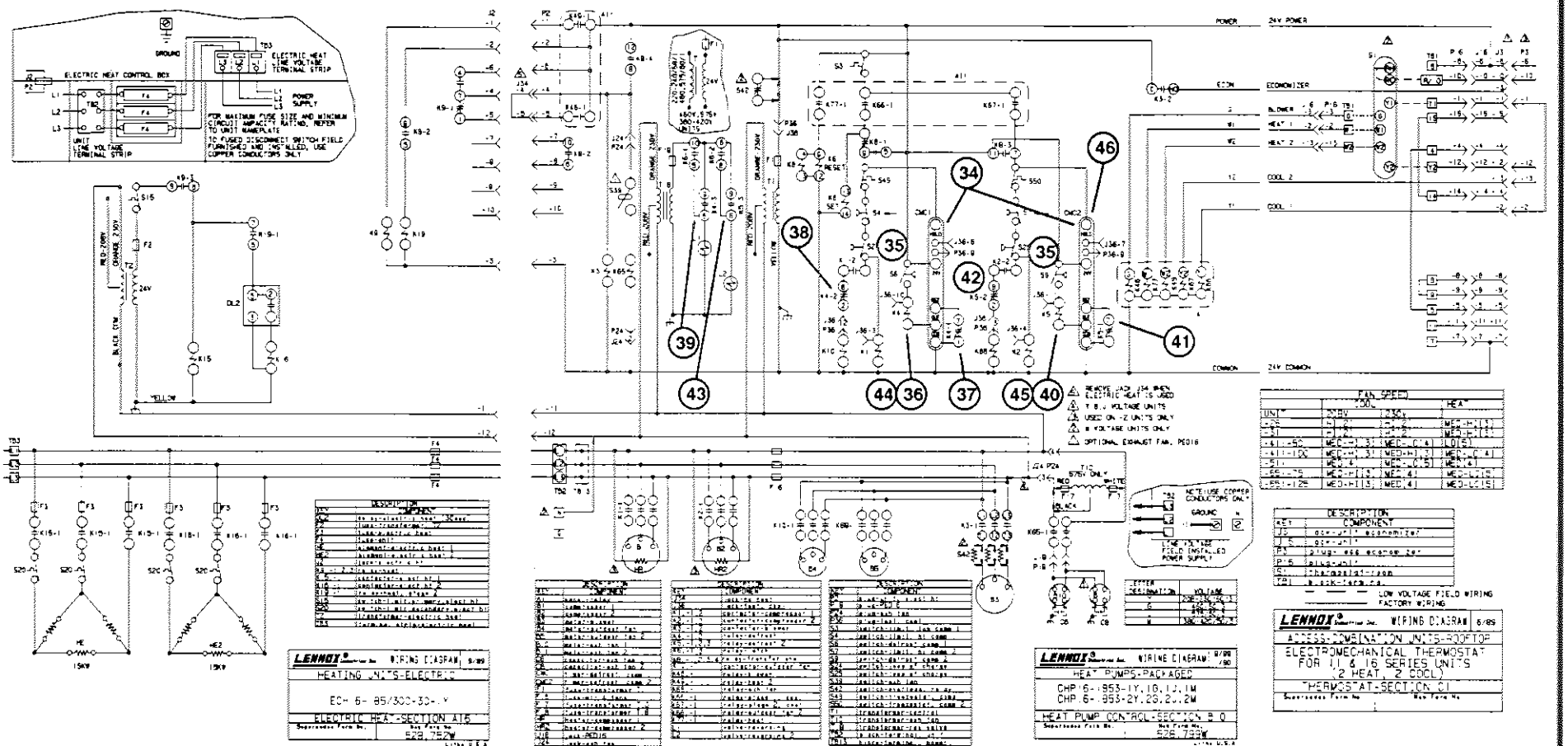
Safety Blower Operation:

32- If either the primary or secondary limits in the electric heat section trip, the heating elements are immediately de-energized.

33- The indoor blower remains energized powered by K9 which is energized by thermostat demand.

C1diagram with B10 and A16 diagrams *(continued)*

basic thermostat with CHP16-1853, with typical electric heat and without economizer



C1 DIAGRAM WITH B10 AND A16 DIAGRAMS (continued)

Electromechanical Thermostat Connected to CHP16-1853 with Typical Electric Heat Unit (and Without Economizer)

Defrost:

34- Although both refrigeration circuits operate during 1st stage heating, each circuit defrosts independently of the other. After 30, 60 or 90 total minutes of heating demand (depending on how the control is preset), CMC1 checks for defrost in the 1st stage circuit by closing an internal relay connected to terminal "OUT." At approximately the same time, CMC2 checks for 2nd stage defrost in the same manner.

35- Defrost pressure switches S6 (1st stage) and S9 (2nd stage) close when the outdoor coil vapor line drops below 45±10psig.

36- If S6 is closed when CMC1 checks for defrost, relay K4 energizes to begin 1st stage defrost.

37- When K4-1 opens, CMC1 internal timer is reset to zero.

38- When K4-2 opens, outdoor fan contactor K10 is de-energized. 1st stage outdoor fan is de-energized during 1st stage defrost.

39- When K4-3 closes, reversing valve L1 is energized.

40- If S9 is closed when CMC2 checks for defrost, relay K5 energizes to begin 2nd stage defrost.

41- When K5-1 opens, CMC2 internal timer is reset to zero.

42- When K5-2 opens, outdoor fan contactor K68 is de-energized. 2nd stage outdoor fan is de-energized during 2nd stage defrost.

43- When K5-3 closes, reversing valve L2 is energized.

44- 1st stage continues defrosting until S6 opens or until 14 minutes have elapsed. 1st stage opens when the 1st stage outdoor coil vapor line rises above 225±10psig.

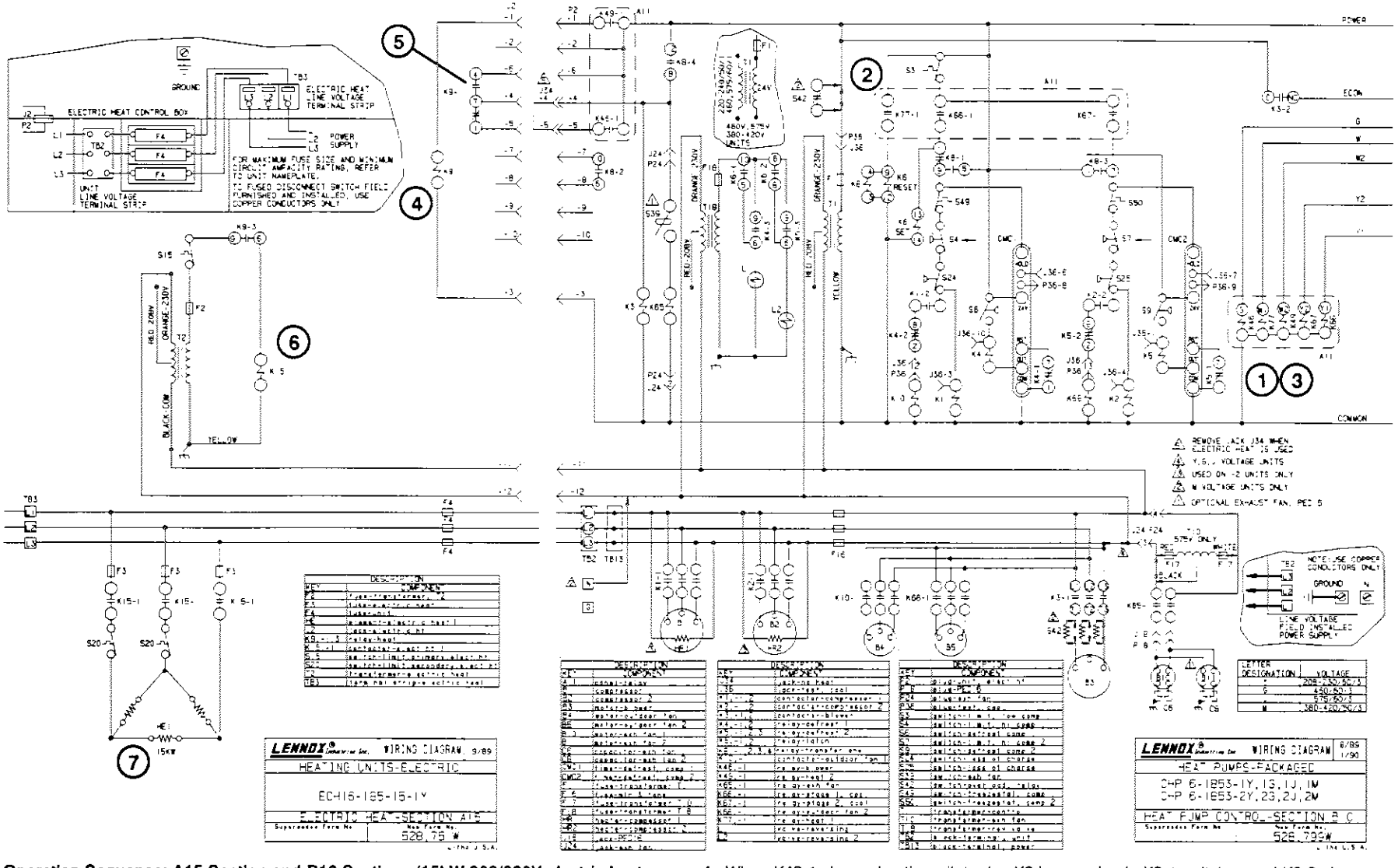
45- 2nd stage continues defrosting until S9 opens or until 14 minutes have elapsed. 2nd stage opens when the 2nd stage outdoor coil vapor line rises above 225±10psig.

46- If heating demand is satisfied during defrost, terminal "24V" and "OUT" (of both defrost controls) remain powered. However, terminal "HLD" of each defrost control loses power. This tells each defrost control that demand is satisfied. Each control "HOLDS" its internal timer in place until thermostat demand returns (when terminal "HOLD" receives 24V).

47- When 1st stage defrost is complete, relay K4 loses power. K4-1 closes to restart internal timer for next defrost. K4-2 closes to restart the 1st stage outdoor fan. K4-3 opens to de-energize the 1st stage reversing valve.

48- When 2nd stage defrost is complete, relay K5 loses power. K5-1 closes to restart internal timer for next defrost. K5-2 closes to restart the 2nd stage outdoor fan. K5-3 opens to de-energize the 2nd stage reversing valve.

A15 diagram with B10 diagram *CHP16-1853 with 15kW 208/230V electric heat*



Operation Sequence: A15 Section and B10 Sections (15kW 208/230V electric heat wired to CHP16-1853)

1- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

2- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Compressors provide all 1st stage heating.

3- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

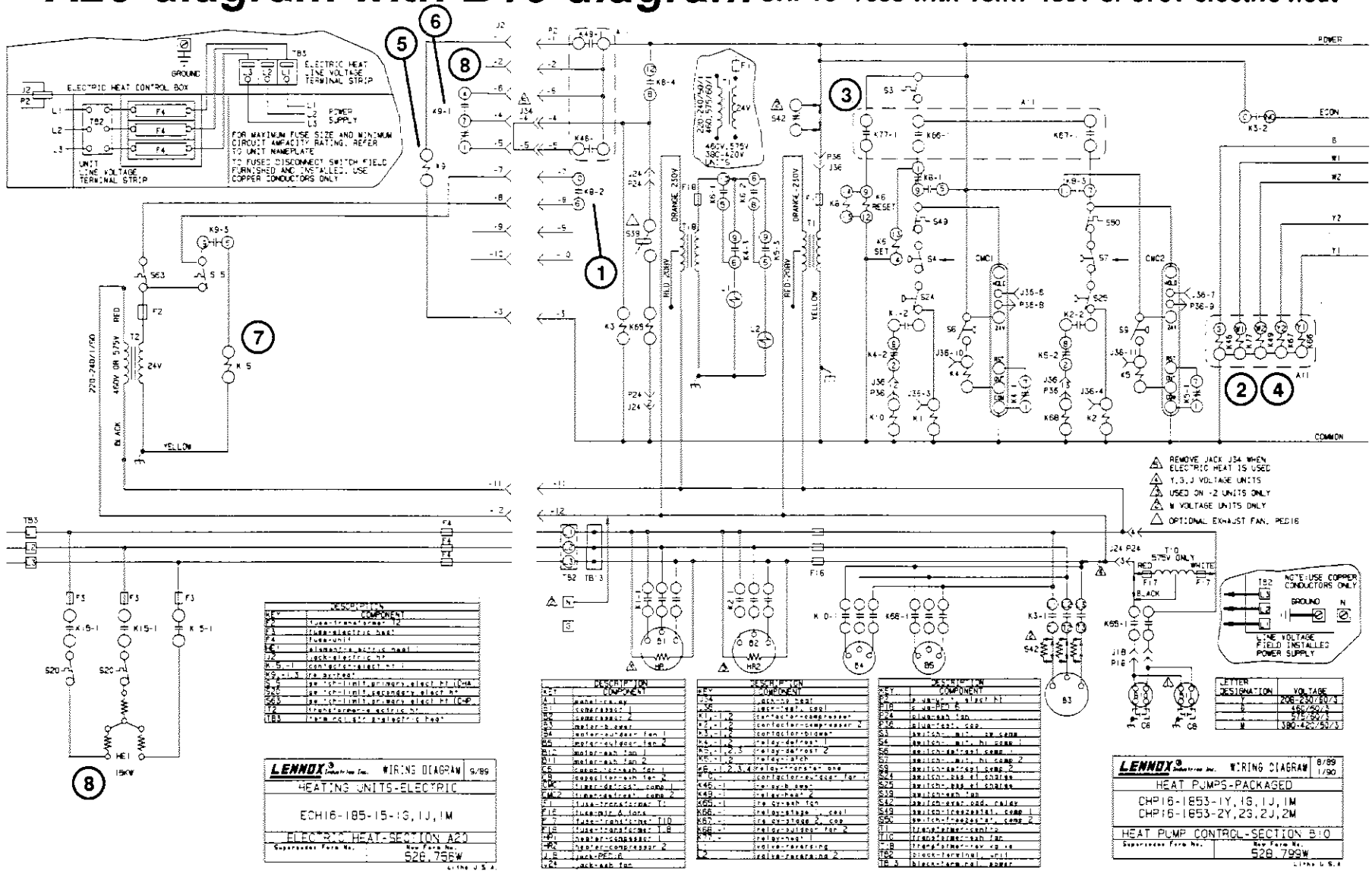
4- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-3 closes.

5- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

6- When K9-3 closes, electric heat contactor K15 is energized. K15-1 closes.

7- When K15-1 closes, the heating elements are energized. The elements are arranged in a "Delta" configuration for 208/230V operation.

A20 diagram with B10 diagram *CHP16-1853 with 15kW 460V or 575V electric heat*



Operation Sequence: A20 Section and B10 Sections (15kW 460V or 575V electric heat wired to CHP16-1853)

1- Temperature limit S63 is a redundant limit used only in CHP16-1853 applications when transfer relay K8 is energized (during a call for heat).

2- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

3- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Both compressors provide 1st stage heating.

4- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

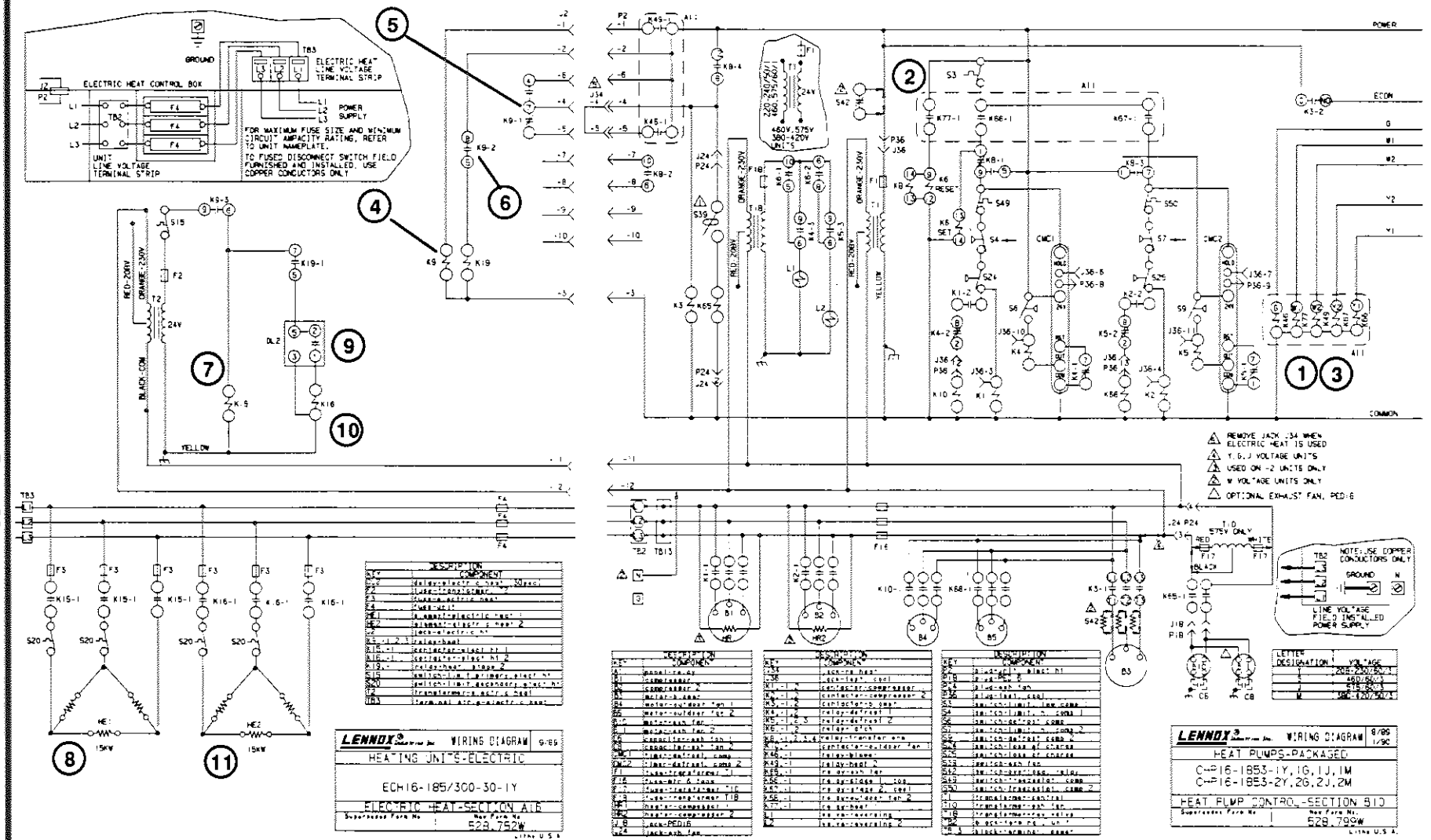
5- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-3 closes.

6- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

7- When K9-3 closes, electric heat contactor K15 is energized. K15-1 closes.

8- When K15-1 closes, the heating elements are energized. The heating elements are arranged in a "wye" configuration for 460V and 575V operation.

A16 diagram with B10 diagram *CHP16-1853 with 30kW 208/230V electric heat*



Operation Sequence: A16 Section and B10 Sections (30kW 208/230V electric heat wired to CHP16-1853)

1- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

2- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Both compressors provide 1st stage heating.

3- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

4- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-2 and K9-3 close.

5- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

6- When K9-2 closes, 2nd stage heat pilot relay K19 is energized. K19-1 closes.

7- When K9-3 closes, electric heat contactor K15 is energized. K15-1 closes.

8- When K15-1 closes, the 1st stage heating elements are energized. All heating elements are arranged in a "Delta" configuration for 208/230V operation.

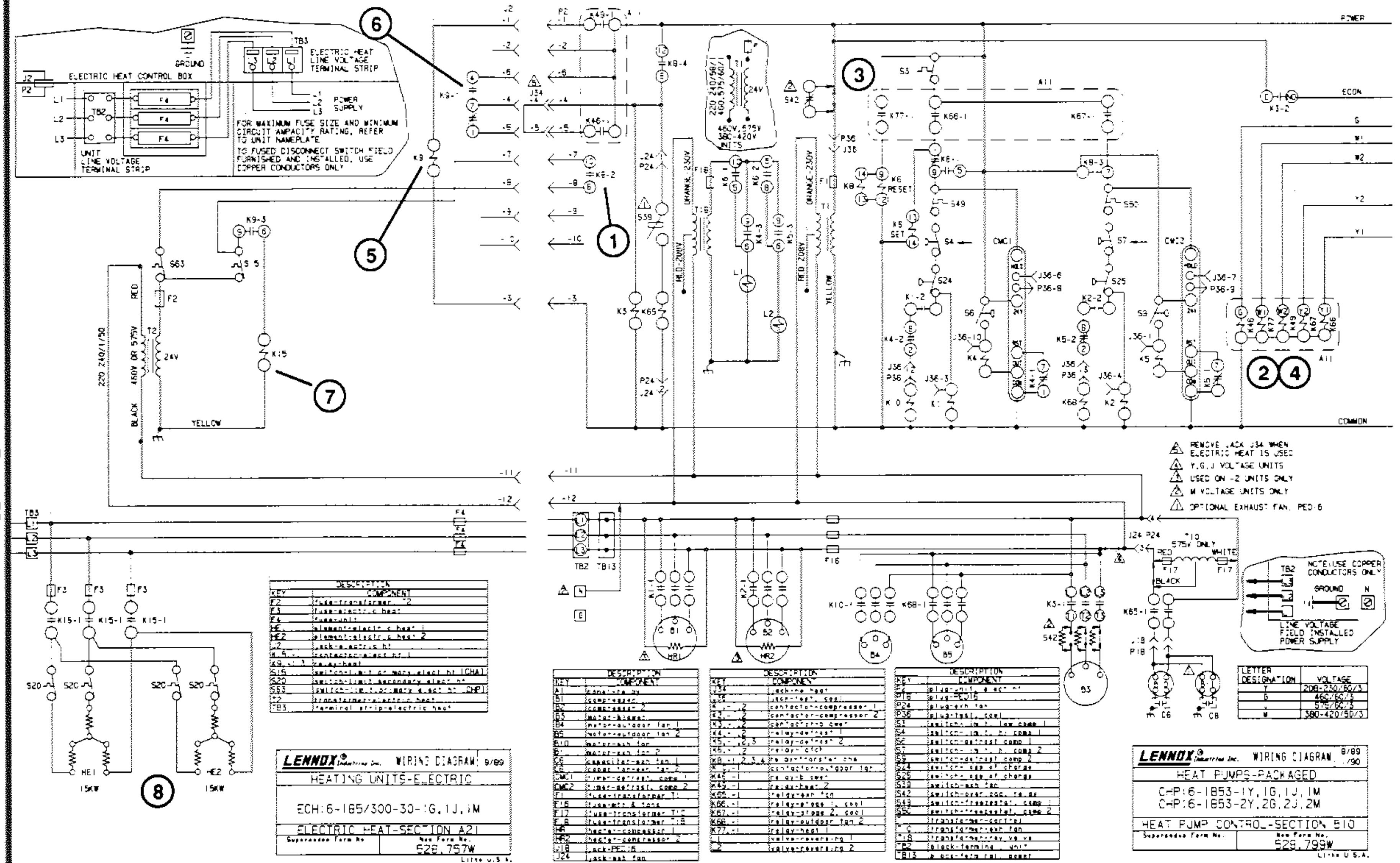
9- When K19-1 closes, time delay DL2 is energized. DL2 begins a 30 second count before closing.

10- When DL2 closes, 2nd stage heat contactor K16 is energized. K16-1 closes.

11- When K16-1 closes, the 2nd stage heating elements are energized.

A21 diagram with B10 diagram

CHP16-1853 with 30kW 460V or 575V electric heat



Operation Sequence: A21 Section and B10 Sections (30kW 460V or 575V electric heat wired to CHP16-1853)

1- S63 is a redundant limit used only in CHP16-1853 applications when transfer relay K8 is energized (call for heat).

2- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

3- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Both compressors provide 1st stage cooling.

4- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

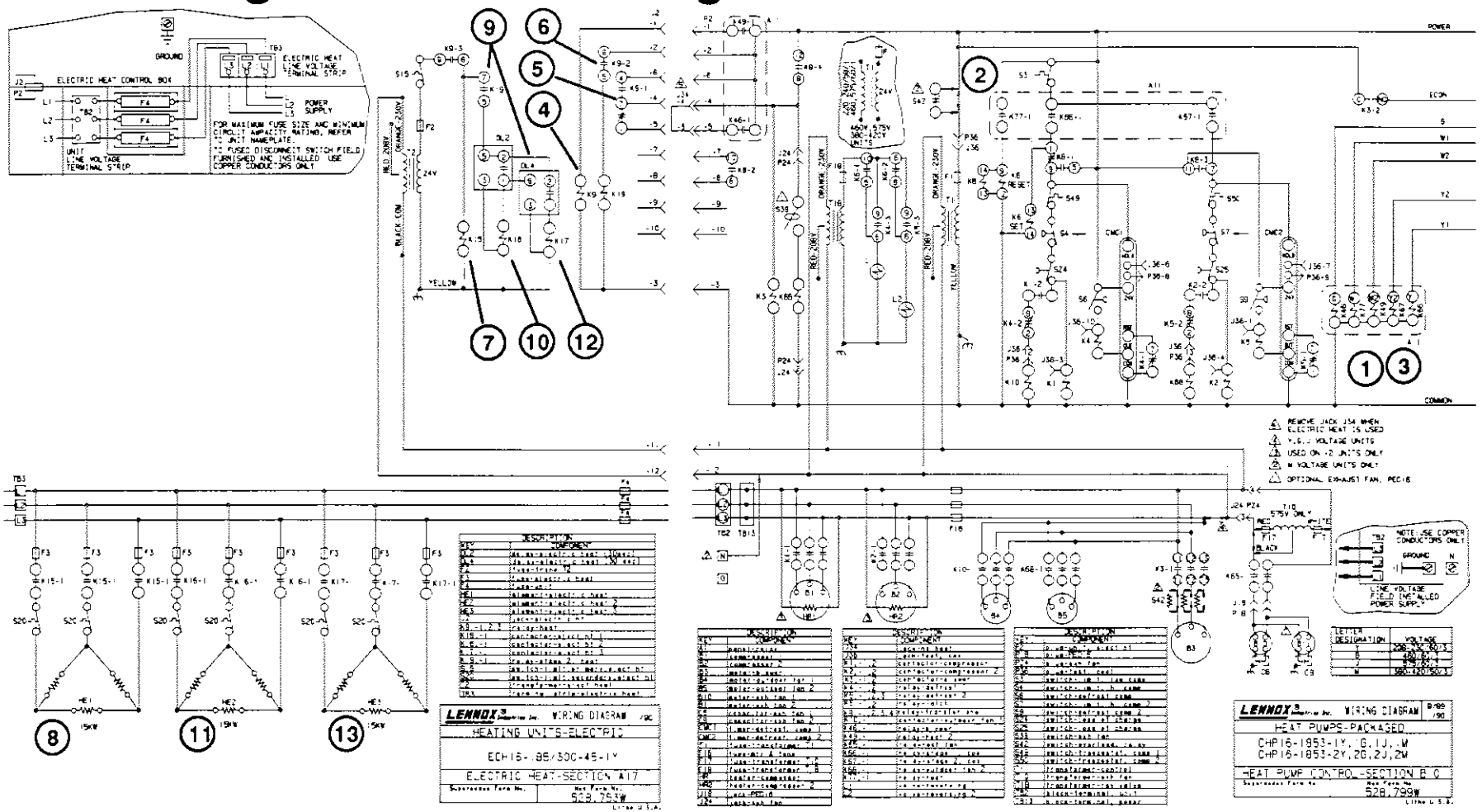
5- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-3 closes.

6- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

7- When K9-3 closes, electric heat contactor K15 is energized. K15-1 closes.

8- When K15-1 closes, the heating elements are energized. The heating elements are arranged in a "wye" configuration for 460V and 575V operation.

A17 diagram with B10 diagram *CHP16-1853 with 45kW 208/230V electric heat*



Operation Sequence: A17 Section and B10 Sections (45kW 208/230V electric heat wired to CHP16-1853)

1- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

2- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Both compressors provide 1st stage heating.

3- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

4- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-2 and K9-3 close.

5- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

6- When K9-2 closes, 2nd stage heat pilot relay K19 is energized. K19-1 closes. .

7- When K9-3 closes, electric heat contactor K15 is energized. K15-1 closes.

8- When K15-1 closes, the 1st stage heating elements are energized. All heating elements are arranged in a "Delta" configuration for 208/230V operation.

9- When K19-1 closes, time delay DL2 is energized. DL2 begins a 30 second count before closing.

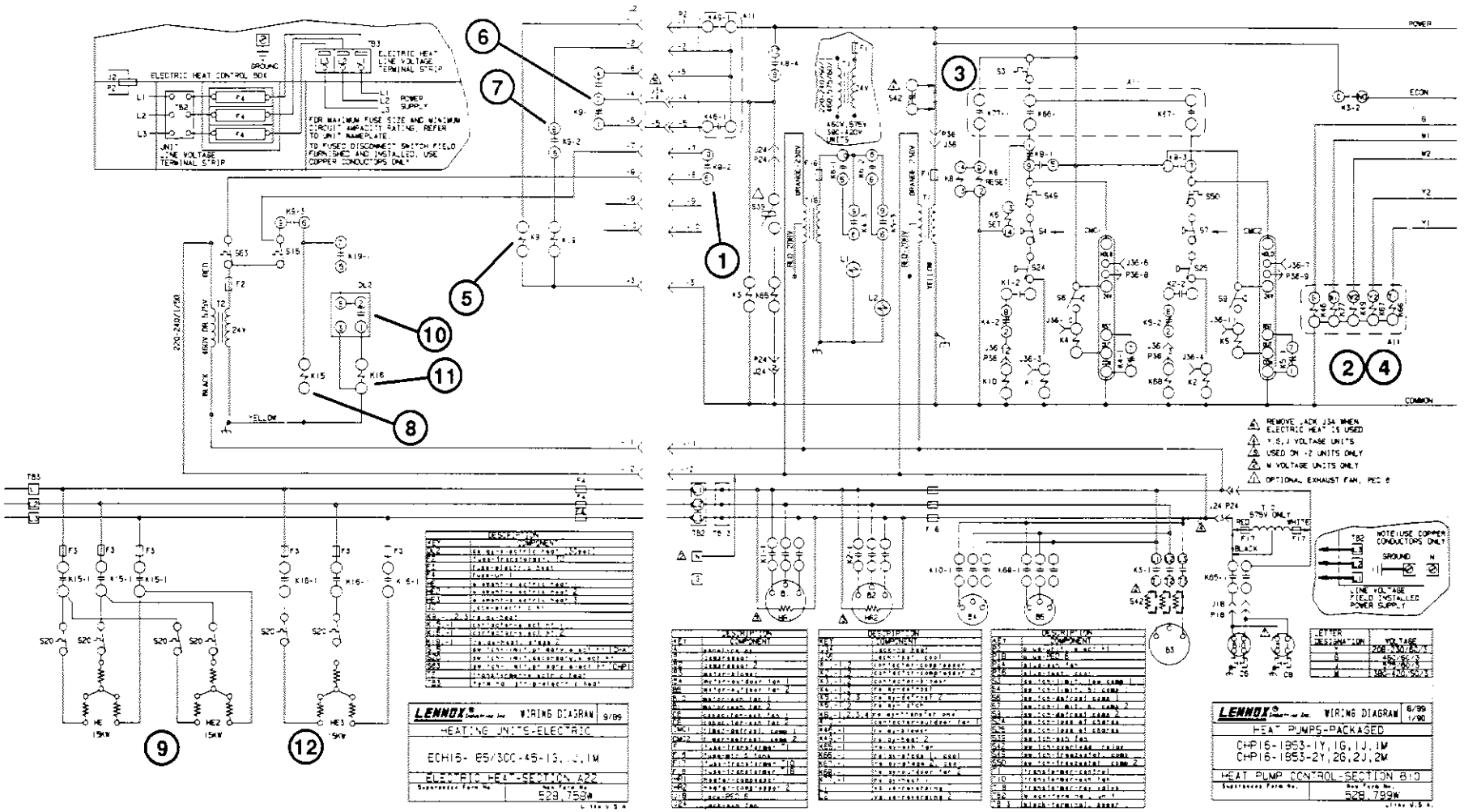
10- When DL2 closes, 2nd stage heat contactor K16 and time delay DL4 are energized. K16-1 closes and DL4 begins 30 second count before closing.

11- When K16-1 closes, the 2nd stage heating elements are energized.

12- When DL4 closes, 3rd stage heat contactor K17 is energized. K17-1 closes.

13- When K17-1 closes, 3rd stage heating elements are energized.

A22 diagram with B10 diagram *CHP16-1853 with 45kW 460V or 575V electric heat*



Operation Sequence: A22 Section and B10 Sections (45kW 460V or 575V electric heat wired to CHP16-1853)

1- Temperature limit S63 is a redundant limit used only in CHP16-1853 applications when transfer relay K8 is energized (call for heat).

2- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

3- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Both compressors provide 1st stage heating.

4- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

5- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-2 and K9-3 close.

6- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

7- When K9-2 closes, 2nd stage heat pilot relay K19 is energized. K19-1 closes.

8- When K9-3 closes, electric heat contactor K15 is energized. K15-1 closes.

9- When K15-1 closes, the 1st stage heating elements are energized. All heating elements are arranged in a "Wye" configuration for 460V or 575V operation.

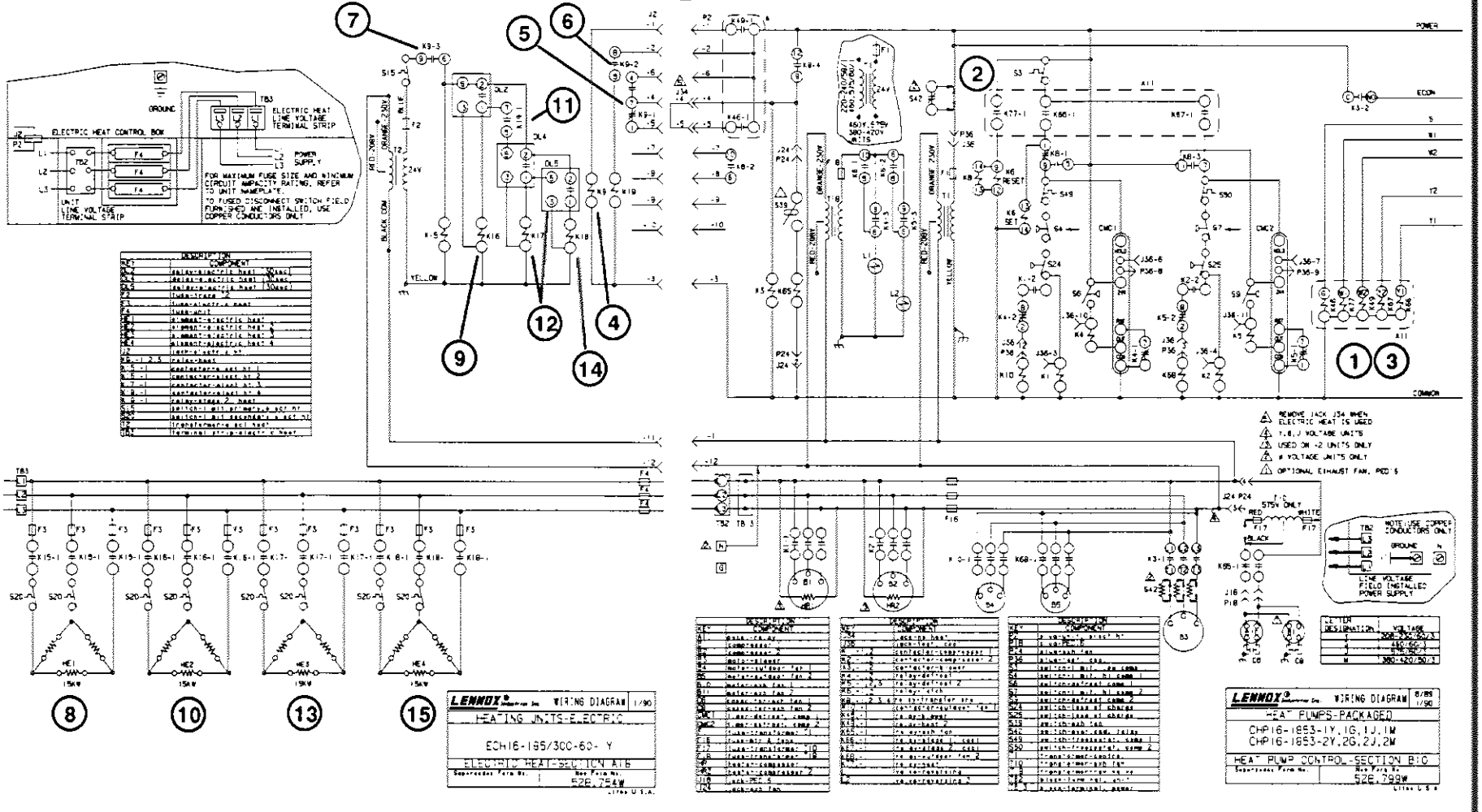
10- When K19-1 closes, time delay DL2 is energized. DL2 begins a 30 second count before closing.

11- When DL2 closes, 2nd stage heat contactor K16 is energized. K16-1 closes.

12- When K16-1 closes, the 2nd stage heating elements are energized.

A18 diagram with B10 diagram

CHP16-1853 with 60kW 208/230V electric heat



Operation Sequence: A18 Section and B10 Sections (60kW 208/230V electric heat wired to CHP16-1853)

1- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

2- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Both compressors provide 1st stage cooling.

3- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

4- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-2 and K9-3 close.

5- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

6- When K9-2 closes, 2nd stage heat pilot relay K19 is energized. K19-1 closes.

7- When K9-3 closes, electric heat contactor K15 and time delay DL2 are energized. K15-1 closes. DL2 begins a 30 second count before closing.

8- When K15-1 closes, the 1st stage heating elements are energized. All heating elements are arranged in a "Delta" configuration for 208/230V operation.

9- When DL2 closes, 2nd stage heat contactor K16 is energized. K16-1 closes.

10- When K16-1 closes, the 2nd stage heating elements are energized.

11- When K19-1 closes, time delay DL4 is energized. DL4 begins 30 second count before closing.

12- When DL4 closes, 3rd stage heat contactor K17 and time delay DL5 are energized. K17-1 closes. DL5 begins 30 second count before closing.

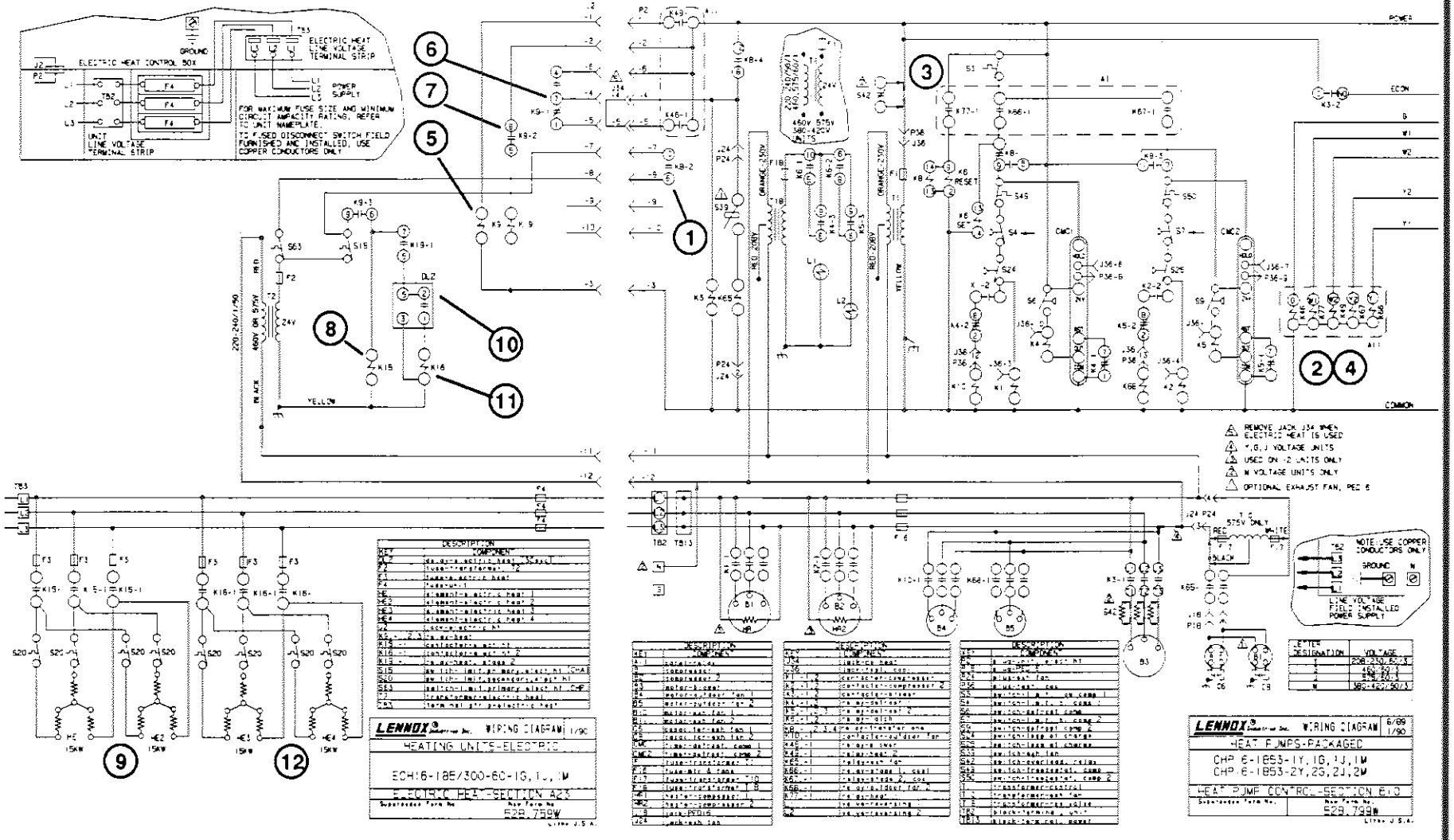
13- When K17-1 closes, 3rd stage heating elements are energized.

14- When DL4 closes, 4th stage heating contactor K18 is energized. K18-1 closes.

15- When K18-1 closes, 4th stage heating elements are energized.

A23 diagram with B10 diagram

CHP16-1853 with 60kW 460V or 575V electric heat



Operation Sequence: A23 Section and B10 Sections (60kW 460V or 575V electric heat wired to CHP16-1853)

1- Temperature limit S63 is a redundant limit used only in CHP16-1853 applications when transfer relay K8 is energized (call for heat).

2- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

3- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Both compressors provide 1st stage heating.

4- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

5- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-2 and K9-3 close.

6- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

7- When K9-2 closes, 2nd stage heat pilot relay K19 is energized. K19-1 closes.

8- When K9-3 closes, electric heat contactor K15 is energized. K15-1 closes.

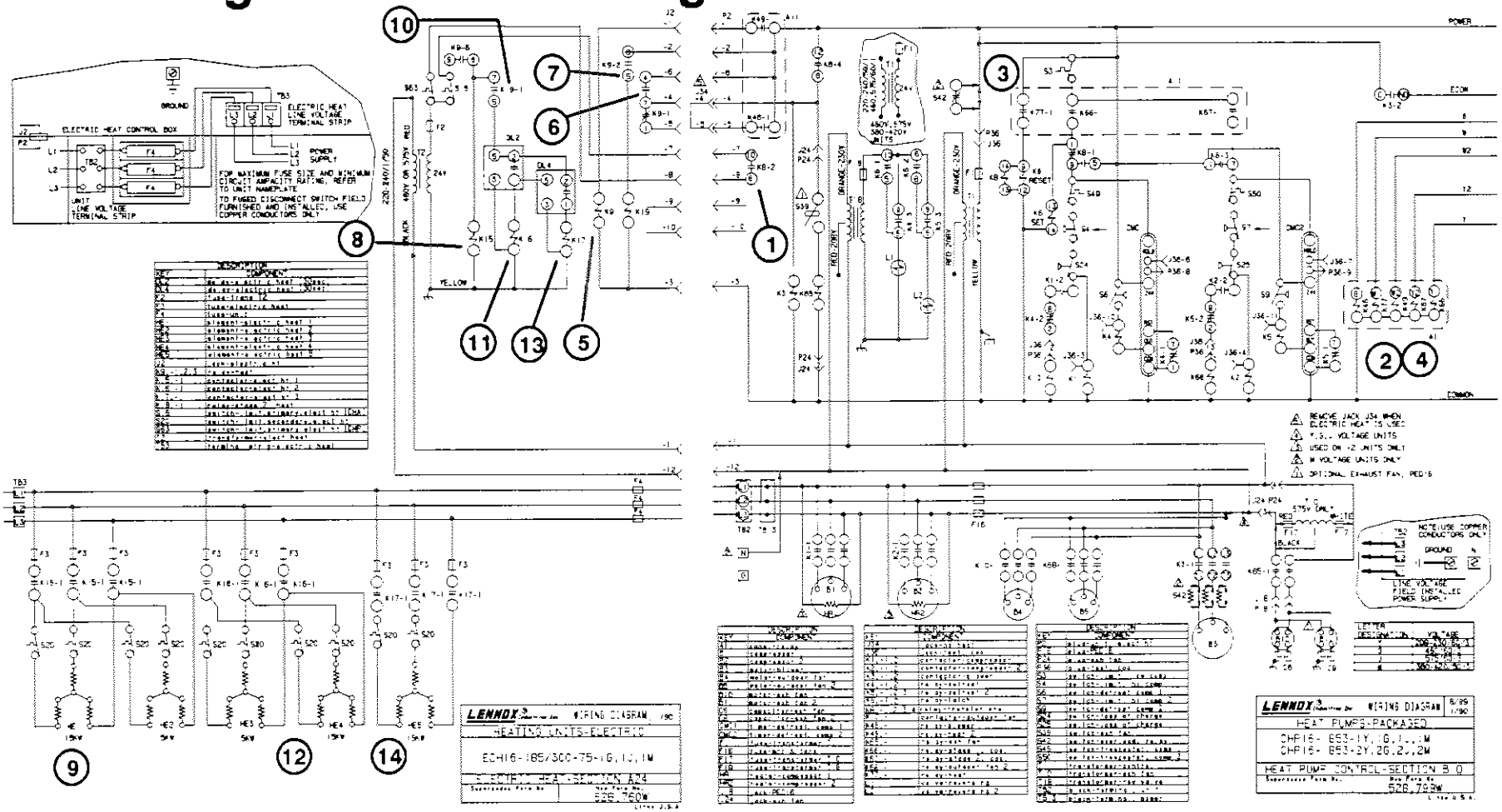
9- When K15-1 closes, the 1st stage heating elements are energized. All heating elements are arranged in a "Wye" configuration for 460V or 575V operation.

10- When K19-1 closes, time delay DL2 is energized. DL2 begins a 30 second count before closing.

11- When DL2 closes, 2nd stage heat contactor K16 is energized. K16-1 closes.

12- When K16-1 closes, the 2nd stage heating elements are energized.

A24diagram with B10 diagram *CHP16-1853 with 75kW 460V or 575V electric heat*



A24 DIAGRAM WITH B10 DIAGRAM

75kW Electric Heat Connected to CHP16-1853

Operation Sequence: A24 Section and B10 Sections (75kW 460V or 575V electric heat wired to CHP16-1853)

1- Temperature limit S63 is a redundant limit used only in CHP16-1853 applications when transfer relay K8 is energized (call for heat).

2- 1st stage heating demand closes W1. W1 energizes pilot relay K77. K77-1 closes.

3- When K77-1 closes, compressors B1 and B2, outdoor fans B4 and B5 and defrost controls CMC1 and CMC2 are energized. Both compressors provide 1st stage heating.

4- Additional heating demand W2 energizes pilot relay K49. K49-1 closes.

5- When K49-1 closes, heating pilot relay K9 is energized. K9-1 switches and K9-2 and K9-3 close.

6- When K9-1 switches, indoor blower contactor K3 is energized (and optional power exhaust fan relay K65 is enabled).

7- When K9-2 closes, 2nd stage heat pilot relay K19 is energized. K19-1 closes.

8- When K9-3 closes, electric heat contactor K15 is energized. K15-1 closes.

9- When K15-1 closes, the 1st stage heating elements are energized. All heating elements are arranged in a "Wye" configuration for 460V or 575V operation.

10- When K19-1 closes, time delay DL2 is energized. DL2 begins a 30 second count before closing.

11- When DL2 closes, 2nd stage heat contactor K16 and time delay DL4 are energized. K16-1 closes and DL4 begins 30 second count before closing.

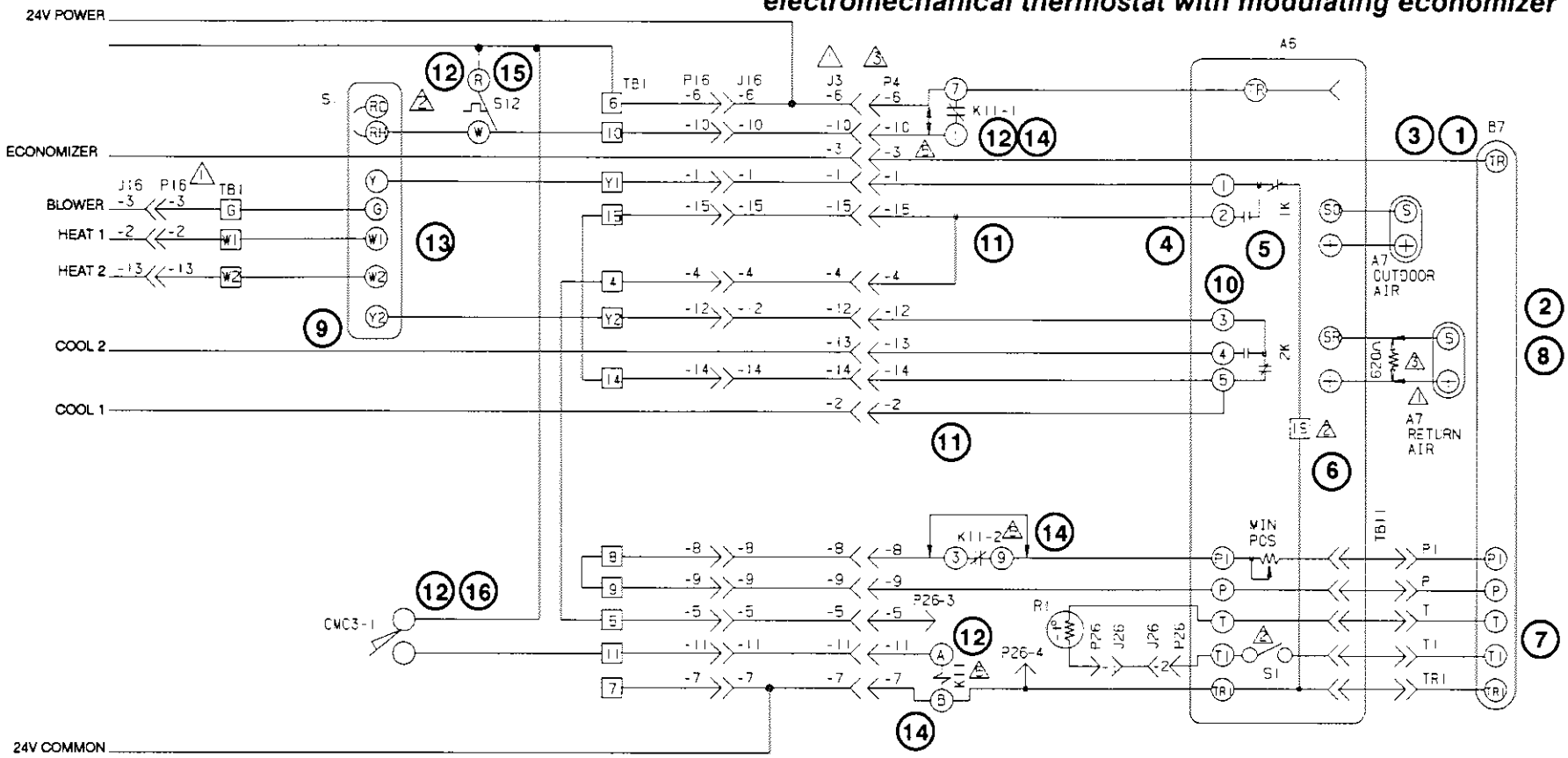
12- When K16-1 closes, the 2nd stage heating elements are energized.

13- When DL4 closes, 3rd stage heat contactor K17 is energized. K17-1 closes.

14- When K17-1 closes, 3rd stage heating elements are energized.

C1 diagram with D5 diagram

electromechanical thermostat with modulating economizer



KEY	DESCRIPTION COMPONENT
J3	jack-unit economizer
J16	jack-unit
P3	plug-less economizer
P16	plug-unit
S1	thermostat-room
TB1	block-terminal

KEY	DESCRIPTION COMPONENT
A6	control-enthalpy W7459A
A7	sensor-enthalpy
B7	motor-damper
J26	jack-enthalpy
J28	jack-W7400
K7,-1	relay-W7400
K11,-1,2	relay-on to setback
P4	plug-economizer
P26	plug-enthalpy
R1	sensor-supply air
TB11	strip-terminal

LOW VOLTAGE FIELD WIRING
FACTORY WIRING

LENNOX Industries Inc.	WIRING DIAGRAM	6/89
ACCESS-COMBINATION UNITS-ROOFTOP		
ELECTROMECHANICAL THERMOSTAT FOR 11 & 16 SERIES UNITS (2 HEAT, 2 COOL)		
THERMOSTAT-SECTION C1		
Supersedes Form No.	New Form No.	

Litho U.S.A.

LENNOX Industries Inc.	WIRING DIAGRAM	4/89
ACCESS-COMBINATION UNITS-ROOFTOP		
REMD16M REMD11M	EMDH16M EMDH17-95/135	
(MODULATING ECONOMIZER)		
ECONOMIZER-SECTION D5		
Supersedes Form No.	New Form No.	

Litho U.S.A.

Economizer Footnotes

△ OPTIONAL-SECOND A7 INSTALLED IN RETURN AIR PROVIDES DIFFERENTIAL ENTHALPY CONTROL

△ WHEN IS RECEIVES POWER, IS1 CLOSES.

△ FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR. REMOVE WHEN SECOND A7 SENSOR IS INSTALLED TO PROVIDE DIFFERENTIAL ENTHALPY CONTROL

△ WHEN W7400 CONTROL IS USED, REMOVE J26 JUMPER AND INSTALL J28. J28 AND K7 RELAY ARE PART OF W7400 KIT (74G11)

△ K11 MITE RELAY MAY NOT BE PART OF ECONOMIZERS ON UNITS BELOW 7.5T CAPACITY

Thermostat Footnotes

△ REMOVE P3 WHEN ECONOMIZER IS USED

△ THERMOSTAT SUPPLIED BY USER

△ J3 MAXIMUM LOAD 20VA 24VAC CLASS II

C1 DIAGRAM WITH D5 DIAGRAM

Electromechanical Thermostat Connected to CHP16-1853 with Economizer

B-REMD16M

When a REMD16M economizer section is applied to the CHP16-1853 with electromechanical thermostat, three stages of cooling are available dependent on the actions of the economizer enthalpy control. By sensing outdoor temperature and relative humidity, the enthalpy control determines if outside air can be used as a first stage of cooling. If so, 1st stage cooling is handled by outdoor air dampers and 2nd stage cooling is handled by the compressor. The enthalpy control continuously adjusts the outdoor air dampers to maintain a balanced mixed air temperature. When outdoor air conditions become unsatisfactory for cooling, the outdoor air dampers and the compressors handle all cooling demand.

NOTE-In order to understand how optional controls affect the operation of the CHP16, you must first read and understand how all the CHP16 components work.

Factory jumper-plug P3 is removed from harness jack J3 and discarded. Economizer plug P4 replaces plug P3. These connections are made in the unit blower compartment.

Operation Sequence: C1 Diagram with D5 Diagram (economizer connected to CHP16-1853 with electromechanical thermostat)

NOTE-In this operation sequence the unit diagram has been omitted in order to concentrate on the interaction between thermostat and economizer.

1- Economizer outdoor air dampers drive full closed anytime blower B3 is not operating (switched by K3-2 in the unit).

2- Damper motor terminal TR is powered by unit contactor K3 when there is a blower demand or by K25 when there is a heating demand. When 24VAC is applied to between terminals TR and TR1, the damper motor is energized and the outdoor air dampers open to minimum position.

3- Blower B3 is energized (indirectly) by thermostat terminal G. On a cooling demand, thermostat terminal G energizes contactor K3 which in turn energizes the blower (refer to operation sequence on previous page for exact sequence). When K3 energizes, K3-1 closes to energize the blower and K3-2 closes to energize the economizer (see step 2) and open the outdoor air dampers to minimum position.

Enthalpy Low, 1st Stage Cool:

4- Initial cooling demand Y1 is sent to enthalpy control A6 and terminal 1.

5- Enthalpy control A6 has determined that outside air can be used for cooling and has switched internal relays 1K and 2K.

6- Cooling demand is routed through enthalpy control to energize internal relay 1S. Internal contacts 1S1 close to complete a circuit through damper motor terminals T and T1.

7- When a voltage is applied across terminals T and T1 of damper motor, the damper motor energizes and outdoor air dampers open. Supply air sensor R1 varies the voltage across T and T1 and the outdoor air dampers open. Supply air sensor R1 varies the voltage across T and T1 and the outdoor air dampers adjust accordingly. 1st stage cooling is provided by outdoor air.

Enthalpy Low, 2nd Stage Cool:

8- Economizer outdoor air dampers remain open.

9- Additional cooling demand is routed from thermostat Y2 through enthalpy control terminals 3 and 5 to energize the 1st stage compressors. The 1st stage compressors provide all additional cooling.

Enthalpy High, 1st Stage Cool:

10- Enthalpy control internal relays 1K and 2K switch. Internal relay 1S is de-energized and 1S1 opens. Outdoor air dampers close to minimum position.

11- Cooling demand is sent from thermostat terminal Y1 through enthalpy control terminals 1 and 2 and through enthalpy control terminal 5 to energize the 1st stage compressors.

Enthalpy High, 2nd Stage Cool:

12- Additional cooling demand is sent from thermostat terminal Y2 through enthalpy control terminals 3 and 4 to energize the 2nd stage compressor.

Night Setback (optional field installed)

13- Optional field installed time clock and night thermostat S12 must be connected for night setback operation.

14- Blower B3 operates only during a heating demand when night thermostat is closed.

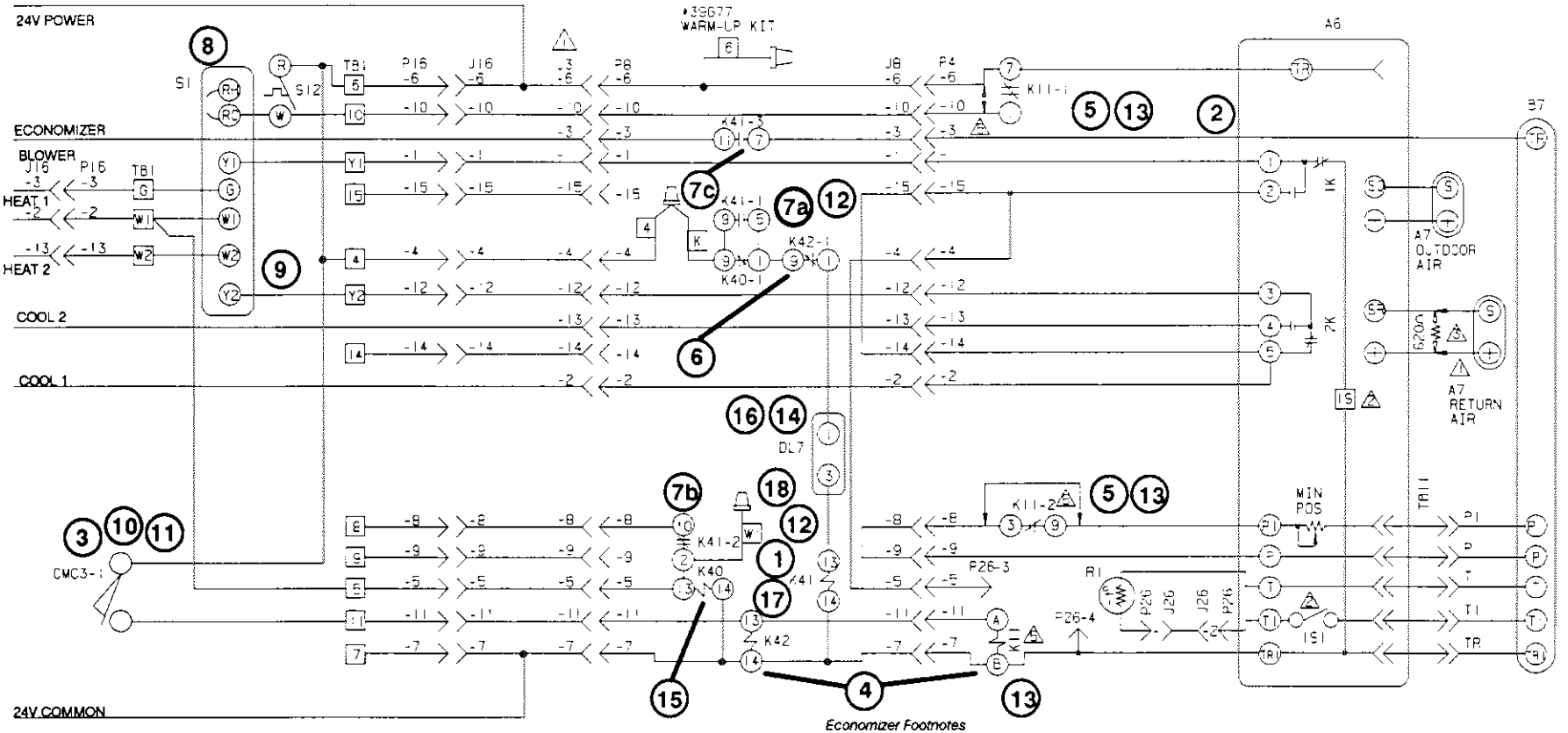
15- When clock contacts close, relay K11 energizes. Contacts K11-1 open to disable the day thermostat and contacts K11-2 open to drive the dampers full closed.

16- Night thermostat S12 is typically set with setpoints below thermostat S1. During unoccupied periods, K11-1 opens while S1 is disabled. When S12 closes, power is applied to S1 and the unit operates normally. When the setpoint is reached, S12 opens, S1 is disabled and unit operation stops.

17- Shortly before the building is to be occupied, clock contacts open to de-energize relay K11. Contacts K11-1 close to restore power to thermostat S1 and contacts K11-2 close to restore power to the minimum positioner. Outdoor air dampers open to minimum position during blower operation.

C2-1 diagram with D5 diagram

electromechanical thermostat with modulating economizer and warm-up



Economizer Footnotes

△ OPTIONAL-SECOND A7 INSTALLED IN RETURN AIR PROVIDES DIFFERENTIAL ENTHALPY CONTROL

△ WHEN IS RECEIVES POWER, IS1 CLOSES.

△ FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR. REMOVE WHEN SECOND A7 SENSOR IS INSTALLED TO PROVIDE DIFFERENTIAL ENTHALPY CONTROL.

△ WHEN W7400 CONTROL IS USED, REMOVE J26 JUMPER AND INSTALL J28. J28 AND K7 RELAY ARE PART OF W7400 KIT (7461)

△ K1 MINI RELAY MAY NOT BE PART OF ECONOMIZERS ON UNITS BELOW 7.5T CAPACITY

Thermostat Footnotes

△ J3 MAXIMUM LOAD 20VA 24VAC CLASS II

DESCRIPTION	
KEY	COMPONENT
CMC3-1	time-clock
DL7	re ay-reapeat
J3	jack-economizer
J8	jack-warm up kit
J16	jack-unit
K40, -1	relay-warm up kit-thermistor
K41, -1,2,3,4	relay-warm up kit-heater
K42, -1	relay-warm up kit-setback
P8	p ug-warm up kit
P16	plug-unit
S1	thermostat-room
S12	thermostat-mite
TB1	b ock-terminal (24v volt)

DESCRIPTION	
KEY	COMPONENT
A6	control-enthalpy W7459A
A7	sensor-enthalpy
B7	motor-damper
J26	jack-enthalpy
J28	jack-W7400
K7, -	re ay,-W7400
K11, -1, 2	re ayr le setback
P4	plug-economizer
P26	p ug-enthalpy
R	sensor-supp y air
TB11	str p-terminal

LENNOX Industries Inc. WIRING DIAGRAM 8/87

ACCESS-COMBINATION UNITS-ROOFTOP

THERMOSTAT SECTION FOR GCS,CHA,CHP11 & 16 SERIES UNITS WITH WARM UP KIT

THERMOSTAT SECTION-C2-

Supersedes Form No. | New Form No.

Litho U.S.A.

LENNOX Industries Inc. WIRING DIAGRAM 4/89

ACCESS-COMBINATION UNITS-ROOFTOP

REMD16M EMDH 8V

REMC 1M EMD17-95/135

MODULATING ECONOMIZER

ECONOMIZER-SECTION D5

Supersedes Form No. | New Form No.

Litho U.S.A.

C2-1 DIAGRAM WITH D5 DIAGRAM

Electromechanical Thermostat Connected to CHP16-1853 with Economizer and Warm-Up

C-WARM-UP KIT

An optional feature of the REMD16M economizer is a warm-up kit which holds the economizer outdoor air dampers closed during night heat operation and while the CHP16 is warming the building the morning after. The warm-up kit temporarily disables the economizer (outdoor air dampers are held closed) during morning warm-up to keep cool outside air from being mixed with return air. Once the temperature setpoint is reached, the economizer is allowed to operate normally (outdoor air dampers open to minimum position to allow required minimum air exchange).

NOTE-In order to understand how optional controls affect the operation of the CHP16, you must first read and understand how all the CHP16 components work.

NOTE-

1-The warm-up kit requires the use of optional time clock CMC3-1.

2-Optional night thermostat S12 must be installed.

3-The warm-up kit can only be installed in CHP16 units with REMD16M economizer.

WARNING-CONNECT ONLY RELAY KITS DESIGNED FOR THIS CONTROL SYSTEM. RELAY KITS DESIGNED FOR OTHER CONTROL SYSTEMS ARE NOT COMPATIBLE AND CONTROL DAMAGE OR FAILURE WILL RESULT. FOR EXAMPLE, A W973 RELAY KIT MUST NOT BE CONNECTED TO A ELECTROMECHANICAL THERMOSTAT CONTROL SYSTEM.

WARNING-BE CAREFUL TO CONNECT RELAY KITS TO THE PROPER JACK AND PLUG IN THE CHP16 BLOWER COMPARTMENT. REFER TO WIRING DIAGRAM. IMPROPER CONNECTION WILL CAUSE CONTROL FAILURE.

The warm-up kit installs in the control mounting area of the CHP16 filter access compartment. No wiring is required. Jumper plug P3 is removed and discarded. Warm-up kit harness plug P8 connects directly into jack J3 in the blower compartment. Warm-up kit harness jack J8 connects to economizer harness plug P4.

Operation Sequence:

NOTE-This operation sequence emphasizes warm-up kit operation. Unit diagram has been omitted.

1- When relay K41 is energized during normal operation, the economizer functions normally and is locked-in until night setback. When relay K41 is de-energized, economizer is disabled.

2- Economizer outdoor air dampers drive full closed anytime blower B3 is not operating.

Night Setback:

3- Time clock CMC3-1 should be adjusted so that clock contacts remain closed during hours when the building is not occupied. The contacts are set to open shortly (usually 1 hour) before the building is to be occupied.

4- When clock contacts close, relay K11 in the economizer and K42 in the warm-up kit are energized.

5- Contacts K11-1 open to disconnect power to thermostat S1. K11-2 open to drive the dampers full closed.

6- Contacts K42-1 open to disengage relay K41.

7- When relay K41 disengages, power is disconnected to the economizer:
a-Contacts K41-1 open to lock-out economizer operation.
b-Contacts K41-2 close (not used).
c-Contacts K41-3 open to disconnect power to the economizer.
d-Contacts K41-4 open (not used).

8- During unoccupied periods, K11-1 opens and S1 is disabled. When S12 closes, power is returned to S1 and the unit operates (heating demand) normally. When S12s setpoint is reached, S12 opens, S1 is disabled and unit operation stops.

9- Blower operates only on demand energized by CHP16 heat relay K25 when S12 is closed.

10- Thermostat S1 and economizer remain inoperable until time clock CMC3-1 contacts open.

First Heat Demand After Night Setback (Begin Warm-Up)

11- Shortly before the building is to be occupied, time clock CMC3-1 contacts open.

12- Relay K42 disengages and contacts K42-1 close.

13- Relay K11 disengages. Contacts K11-1 close to allow power to thermostat S1. Contacts K11-2 close to allow outdoor air dampers to open. Note that dampers remain closed until relays K3 and K41 are energized.

14- Since contacts K40-1 are normally closed and contacts K42-1 have just switched closed, timer DL7 is energized. Timer DL7 is normally open and closes 30 sec. after being energized.

15- If heat demand W1 reaches relay K40 before delay DL7 closes, contacts K40-1 open, delay DL7 loses power and resets and the economizer is locked out for the first heat demand by relay K41 (contacts K41-3 remain open). If heat demand W1 reaches relay K40 after delay DL7 closes, relay K41 energizes and the economizer locks in for the day until night setback.

16- When first heat demand is satisfied, relay K40 disengages and relay K40 contacts K40-1 close. Relay contacts K42-1 are already closed (clock contacts open). Time delay DL7 begins 30 sec. count. If a second heat demand W1 does not reach relay K42 within 30 sec., time delay DL7 contacts close and relay K41 energizes.

17- When relay K41 energizes, the economizer is allowed to operate normally, controlled by relay K3:
a-Contacts K41-1 closes to lock in economizer operation until night setback.
b-Contacts K41-2 open (not used).
c-Contacts K41-3 close to allow power to the economizer.
d-Contacts K41-4 close (not used).

18- Once energized, relay K41 locks in and the economizer operates until relay K42 is energized by night setback (contacts K42-1 open to disengage relay K41).