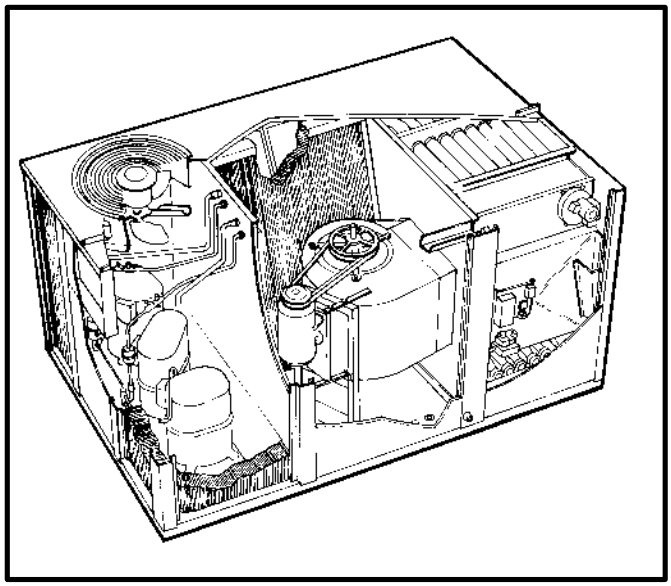
GCS16 SERIES 15 TON UNITS

GCS16 series units in the 15 ton cooling size were introduced in the fall of 1989. The units are packaged combination two-stage gas heat / two-stage dx cool units designed for commercial applications. Gas heat sections are designed with Lennox' aluminized steel tube heat exchanger in 235,000 and 330,000 Btuh input sizes. Units are designed for rooftop or side of building installation with either bottom or horizontal discharge and return air.

For commercial applications, the GCS16 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. Commercial 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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GCS16-1853
SPECIFICATIONS

Model No.			GCS16-1853-235	GCS16-1853-330
Two Stage Heating Capacity (Natural Gas Only)	Input (Btuh) - Low		145,000	205,000
	Output (Btuh) - Low		116,000	159,900
	Input (Btuh) - High		235,000	330,000
	Output (Btuh) - High		188,000	257,400
	A.G.A. Thermal Efficinecy		80%	78%
Two Stage Heating Capacity (**LPG Gas Only)	Input (Btuh) - Low		164,000	237,000
	Output (Btuh) - Low		131,200	189,600
	Input (Btuh) - High		235,000	330,000
	Output (Btuh) - High		188,000	264,000
	A.G.A. Thermal Efficinecy		80%	80%
*ARI Standard 360 Rating	Total Cooling Capacity (Btuh)		178,000	
	Total unit watts		20,300	
	EER (Btuh/Watts)		8.8	
Refrigerant (R-22) charge - Stages 1, 2 and 3			7 lbs. 9 oz.	
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	
Evaporator Coil	Net face area (sq. ft.)		16.0	
	Tube diameter (in.) & Number of rows		3/8 - 3	
	Fins per inch		13	
Condenser Coil	Net face area (sq. ft.)		30.5	
	Tube diameter (in.) & Number of rows		3/8 - 2	
	Fins per inch		20	
Condenser Fan	Diameter (in.) & Number of blades		(2) 26 - 4	
	Air volume (cfm)		12,000 Total	
	Motor horsepower		(2) 1	
	Motor watts		2200 Total	
Gas Supply Connections fpt (in.)		Natural	3/4	
		**LPG	3/4	
Recommended Gas Supply Pressure (wc. in.)		Natural	7	
		**LPG	11	
**Optional LPG Conversion Kit			LB-81509DA	
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 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 (Down-Flow Only)	Model No.		PED16-185	
	Diameter (in.) and No. of blades		16 — 5	
	Total air volumn (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.

**For LPG units a field changeover kit is required and must be ordered extra.

†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.

††Two stage cooling thermostat required with economizer applications.

ELECTRICAL DATA

Model No.			GCS16-1853			
Line Voltage Data - 60Hz.- 1ph			208/230V		460V	
CompressorS 3	Rated load amps	each	19.2		9.6	
		total	57.6		28.8	
	Locked Rotor Amps	each	124		62	
		total	372.0		186.0	
Condenser Fan Motors (2)	Full load amps (total)		9.6		4.8	
	Locked rotor amps (total)		24.0		12.0	
Evaporator 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	110	50	50
	With Power Exhaust		100	110	50	50
Unit Power Factor	Less Power Exhaust		.84	.84	.84	.84
	With Power Exhaust		.84	.84	.84	.84
*Minimum Circiut Ampacity	Less Power Exhaust		82.0	92.0	43.0	48.0
	With Power Exhaust		85.0	95.0	45.0	50.0

†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	
GCS16-1853	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
GCS16-1853-330 (HIGH HEAT) BLOWER PERFORMANCE

AIR VOLUME (CFM)	STATIC PRESSURE EXTERNAL TO UNIT — (INCHES WATER GAUGE)																									
	0.20		0.30		0.40		0.50		0.60		0.70		0.80		0.90		1.00		1.10		1.20		1.30		1.40		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	RPM	BHP	RPM	BHP
5200	580	1.75	600	1.80	620	1.95	650	2.10	680	2.40	705	2.55	725	2.70	750	2.85	775	3.00	795	3.30	815	3.40	840	3.45	860	3.55	880	3.65
5400	590	1.90	620	2.00	640	2.15	665	2.35	695	2.55	715	2.75	740	2.85	765	2.95	785	3.10	810	3.35	830	3.45	850	3.55	870	3.60	890	3.80
5600	605	2.00	625	2.15	655	2.35	680	2.45	710	2.75	730	2.90	755	2.95	775	3.15	795	3.25	815	3.45	840	3.60	860	3.70	880	3.80	900	4.00
5800	615	2.20	645	2.30	670	2.50	700	2.70	720	2.90	740	3.10	765	3.15	785	3.30	810	3.50	830	3.60	850	3.75	870	3.80	890	3.85	910	4.10
6000	630	2.35	660	2.45	690	2.70	710	2.85	730	3.10	755	3.25	775	3.40	795	3.50	820	3.65	840	3.80	860	3.95	880	4.10	900	4.25	920	4.30
6200	650	2.55	680	2.75	705	2.95	725	3.15	750	3.35	770	3.50	790	3.55	810	3.75	830	3.90	850	4.00	870	4.30	890	4.35	910	4.65	930	4.80
6400	670	2.75	695	3.00	720	3.25	740	3.40	760	3.50	780	3.65	800	3.75	820	4.00	845	4.10	865	4.20	880	4.40	900	4.50	920	4.80	940	4.95
6600	690	3.15	710	3.25	730	3.55	755	3.65	775	3.75	795	3.85	810	4.05	835	4.15	855	4.30	875	4.45	890	4.65	910	4.75	930	4.95	950	5.15
6800	705	3.20	730	3.40	750	3.75	770	3.85	790	4.00	805	4.10	825	4.30	845	4.45	865	4.55	885	4.70	900	4.80	925	5.05	945	5.30	965	5.45
7000	720	3.60	740	3.80	760	3.95	780	4.00	800	4.30	820	4.45	840	4.55	860	4.75	880	4.95	895	5.05	915	5.15	935	5.35	955	5.65	—	—
7200	740	3.85	760	3.95	775	4.10	795	4.20	810	4.50	830	4.65	850	4.80	870	4.95	890	5.05	905	5.35	925	5.55	945	5.70	—	—	—	—
7400	755	3.95	770	4.15	790	4.25	810	4.45	825	4.65	845	4.75	865	4.90	885	5.15	900	5.35	930	5.65	—	—	—	—	—	—	—	—
7500	765	4.20	780	4.30	800	4.40	815	4.65	830	4.80	850	4.90	870	5.15	890	5.40	905	5.60	—	—	—	—	—	—	—	—	—	—

NOTE-Blower performance is measured with a dry coil and with air filters in place. Measurement is taken external to unit.

NOTE-Shaded area indicates 5 horse power motor.

TABLE 2
GCS16-1853-235 (LOW HEAT) BLOWER PERFORMANCE

AIR VOLUME (CFM)	STATIC PRESSURE EXTERNAL TO UNIT — (INCHES WATER GAUGE)																									
	0.20		0.30		0.40		0.50		0.60		0.70		0.80		0.90		1.00		1.10		1.20		1.30		1.40		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	RPM	BHP	RPM	BHP
5000	520	1.50	550	1.60	580	1.75	610	1.80	640	2.00	670	2.30	690	2.45	715	2.65	745	2.75	770	2.95	795	3.05	820	3.15	845	3.30	865	3.45
5200	540	1.60	565	1.75	590	1.90	620	2.00	650	2.30	680	2.45	705	2.60	725	2.75	755	2.90	780	3.20	805	3.30	830	3.35	855	3.45	875	3.55
5400	550	1.70	575	1.85	605	2.00	635	2.25	665	2.45	690	2.65	710	2.75	735	2.85	760	3.05	790	3.30	815	3.40	840	3.50	865	3.55	885	3.75
5600	565	1.80	585	2.05	615	2.25	645	2.30	675	2.60	700	2.85	720	2.90	745	3.10	770	3.20	800	3.40	825	3.55	850	3.65	870	3.75	890	3.95
5800	580	2.10	600	2.20	625	2.40	660	2.60	685	2.80	710	3.00	730	3.10	760	3.25	780	3.40	810	3.55	835	3.70	855	3.75	880	3.80	900	4.05
6000	600	2.30	620	2.40	650	2.65	670	2.80	695	3.05	720	3.20	745	3.35	770	3.45	795	3.60	820	3.75	845	3.90	870	4.05	890	4.20	910	4.25
6200	610	2.45	635	2.65	660	2.85	685	3.05	705	3.25	730	3.40	755	3.50	780	3.65	805	3.85	830	3.95	850	4.25	875	4.30	895	4.55	915	4.75
6400	625	2.70	650	2.90	675	3.15	695	3.30	715	3.45	740	3.60	765	3.70	790	3.95	815	4.00	840	4.15	865	4.35	885	4.45	905	4.70	930	4.90
6600	640	2.95	665	3.15	690	3.45	705	3.55	730	3.65	755	3.75	775	3.95	805	4.10	825	4.25	850	4.40	875	4.60	895	4.70	915	4.90	935	5.10
6800	655	3.10	675	3.35	700	3.65	720	3.75	745	3.90	765	4.00	790	4.20	815	4.35	835	4.45	860	4.65	885	4.80	905	4.95	925	5.20	945	5.35
7000	670	3.50	690	3.70	710	3.85	730	4.00	755	4.10	780	4.35	800	4.45	825	4.65	845	4.75	870	4.95	895	5.10	910	5.25	935	5.50	—	—
7200	685	3.60	710	3.75	735	3.90	755	4.15	770	4.45	790	4.60	815	4.75	835	4.90	860	5.10	880	5.25	905	5.45	925	5.65	—	—	—	—
7400	700	3.80	725	4.00	750	4.15	760	4.35	780	4.55	805	4.65	825	4.85	850	5.00	875	5.25	890	5.50	920	5.75	—	—	—	—	—	—
7500	710	4.00	730	4.15	760	4.30	770	4.45	790	4.65	815	4.80	835	5.00	860	5.25	880	5.50	—	—	—	—	—	—	—	—	—	—

NOTE-Blower performance is measured with a dry coil and with air filters in place. Measurement is taken external to unit.

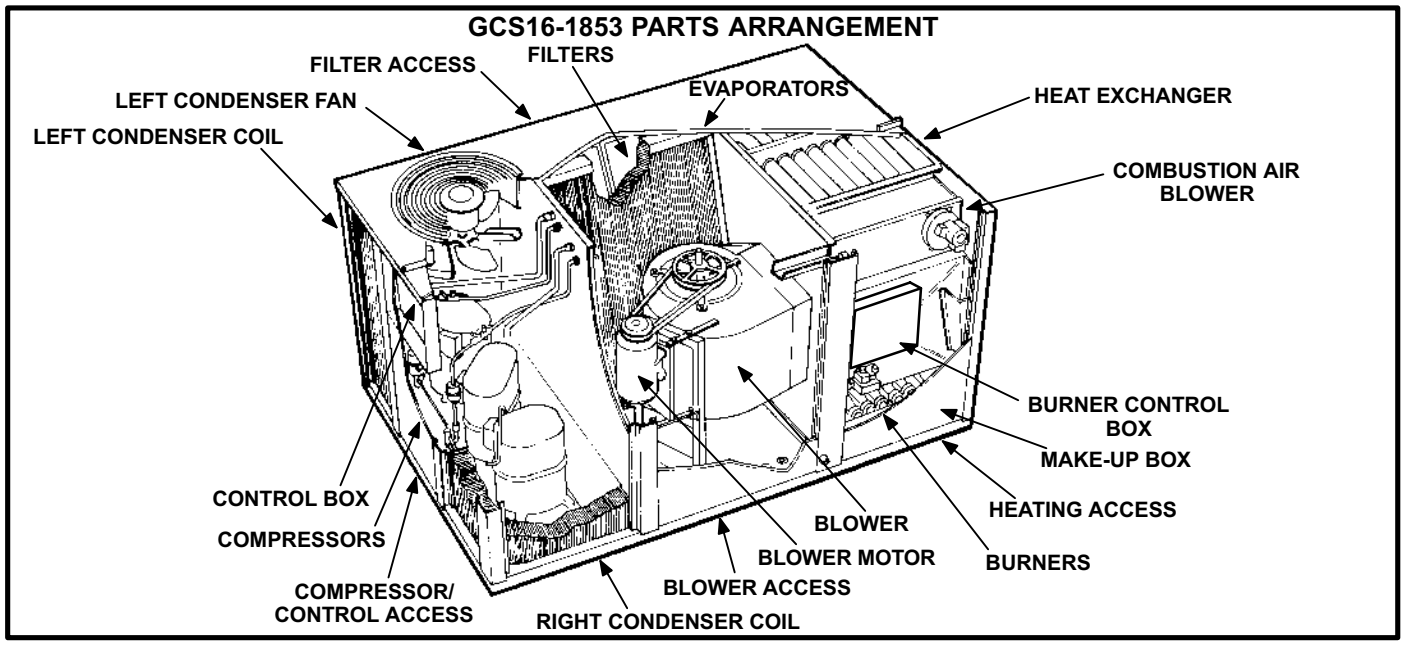


FIGURE 1

I-APPLICATION

GCS16 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 GCS16 commercial units. For example, a Honeywell W973 control will plug in to a GCS16-1853 as easily as it will plug in to a GCS16-411 (and no field wiring is required for either).

II-UNIT COMPONENTS

An overview of GCS16-1853 unit components is shown in figure1.

A-Lifting Lugs

Each unit is equipped with factory installed lifting lugs as shown in figure 2. The 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 lugs to lift unit.

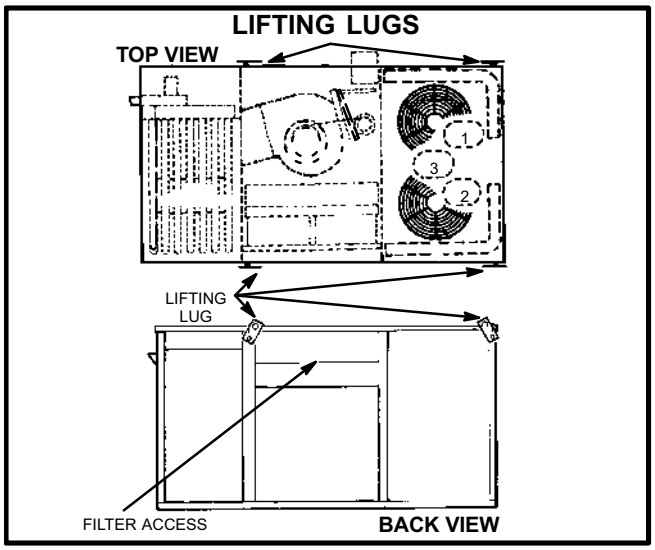


FIGURE 2

B-Control Box Components

GCS16 control box is shown in figure 3. 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 GCS16 units use a power distribution terminal block to provide a line voltage electrical 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-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). The fuses are rated at 35A in 208/230V units and 30A in all others.

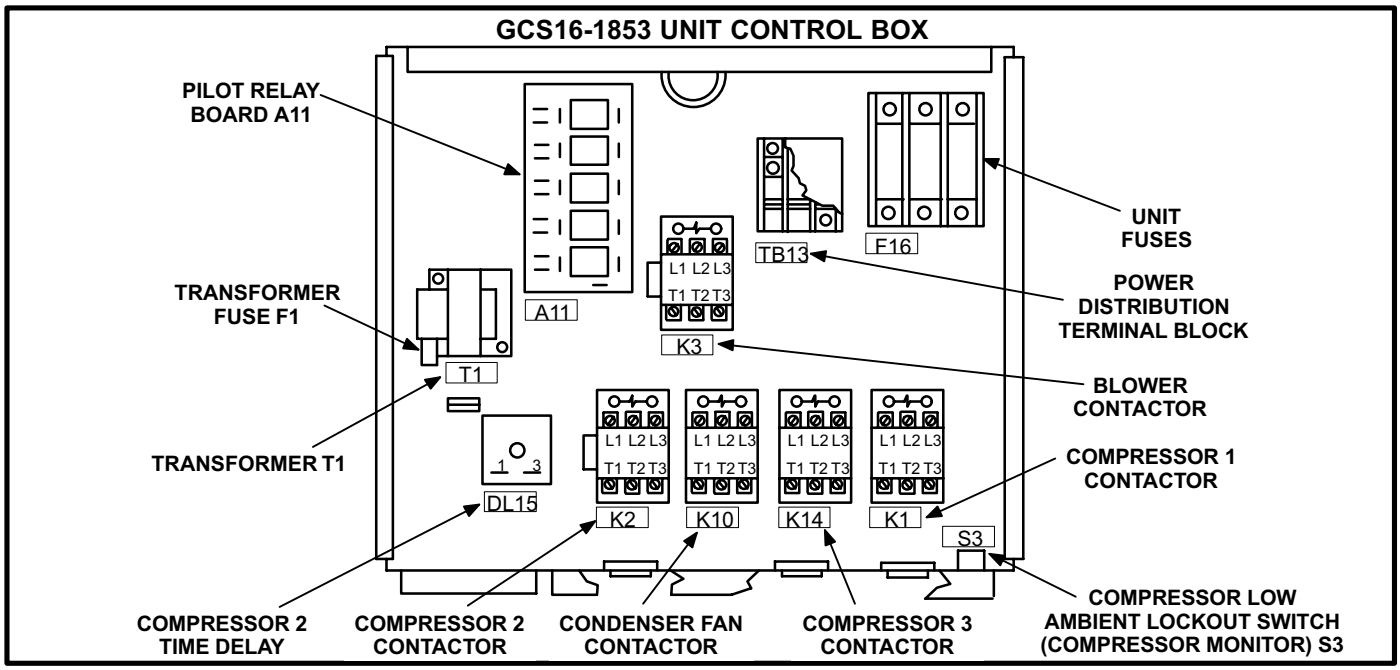


FIGURE 3

3-Transformer T1

All GCS16 series units use a single line voltage to 24VAC transformer mounted in the control box. The transformer supplies power to control circuits in the unit (except the heating section). Transformer is rated at 70VA. 208/230 (P) voltage transformers use two primary voltage taps as shown in figure 4.

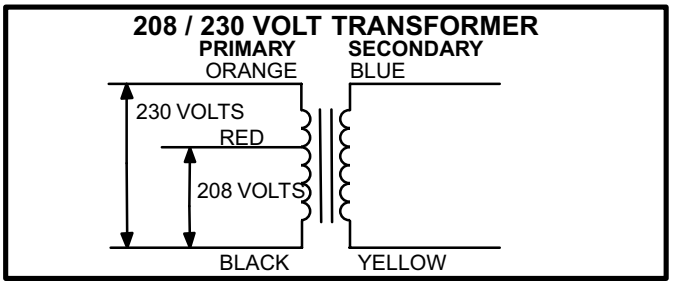


FIGURE 4

4-Transformer Fuse F1

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

5-1st Stage (Pump No. 1) Contactor K1

K1 is a 24V to line voltage contactor used to energize the 1st compressor (B1) in response to 1st stage cooling demand. All units use three-pole-double-break contactors.

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.

6-1st Stage (Pump No. 2) Contactor K2

K2 is a 24V to line voltage contactor used to energize the 2nd compressor (B2) in response to 1st stage cooling demand. Contactor K2 can only be energized after a 30 second delay initiated by time delay DL15. The time delay is used to stagger the electrical load and limit the effects of electrical inrush on unit components. All units use three-pole-double-break contactors.

7-2nd Stage (Pump No. 3) Contactor K14

K14 is a 24V to line voltage contactor used to energize the 3rd compressor (B13) in response to 2nd stage cooling demand. All units use three-pole-double-break contactors.

8-Condenser Fan Contactor K10

K10 is a 24V to line voltage contactor used to energize both condenser fans (B4 and B5) in response to cooling demand. Both condenser fans are energized with the 1st compressor upon receiving a cooling demand. Both fans operate throughout all cooling demand. All units use three-pole-double-break contactors.

9-Indoor Blower Contactor K3

K3 is a 24V to line voltage contactor 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 cooling or constant fan demand. In heating mode K3 is energized by relays K20 or K25 (in the heating section) in response to heating demand. All units use three-pole-double-break contactors.

10- Low Ambient Lockout Switch (Compressor Monitor) S3

All GCS16 units are equipped with a single compressor monitor mounted 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 REMD16 economizer (if installed). The monitor automatically resets when outdoor temperature rises above 50°F.

11-1st Stage (Pump No. 2) Delay DL15

Time delay DL15 is a SPST N.O. switch wired in series with the 1st stage compressor 2 contactor coil. The delay is energized simultaneously with compressor 1 contactor K1 and condenser fan contactor K10. Once energized, the delay waits 30 seconds ± 3 seconds before closing. The purpose of the delay is to prevent voltage drop at the contactor coil due to three contactors being energized at the same time. With the delay added, only two contactors (K1 and K10) can energize at the same time while the third contactor (K2) must wait 30 seconds before energizing. Once contactor K2 is energized, a set of N.O. K2-2 auxiliary contacts close to bypass the time delay (wired in parallel with time delay DL15). When K2-2 closes, the resulting shunt eliminates any load added by the time delay (allows K2 to receive full voltage). When thermostat demand stops DL15 immediately opens and resets.

12-Pilot Relay Board A11

A11 is a pilot relay board (figure 5) used in all GCS16-1853 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 and thereby minimize the potential for voltage drop at the contactors.

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

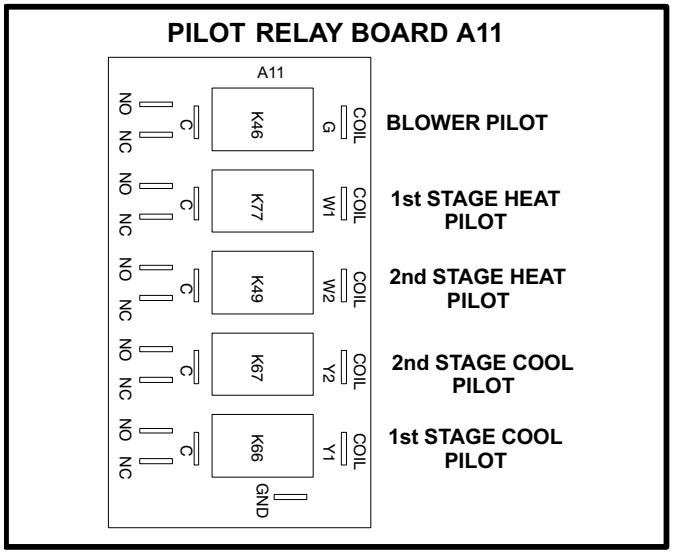


FIGURE 5

III-Heating Components (Figure 6)

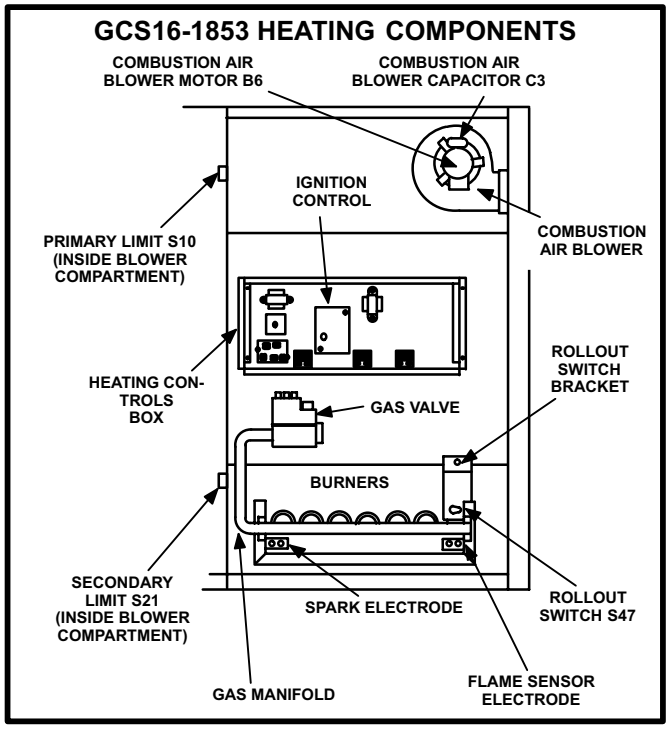


FIGURE 6

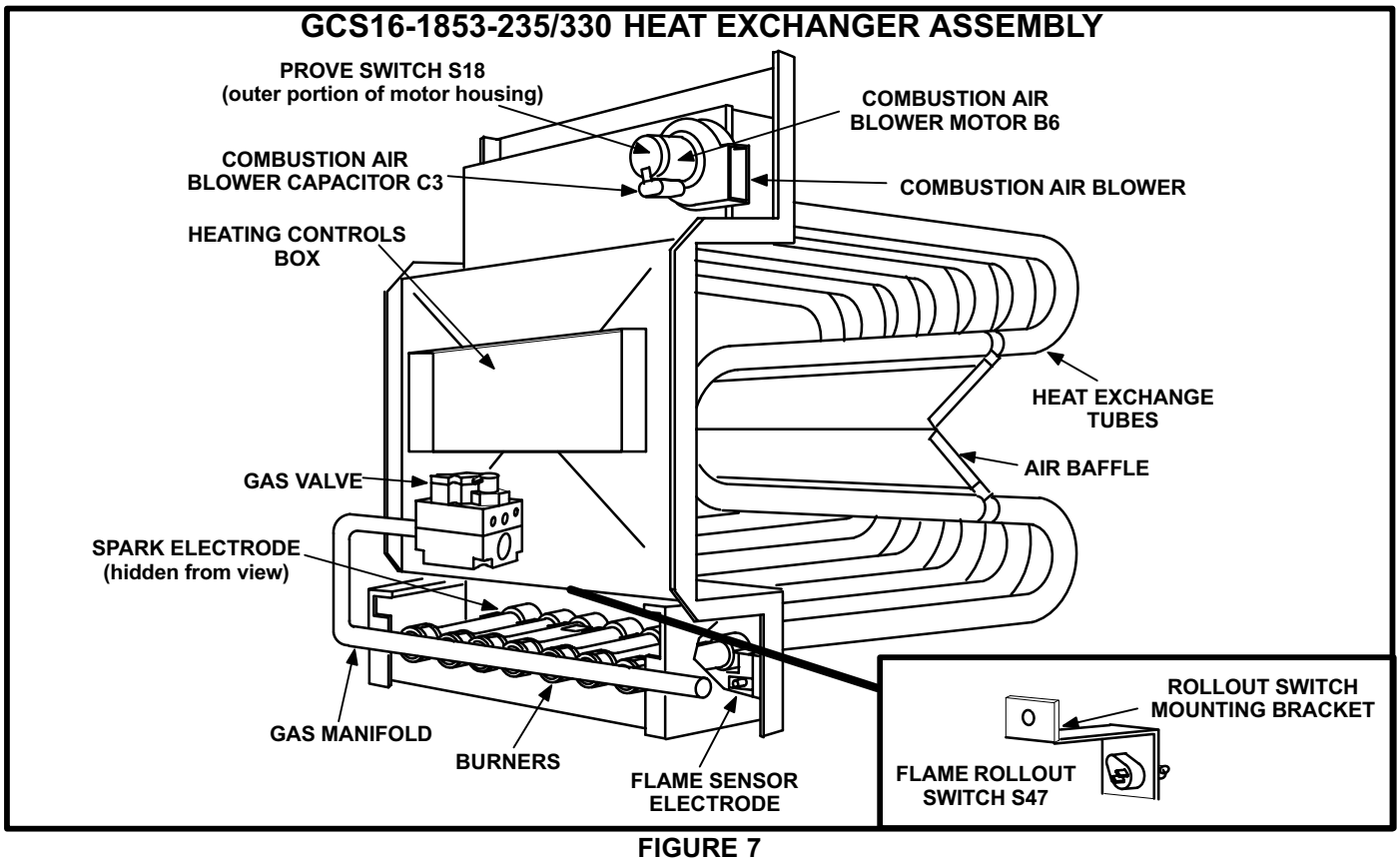


FIGURE 7

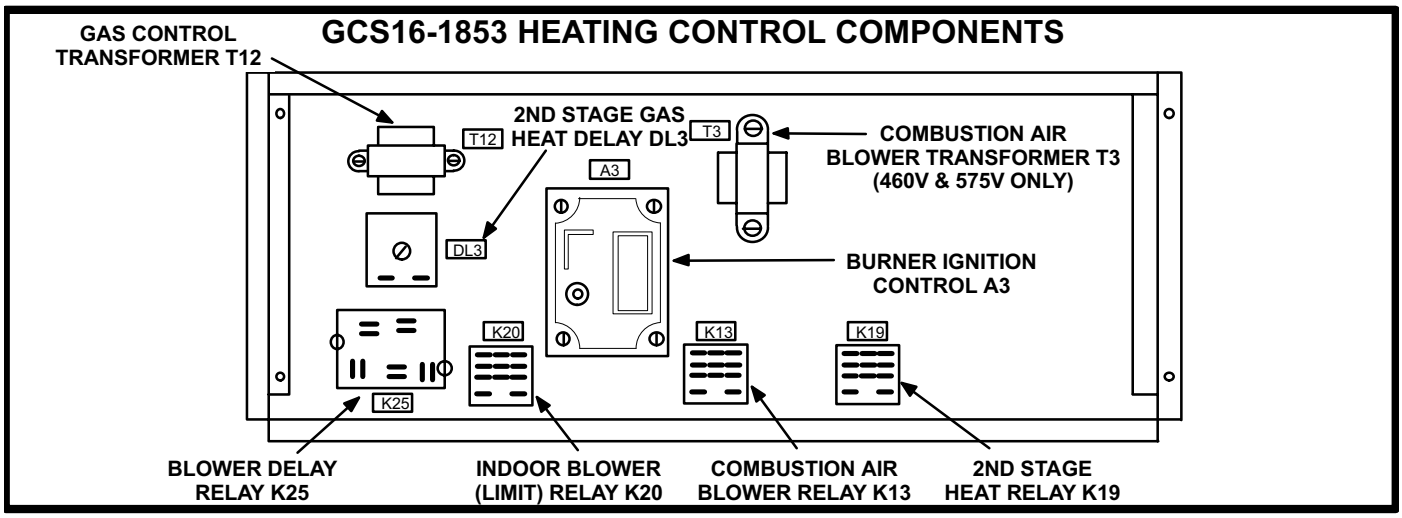


FIGURE 8

A-Terminal Strip TB1

All GCS16 commercial units are equipped with a low voltage terminal strip (TB1). The strip is used for making up all indoor thermostat and outdoor unit low voltage control wiring connections (see figures 20 and 21). The terminal strip is located in the burner compartment on the outside panel of the control box.

B-Heating Control Box Components Figure 8

1-Transformer T3

460 (G) and 575 (J) voltage units use a line voltage to 230V autotransformer to power the combustion air blower. The autotransformer is connected directly to line voltage and is powered at all times. It has an output rating of 0.5A.

2-Transformer T12

All units use a line voltage to 24V transformer to power the heating control circuits. This transformer is also connected directly to line voltage and is powered at all times. It has a maximum VA rating of 30VA.

3-Combustion Air Blower Relay K13 (1st Stage Heat Relay)

Relay K13 is a DPDT relay located inside the heating control box. K13 is energized by 1st stage heating demand from thermostat (pilot relay K77) and is energized throughout the heating demand. When energized, K13 normally open contacts close to energize combustion air blower and begin a heating sequence. A centrifugal "prove" switch located in combustion air blower motor closes as the motor nears full speed to "prove" combustion air blower operation. When the switch closes, the ignition control and gas valve are energized to begin a heating sequence.

4-Indoor Blower (Limit) Relay K20

Relay K20 is a SPDT relay also located in the heating control box. Relay K20 is energized when either the primary or secondary high temperature limits trip. When K20 is energized, a set of N.O. contacts close to energize relay K3 in the unit (and relay K65 if so equipped). Relay K3 is responsible for energizing the indoor blower. When either the primary or secondary limit are reset relay K20 is de-energized and indoor blower stops.

5-2nd Stage Heat Relay K19

Relay K19 is also a SPDT relay located in the heating control box. Relay K19 is energized by 2nd stage heating demand (pilot relay K49) and is energized throughout 2nd stage heating demand. When energized, K19 normally open contacts close to energize 2nd stage heat delay relay DL3. When time has elapsed, DL3 closes to energize the 2nd stage operator of the gas valve. When 2nd stage demand stops relay K19 is de-energized, time delay DL3 resets and the gas valve 2nd stage operator closes.

6-2nd Stage Gas Heat Delay DL3

DL3 is a SPST time delay located in the heating control box. Upon receiving increased heating demand from relay K19, DL3 initiates a 180 second time delay before closing its N.O. contacts. The purpose of DL3 is to prevent frequent cycling of 2nd stage heat. When DL3 contacts close, 2nd stage operator of gas valve is energized and 2nd stage operation begins. When K19 contacts open (2nd stage demand stops) time delay DL3 is de-energized and reset immediately. When DL3 resets, the 2nd stage operator of the gas valve is de-energized and closed.

7-Blower Delay Relay K25

A heat type combination blower delay / relay (K25) located in the heating controls box is used to coordinate blower operation with burner operation. K25 is a SPDT relay which closes 40±10 seconds after being energized and opens 110±20 seconds after being de-energized.

8-Burner Ignition Control A3

Ignition control A3 is located in the heating control box. On a heating demand, the ignition control is energized after combustion air blower prove switch closes. The ignition control then allows 30 to 40 seconds for the combustion air blower to vent exhaust gases from the burners. At the end of the delay the ignition control activates gas valve GV1, the spark electrode, the flame sensing electrode and blower delay relay K25 (and status panel no heat relay K29 - if so equipped). Sparking stops after flame is sensed. The combustion air blower continues to operate throughout the heating demand. If the flame fails or if the burners do not ignite, the ignition control will attempt to ignite the burners up to two more times. If ignition cannot be obtained after the third attempt the control will lock out. The ignition control is not adjustable.

WARNING - SHOCK HAZARD. SPARK RELATED COMPONENTS CONTAIN HIGH VOLTAGE WHICH CAN CAUSE PERSONAL INJURY OR DEATH. DISCONNECT POWER BEFORE SERVICING. CONTROL IS NOT FIELD REPAIRABLE. UNSAFE OPERATION WILL RESULT. IF THE CONTROL IS INOPERABLE, SIMPLY REPLACE THE ENTIRE CONTROL.

a- Electronic direct spark ignition with flame rectification sensing is used on all GCS16 units. Flame signal strength ranges from 8 to 20 micro-amps. All units have controls manufactured by Fenwal.

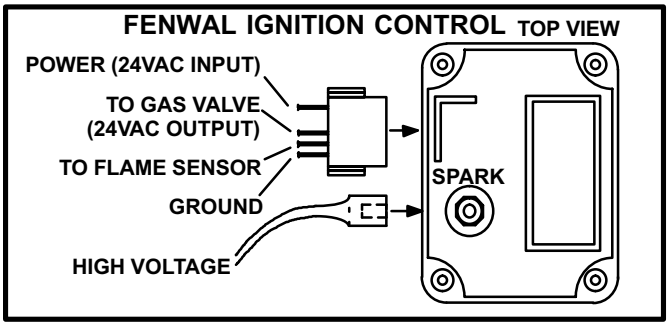


FIGURE 9

b- The Fenwal control is illustrated in figure 9. The four-wire harness, plugged directly into a jack on the side of the control, is used to connect control to unit. Each of the four jack terminals is identified by function. The spark electrode wire connects to the spark plug-type connector on top of the control.

c- The ignition control provides three main functions: gas valve control, ignition and flame sensing. It is powered only after the combustion air prove switch has closed. The ignition attempt sequence provides three trials for ignition before locking out. The blower control (K25) is energized simultaneously with the gas valve, so the blower will energize 30 to 45 seconds after flame has successfully been established. The unit will usually ignite on the first attempt. See figure 10 for a normal ignition sequence with nominal timings for simplicity.

d- Proper gas/air mixture is required for ignition on the first attempt. If there is any deviation, within tolerance of the unit, a second or third trial may be necessary for ignition. The control will lock out the heating system if ignition is not obtained within three trials and the (indoor) blower will not start. Reset after lockout requires only breaking and remaking thermostat demand. See figure 11 for the ignition attempt sequence with retrials (minimal timings given for simplicity). Loss of flame during a heating cycle is indicated by an absence of flame signal (0 microamps). If this happens, the control will immediately restart the ignition sequence and then lock out if ignition is not gained after the third trial.

e- Specific timings for the Fenwal control are shown in figure 12.

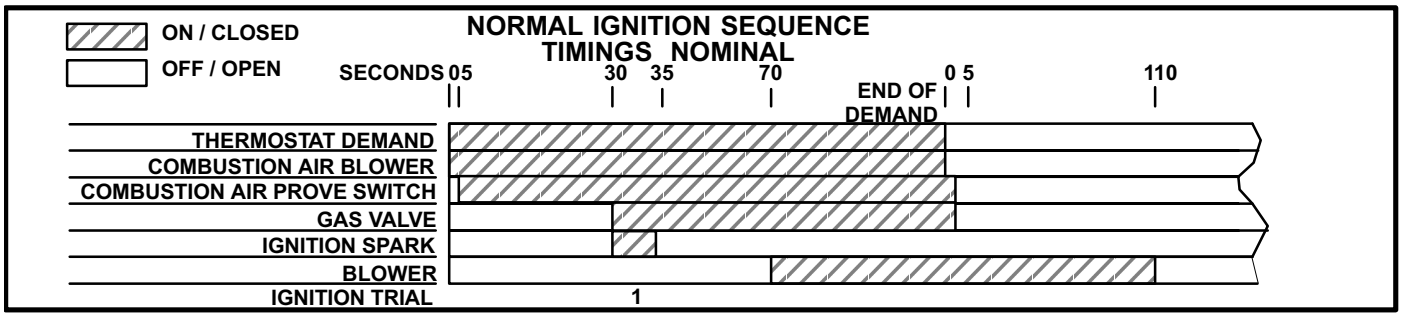


FIGURE 10

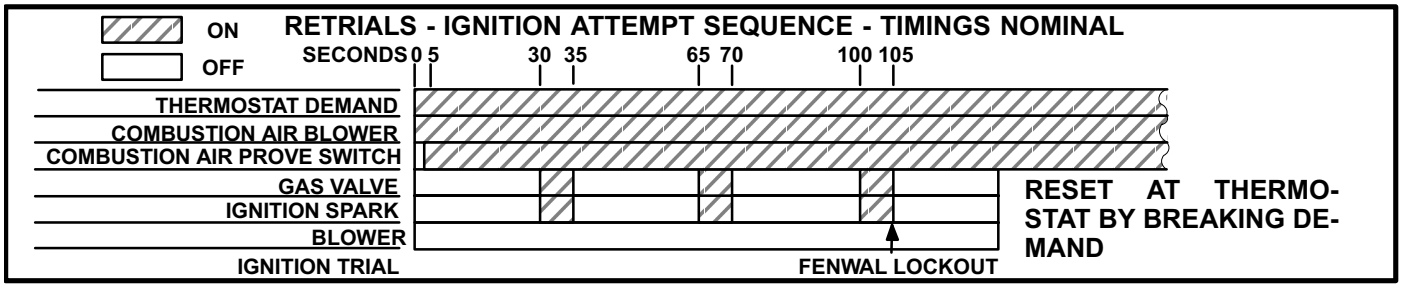
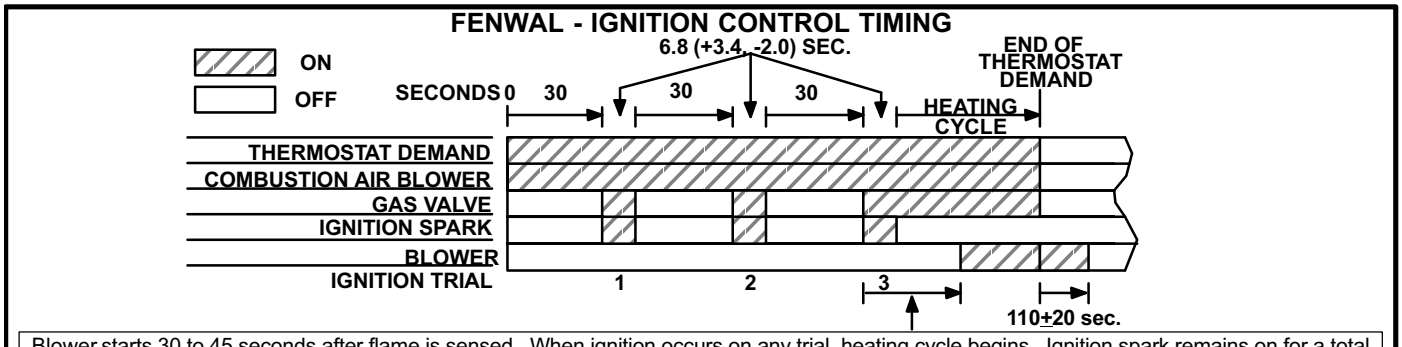


FIGURE 11



Blower starts 30 to 45 seconds after flame is sensed. When ignition occurs on any trial, heating cycle begins. Ignition spark remains on for a total of 6.8 +3.4, -2.0 seconds from the beginning of the trial period. If flame sensor detects loss of flame during heating cycle, gas valve remains open and ignition spark begins for one second. If flame is detected before the end of one second, spark stops and the heating cycle continues. If flame is not detected during the one second ignition retrial, the control cycles through the complete ignition sequence before locking out.

FIGURE 12

9-Heat Exchanger (Figure 7)

The GCS16 uses aluminized steel inshot burners with matching tubular aluminized steel heat exchangers. The GCS16-1853 uses a 7-tube/burner assembly controlled by a single two-stage gas valve. Each burner uses a burner venturi to mix gas and air for proper combustion. Combustion takes place at each tube entrance. As hot combustion gases are drawn upward through each tube by the combustion air blower, exhaust gases are drawn out the top and fresh air/gas mixture is drawn in at the bottom. Heat is transferred to the air stream from all surfaces of the heat exchange tubes. The supply air blower, controlled by the ignition control or the control system (depending on which control system is installed), forces air across all surfaces of the tubes to extract the heat of combustion. The shape of the tubes and a deflector ensure maximum heat exchange.

The gas valve accomplishes staging by allowing more or less gas to the burners as called for by heating demand.

10-Burner Assembly (Figure 13)

The burners are controlled by the spark electrode, flame sensing electrode, gas valve GV1 and combustion air blower B6. The spark electrode, flame sensing electrode and gas valve GV1 are directly controlled by ignition control A3. Ignition control A3 is controlled by combustion air blower B6. Combustion air blower B6 is controlled by heating demand from the thermostat or control system by way of pilot relay K77 in the unit.

a-Burners

All units use inshot burners (see figures 13).

Burners are factory set and do not require adjustment. Burner air shutters are designed to be fully open only. A peep hole with cover is furnished in the heating access panel for flame viewing. Always operate the unit with the access panel in place. Burners can be removed individually for service. Burner maintenance and service is detailed in the SERVICE CHECKS and MAINTENANCE sections of this manual.

b-Orifice

Each burner uses an orifice which is precisely matched to the burner input. The orifice is threaded into the burner manifold. The burner is supported by the orifice and will easily slide off for service.

Each orifice and burner are sized specifically to the unit. Refer to Lennox Repair Parts Listing for correct sizing information.

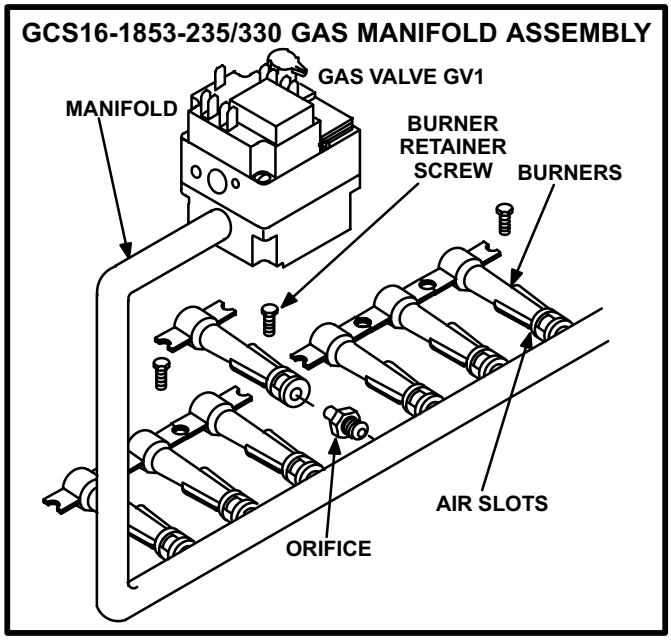


FIGURE 13

C-Primary High Temperature Limit S10

S10 is the primary high temperature limit. It is located in the heating compartment and is mounted to the lower portion of the panel dividing the heating compartment from the blower compartment.

Primary limit S10 is wired in series with the ignition control. Its N.C. contacts open to de-energize the ignition control when excessive temperature is reached in the blower compartment. The limit is a SPDT auto-reset switch. The limit is factory preset to open its N.C. terminals at 165°F $\pm$6°F on a temperature rise and automatically reset at 125°F $\pm$7°F on a temperature fall. The ignition circuit is immediately de-energized when terminals 1-3 open and relay K20 is energized when terminals 1-2 close. This is a primary safety shut-down function of the unit.

D-Secondary High Temperature Limit S21

S21 is the secondary high temperature limit. It is also located in the heating compartment and is mounted to the upper portion of the panel dividing the heating compartment from the blower compartment.

S21 is also wired in series with the ignition control. It functions in the same manner as S10 but is factory set to trip at 140°F ±6°F on a temperature rise and automatically reset at 100°F ±7°F on a temperature fall. This is a secondary safety shut-down function of the unit.

E-Flame Rollout Switch S47

Flame rollout switch S47 is a high temperature cutoff fuse located just above the right burner air intake opening in the burner compartment. The N.C. limit is connected in series with ignition control A3. When S47 senses flame rollout (indicating a blockage in the combustion air passages), S47 trips, the ignition control immediately stops ignition and closes the gas valve. The switch is factory set to trip at 171°F and cannot be adjusted. The limit is a ceramic non-resettable fusible link which must be replaced after being tripped.

F-Combustion Air Prove Switch S18

The combustion air prove switch (S18) is a SPST N.O. centrifugal switch inside the combustion air motor. It is used to monitor combustion air blower operation. The switch is wired in series with ignition control A3. On start-up, the switch closes when the combustion air motor reaches between 1850 and 2500 RPM to allow power to the ignition control (proves, by closing, that the combustion air blower is operating before allowing the ignition control to energize). At the end of a heating demand (when combustion air motor is de-energized), S18 opens when the combustion air motor slows 50 to 450 RPM below the "make." The combustion air prove switch is factory set and is not adjustable.

G-Combustion Air Blower B6

Combustion air blower B6 provides fresh air to the burner while clearing the combustion chamber of exhaust gases. The blower begins operating (relay K13 closes) immediately upon receiving a thermostat demand (relay K77 closes) and is de-energized (relay K13 opens) immediately when thermostat demand is satisfied (relay K77 opens).

All combustion air blower motors are sealed and cannot be oiled. The blower cannot be adjusted but can be disassembled for cleaning.

The combustion air blower uses a single-phase PSC motor which requires a run capacitor (C3). Combustion Air Blower Ratings are shown in Table 3.

H-Combustion Air Motor Capacitor

The combustion air blower in GCS16-1853 units uses a 208/230V single-phase PSC ball-bearing motor which requires a run capacitor. The capacitor is rated as shown in Table 3.

TABLE 3

COMBUSTION AIR BLOWER 208/230v/1ph				
Unit	**Make**	**HP**	**RPM**	**Misc.**
GCS16-1853 -235	Fasco	.083	3200	Requires T3 When used on 460v or 575v units
	Arialal	.095	3000	
GCS16-1853 -330	Fasco	0.1	3300	
	Arialal	0.1	3000	

I-Gas Valve GV1

Gas valve GV1 is a two-stage redundant valve. Units may be equipped with valves manufactured by either Honeywell or White-Rodgers. First stage is quick opening (on and off less than 3 seconds) Second stage is slow opening (on 1 minute, off 1-1/2 minute) On a call for first stage heat, the valve is energized by the ignition control simultaneously with the spark electrode. On a call for second stage heat, the second stage operator is energized after time delay DL3 closes. When demand is satisfied, second stage must be closed (1-1/2 minutes to close completely) before 1st stage can close. A manual shut-off knob is provided on the valve for shut-off. Manual shut-off knob immediately closes both stages without delay. Figure 14 shows Honeywell gas valve components and figure 15 shows White-Rodgers gas valve components. Table 4 shows factory gas valve regulation for GCS16 series units.

TABLE 4

GAS VALVE REGULATION					
Unit Input K Btuh	**Maximum Inlet Pressure in. W.C.**	**Operating Pressure (outlet) in. W.C. Factory Setting**			
		Natural*		**L.P.****	
		Low	High	Low	High
235	13.0	1.6±0.1	3.7±0.2	5.5±0.3	10.5±0.5
330	13.0	1.6±0.1	3.7±0.2	5.5±0.3	10.5±0.5

* Adjustable Range 3.0 to 5.0 in. W.C. Honeywell Gas Valve only. White-Rodgers gas valve is not adjustable.

** Field Installed Kit Adjustable Range 8.0 to 12.0 in. W.C.Honeywell Gas Valve only. White-Rodgers gas valve is not adjustable.

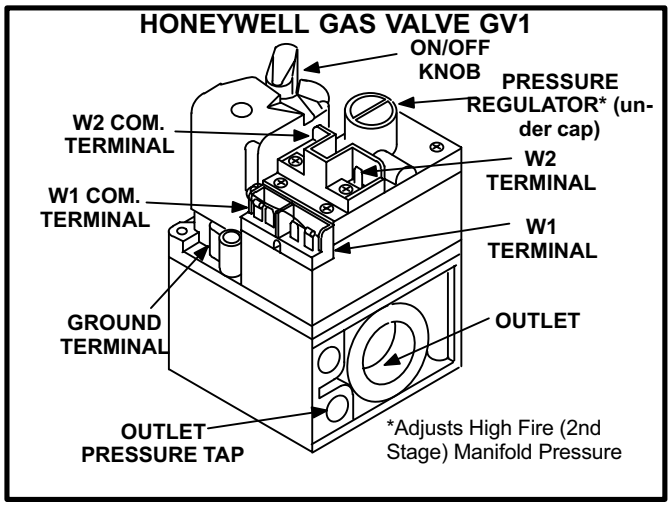


FIGURE 14

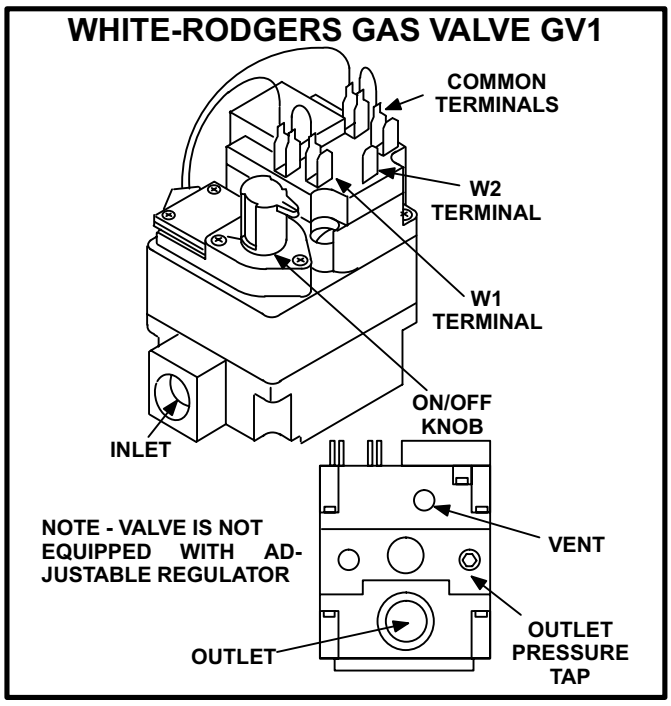


FIGURE 15

J-Electrode Assembly

An electrode assembly is used for both ignition spark and flame sensing. Two identical electrodes are used. Each electrode is mounted at extreme ends of the burner support. The electrodes are mounted through holes in the burner support and the electrode tips protrude into the flame envelope of the adjacent burner. The electrode on the left acts as the flame ignitor and the electrode on the right acts as the flame sensor. The electrode assembly is fastened to burner supports and can be removed for service without removing any part of the burners.

During ignition spark travels through the spark (left) electrode and ignites the left burner. Flame travels from burner to burner until all are lit. When flame is sensed by the right electrode (rightmost burner lit - indicated by microamp signal through the flame) sparking stops. During operation, flame is sensed by current passed along the ground electrode, through the flame and into the sensing electrode. The ignition control allows the gas valve to stay open as long as a flame signal (current passed through the flame) is sensed.

1-Spark Electrode

The spark electrode is connected to the ignition control by a 5mm silicone insulated stranded high voltage wire. The wire uses 1/4” female quick connect on the electrode end and female spark plug-type terminal on the ignition control end.

NOTE-IN ORDER TO MAXIMIZE SPARK ENERGY TO ELECTRODE, HIGH VOLTAGE WIRE SHOULD TOUCH UNIT CABINET AS LITTLE AS POSSIBLE.

2-Flame Sensor

Flame is sensed by rectification through the flame sensing electrode.

K-Cooling Components

Summary of Features

Every GCS16-1853 uses three independent cooling circuits (figure 16) consisting of three compressors, condenser coils and evaporator coils. Two draw-through type condenser fans draw air across all three condenser coils during all compressor operation. A single belt drive blower draws air across all three evaporators during all unit operation. Cooling may also be supplemented by field-installed economizer. The evaporators are slab type and are stacked as shown in figure 18. Each evaporator uses a non-adjustable externally equalized 5 ton expansion valve as the primary expansion device. Each evaporator is also equipped with enhanced fins and rifled tubing. The two condenser coils are split into three independent circcuits. Compressor 1 uses an independent circuit in the right condenser coil (figure 16), compressor 2 uses an independent circuit in the left condenser coil and compressor 3 uses an independent circuit in both the left and right condenser coils. Each compressor is protected by a crankcase heater, 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 evaporator). All units are equipped with thermometer well for charging.

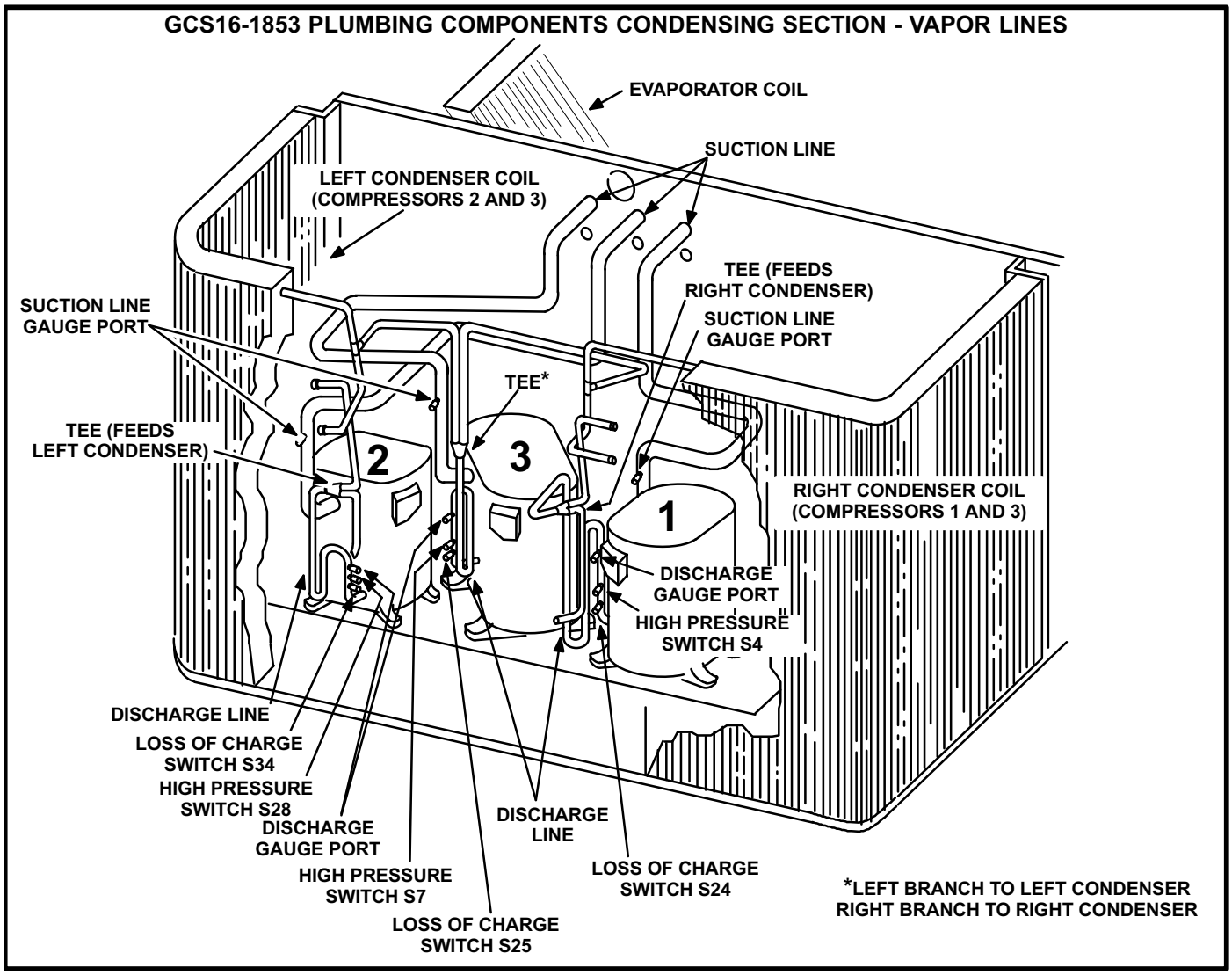


FIGURE 16

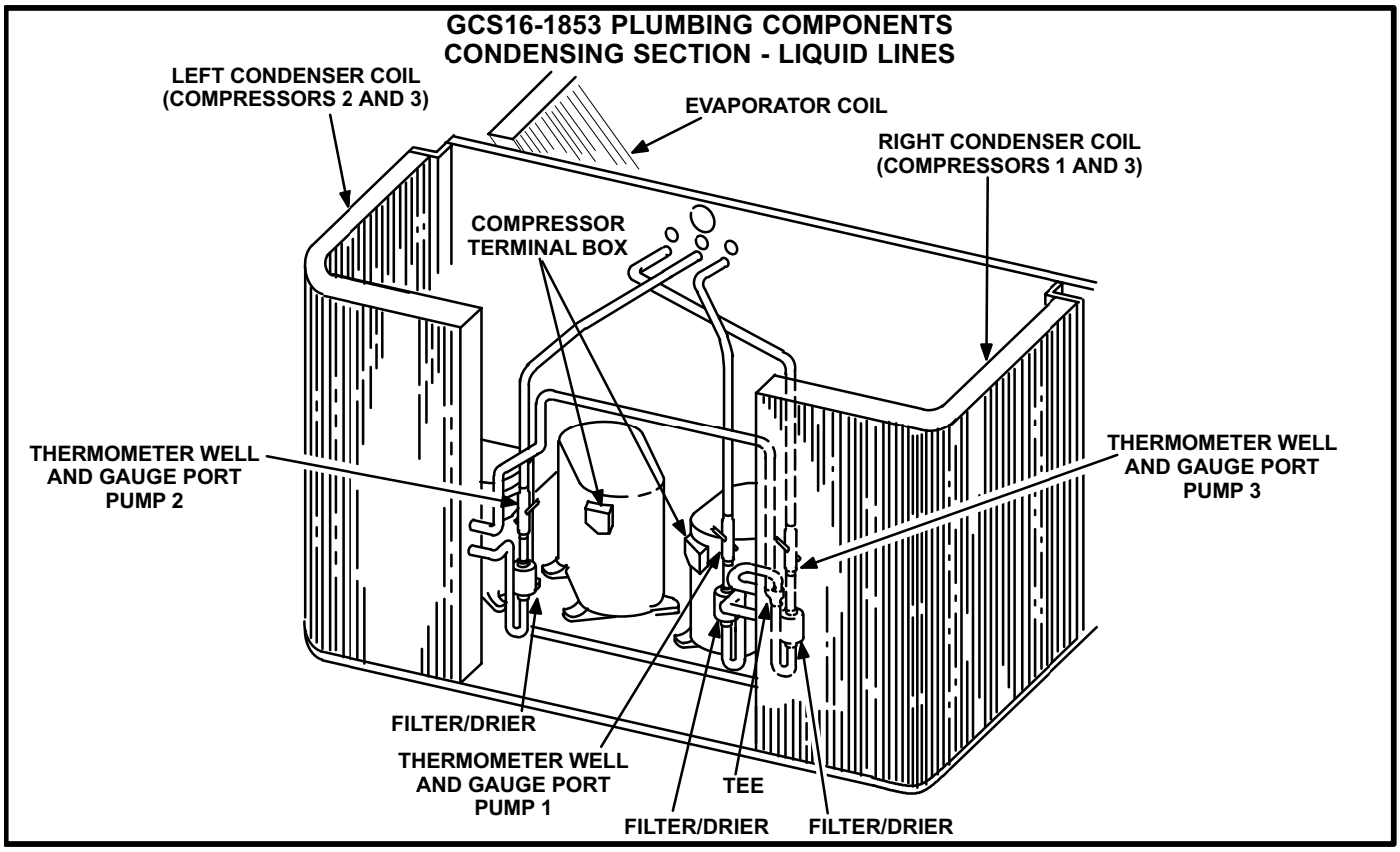


FIGURE 17

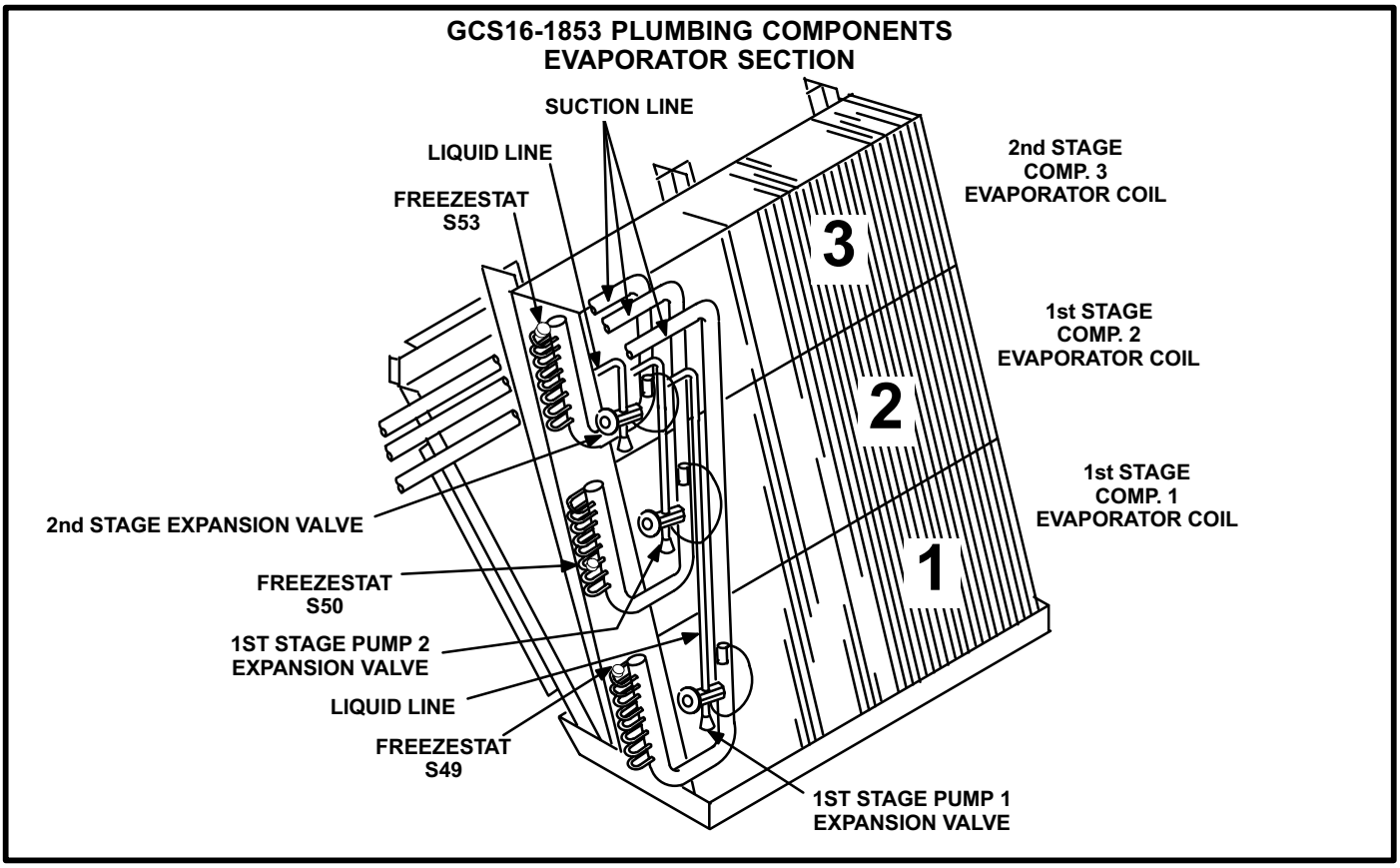


FIGURE 18

TABLE 5

GCS16 SERIES UNITS - COMPRESSOR SPECIFICATIONS								
Unit	**Voltage/ Phase**	**Compressor Manufacturer**	**Locked Rotor Amps**	**Rated Load Amps**	**Oil Charge Fl. Oz.**	**Viscosity**	**Oil Type**	**Crankcase Heater**
GCS16-1853-235	208/230V/3	Bristol	124	18.5	55	†	†	30 watt Insertion Type Self-Regulating
GCS16-1853-330								
GCS16-1853-235	460V/3	Bristol	62	9.9				
GCS16-1853-330								
GCS16-1853-235	575V/3	Bristol	50	6.7				
GCS16-1853-330								
GCS16-1853-235	208/230V/3	Copeland	105	18.5	70	†	*	40 watt Insertion Type Self-Regulating
GCS16-1853-330								
GCS16-1853-235	460V/3	Copeland	55	9.9				
GCS16-1853-330								
GCS16-1853-235	575V/3	Copeland	45	6.7		190-210	**	
GCS16-1853-330								

*Texaco Capella WF-32 or Suniso 3GS or White Oil M/M Sontex 200-LT
**Heat Pump Grade Mineral
†Not Specified

1-Compressors B1, B2 and B13

Table 5 shows the specifications of compressors used in all units. Compressor B1 is compressor 1 and is energized by contactor K1 upon receiving a 1st stage demand. Compressor B2 is compressor 2 and is energized by contactor K2 upon receiving a 1st stage demand (after time delay DL15 closes). Compressor B13 is compressor 3 and is energized by contactor K14 upon receiving a 2nd stage demand.

NOTE-Refer to wiring diagram section B9 for specific unit operation.

Each compressor used in GCS16 units is equipped with insertion type crankcase heaters. All compressors are protected by internal overload protection circuitry.

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

WARNING - CRANKCASE 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, HR2 and HR5

CAUTION - Crankcase heaters are connected to line voltage at all times (not switched by unit circuitry).

All GCS16-1853 compressors are equipped with 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. Bristol compressors use 30 watt heaters and Copeland compressors use 40 watt heaters.

3-High Pressure Limit S4, S7 and S28

The high pressure limit is a manually reset SPST N.C. switch which opens on a pressure rise. All GCS16 commercial units are equipped with this limit. The switch is located in the compressor discharge line and is wired in series with the compressor contactor. S4 is wired in series with the 1st stage compressor 1 contactor, S7 is wired in series with the 1st stage compressor 2 contactor and S28 is wired in series with the 2nd stage compressor 3 contactor. When discharge pressure rises above 410$\pm$10 psig (indicating a problem in the system) the switch opens and the respective compressor is 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 switch button.

4-Loss of Charge Switch S24, S25 and S34

The loss of charge switch is an auto-reset SPST N.C. switch which opens on a pressure drop. All GCS16 commercial 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 contactor. S24 is wired in series with the 1st stage compressor 1 contactor, S25 is

wired in series with the 1st stage compressor 2 contactor and S34 is wired in series with the 2nd stage compressor 3 contactor. 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-Freezestats S49, S50 and S53

Each evaporator is equipped with a low temperature limit located on a suction feeder. S49 is located on the 1st stage compressor 1 coil, S50 is located on the 1st stage compressor 2 coil and S53 is located on the 2nd stage coil. Each freezestat is wired in series with its respective compressor 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 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 evaporator ice buildup.

6-Condenser Fans B4 and B5

The specifications table on page 1 in this manual shows the specifications of condenser fans used in GCS16-1853 units. Both condenser fans are energized upon receiving a 1st stage cooling demand from pilot relay K66. The condenser fans draw air across all three condenser coils during all compressor operation. Condenser fans in all GCS16-1853 units (all voltages) use three-phase motors which do not require a run capacitor.

7-Thermometer Well (Figure 19)

All units are factory equipped with a thermometer well for charging the unit. The well is 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.

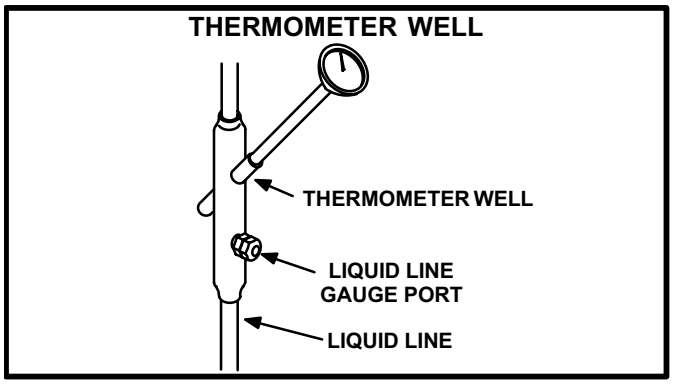


FIGURE 19

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.

L-Blower Compartment Components

TABLE 6

BLOWER MOTOR				
Unit	**Volts**	**Phase**	**HP**	**FLA**
GCS16-1853-235/330	208/230	3	3	10.6
GCS16-1853-235/330	208/230	3	5	16.7
GCS16-1853-235/330	460	3	3	4.8
GCS16-1853-235/330	460	3	5	7.6
GCS16-1853-235/330	575	3	3	3.9
GCS16-1853-235/330	575	3	5	6.1

1-Indoor Blower Motor B3

All GCS16-1853 units use three-phase single-speed blower motors. CFM adjustments are made by adjusting the motor pulley. Blower motor ratings are shown in table 6.

2-Line Voltage Make-Up Strip TB2

Line voltage terminal strip TB2 (figure 20) is provided in all GCS16-1853 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. A detail drawing of TB2 is shown in figure 21.

3-Low Voltage Terminal Strip TB1

All GCS16-1853 units are equipped with a low voltage terminal strip TB1 located in the blower compartment (figure 20). 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 instrucions 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 21.

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 21). Strip wire no more than 1/4".

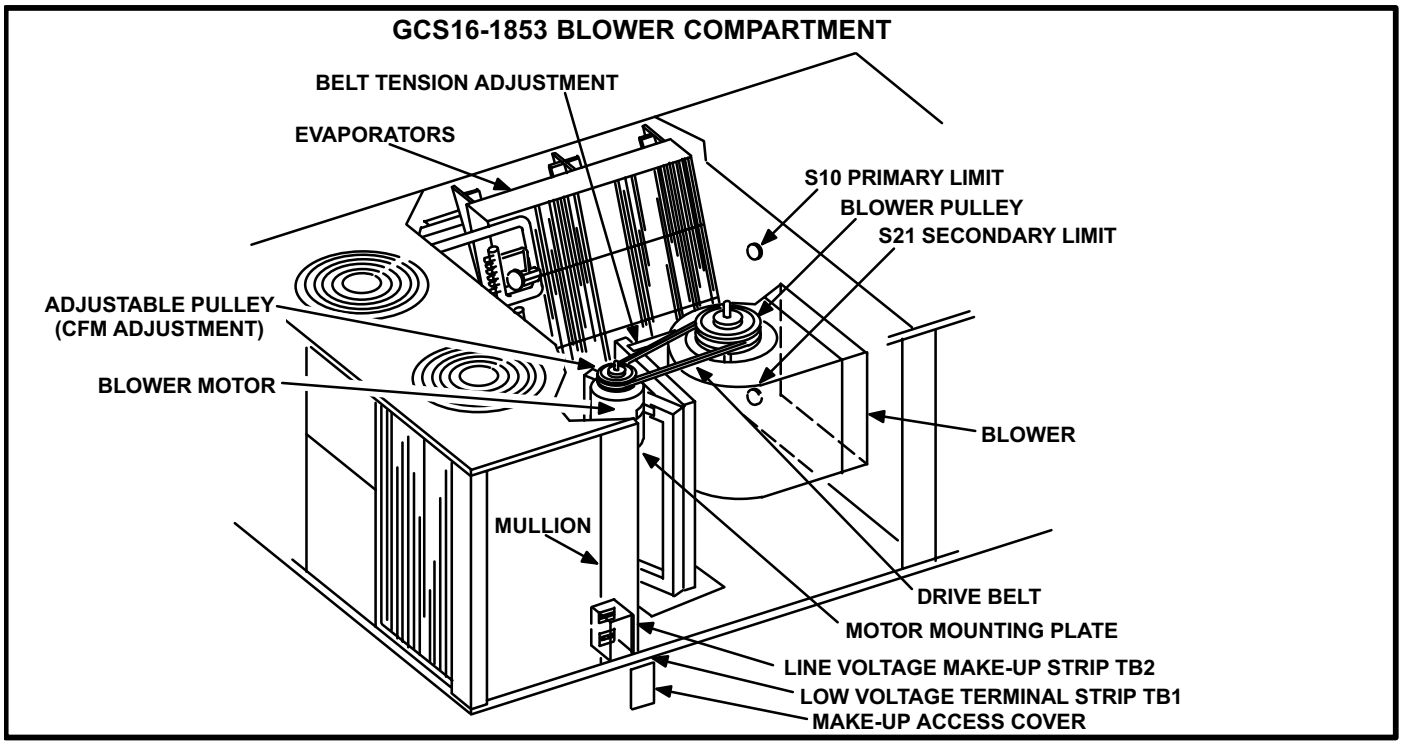


FIGURE 20

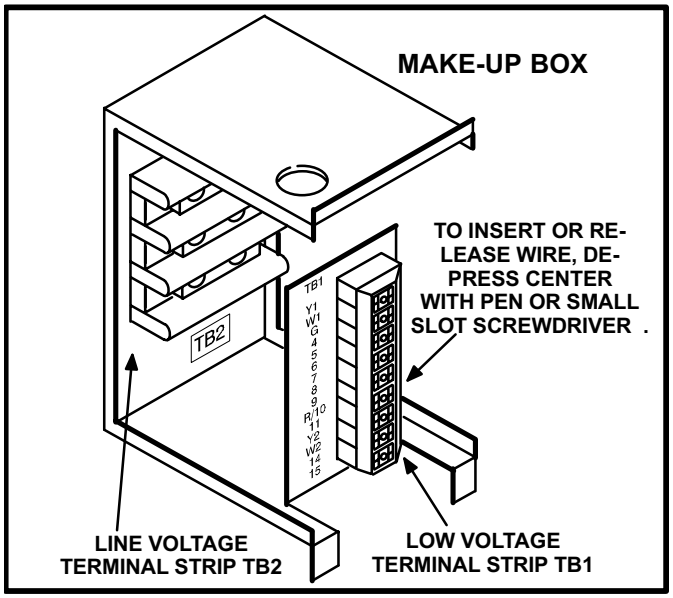


FIGURE 21

IV-PLACEMENT AND INSTALLATION

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

V-ELECTRICAL CONNECTIONS

A-Power Supply

Refer to startup directions and refer closely to the unit wiring diagram when servicing. Refer to 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.

VI-STARTUP - OPERATION

A-Preliminary and Seasonal Checks

1- Make sure that 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 the disconnect switch. Voltage must be within the range listed on the nameplate. If not, consult the power company and have the 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 IX-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 - The crankcase 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.

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 all 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 amount of charge.

3- Refer to Cooling Operation and Adjustment section for the proper method to check refrigerant charge.

C-Heating Startup

CAUTION-This unit is equipped with a direct spark ignition system. Do not attempt to light manually.

1- Set thermostat to OFF position. Close manual knob on gas valve.

2- Wait 5 minutes.

3- Open manual knob on gas valve, replace burner access door and turn on unit electrical supply.

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

5- The combustion air blower immediately starts. The burners light within 40 sec.

6- If the unit does not light the first time, it will attempt up to two more times before locking out.

7- If lockout occurs,repeat steps 1, 2, 3 and 4.

D-Safety or Emergency Shutdown

Turn off power to the unit. Close the manual and/or main gas valves.

E-Extended Period Shutdown

Turn off the thermostat or set to “UNOCCUPIED” mode. Close all gas valves both internal and external to the unit to prevent gas leakage into the combustion chamber. Turn off power to the unit. All access panels, covers and vent caps must be in place and secured.

VII-COOLING SYSTEM SERVICE CHECKS

GCS16-1853 is factory charged and requires no further adjustment; however, charge should be checked periodically 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.

A-Gauge Manifold Attachment

Service gauge ports are identified in figures 16 and 17. Attach high pressure line to liquid line gauge port on thermometer well. Attach low pressure line to suction line service port.

NOTE-When unit is properly charged (whether by approach or subcooling method) liquid line pressures should approximate those given in table 8.

B-Charging

This unit is factory charged and requires no further adjustment; however, check charge during start-up using the approach method outlined below. The approach method compares actual liquid temperature with the outdoor ambient temperature. Thermometer wells have been provided to allow accurate liquid temperature measurement.

If the system is completely void of refrigerant, the recommended and most accurate method of charging is to weigh the 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- *IMPORTANT - Block compressor compartment with access panel so air will not by-pass the coils.*

3- Operate unit (all three compressors) for at least five minutes to stabilize pressures.

4- Check each stage separately with all stages operating. Compare liquid temperatures to outdoor ambient temperature.
Approach Temperature = Liquid temperature minus ambient temperature. (For best results use same thermometer for both readings).

TABLE 7

APPROACH TEMPERATURE	
UNIT	**LIQUID TEMP. MINUS AMBIENT TEMP.**
GCS16-1853	7°F ± 1 (3.9°C ± 0.5)

5- Approach temperature should match values on the unit label (table 7). An approach temperature greater than value shown indicates an undercharge. An approach temperature less than value shown indicates an overcharge.

6- When unit is properly charged, the system pressure should approximate pressure given in the Normal Operating Pressure Table (table 8).

NOTE - Use table 8 as a general guide for performing maintenance checks. When unit is properly charged line pressures should approximate those given in table 8. Table 8 is not a procedure for charging the system. Minor variations in these 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 in the system. Used prudently, table 8 could serve as a useful service guide.

TABLE 8

GCS16-1853 NORMAL OPERATING PRESSURES						
	Stage 1		**Stage 2**		**Stage 3**	
Outdoor Entering Air Temperature	**Liq. ± 10 PSIG**	**Suct. ± 5 PSIG**	**Liq. ± 10 PSIG**	**Suct. ± 5 PSIG**	**Liq. ± 10 PSIG**	**Suct. ± 5 PSIG**
65°F	160	73	164	75	166	75
75°F	190	73	193	75	194	75
85°F	219	73	222	76	223	76
95°F	252	74	252	77	254	77
105°F	282	75	282	78	284	78

VIII-HEATING SYSTEM SERVICE CHECKS

A-A.G.A./C.G.A. Applications and Requirements

All GCS16s are A.G.A and C.G.A. design certified without modification.

Before checking piping, check with gas company or authorities having jurisdiction for local code requirements. Refer to the GCS16 Operation and Installation Instruction Manual for more information.

B-Gas Piping

Gas supply piping must not allow more than 0.5"W.C. drop in pressure between the gas meter and the unit. Supply gas pipe must not be smaller than the unit gas connection. Refer to installation instructions for details.

C-Testing Gas Piping

NOTE-In case emergency shutdown is required, turn off the main manual shut-off valve and disconnect the main power to the unit. These controls should be properly labeled by the installer.

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 0.5 psig (14"W.C.). See Figure 22.

If the test pressure is equal to or less than 0.5 psig (14"W.C.), use the main manual shut-off valve before pressure testing to isolate the unit from the gas supply system.

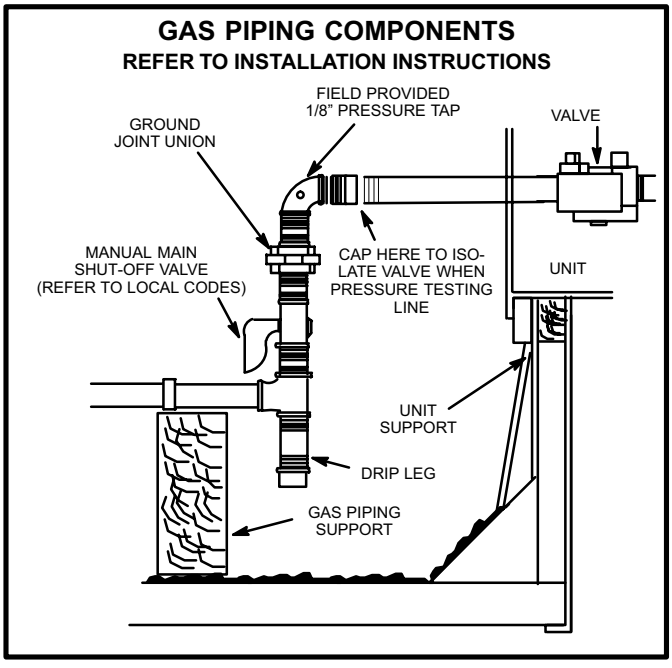


FIGURE 22

When checking piping connection for gas leaks, use a soap solution or other preferred means. Do not use matches, candles, flame, or other source of ignition to check for gas leaks.

Compounds used on threaded joints of gas piping should be resistant to the action of liquefied petroleum gas.

D-Testing Gas Supply Pressure

When testing gas supply pressure, connect test gauge to the inlet pressure tap (field provided - figure 22). Test supply gas pressure with unit firing at maximum rate (both stages energized). Make sure the reading falls within the range of the following values. Low pressure may result in erratic operation or "underfire." High pressure can result in permanent damage to the gas valve or "overfire." For natural gas units, operating pressure at the unit gas connection must be between 5.5"W.C. and 13.5"W.C. For L.P. gas units, operating pressure at the unit gas connection must be between 10.8"W.C. and 13.5"W.C.

On multiple unit installations, each unit should be checked separately while operating at maximum rate, with and without the other units operating. Supply pressure must fall within the range listed in the previous paragraph. On multiple unit installations, each unit should be checked in sequence beginning with the one closest to the supply gas main and progressing to the one furthest from the main.

E-Check and Adjust Manifold Pressure

After line pressure has been checked and adjusted, check manifold pressure. Move test gauge to the outlet pressure tap located on unit gas valve GV1. See figure 14 for location of pressure tap on the gas valve.

The manifold pressure is factory set and should not require adjustment. White-Rodgers gas valve is not adjustable. If manifold pressure is incorrect and no other source of improper manifold pressure can be found, the valve must be replaced. Honeywell gas valve can be adjusted from 3.0" W.C. to 5.0" W.C. Refer to figure 14 for location of Honeywell gas valve (manifold pressure) adjustment screw.

All gas valves are factory regulated as shown in table 9. The gas valve should completely and immediately cycle off in the event of gas or power failure. The manual shut-off knob can be used to immediately shut off gas supply.

CAUTION-For safety, connect a shut-off valve between the manometer and the gas tap to permit shut off of gas pressure to the manometer.

TABLE 9

MANIFOLD PRESSURE GCS16-1853-235/330*		
	Operating Pressure (outlet) in. W.C.	
Stage	Natural	L.P.
First (Low Fire)	1.6 ± 0.2	5.5 ± 0.3
Second (High Fire)	3.7 ± 0.3	10.5 ± 0.5

*Maximum inlet pressure for all gas valves is 13" W.C.

Manifold Adjustment Procedure:

1- Connect a test gauge to the outlet pressure tap on the gas valve. Start the unit (call for 2nd stage heat) and allow five minutes for the unit to reach steady state.
2- While waiting for the unit to stabilize, notice the flame. The flame should be stable without flashback and should not lift from the burner heads. Natural gas should burn basically blue with some clear streaks. L.P. gas should burn mostly blue with some clear yellow streaks.
3- After allowing the unit to stabilize for five minutes, record the manifold pressure and compare to the values given in table 9.

CAUTION-Disconnect heating demand as soon as an accurate reading has been obtained.

F-Proper Gas Flow

To check for proper gas flow to burners, determine Btuh input from the unit rating plate or table 10. Divide this input rating by the Btuh per cubic foot of available gas. Result is the number of cubic feet per hour required. Determine the flow of gas through gas meter for two minutes and multiply by 30 to get the hourly flow of gas to the burners.

NOTE - To obtain accurate reading, shut off all other gas appliances connected to meter.

TABLE 10

Unit	Fuel	Stage	Input Btuh	Output Btuh	Input ($ft.^3$/hr.)
1853-235	Nat.	1st	145,000	116,000	
		2nd	235,000	188,000	
1853-330	Nat.	1st	205,000	159,900	
		2nd	330,000	257,400	
1853-235	L.P.G.	1st	164,000	131,200	
		2nd	235,000	188,000	
1853-330	L.P.G.	1st	237,000	189,600	
		2nd	330,000	264,000	

G-High Altitude Derate
Units With Adjustable Regulator Only (Honeywell Gas Valve)

The maximum input may be reduced by up to 20 percent on A.G.A. units equipped with adjustable (Honeywell) gas valves and operating on natural gas. See table 11.

To derate the unit use the following instructions. If high altitude conditions are present, also follow the instructions in table 11.

Derate Procedure:

1- Check manifold pressure at the gas valve pressure tap with unit operating at high fire (2nd stage).
2- To reduce maximum input, turn regulator adjusting screw (figure 14) counterclockwise.
3- Re-check manifold pressure.

TABLE 11

HIGH ALTITUDE DERATE

If the heating value of the gas does not exceed the values listed in this table, derating of unit is not required. Should the heating value of the gas exceed the table values, or if the elevation is greater than 6,000 ft. above sea level, it will be necessary to derate the unit. Lennox requires that derate conditions be 4 percent per thousand feet above sea level. Thus at an altitude of 4000 feet, if the heating value of the gas exceeds 1000 Btu/cubic ft., the unit will require a 16 percent derate.

Elevation Above Sea Level (Feet)	Maximum Heating Value (Btu/cubic ft.
5001-6000	900
4001-5000	950
3001-4000	1000
2001-3000	1050
Sea Level - 2000	1100

H-Inshot Burner

Burner air shutters are factory set for maximum air and cannot be adjusted. Air shutters should always be fully open. Always operate the unit with access panel in place. A peep hole with cover is furnished in the heating access panel for flame viewing. The flame should be blue with yellow streaks.

Figure 23 shows how to remove burner assembly.

1- Turn off power to unit and shut off gas supply.
2- Remove screws as shown in figure 23.
3- Slide each burner off its orifice.
4- Clean as necessary and reassemble (reverse steps 1-3).
5- Be sure to secure all wires and check plumbing.
6- Turn on power to unit. Follow lighting instructions attached to unit and operate unit in heating mode. Check burner flames. They should be blue with yellow streaks.

NOTE-If the unit is operated with the heating access panel off and burners cold, the burner sound will increased due to cold, dense primary air. This is normal and will subside as the heat exchanger warms up during operation. The sound will be even further reduced with the access panel in place.

I-Heat Exchanger

To Access or Remove Heat Exchanger From Unit:

1- Turn off gas and electric power.
2- Remove access panel and unit end panel.
3- Remove gas valve, manifold assembly and burners.
4- Remove combustion air blower and flue box. Pay careful attention to the order in which gaskets and orifice are removed.
5- Support heat exchanger (to prevent heat exchanger from dropping when final bolts are removed.)
6- Remove bolts supporting heat exchanger.
7- To install heat exchanger, reverse procedure. Be sure to secure all wires and check plumbing and burner plate for airtight seal. Bolts must be torqued to 35 in-lbs. to ensure proper operation.

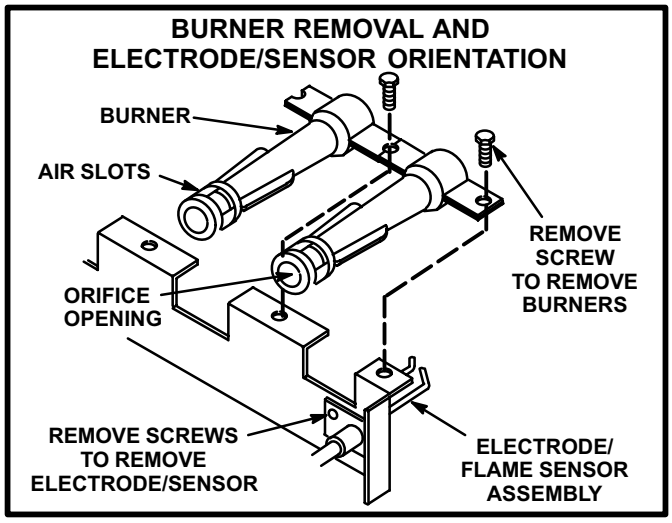


FIGURE 23

J-Ignition (Burner) Control A3

Ignition control A3 is factory set and is not adjustable. The control makes three attempts at ignition and then locks out the system if ignition is not obtained after the third trial. Reset after lockout requires only breaking and remaking thermostat demand. The control shuts off gas flow immediately in the event of a gas or power failure. Upon restoration of gas and power, the control will restart the ignition sequence and continue until flame is established or system lockout occurs.

For proper unit operation, the electrodes must be positioned correctly in the flame and must be gapped correctly.

DANGER-SHOCK HAZARD. SPARK RELATED COMPONENTS CONTAIN HIGH VOLTAGE. DISCONNECT POWER BEFORE SERVICING.

WARNING-THE IGNITION CONTROL IS NOT FIELD REPAIRABLE. UNSAFE OPERATION WILL RESULT.

K-Spark Electrode/Flame Sensor Gap

The electrode assembly can be removed for inspection by removing two screws securing the electrode assembly and sliding it out of unit.

Spark gap may be checked with appropriately sized twist drills or feeler gauges. Disconnect power to the unit and remove electrode assembly. The gap should be between 0.094" and 0.156". See figure 24.

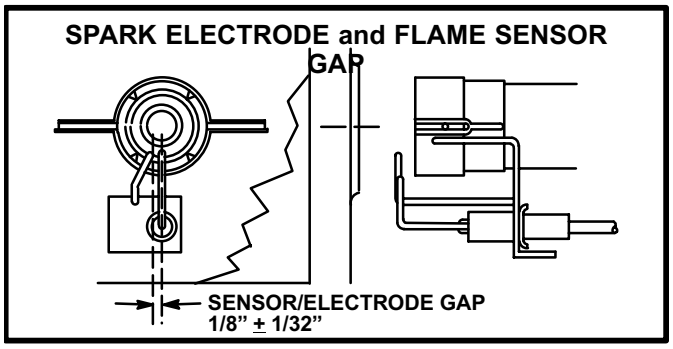


FIGURE 24

DANGER-SHOCK HAZARD. SPARK RELATED COMPONENTS CONTAIN HIGH VOLTAGE. DISCONNECT POWER BEFORE SERVICING.

DANGER-ELECTRODES ARE NOT FIELD ADJUSTABLE. ANY ALTERATIONS TO THE ELECTRODE MAY CREATE A HAZARDOUS CONDITION THAT CAN CAUSE PROPERTY DAMAGE OR PERSONAL INJURY.

L-Flame Sensing

Flame current is an electrical current which passes from the ignition control through the sensor electrode during unit operation. The current passes from the sensor through the flame to ground electrode to complete a safety circuit. The minimum flame current necessary to keep the ignitor from lockout is 5 microamps. The electrodes should be located so the tips are at least 1/2" inside the flame envelope. Do not bend electrodes. To measure flame current, follow the procedure below:

1- Disconnect power to unit.

2- Remove lead from sensing electrode and install a 0-50DC microamp meter in series between the sensing electrode and the sensing lead.

3- Reconnect power and adjust thermostat for heating demand.

4- When flame is established, meter reading should be 8 to 20 microamps. Do not bend electrodes.

5- When finished, disconnect power to unit before disconnecting meter. Make sure sensor wire is securely reconnected before reconnecting power to unit.

NOTE-If the meter scale reads 0, the leads are reversed. Disconnect power and reconnect leads for proper polarity.

M-Combustion Air Blower B6

The combustion air blower and prove switch are factory set and are not field adjustable. However, operation should be monitored to ensure proper operation. The combustion air blower is used to draw fresh air into the combustion chamber while simultaneously expelling exhaust gases. The blower operates throughout the heating cycle. On a heating demand, the combustion air blower immediately energizes but the ignition control circuit does not. Once the combustion air blower is energized, the combustion air prove switch closes to energize the ignition control. The ignition control then begins attempting ignition after 30-40 seconds.

If the combustion air blower does not reach full speed the prove switch will not close and the ignition control will not energize. The unit will remain locked out until the problem is found and corrected.

IX-INDOOR BLOWER OPERATION / ADJUSTMENT

A-Blower Operation

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

1- Blower operation is dependent on the thermostat control system option that has been installed in the GCS16. Refer to the operation sequence for the control system installed for detailed descriptions of blower operation.

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 in the "OFF" position. The only exception is immediately after a heating demand until blower control 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).

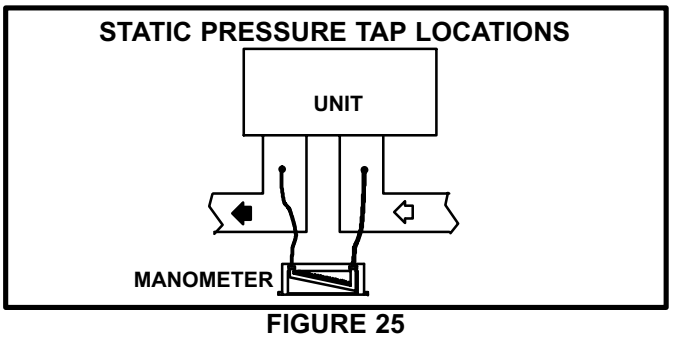


FIGURE 25

To Measure Discharge Static Pressure:

a- Locate taps as shown in figure 25.

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.

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

d- Seal around the hole when the check is complete.

3- Measure the indoor blower wheel RPM (See figure 26).

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 positive or high 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 negative or low pressure side of draft gauge.

4- Turn on blower and compare draft gauge reading to table 12.

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

TABLE 12

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.

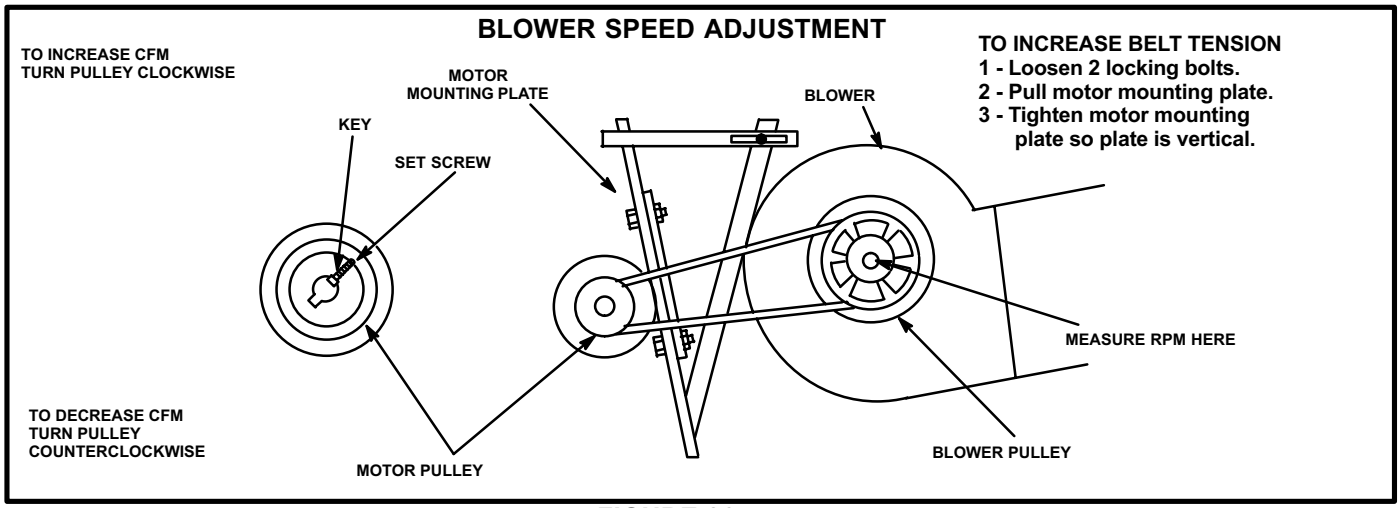


FIGURE 26

Adjusting Unit CFM:

The CFM can be changed by using the following procedure.

1- Remove the blower belt.

2- Loosen the set screws on motor pulley and remove key as shown in figure 26.

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.

X-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 CONTACTS WITH SHARP METALLIC EDGES WHICH MAY CAUSE INJURY.

A-Lubrication

All motors used in GCS16-1853 units are prelubricated; no further lubrication is required.

B-Filters (Figure 27)

GCS16 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. Take note of the "AIR FLOW DIRECTION" marking on the filter frame when reinstalling.

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

GCS16-1853 RETURN AIR FILTERS

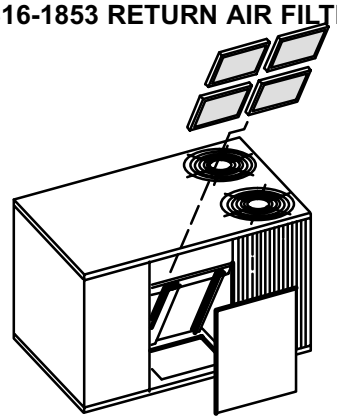


FIGURE 27

C-Heat Exchanger

Periodically check heat exchanger (once every two heating seasons). Remove unit side panel adjacent to heat exchanger. Inspect heat exchanger tubes, connections and supports for cracks or signs of deterioration. Heat exchanger *must* be replaced if cracks or holes are found.

D-Burner

1- Periodically examine burner flames for proper appearance during the heating season. Use inspection port in the front of the burner compartment access panel.

2- Before each heating season examine the burners for any deposits or blockage which may have occurred.

3- Clean burner as follows:

a- Turn off both electrical power and gas supply to unit.

b- Remove the access panel to the burner compartment.

c- Remove burner mounting screws and lift burner from orifice.

d- Clean as necessary. Replace burners and secure with mounting screws. Make sure that burner heads line up correctly. Spark gaps on ignitor and flame sensing electrode must be properly set. Refer to Heating Adjustment section. Replace access panel.

CAUTION-Do not over tighten burner mounting screws. Over tightening will distort burner flame.

e- Restore electrical power and gas supply. Follow lighting instructions attached to unit and use inspection port in access panel to check flames.

E-Combustion Air Blower

All GCS16 units use combustion air blowers with pre-lubricated sealed stainless-steel ball bearings.

The combustion air blower centrifugal switch, S18, checks combustion air blower operation before allowing power to the ignition control. Ignition control will not operate if blower is obstructed.

Under normal operating conditions, the combustion air blower wheel should be checked and cleaned prior to the heating season. However, it should be examined periodically during the heating season to establish an ideal cleaning schedule. With power supply disconnected, the condition of the blower wheel can be determined by looking through the vent opening.

Maintenance consists of:

1- Checking prove switch. Prove switch should close as the combustion air blower approaches full speed.

2- Clean combustion air blower assembly.

Combustion air blower cleaning procedure:

1- Shut off power supply and gas to the unit.

2- Remove four screws retaining vent cap and induced draft blower side panel. Clean vent cap as necessary.

3- Remove three screws holding blower housing to flue box cover plate and four wires attached to motor. Take care not to lose or damage vent screen.

4- Clean blower wheel with a small brush (figure 28) and wipe off any dust from housing. Clean accumulated dust from front of flue box cover.

5- Replace induced draft blower motor by reversing this procedure. It is recommended that the combustion air blower gasket be replaced during reassembly.

6- Clean louvers in combustion air supply (right side of heating access panel below flue vent) using a small brush.

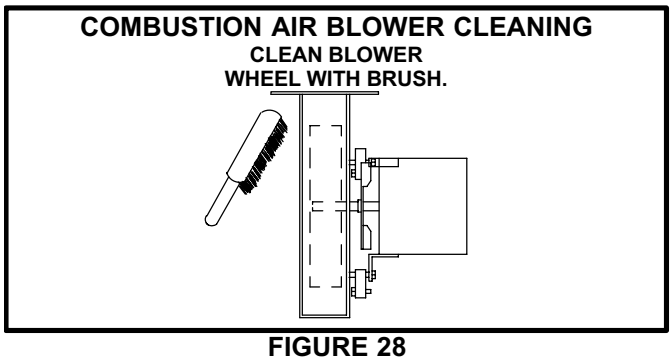


FIGURE 28

F-Flue Passageway and Flue Box

1- Remove combustion air blower assembly as described in section X-E-Combustion Air Blower.

2- Remove flue collector cover and flue collector baffle. Clean with a wire brush as required.

3- Pull tube baffles from heat exchanger and clean tubes with a wire brush.

4- Reinsert tube baffles by gently bending them to lock tab against tube outlets. Reassemble the unit. The flue collector cover gasket and combustion air blower gasket should also be replaced during reassembly.

G-Flue Vent

WARNING - VENT CAP MUST BE INSTALLED WITHOUT MODIFICATION. ANY MODIFICATION TO THE VENT CAP ASSEMBLY OR FAILURE TO INSTALL ASSEMBLY CAN RESULT IN IMPROPER OPERATION AND WILL VOID THE AGA/CGA CERTIFICATION.

CAUTION - DO NOT START OR OPERATE UNIT UNLESS VENT CAP IS IN PLACE.

Periodically make sure the flue vent cap (figure 29) and screen are clean and free of debris.

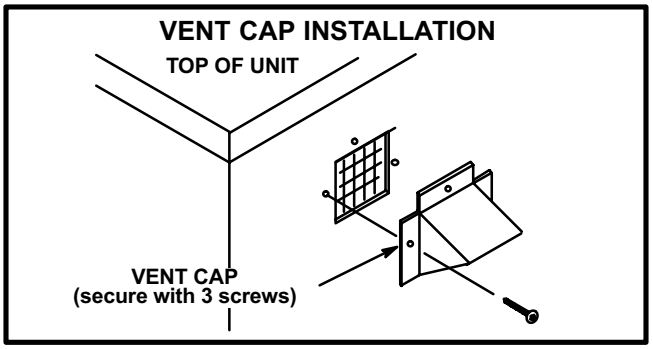


FIGURE 29

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.

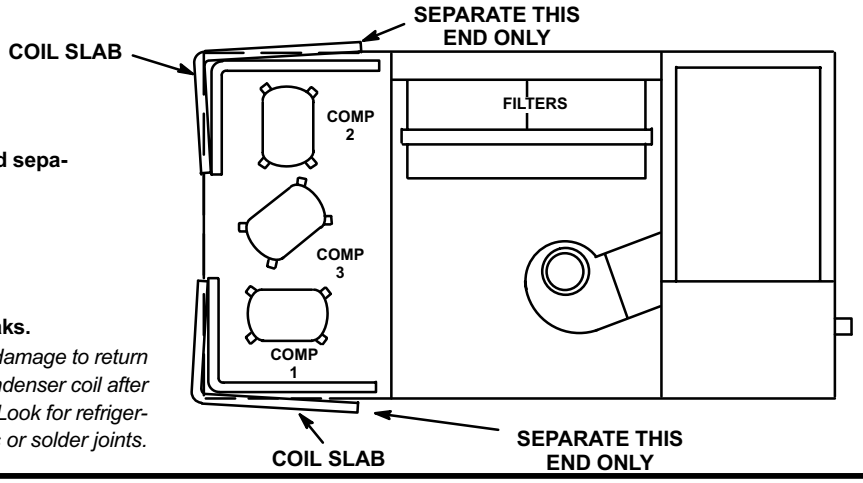


FIGURE 30

H-Evaporator Coil

CAUTION-Disconnect power to unit 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, return air ducts wet. Check connecting lines and coil for evidence of oil leaks.

I-Condenser Coil

CAUTION-Disconnect power to unit before cleaning.

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

Condenser 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 30.

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.

J-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.

K-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____

XI-ELECTRICAL CONNECTIONS

A-Power Supply

Refer to start up directions and refer closely to the unit wiring diagram when servicing. Refer to the unit nameplate for minimum circuit ampacity and maximum fuse size. 208/460/575 volt units are wired with a red wire connecting transformer T1 primary to L1. 230 volt units use an orange wire connecting transformer T1 primary to L1.

B-Field Wiring

Unit field wiring is shown in the unit diagram section of this manual.

XII-ACCESSORIES

This section describes the application of most of the optional accessories which can be connected to the GCS16. 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 GCS16 unit on a combustible surface for downflow discharge applications, the Lennox RMF16 roof mounting (figure 32) frame is required. Otherwise, the RMF16 is recommended but not required. The GCS16, if not mounted on a flat (roof) surface, MUST be supported under all edges and under the middle of the unit to prevent sagging. The GCS16 MUST be mounted level within 1/16" per linear foot in any direction.

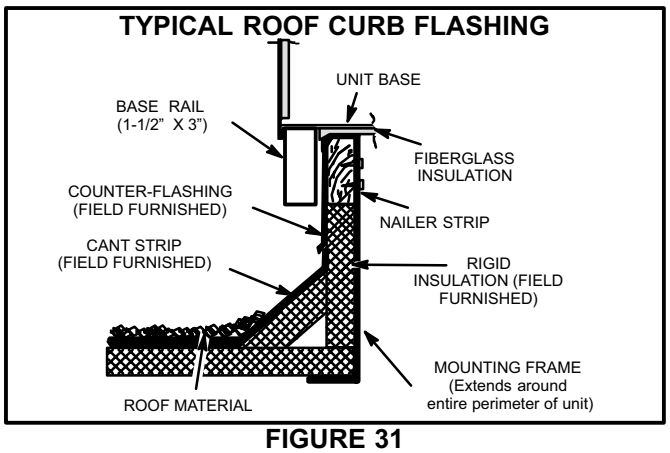


FIGURE 31

The assembled RMF16 mounting frame is shown in figure 32. 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 31. Refer to the RMF16 installation instructions for proper plenum construction and attachment.

B-Economizer

1-Application

REMD16M-185 economizer can be applied directly to GCS16-1853 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 Downflow Economizer

The REMD16M economizer (figure 38) is designed for use with standard (downflow) GCS16-1853 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 (2nd 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.

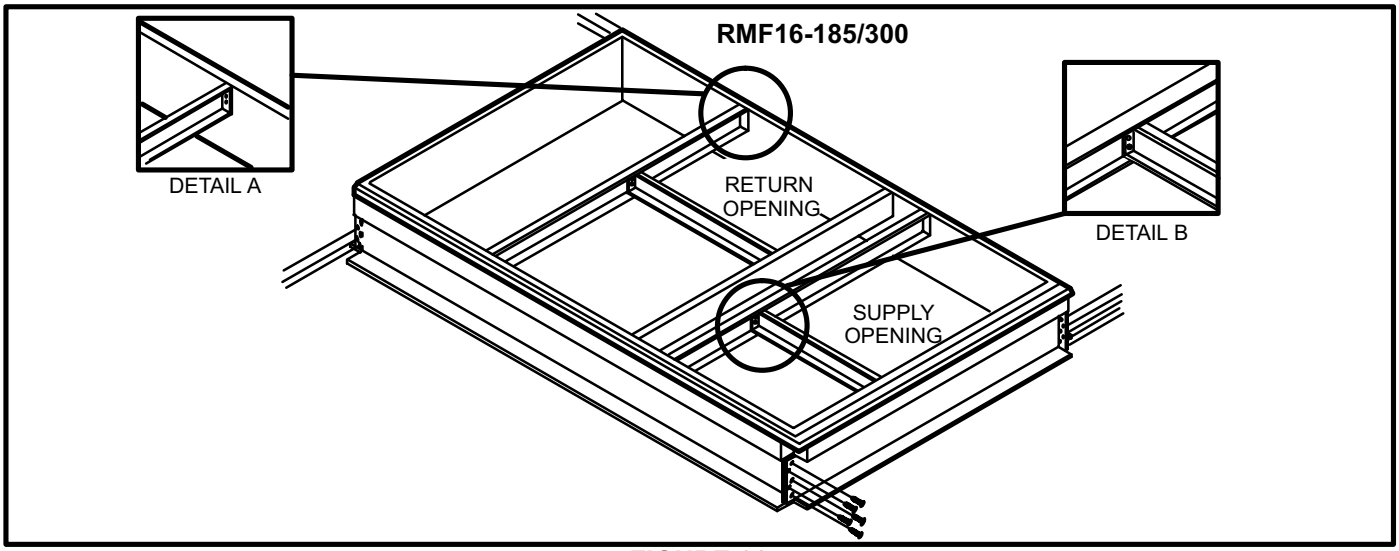


FIGURE 32

Refer to the REMD16-185,-300 Installation Instruction Manual for specific details regarding installation. Refer to the sequence of operation flowcharts (in back of this manual) for detailed operation of the economizer. The sequence of operation flowcharts also describe how the economizer interacts with the GCS16 and the control system being used.

3-Economizer Operation

a-Enthalpy Control: Setpoint Control

The key to economizer operation is the enthalpy control. The enthalpy control senses the total heat content of the outside air (temperature plus humidity) and uses that information to control the amount of outside air brought into the system. When the enthalpy of the outside air drops below the control setpoint and a cooling demand is present, the control actuates a motor which in turn adjusts the outdoor dampers to meet the cooling demands of the building. With the outdoor air dampers open, the indoor blower draws in outdoor air for cooling and the first stage compressors are disabled. When the heat content rises above the control setpoint, the control de-activates and the dampers close to the preset minimum (not closed) position. First stage compressors are switched to handle all first stage cooling.

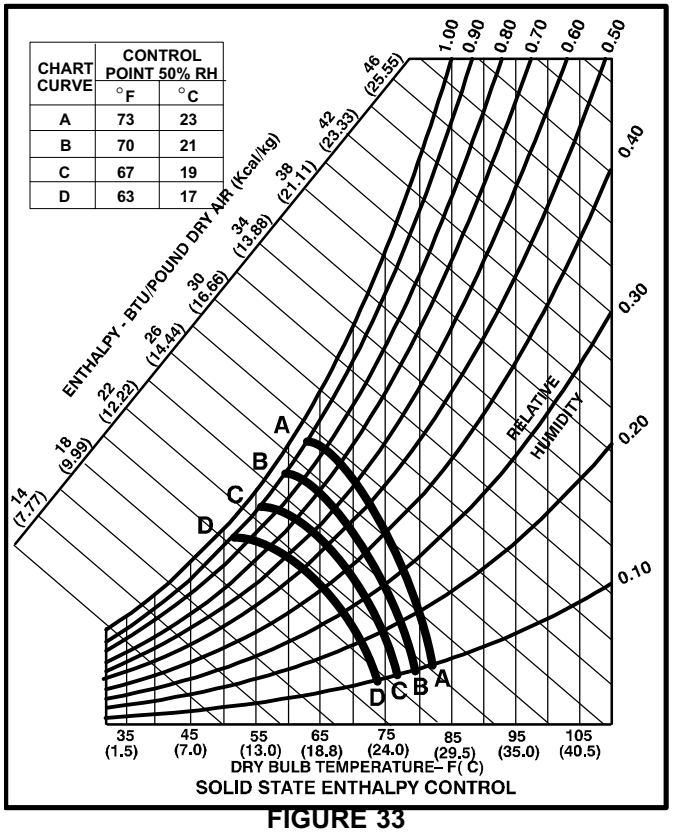


FIGURE 33

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 33.

Example:

If the enthalpy control is set at setpoint "A" as shown in figure 33, 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 unit (blower) operation. When unit operation stops, the dampers drive fully 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 34). 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.

d-Mixed Air Sensor

The sensor measures the resultant temperature of the mixed air downstream from the evaporator coil. The mixed air temperature is measured in the heating compartment (figure 35). The mixed air temper-

ature is used by the enthalpy control when outdoor dampers are open to help determine whether outdoor air dampers should close. 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 35).

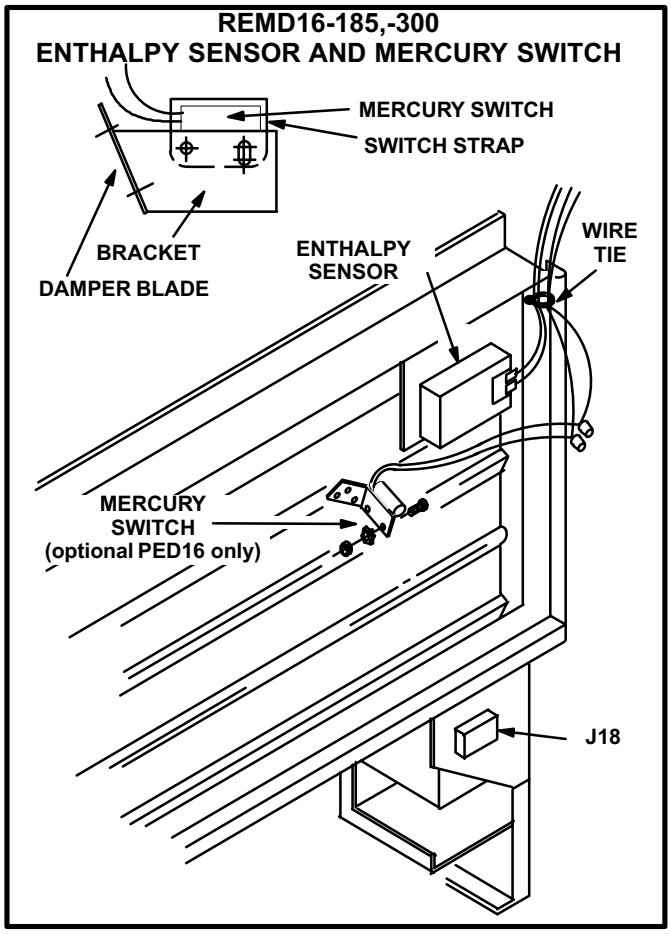


FIGURE 34

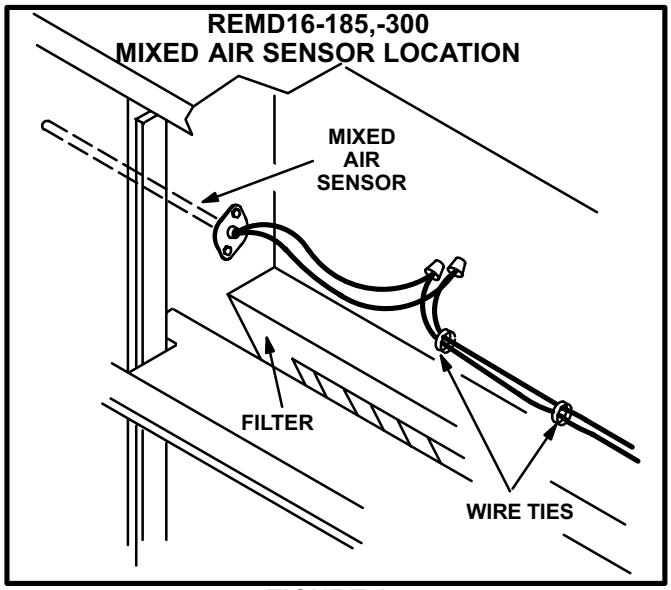


FIGURE 35

e-Wiring, Installation, Maintenance

The economizer uses harness plugs to connect to the GCS16 unit harness connector located in the filter access compartment. Unlike smaller 16 series economizers which are unitary in construction (all one piece), the REMD16-185,-300 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 36 shows economizer control installation and wiring. Figures 37 and 38 show REMD16 installation. Although harness connectors are used to connect the GCS16 to the economizer, the economizer electrically connects to the GCS16 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.

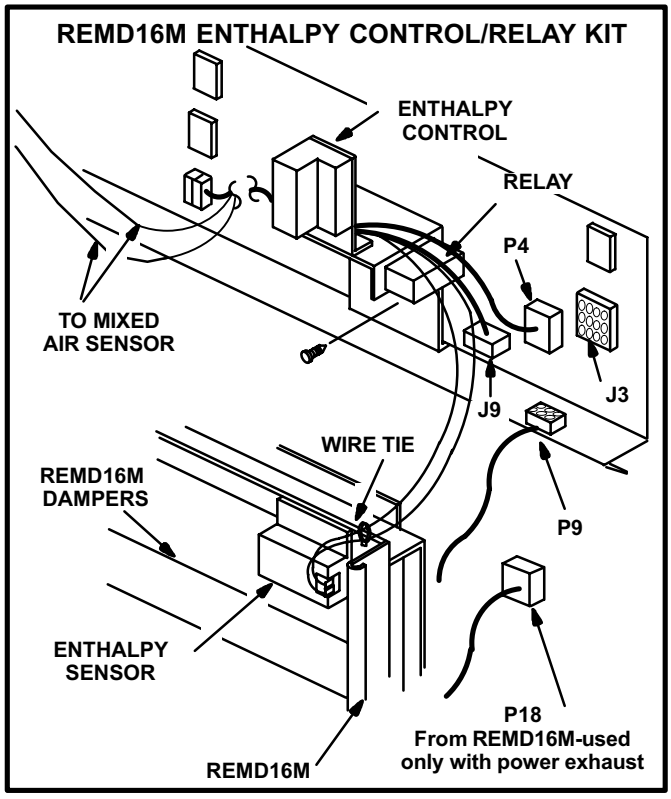


FIGURE 36

Figures 37 and 38 show how an REMD16 is installed in a GCS16 cabinet. For detailed installation and maintenance instructions, refer to the REMD16-185,-300 Installation Instruction Manual.

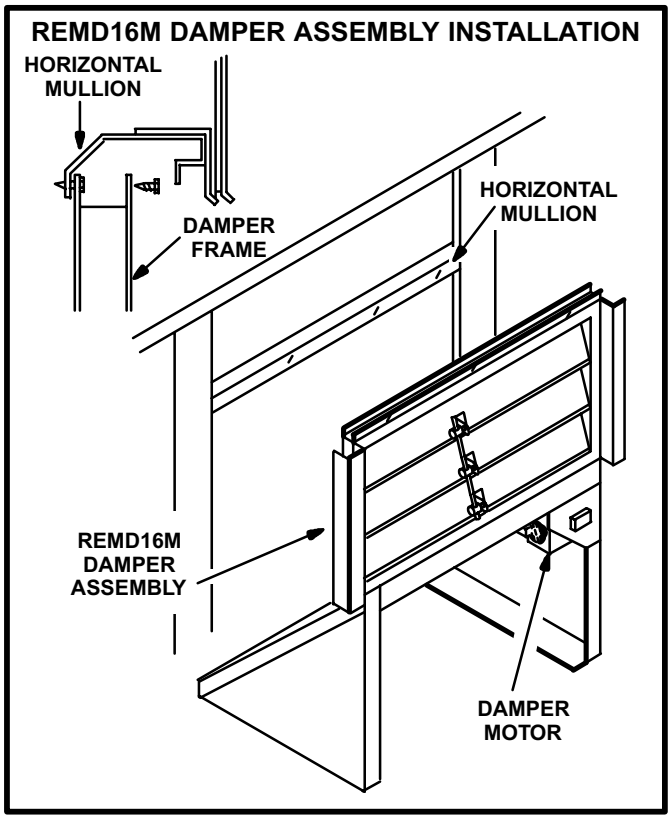


FIGURE 37

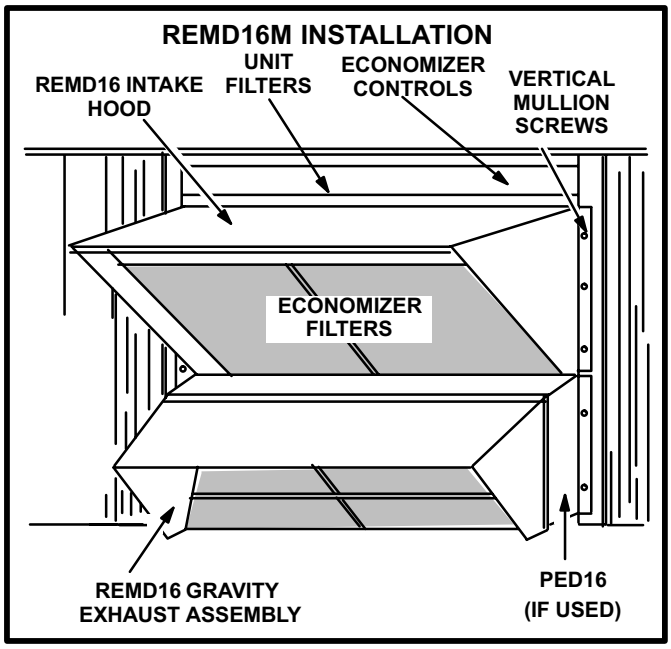


FIGURE 38

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 39 for terminal location.

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 39.

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

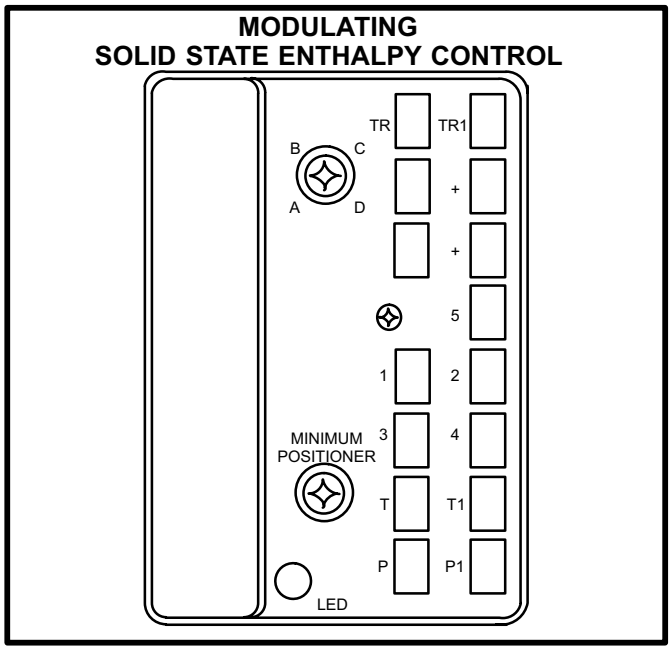


FIGURE 39

g-Warm Up Kit

An optional warm up kit may be added to the REMD16 economizer (except GCS16 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 GCS16 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 38) are used in conjunction with REMD16 economizer to provide forced exhaust of return air. PED16 consists of two fans (figure 40) which install in the return air portion of the economizer and a control kit which installs in the unit filter section.

The PED16 is operated by a relay control kit (figure 42) located in the unit filter access section. A mercury switch located on the damper blades senses economizer operation. As the damper blades open (figure 34) 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 42) and the economizer enthalpy control (figure 36) 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 41.

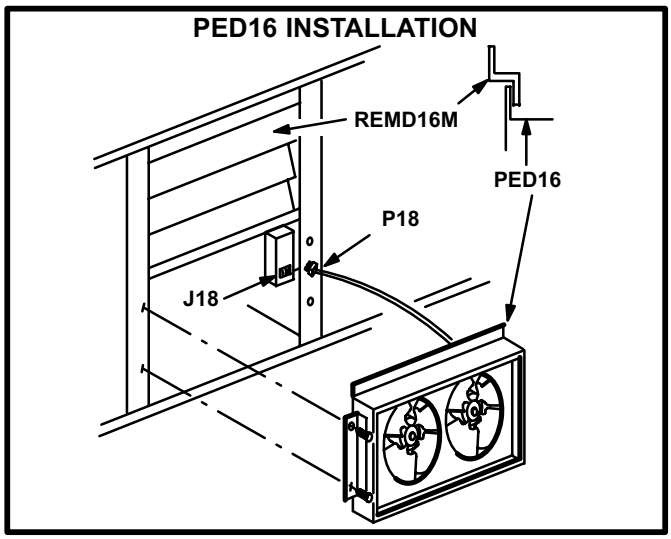


FIGURE 40

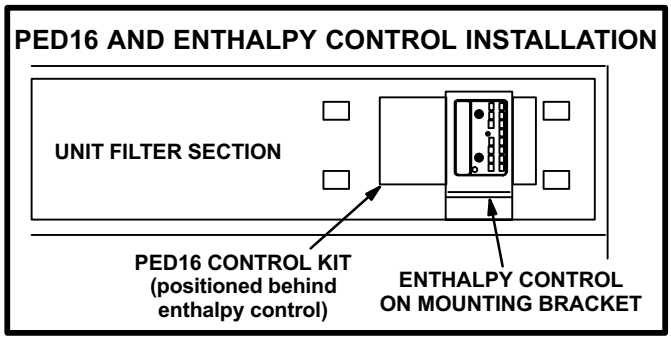


FIGURE 41

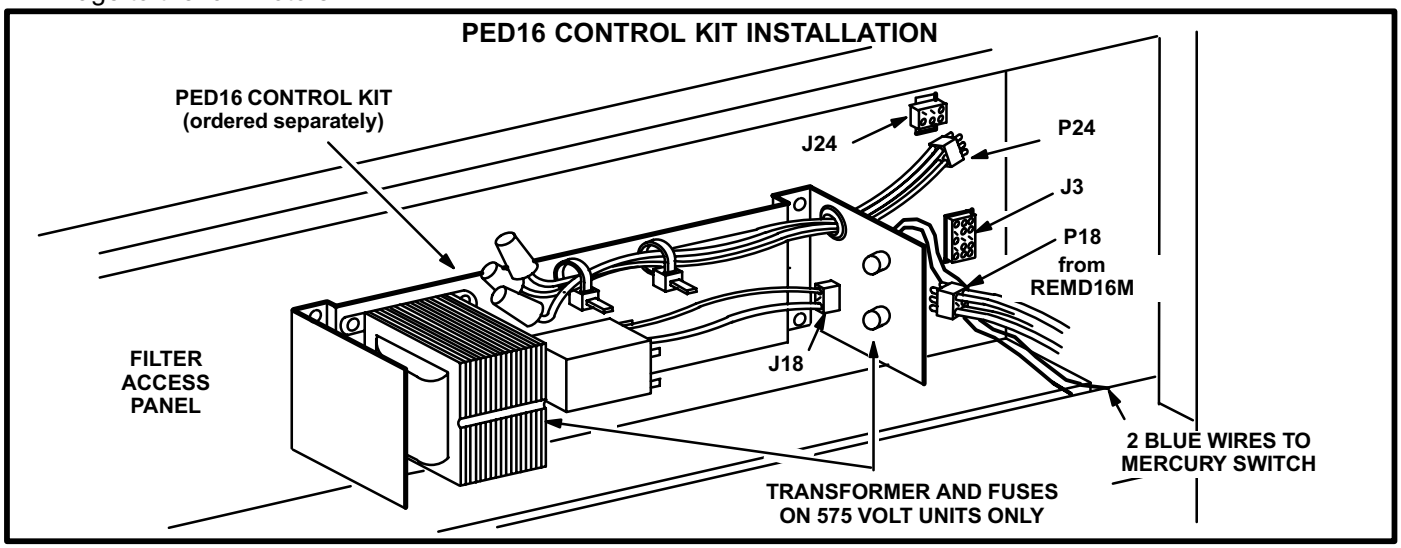


FIGURE 42

C-OAD16 Outdoor Air Damper

The OAD16 outdoor air damper section (figure 43) installs in the GCS16 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 the addition of an electric spring-return three-position damper actuator. Refer to the OAD16 installation instruction manual for specific installation procedure. The 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.

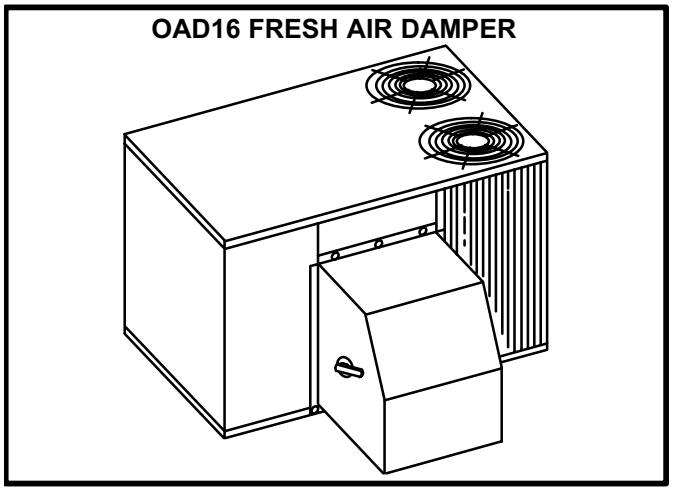


FIGURE 43

D-LPG Kit

All A.G.A rated GCS16 units are factory set for use with Natural Gas. An optional L.P.G. conversion kit allows changeover from Natural to L.P.G. supply. The kit includes a gas valve and orifices all specifically sized to the GCS16.

All C.G.A. rated GCS16 units are *factory* set for use with Natural or L.P. gases. Each unit must be ordered for the type of gas to be used. Field changeover is not allowed.

WARNING - IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE INJURY, PROPERTY DAMAGE OR DEATH. CONSULT A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER FOR INFORMATION OR ASSISTANCE.

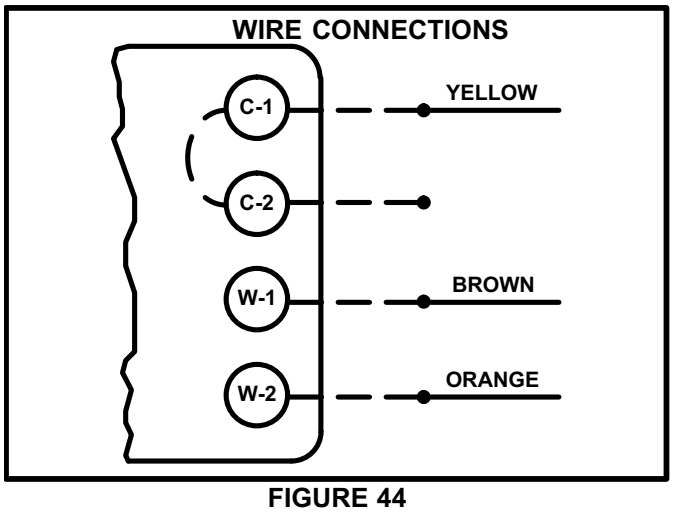


FIGURE 44

IMPORTANT-Carefully check all piping connections for gas leaks. Use a soap solution or other preferred means. Do not use matches, candles, flame, or other sources of ignition to check for gas leaks.

All units which have been changed to L.P.G. operation should be marked with a yellow sticker located near the gas valve.

L.P.G. conversion in all GCS16 units requires that the gas valve and the burner orifices be changed. Figure 44 shows the field wiring of the new gas valve. Figure 45 shows the orifice changeout.

Refer to the L.P.G. Conversion Kit Installation Instruction for specific installation procedures.

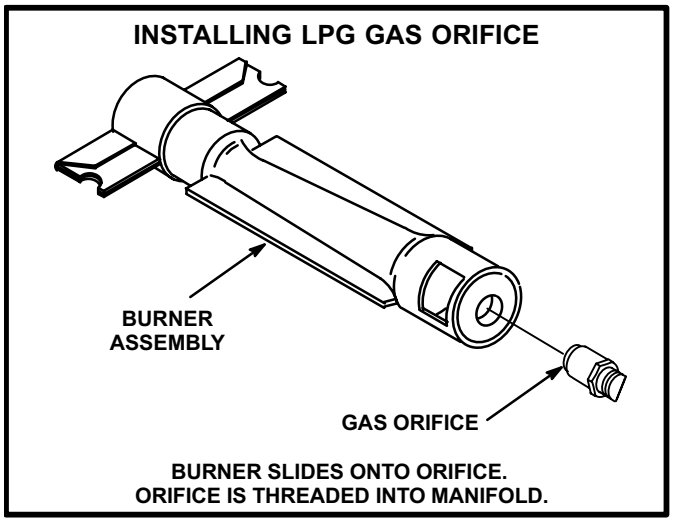


FIGURE 45

E-Timed-Off Control Kit (Figure 46)

Optional field installed timed-off controls prevent the GCS16 compressors from short cycling. GCS16-1853 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 46. 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.

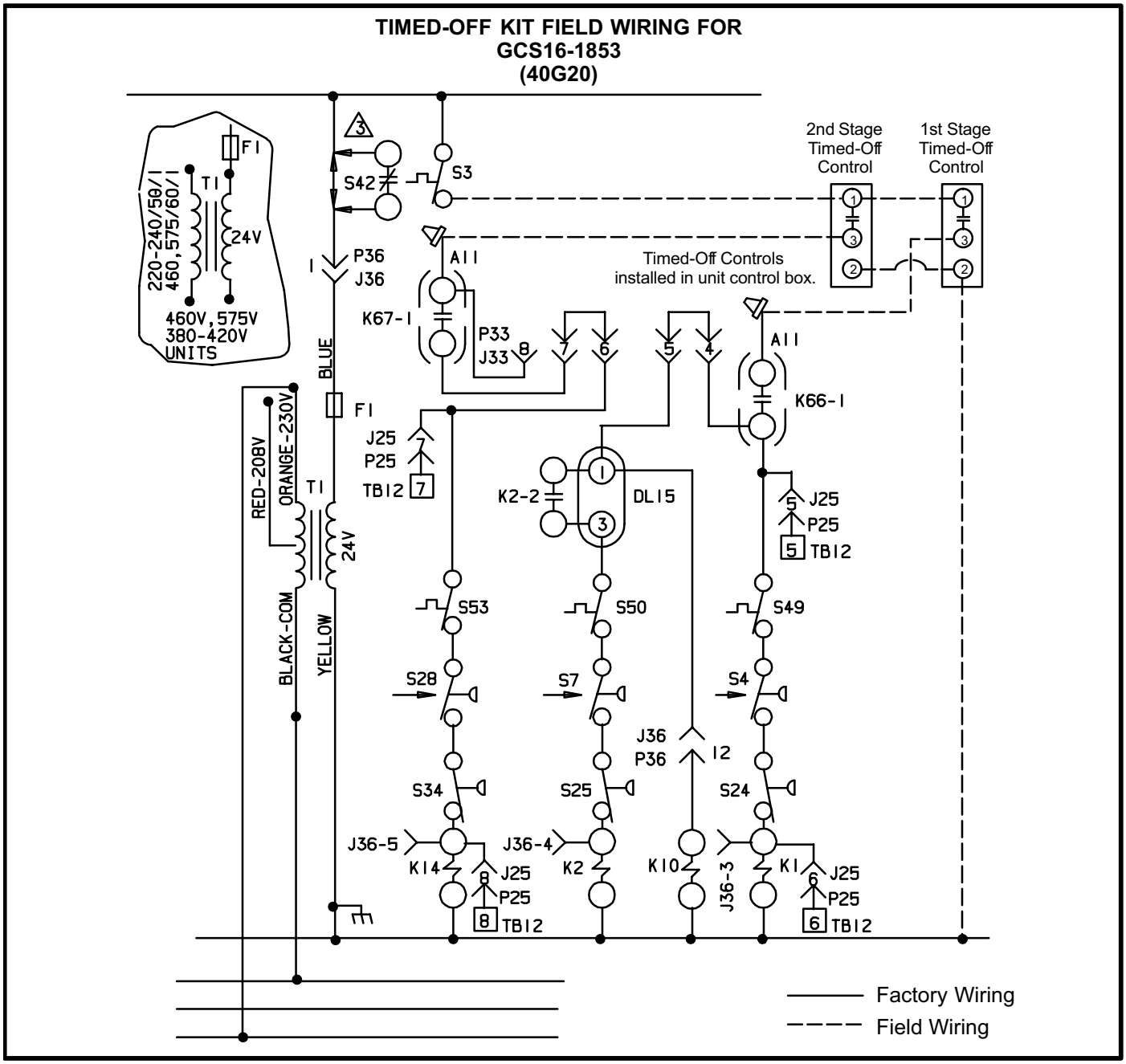


FIGURE 46

F-Low Ambient Kit

The optional low ambient kit (figure 47) allows for mechanical cooling operation at low outdoor temperature. *NOTE-See CAUTION.*

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

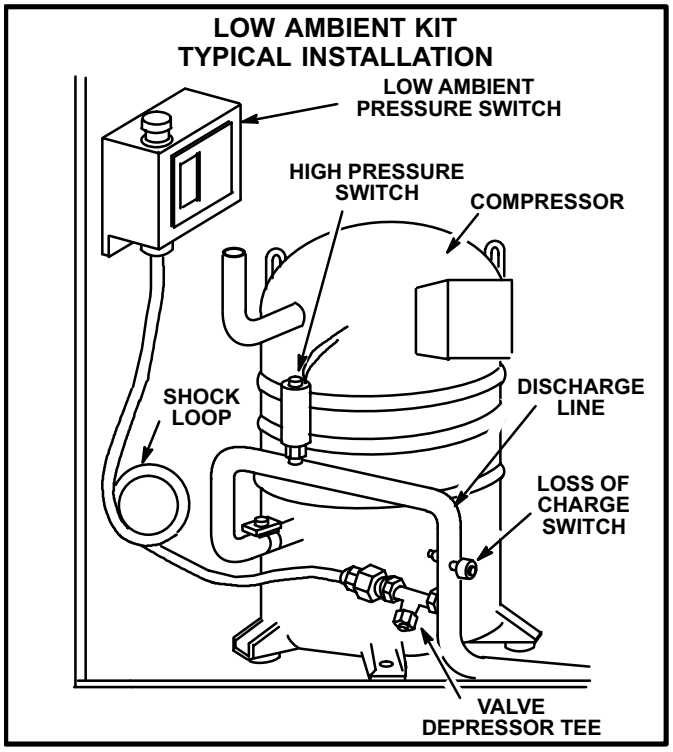


FIGURE 47

Low ambient kit field wiring is shown in figure 49. The low ambient pressure switch is installed on an inside mullion inside the compressor compartment and is wired in series with the condenser fan contactor coil. The low ambient thermostat is also installed in the compressor compartment and is wired in series with the 2nd stage contactor coil. Refer to the low ambient kit installation instruction manual for detailed installation procedures.

Operation:

The low ambient pressure switch monitors 1st stage compressor discharge pressure and cycles the condenser fans when discharge pressure drops below a predetermined setpoint. The cycling fan raises the condensing temperature (for all compressors operating). The increased condensing temperature reduces capacity and keeps evaporating temperatures above freezing

The low ambient thermostat monitors temperature of air inside unit compressor compartment and de-energizes the 2nd stage compressor when temperature drops below a predetermined setpoint.

Pressure Switch Adjustment:

The low ambient pressure switch is adjustable but the adjustment knob *does not* adjust CUT-IN point. CUT-IN point is fixed and cannot be adjusted. The scale on the switch measures the difference in pressure between preset CUT-IN and adjustable CUT-OUT points. Adjustment knob changes CUT-OUT point (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 48).

DIFFERENCE (set by knob) = CUT-IN POINT (fixed) minus CUT-OUT POINT

To find CUT-OUT point, this equation can be re-arranged:

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.

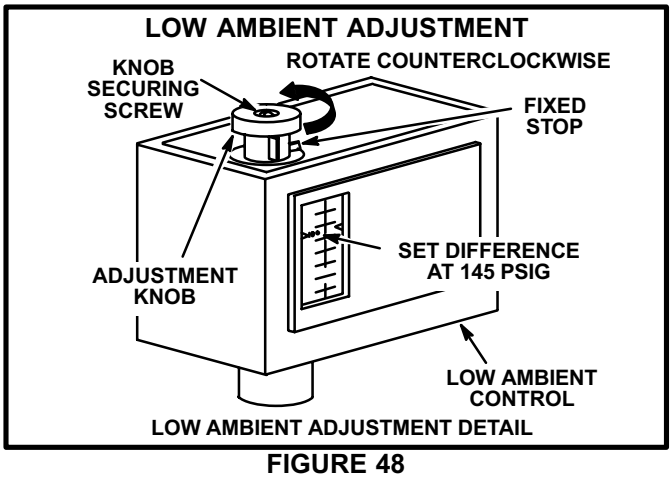


FIGURE 48

LOW AMBIENT THERMOSTAT AND LOW AMBIENT PRESSURE SWITCH FIELD WIRING FOR GCS16-1853 (LB-57113BB)

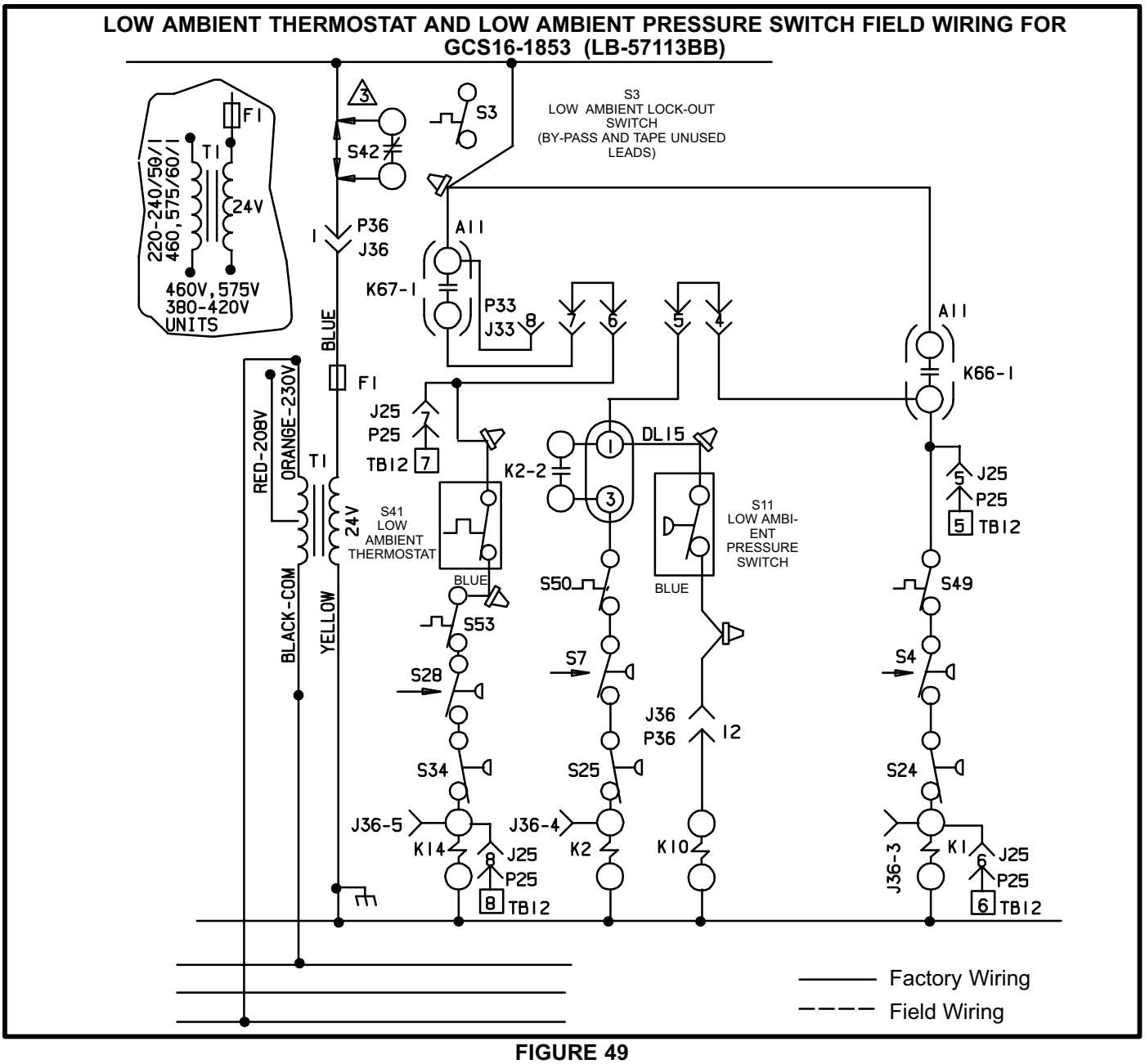


FIGURE 49

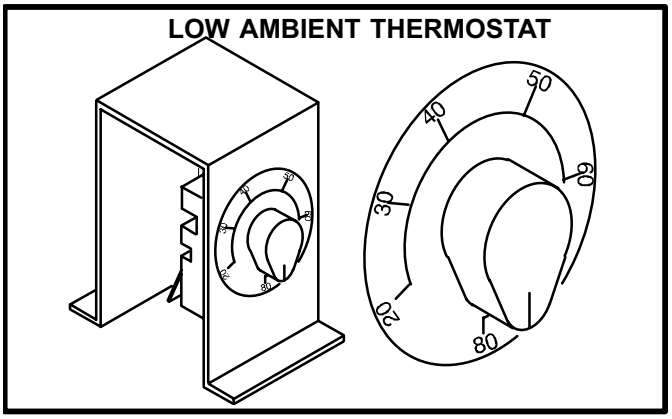


FIGURE 50

Thermostat Adjustment:
Thermostat is adjustable. A setting of 55°F is recommended. See figure 50.

G-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.

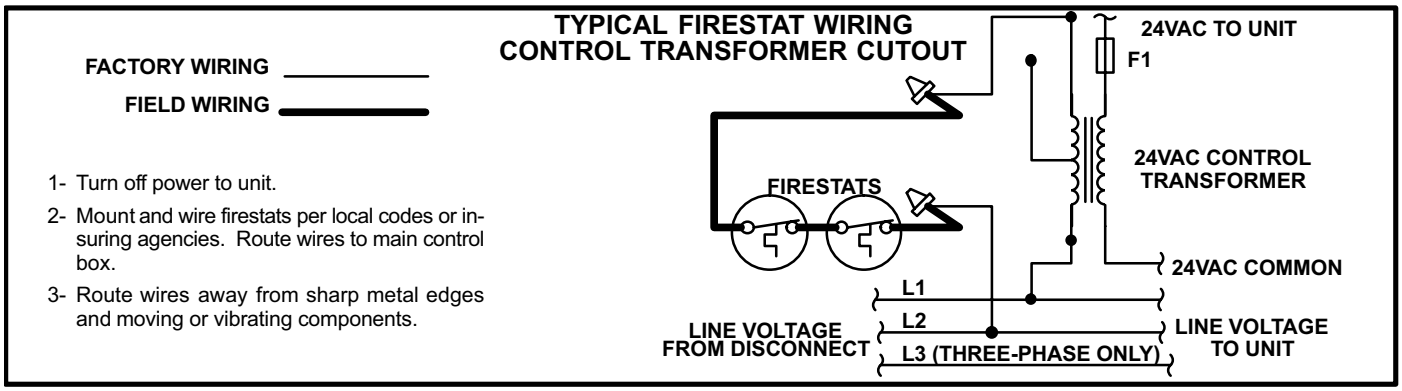


FIGURE 51

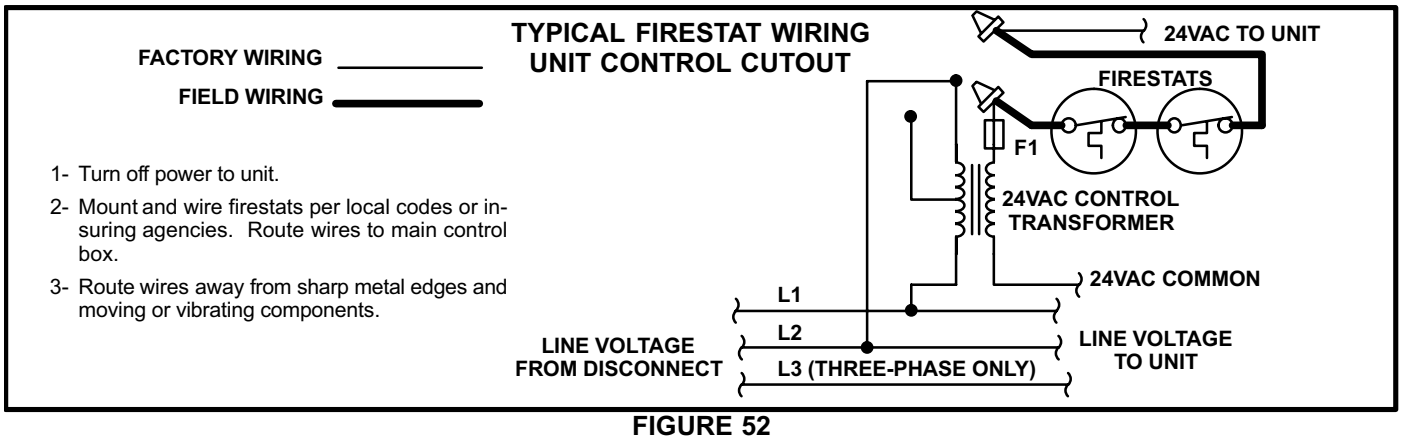


FIGURE 52

Figures 51 and 52 show typical firestat wiring connections. Figure 51 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 52 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.

H-Transitions

Optional supply/return transition SRT16-185 is available for use with GCS16-1853 utilizing the optional RMF16 roof mounting frame. The transition must be installed in the RMF16 mounting frame before mounting the GCS16 to the frame. Refer to the manufacturer's instructions included with the transition for detailed installation procedures.

I-Supply and Return Diffusers

Optional flush mount diffuser/return FD11 and extended mount diffuser/return RTD11 are available for use with the GCS16. Refer to the manufacturer's instructions included with the transition for detailed installation procedures.

J-Status Panels SP11 and SSP11

Optional status panels allow remote monitoring of system operation. Two types of panels are available. The SP11 (figure 53) provides system readout only. The SSP11 switching status panel (figure 54) 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 GCS16 control systems. The following section details status panel applications.

1-SP11 Application

The SP11 can be applied to all GCS16 control systems. To operate an SP11, a readout relay kit is required to interface the GCS16 to the SP11. Optional filter switch kit must be added in order to make the filter light functional.

2-SSP11 Application

The SSP11 can be applied to GCS16 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 re-

quired to interface the GCS16 to the SSP11. An SSP11 relay kit is also required (in addition to the readout relay kit) in units using an electromechanical thermostat.

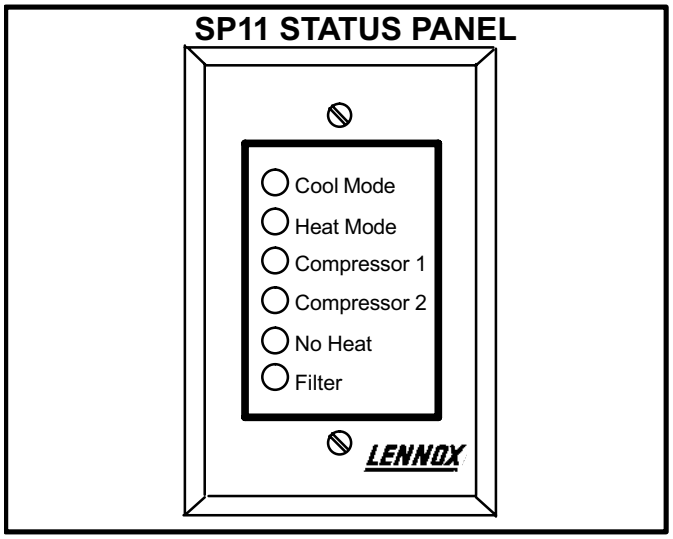


FIGURE 53

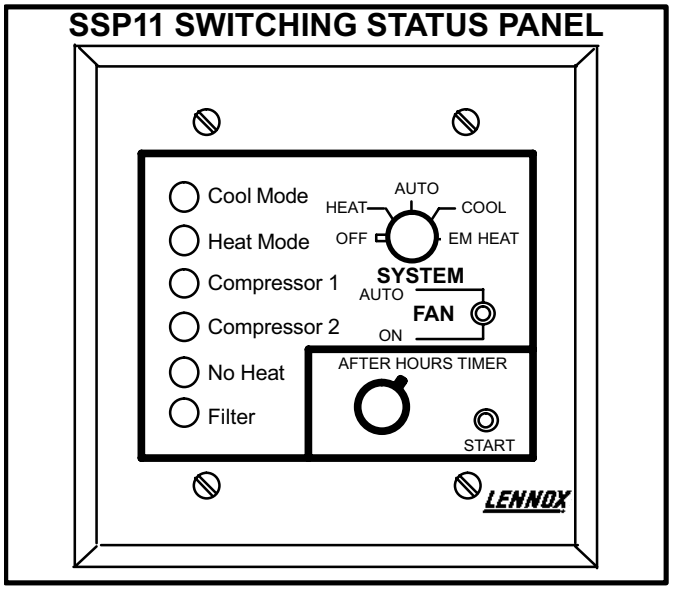


FIGURE 54

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.

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) Not used in GCS16 units, but if placed in this position, the unit operates in the normal heating only mode.

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 55. RRB includes relays which interface the status panels to the unit. Status panels will not operate without the RRB.

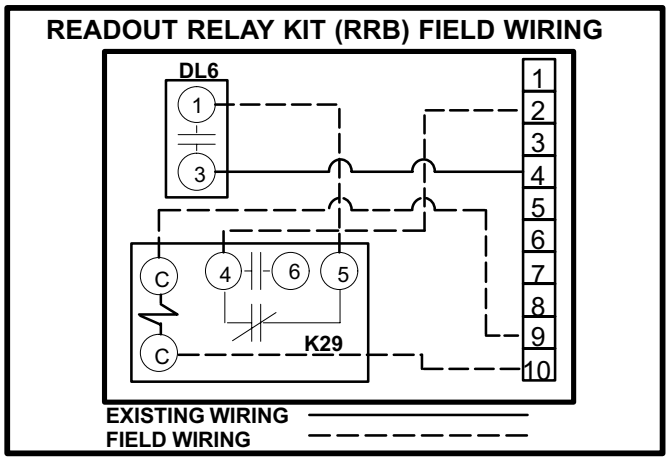


FIGURE 55

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- Delay DL6 begins 60 sec. count before closing.

4- After gas valve GV1 receives power, relay K29 is energized. Contacts K29-1 open and time delay DL6 resets.

5- If the gas valve does not receive power (indicating a problem with the ignition control or the safety circuits) before time delay DL6 finishes its 60 sec. count, time delay contacts close and red “NO HEAT” light is energized.

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

7- 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-To wire an SP11 to a GCS16

1- Disconnect power to the unit.

2- Make electrical connections as shown in figures 57, 58 and 59.

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 56. 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.

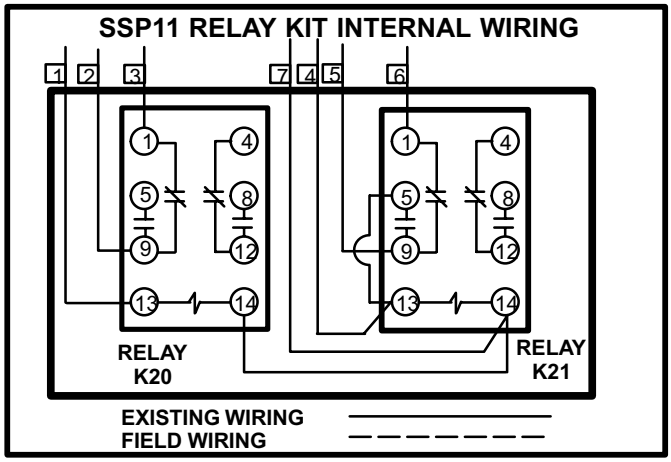


FIGURE 56

d-To wire an SSP11 to a GCS16

1- Disconnect power to the unit.

2- Make electrical connections as shown in figures 60 or 61 for SSP11.

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 62.

SP11 FIELD WIRING
ELECTROMECHANICAL OR
ELECTRONIC THERMOSTATS

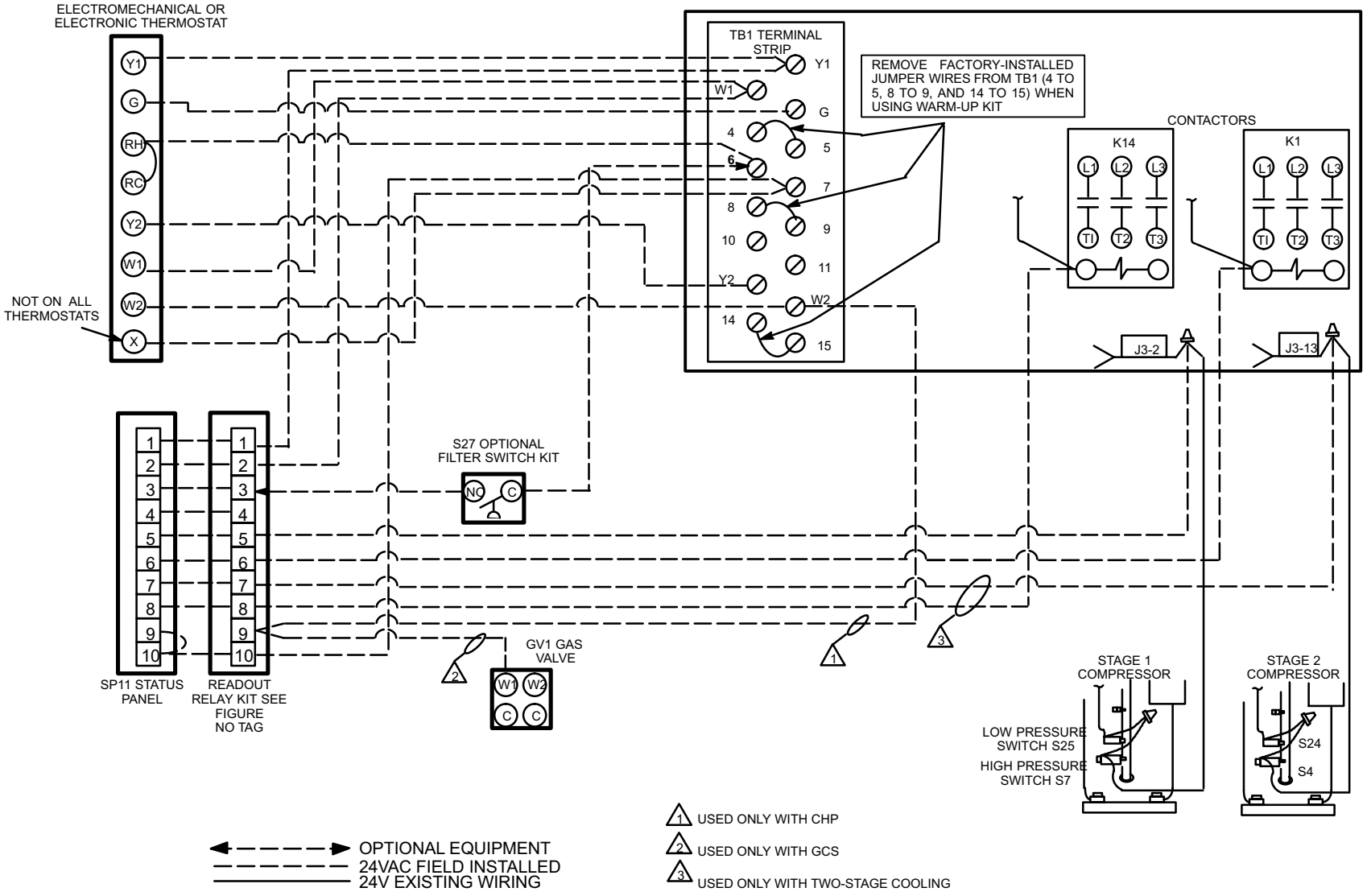


FIGURE 57

SP11 FIELD WIRING W973 CONTROL SYSTEM

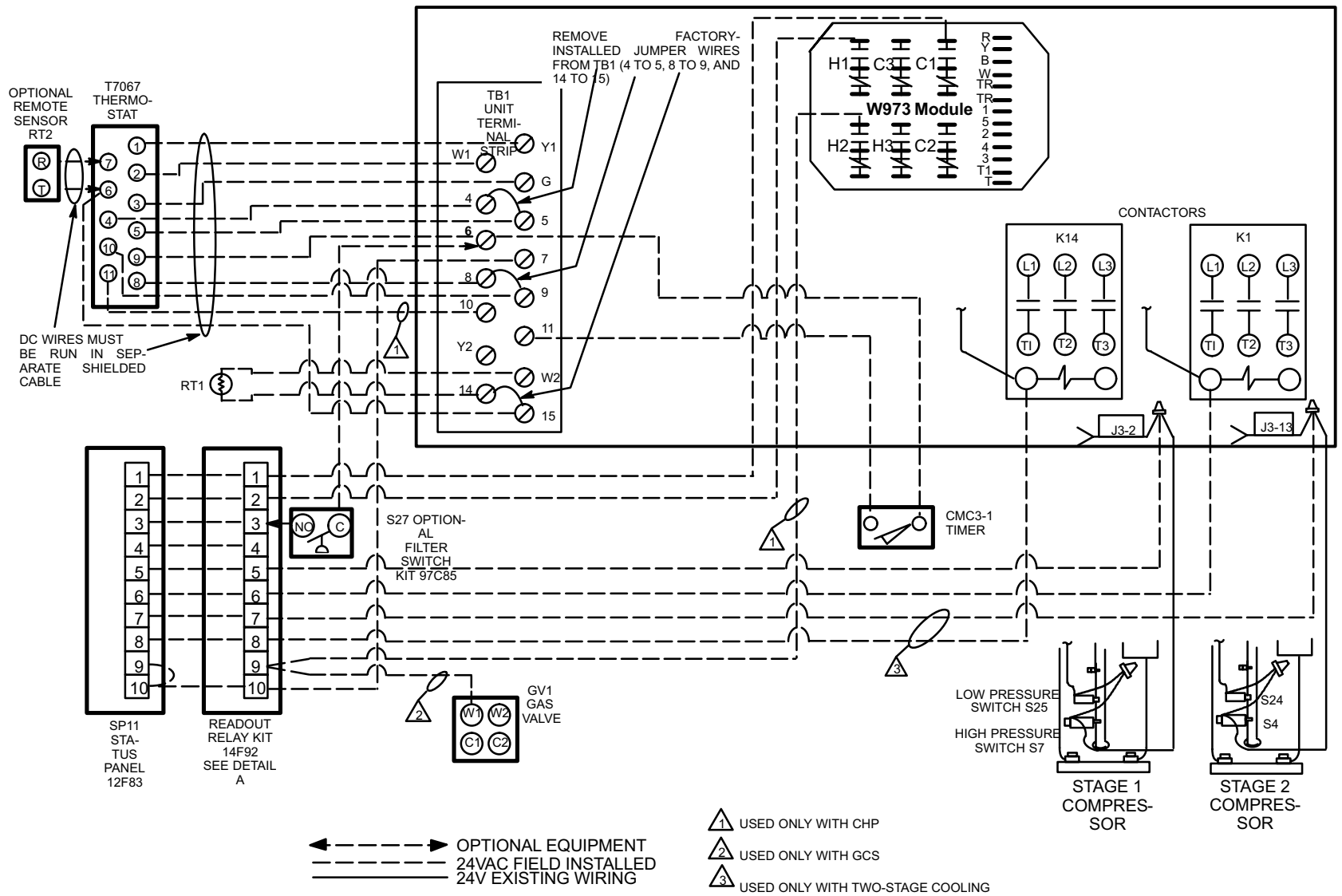


FIGURE 58

SP11 FIELD WIRING
W7400 CONTROL SYSTEM

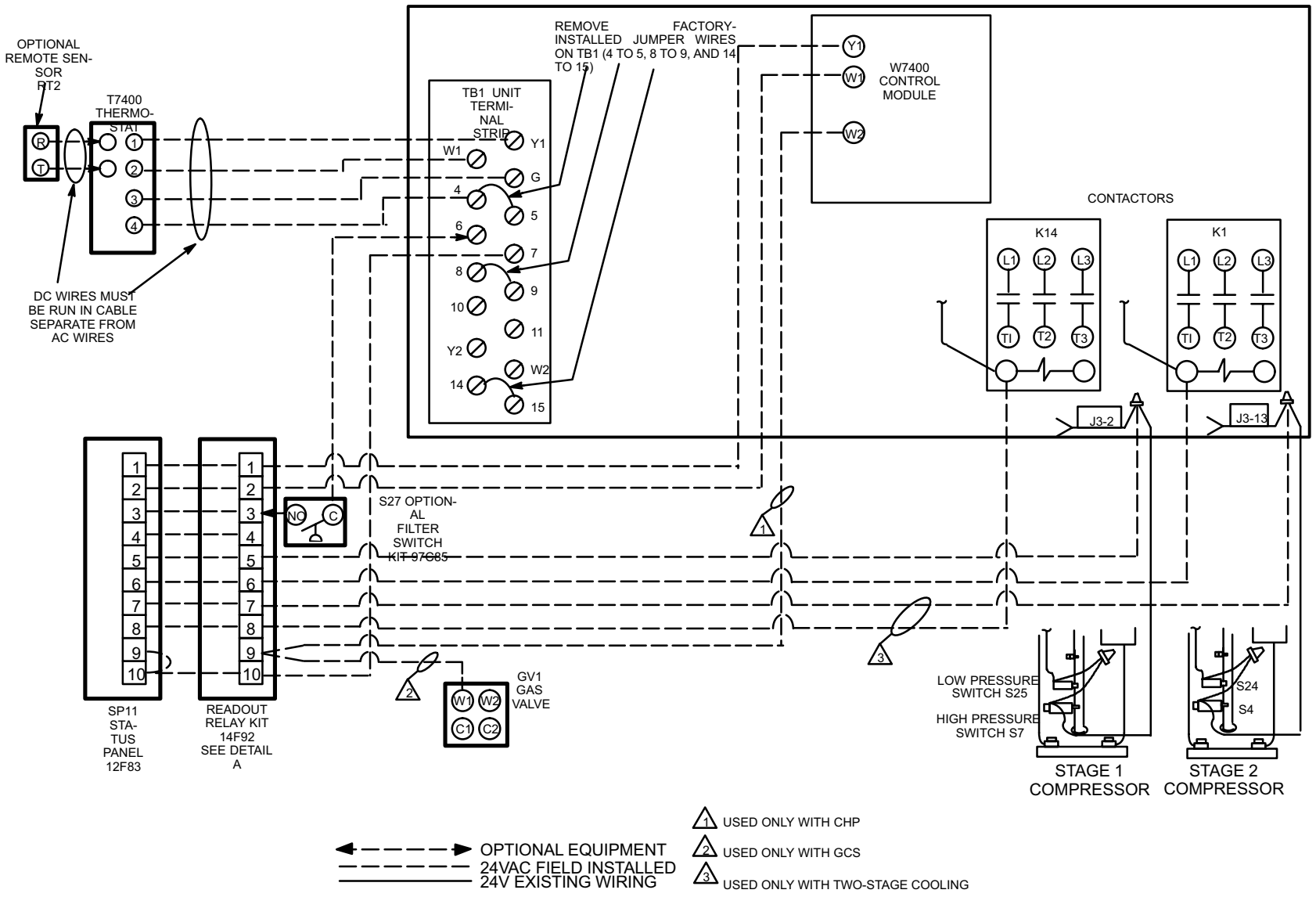


FIGURE 59

SSP11 FIELD WIRING
W973 CONTROL SYSTEM

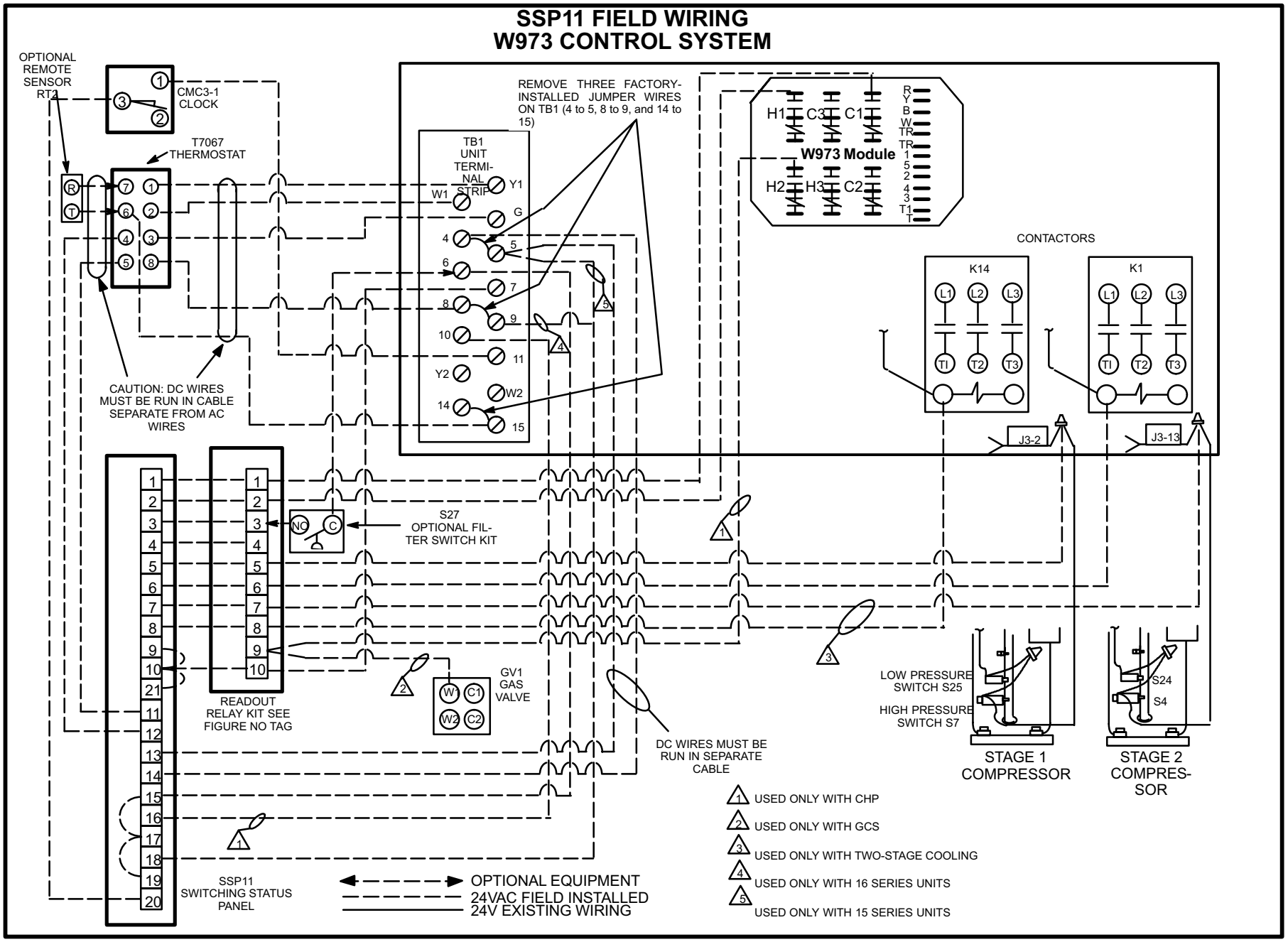


FIGURE 60

SSP11 FIELD WIRING ELECTROMECHANICAL AND ELECTRONIC THERMOSTATS

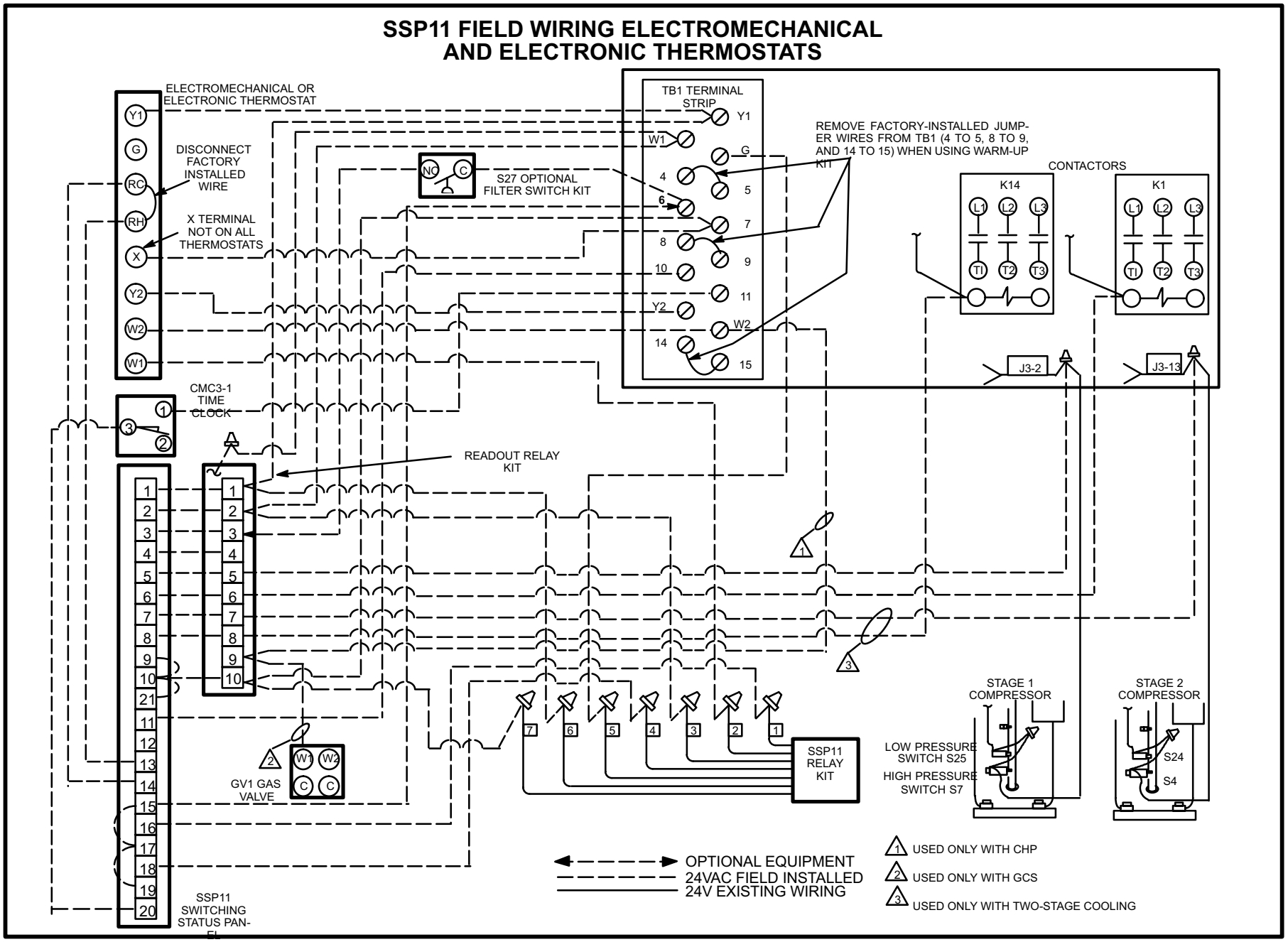


FIGURE 61

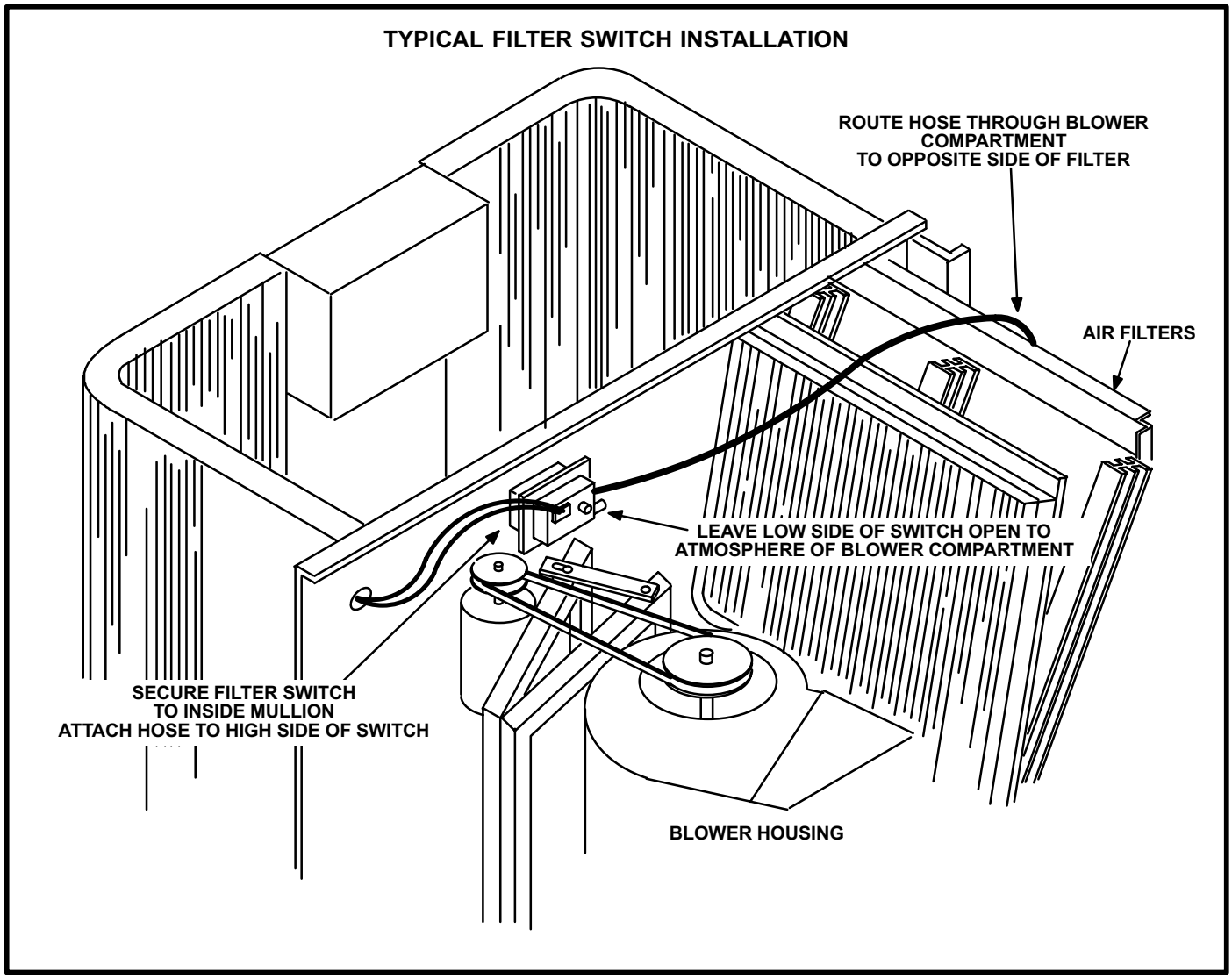

TYPICAL FILTER SWITCH INSTALLATION
ROUTE HOSE THROUGH BLOWER COMPARTMENT TO OPPOSITE SIDE OF FILTER
AIR FILTERS
LEAVE LOW SIDE OF SWITCH OPEN TO ATMOSPHERE OF BLOWER COMPARTMENT
SECURE FILTER SWITCH TO INSIDE MULLION ATTACH HOSE TO HIGH SIDE OF SWITCH
BLOWER HOUSING

FIGURE 62

K-Commercial Controls Hardware

All GCS16-1853 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 63) 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 63) with a slot screwdriver. The quarter-turn fasteners hold the access door shut with a spiral spring as shown in figure 64.

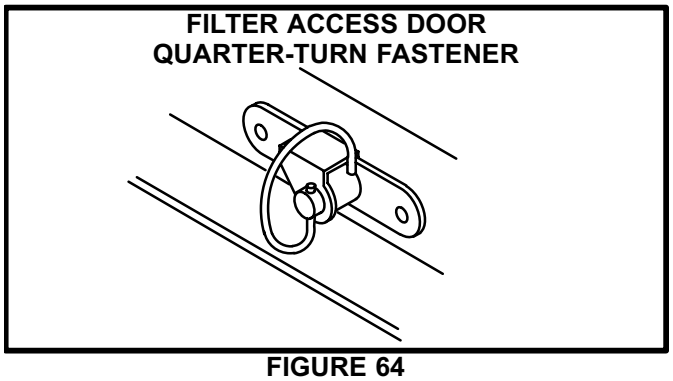


FIGURE 64

L-Optional Commercial Controls Systems

Optional "16 Series Commercial Controls" may be connected to all GCS16-1853 units. These are the same controls which are optional in all other size GCS16 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 GCS16 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 the control system 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 GCS16 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 65. 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.

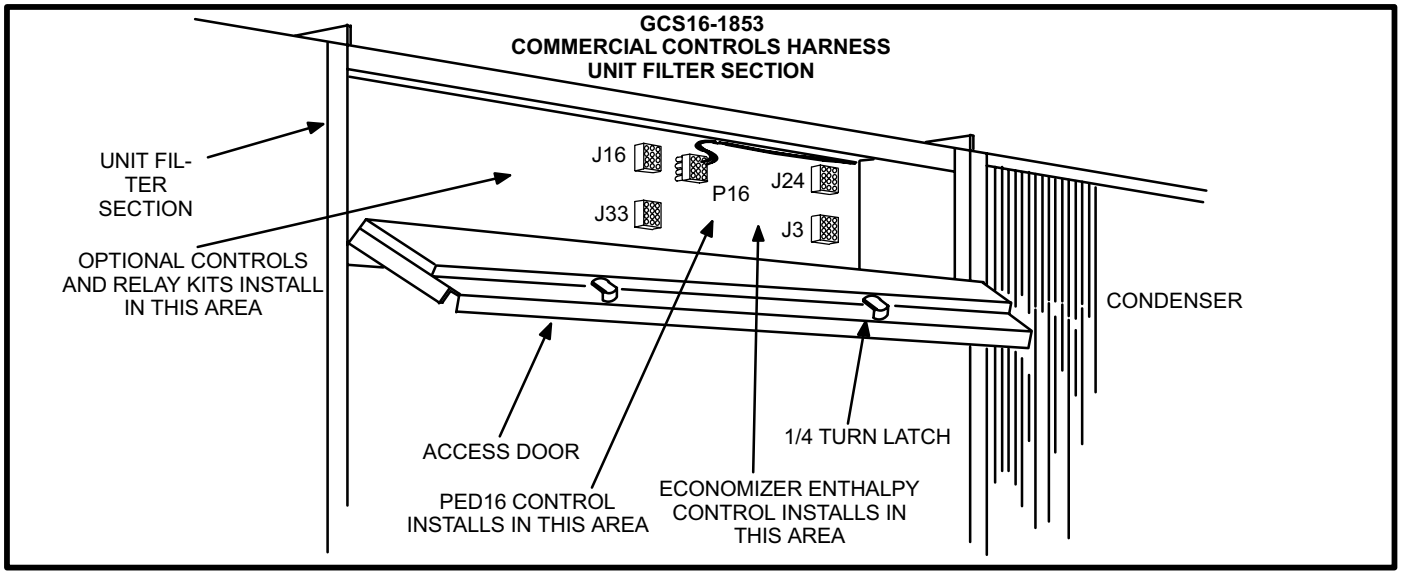


FIGURE 63

Some of the following optional thermostat control systems have built-in warm up capabilities and the warm up kit shown in figure 65 cannot be added due to wiring incompatibility.

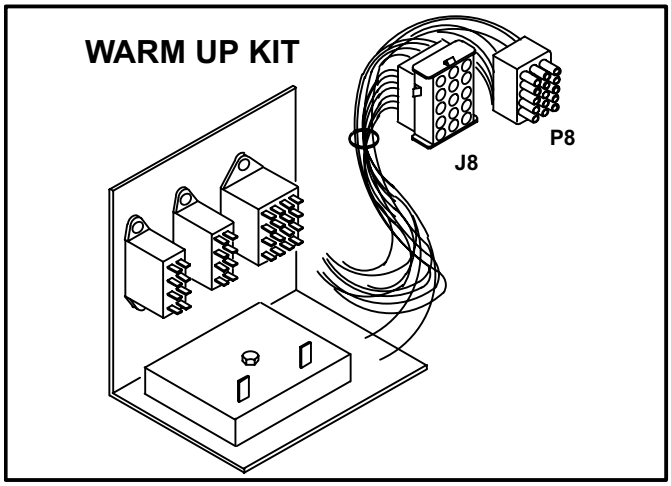


FIGURE 65

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

4- *C2-1 Wiring Diagram*
Standard 2heat/2cool thermostat for all commercial 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.

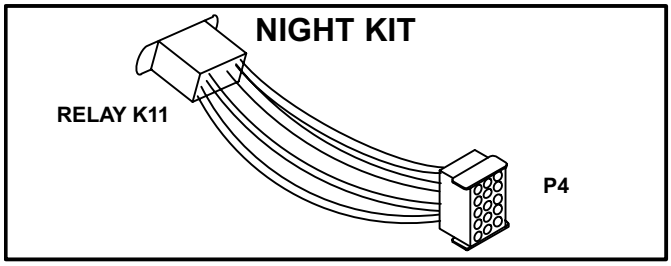


FIGURE 66

5- C11-1 *Wiring Diagram*
Standard 2heat/2cool thermostat for all commercial units without economizer or warm-up. C11 Night Kit adds a relay facilitating night setback function (see figure 66). CMC3-1 clock and night thermostat must also be added to make setback relay functional.

NOTE - Flexstat (C3 and C4 diagrams) was discontinued as a control system option in July 1989 and is not shown in the GCS16-1853. However, Flexstat remains a valid matchup to commercial GCS16 units of all sizes until inventories are depleted. You may find some GCS16-1853 units using it.

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

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

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

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

10- *C7-3 Wiring Diagram*
W7400 control system for commercial units. See figure 67. Requires W7400 relay kit and economizer. Warm up and setback are built in.

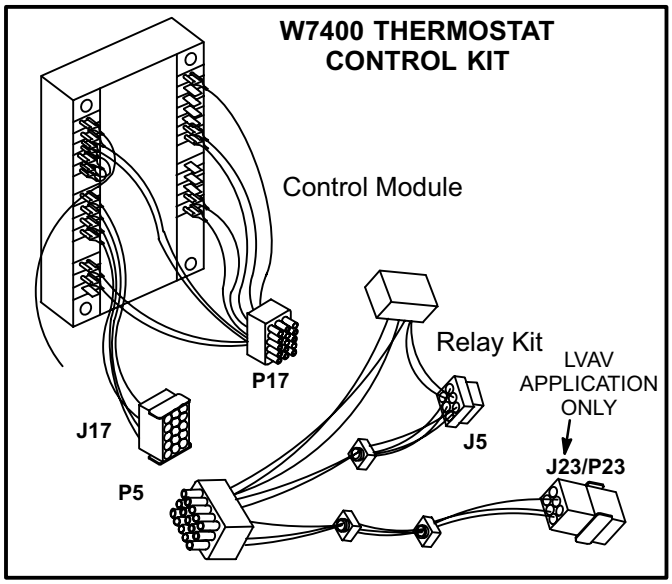


FIGURE 67

11- *C8-1 Wiring Diagram*
W973 control system for commercial units without economizer or warm-up. See figure 68. Requires W973 relay kit. Also requires CMC3-1 clock for night setback.

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

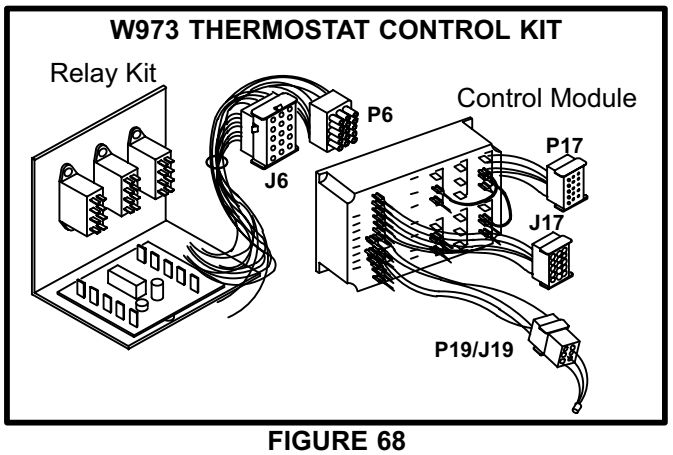


FIGURE 68

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

14- *C12-2 Wiring Diagram*
T7300 electronic thermostat for commercial 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 GCS16 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.*

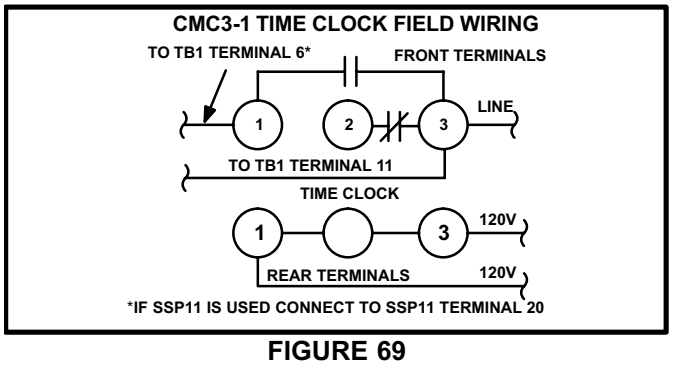


FIGURE 69

Wiring connections should be made to N.O. terminal 1 and 3 (see figure 69). 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.

XIII-COMMERCIAL CONTROLS INSTALLATION OF PLUG-IN KITS

The commercial controls harness allows optional commercial controls and economizer to "plug in" to the GCS16 so field wiring is minimized. Figure 63 shows the commercial controls harness which is located in the GCS16 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 GCS16 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 70). Jumper-plug P3 is removed and discarded. Night kit harness plug P4 connects directly into economizer harness jack J3.

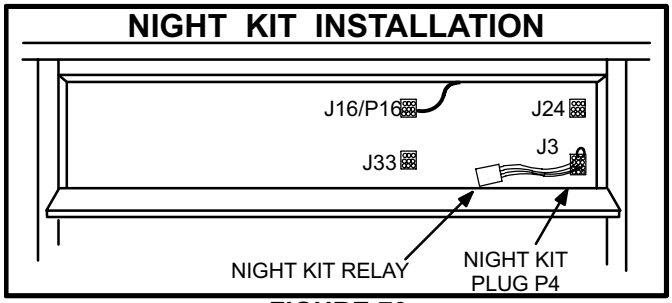


FIGURE 70

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 GCS16, 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 71). 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 72). 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.

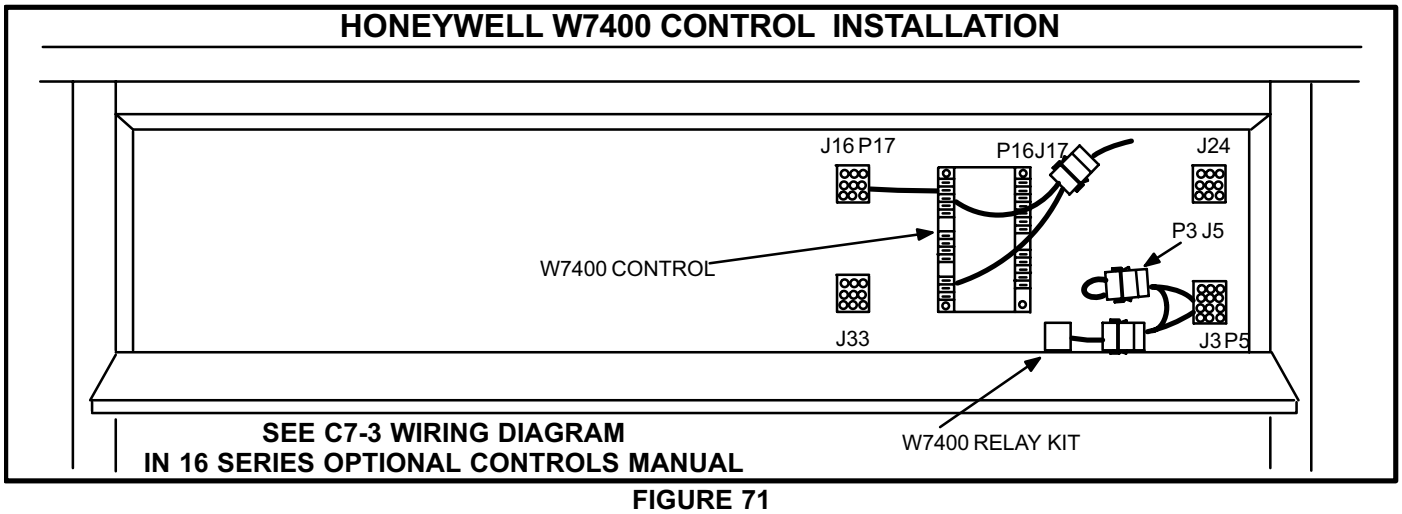


FIGURE 71

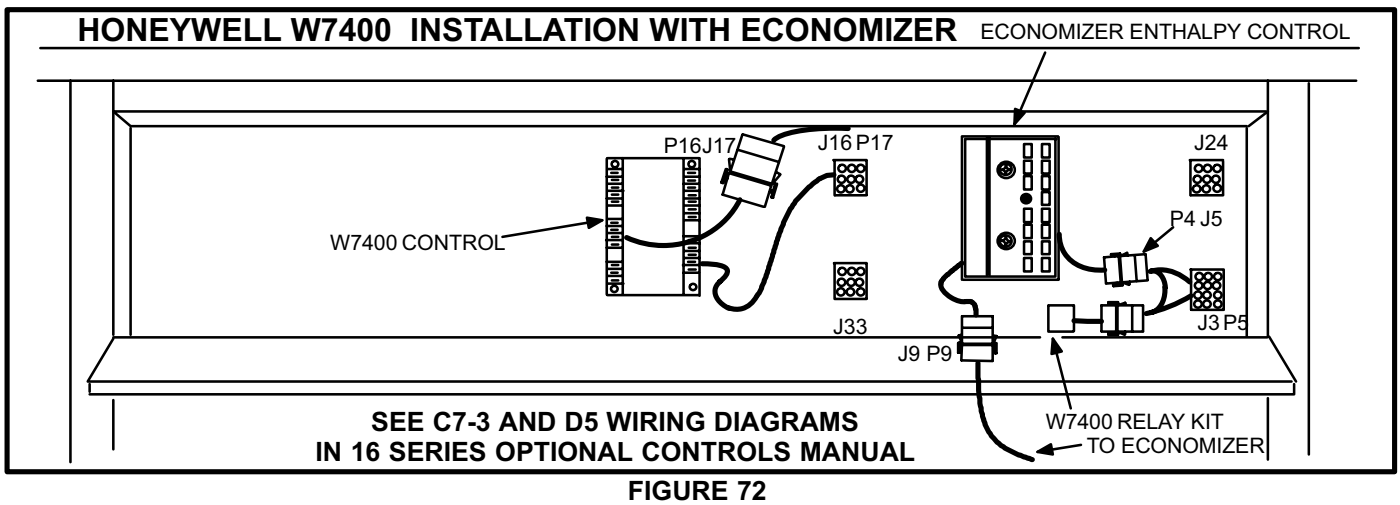


FIGURE 72

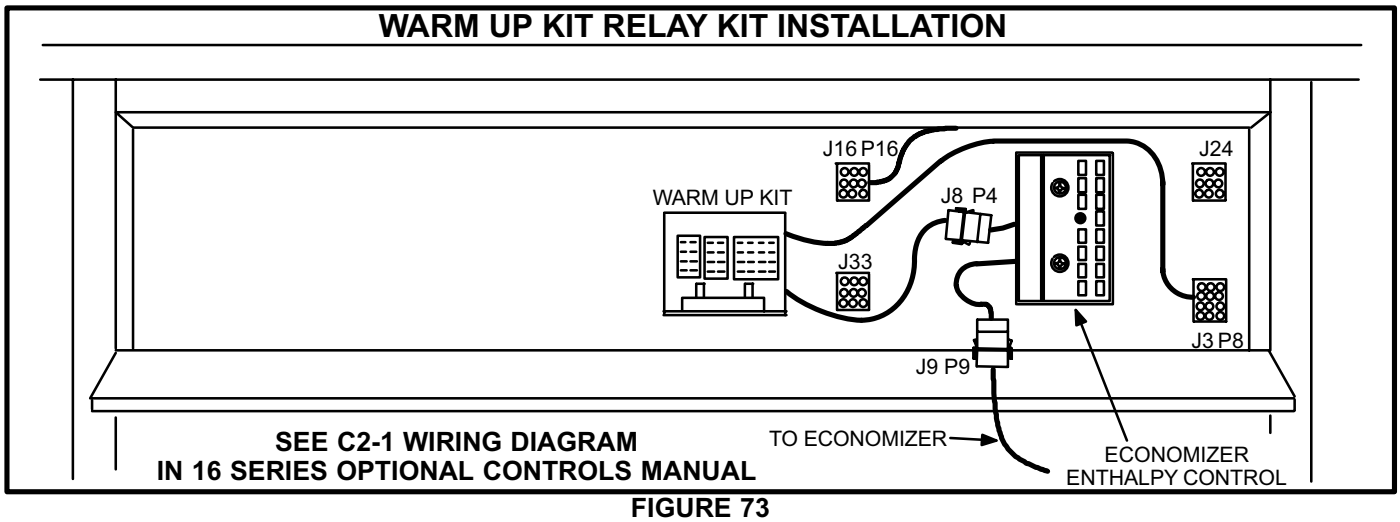


FIGURE 73

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 73). 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 GCS16, 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 GCS16. 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 74). 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 GCS16s 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 75). 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 76). 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.

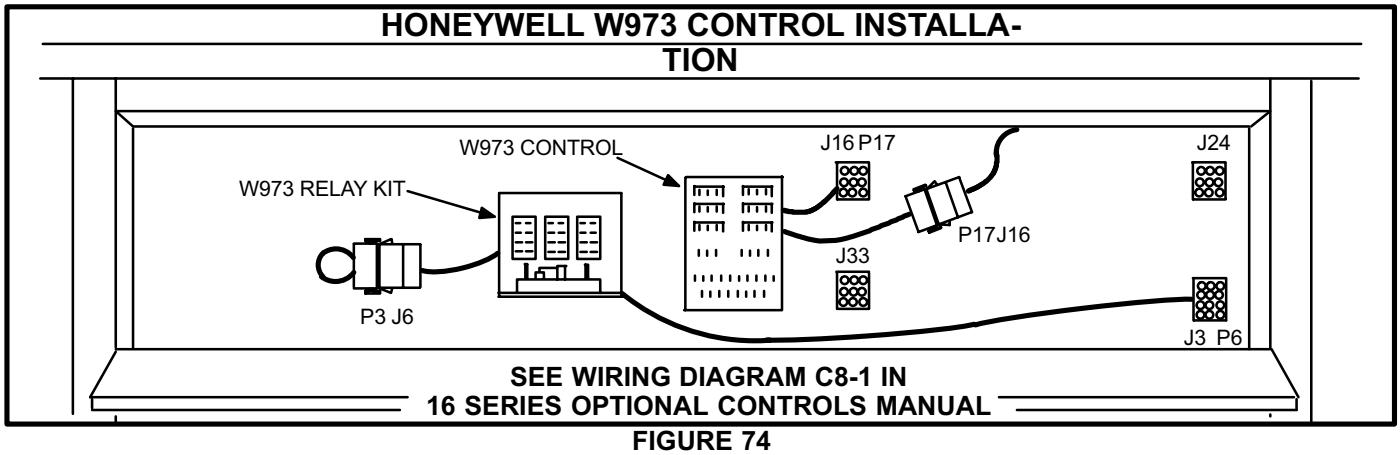


FIGURE 74

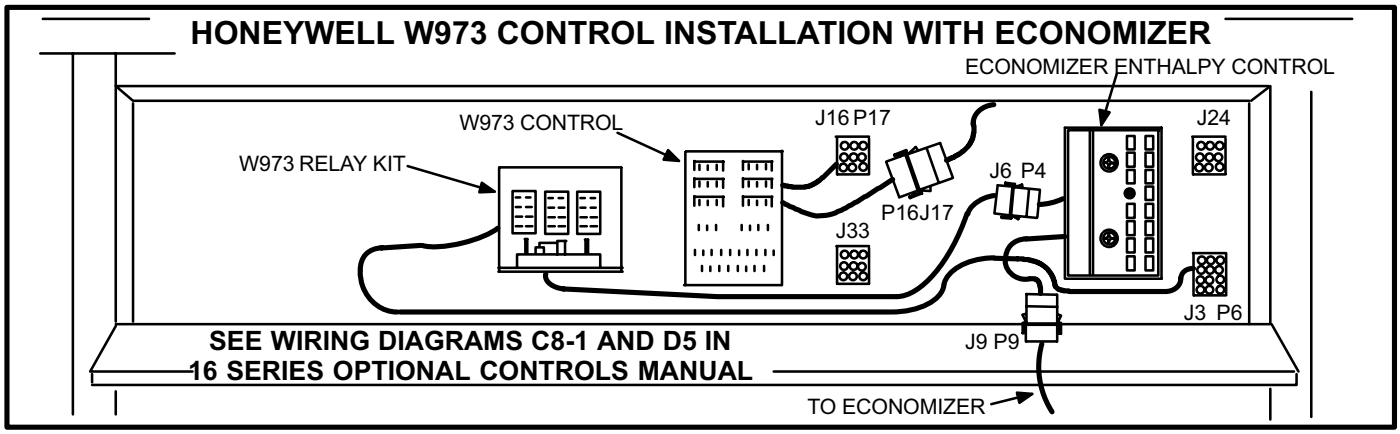


FIGURE 75

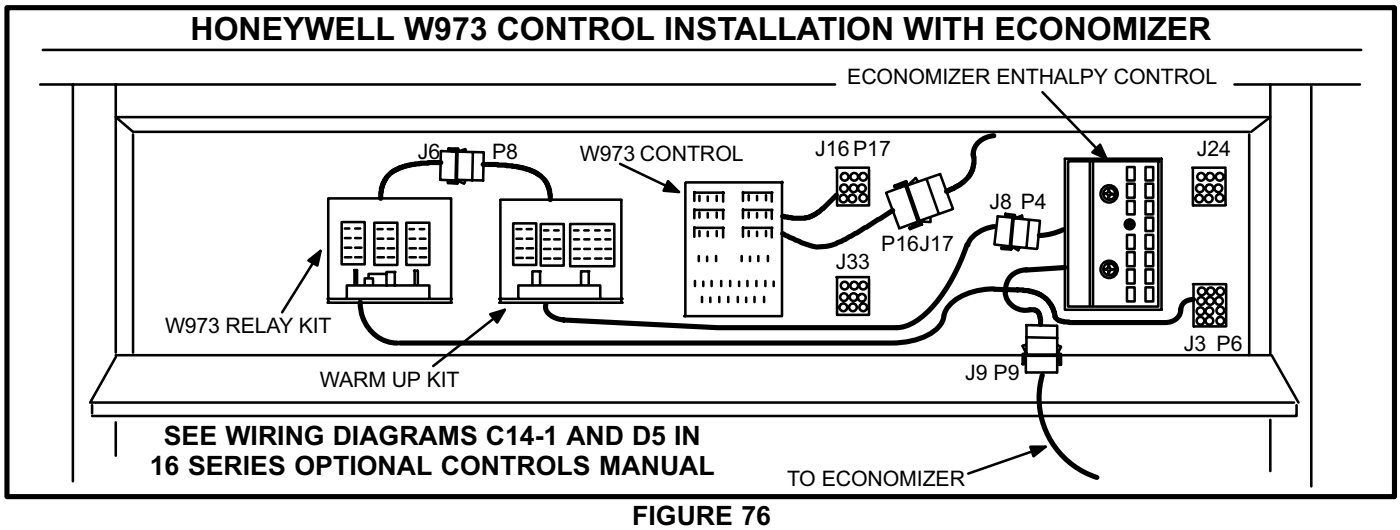


FIGURE 76

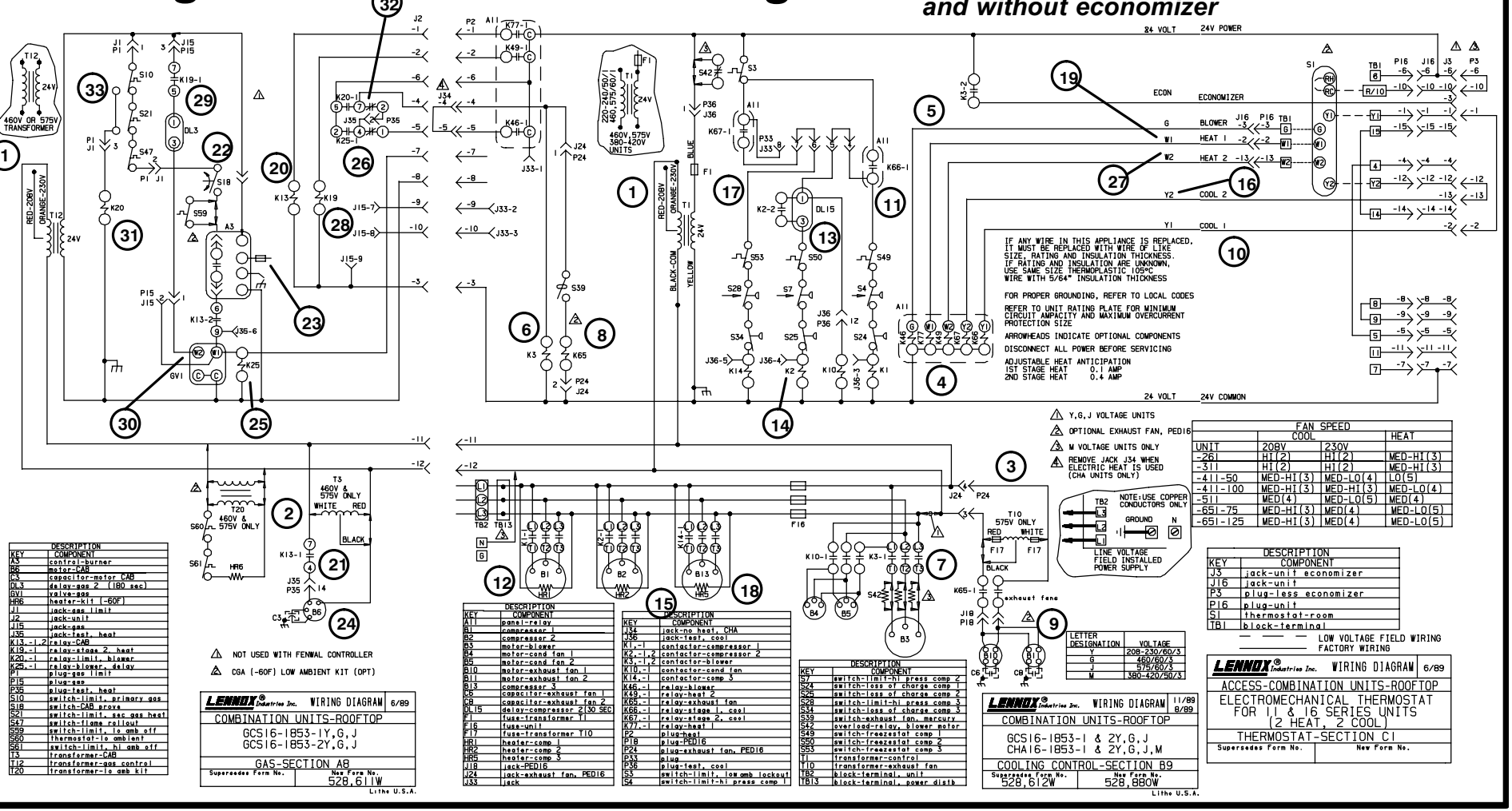
XIV-WIRING DIAGRAMS AND OPERATION SEQUENCE

NOTE-THE FOLLOWING DIAGRAM AND OPERATION SEQUENCE SHOWS A BASIC UNIT (B9 and A8 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 B9 and A8 diagrams

basic thermostat with GCS16-1853 and without economizer



FAN SPEED	COOL		HEAT
UNIT	208V	230V	
-261	HI(2)	HI(2)	MED-HI(3)
-311	HI(2)	HI(2)	MED-HI(3)
-411-50	MED-HI(3)	MED-LO(4)	LO(5)
-411-100	MED-HI(3)	MED-HI(3)	MED-LO(4)
-511	MED(4)	MED-LO(5)	MED(4)
-651-75	MED-HI(3)	MED(4)	MED-LO(5)
-651-125	MED-HI(3)	MED(4)	MED-LO(5)

DESCRIPTION	
KEY	COMPONENT
A3	control-burner
B6	motor-CAB
C3	capacitor-motor CAB
DL3	delay-gas 2 (180 sec)
GV1	valve-gas
HR6	heater-kit (-60F)
J1	jack-gas limit
J2	jack-unit
J15	jack-gas
J35	jack-test, heat
K13-1,2	relay-CAB
K19-1	relay-stage 2 heat
K20-1	relay-limit, blower
K25-1	relay-blower, delay
P1	plug-gas limit
P15	plug-gas
P35	plug-test, heat
S10	switch-limit, primary gas
S18	switch-CAB prove
S21	switch-limit, sec gas heat
S47	switch-flame rollout
S59	switch-limit, lo amb off
S60	thermostat-lo ambient
S61	switch-limit, hi amb off
T3	transformer-CAB
T12	transformer-gas control
T20	transformer-lo amb kit

DESCRIPTION	
KEY	COMPONENT
A11	panel-relay
B1	compressor 1
B2	compressor 2
B3	motor-blower
B4	motor-cond fan 1
B5	motor-cond fan 2
B10	motor-exhaust fan 1
B11	motor-exhaust fan 2
B13	compressor 3
C6	capacitor-exhaust fan 1
C8	capacitor-exhaust fan 2
DL15	delay-compressor 2 (30 SEC)
F1	fuse-transformer T1
F16	fuse-unit
F17	fuse-transformer T10
HR1	heater-comp 1
HR2	heater-comp 2
HR5	heater-comp 3
J18	jack-PED16
J24	jack-exhaust fan, PED16
J33	jack

DESCRIPTION	
KEY	COMPONENT
J34	jack-no heat, CHA
J36	jack-test, cool
K1,-1	contactor-compressor 1
K2,-1,2	contactor-compressor 2
K3,-1,2	contactor-blower
K10,-1	contactor-cond fan
K14,-1	contactor-comp 3
K46,-1	relay-blower
K49,-1	relay-heat 2
K65,-1	relay-exhaust fan
K66,-1	relay-stage 1, cool
K67,-1	relay-stage 2, cool
K77,-1	relay-heat 1
P2	plug-heat
P18	plug-PED16
P24	plug-exhaust fan, PED16
P33	plug
P36	plug-test, cool
S3	switch-limit, low amb lockout
S4	switch-limit-hi press comp 1

DESCRIPTION	
KEY	COMPONENT
S7	switch-limit-hi press comp 2
S24	switch-loss of charge comp 1
S25	switch-loss of charge comp 2
S28	switch-limit-hi press comp 3
S34	switch-loss of charge comp 3
S39	switch-exhaust fan, mercury
S42	overload-relay, blower motor
S49	switch-freezestat comp 1
S50	switch-freezestat comp 2
S53	switch-freezestat comp 3
T1	transformer-control
T10	transformer-exhaust fan
TB2	block-terminal, unit
TB13	block-terminal, power distb

LETTER DESIGNATION	VOLTAGE
Y	208-230/60/3
G	460/60/3
J	575/60/3
M	380-420/50/3

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

LENNOX Industries Inc. WIRING DIAGRAM 6/89

COMBINATION UNITS-ROOFTOP

GCS16-1853-1Y,G,J
GCS16-1853-2Y,G,J

GAS-SECTION A8

Supersedes Form No. | New Form No. 528,611W

Litho U.S.A.

LENNOX Industries Inc. WIRING DIAGRAM 11/89 6/89

COMBINATION UNITS-ROOFTOP

GCS16-1853-1 & 2Y,G,J
CHA16-1853-1 & 2Y,G,J,M

COOLING CONTROL-SECTION B9

Supersedes Form No. 528,612W | New Form No. 528,880W

Litho U.S.A.

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.

C1 DIAGRAM WITH B9 AND A8 DIAGRAMS

Electromechanical Thermostat Connected to GCS16-1853 without Economizer

A-GCS16-1853

This flowchart is used to show the step by step sequence that takes place when thermostat demand is sent to the GCS16. 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 B9 and A8 Sections (electromechanical thermostat wired to GCS16-1853)

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 T12 provides 24VAC power to unit heating controls.

2- If the unit is 460V or 575V, line voltage simultaneously energizes transformers T3 and T20 (optional). T20 provides 230VAC power to optional low ambient control heater kit and is switched through low ambient switch S60 and high ambient switch S61. T3 provides 230VAC power to combustion air blower B6 and is switched through relay K13.

3- 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:

4- 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:

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

6- When K46-1 closes 24VAC power is routed through N.C. K25-1 contacts and through N.C. K20-1 contacts to energize blower contactor K3 (and mercury exhaust switch S39 if optional PED16 is installed).

7- 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).

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

9- 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):

10- 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.

11- When K66-1 closes, 24VAC power is routed through low ambient thermostat S3, high temperature limit S49, high pressure limit S4 and low pressure limit S24 to energize compressor contactor K1.

12- Contactor K1-1 contacts close to energize compressor B1.

13- Simultaneously when K66-1 closes, time delay DL15 and contactor K10 are energized. DL15 initiates a 30 second delay before closing. K10-1 closes to energize both condenser fan motors B4 and B5.

14- After 30 second delay has elapsed, DL15 closes and 24VAC power is routed through high temperature limit S50, high pressure limit S7 and low pressure limit S25 to energize compressor contactor K2.

15- Contactor K2-1 contacts close to energize compressor B2. K2-2 auxiliary contacts close to bypass (latch) DL15.

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

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

17- When K67-1 closes, 24VAC power is routed through high temperature limit S53, high pressure limit S28 and low pressure limit S34 to energize compressor contactor K14.

18- Contactor K14-1 closes to energize compressor B13.

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, 24VAC power is routed into the heating compartment to energize combustion air blower relay K13. Normally open K13-1 and K13-2 close.

21- When K13-1 closes, combustion air blower motor B6 is energized. When K13-2 closes, a circuit is completed from the ignition control to the gas valve (K13-2 act only as a set of redundant safety contacts).

22- As combustion air blower B6 nears full speed combustion air prove switch S18 closes (S18 is a centrifugal switch located inside the combustion air blower motor).

23- When S18 closes, 24 VAC power is directed through high temperature limits S10 and S21 and through rollout switch S47, through combustion air prove switch S18 (and through low ambient high temperature switch S59, if so equipped) to energize ignition control A3.

24- Ignition control A3 then waits 30 to 40 seconds to allow combustion air blower B6 time to draw exhaust gas from combustion chamber and to introduce fresh air. Combustion air blower B6 operates throughout the heating cycle.

25- After the ignition control delay, A3 activates gas valve GV1 (through contacts K13-2, see step 21- regarding K13 contacts), delay relay K25 and the spark electrode. When flame is sensed by the flame sensor (minimum 5 microamps) the spark electrode stops. If flame is not sensed after the first trial for ignition, controller A3 repeats steps 21 through 25 up to two more times before locking out. Delay relay K25 delays 60 seconds before closing.

If the control locks out, it can be reset by breaking and remaking thermostat demand.

The 1st stage operator of gas valve GV1 opens and closes quickly.

26- After the 60 second delay, relay K25 normally open contacts K25-1 close. 24VAC power is directed through K20-1 N.C. contacts to energize the blower. See steps 6 through 9 for blower operation.

2nd Stage Heating Operation:

27- Additional heating demand energizes W2 in the thermostat. W2 energizes pilot relay K49. Normally open K49-1 contacts close.

28- When K49-1 closes, 24VAC power is routed into the heating compartment to energize 2nd stage heat relay K19. Normally open K19-1 contacts close.

29- When K19-1 closes, delay DL3 is energized. DL3 initiates 180 sec. delay before closing.

30- When DL3 closes, gas valve GV1 2nd stage operator is energized. The 2nd stage operator opens and closes slowly and must be completely closed before the 1st stage operator can close.

Safety Blower Operation:

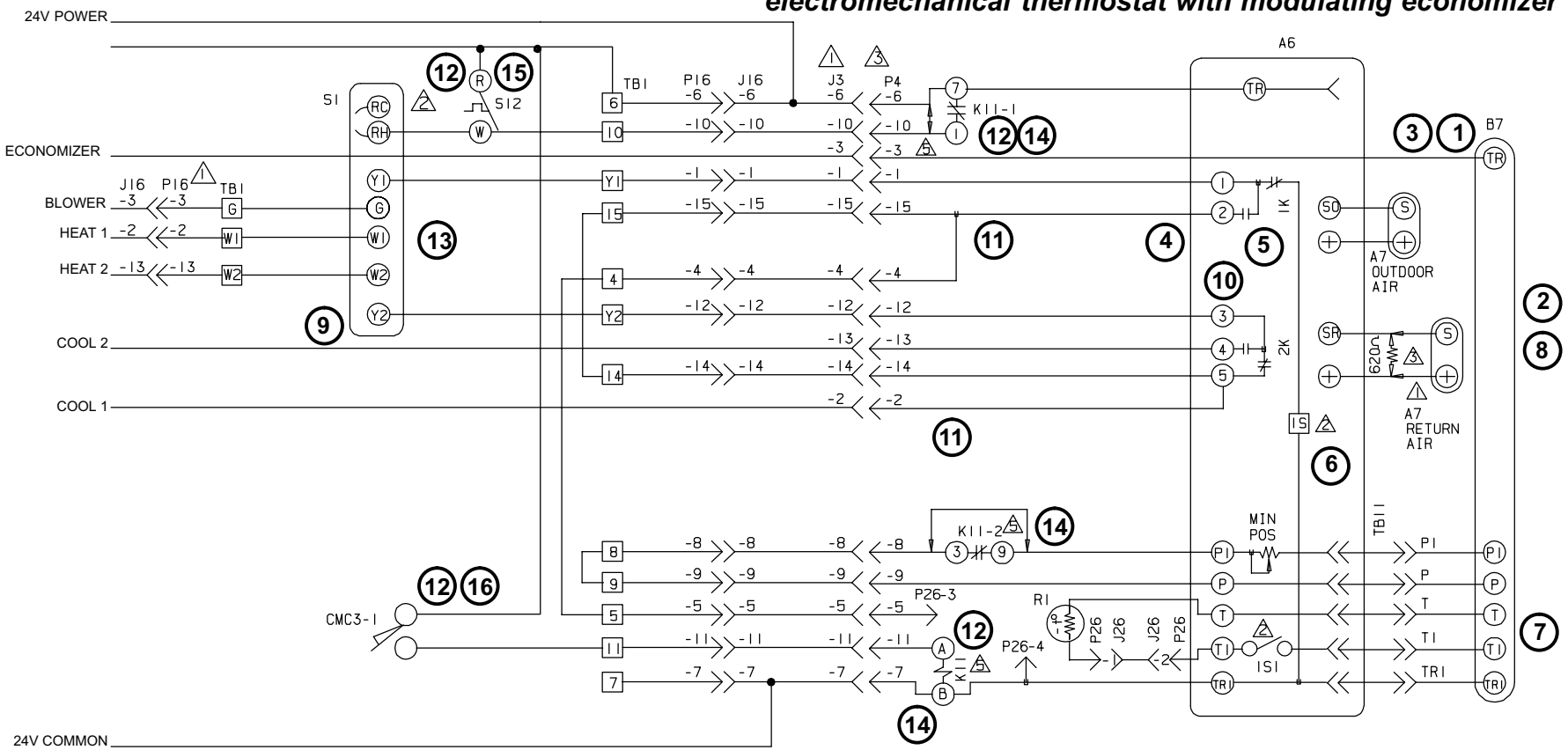
31- During heating operation, if either high temperature limit S10 or S21 trip, relay K20 is energized. Ignition control A3 and gas valve GV1 are immediately de-energized. Normally open K20-1 contacts close.

32- When N.O. K20-1 closes, 24VAC power is directed through K20-1 N.O. contacts to energize the blower. See steps 6 through 9 for blower operation.

33- Blower operation continues until either S10 or S21 reset.

C1 diagram with D5 diagram

electromechanical thermostat with modulating economizer



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

DESCRIPTION	
KEY	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-nite setback
P4	plug-economizer
P26	plug-enthalpy
RI	sensor-supply air
TB11	strip-terminal

LOW VOLTAGE FIELD WIRING

FACTORY WIRING

Economizer Footnotes

1. OPTIONAL-SECOND A7 INSTALLED IN RETURN AIR PROVIDES DIFFERENTIAL ENTHALPY CONTROL
2. WHEN IS RECEIVES POWER, ISI CLOSES.
3. FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR. REMOVE WHEN SECOND A7 SENSOR IS INSTALLED TO PROVIDE DIFFERENTIAL ENTHALPY CONTROL
4. WHEN W7400 CONTROL IS USED, REMOVE J26 JUMPER AND INSTALL J28. J28 AND K7 RELAY ARE PART OF W7400 KIT (74G11)
5. K11 NITE RELAY MAY NOT BE PART OF ECONOMIZERS ON UNITS BELOW 7.5T CAPACITY

Thermostat Footnotes

3. REMOVE P3 WHEN ECONOMIZER IS USED
2. THERMOSTAT SUPPLIED BY USER
1. J3 MAXIMUM LOAD 20VA 24VAC CLASS II

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 EMD17-95/135 (MODULATING ECONOMIZER)		
ECONOMIZER-SECTION D5		
Supersedes Form No.	New Form No.	

Litho U.S.A.

C1 DIAGRAM WITH D5 DIAGRAM

Electromechanical Thermostat Connected to GCS16-1853 with Economizer

B-REMD16

When a REMD16 economizer section is applied to the GCS16-1853 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 GCS16, you must first read and understand how all the GCS16 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 GCS16-1853 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.

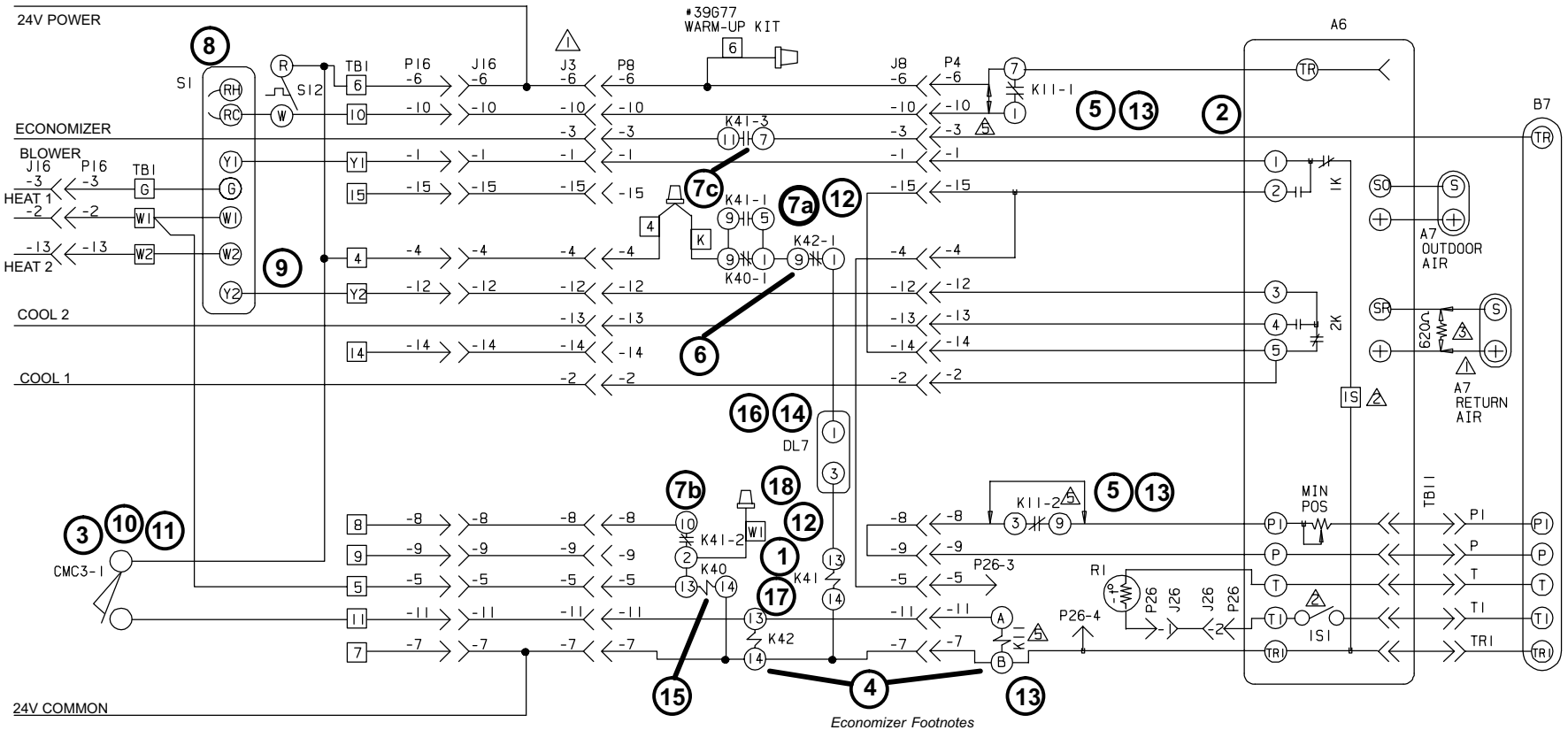
15- When clock contacts close, relay K11 energizes. Contacts K11-1 open to disable the day thermostat and contacts K11-2 open to drive the dampers full closed.

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



Thermostat Footnotes

⚠1 J3 MAXIMUM LOAD 20VA 24VAC CLASS II

Economizer Footnotes

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

⚠2 WHEN IS RECEIVES POWER, ISI CLOSES.

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

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

⚠5 K11 NITE RELAY MAY NOT BE PART OF ECONOMIZERS ON UNITS BELOW 7.5T CAPACITY

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-C2-1		
Supersedes Form No.	New Form No.	

Litho U.S.A.

DESCRIPTION	
KEY	COMPONENT
CMC3-1	timer-clock
DL7	delay-readout
J3	jack-economizer
J8	jack-warm up kit
J16	jack-unit
K40,-1	relay-warm up kit-ht latch
K41,-1,2,3,4	relay-warm up kit-latch
K42,-1	relay-warm up kit-clock
P8	plug-warm up kit
P16	plug-unit
SI	thermostat-room
SI2	thermostat-nite
TBI	block-terminal(low volt)

DESCRIPTION	
KEY	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-nite setback
P4	plug-economizer
P26	plug-enthalpy
RI	sensor-supply air
TBII	strip-terminal

LENNOX® Industries Inc.	WIRING DIAGRAM	4/89
ACCESS-COMBINATION UNITS-ROOFTOP		
REMD16M EMDH16M REMD11M 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 GCS16-1853 with Economizer and Warm-Up

C-WARM-UP KIT

An optional feature of the REMD16 economizer is a warm-up kit which holds the economizer outdoor air dampers closed during night heat operation and while the GCS16 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 GCS16, you must first read and understand how all the GCS16 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 GCS16 units with REMD16 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 GCS16 BLOWER COMPARTMENT. REFER TO WIRING DIAGRAM. IMPROPER CONNECTION WILL CAUSE CONTROL FAILURE.

The warm-up kit installs in the control mounting area of the GCS16 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 GCS16 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).