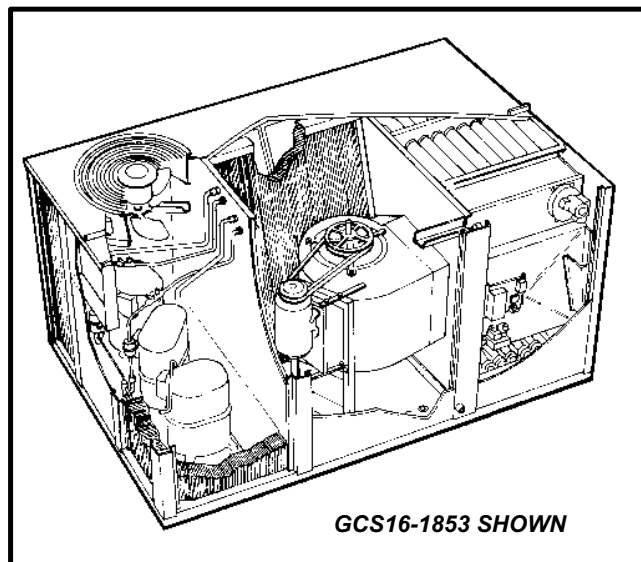


**GCS16 SERIES**

GCS16 series units in the 6 ton and larger cooling size 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 exchangers ranging in size from 135,000 to 470,000 Btuh input. 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, Honeywell W7400 control or other field specified controls connect to the unit with jack-plugs. When "plugged in" the controls become an integral part of the unit wiring. Units are also equipped with a low voltage terminal strip to facilitate thermostat field wiring.

All specifications in this manual are subject to change.

**GCS16-1853 SHOWN****TABLE OF CONTENTS**

Introduction .....	Page 1	Heat Exchanger .....	Page 45
Specifications .....	Pages 2-9	Ignition Control .....	Page 45
Electrical Data .....	Page 10	Electrode Gap and Flame Sensing .....	Pages 45-46
Blower Data .....	Pages 11-16	Combustion Air Blower .....	Page 46
Air Resistance Data .....	Pages 17-18	<b>VIII- INDOOR BLOWER OPERATION / ADJUSTMENT</b>	
Parts Arrangement .....	Pages 18-22	.....	Pages 46-47
<b>I- APPLICATION</b> .....	Page 22	Blower Operation .....	Page 46
<b>II- UNIT COMPONENTS</b> .....	Pages 22-41	Determining Unit CFM .....	Page 46
Control Box Components .....	Pages 22-25	Blower Belt Adjustment .....	Pages 46-47
Heating Components .....	Pages 26-34	<b>IX- MAINTENANCE</b> .....	Page 47
Cooling Components .....	Pages 34-40	Filters .....	Page 47
Blower Compartment Components .....	Pages 40-41	Lubrication .....	Page 47
<b>III- ELECTRICAL CONNECTIONS</b> .....	Page 41	Supply Air Blower Wheel .....	Page 47
<b>IV- PLACEMENT AND INSTALLATION</b> .....	Page 41	Evaporator and Condenser Coil .....	Page 47
<b>V- START UP - OPERATION</b> .....	Pages 41-42	Electrical .....	Page 47
Preliminary Checks .....	Page 41	<b>X- ACCESSORIES</b> .....	Pages 48-63
Cooling / Heating Start Up .....	Pages 41-42	RMF16 Roof Mounting Frame .....	Page 48
<b>Safety or Emergency Shut Down</b> .....	Page 42	OAD16 Outdoor Air Damper .....	Page 48
<b>VI- COOLING SYSTEM CHECKS</b> .....	Page 42	Economizers .....	Pages 48-54
Gauge Manifold Attachment .....	Page 42	Transitions and Supply / Return Diffusers .....	Page 54
Charging .....	Page 42	Firestats .....	Page 54
<b>VII- HEATING SYSTEM SERVICE CHECKS</b> .....	Pages 42-46	Cycle Control Kit .....	Page 55
A.G.A./C.G.A. Applications and Requirements .....	Page 42-43	Low Ambient Kit .....	Page 56
Gas Piping .....	Page 43	Status Panels .....	Pages 56-57
Testing Gas Piping .....	Page 43	Commercial Controls Hardware .....	Pages 58-59
Testing Supply Pressure .....	Page 43	Optional Commercial Controls Systems .....	Pages 59-63
Check and Adjust Manifold Pressure .....	Page 43-44	Clocks / Timers .....	Page 63
Proper Gas Flow .....	Page 44	<b>XI- WIRING DIAGRAMS / OPERATION SEQUENCE</b>	
High Altitude Derate .....	Pages 44	.....	Pages 64-79
Inshot Burner .....	Pages 44-45	Unit Operation Sequence .....	Pages 64-75
		REMD16M Economizer Operation Sequence .....	Pages 76-77
		Warm Up Kit Operation Sequence .....	Pages 78-79

## SPECIFICATIONS - GCS16-823 & GCS16-953

Model No.		GCS16-823	GCS16-953
*ARI Standard 210/240 Ratings	Total cooling capacity (Btuh)	73,000	88,000
	Total unit watts	8,110	9,780
	EER (Btuh/Watts)	9.0	
★ARI Standard 270 SRN (Bels)		8.6	
Refrigerant (22) Charge	Stage 1	5 lbs. 10 oz.	6 lbs. 4 oz.
	Stage 2	5 lbs. 2 oz.	5 lbs. 14 oz.
Evaporator Blower and Drive Selection	Blower wheel nominal diameter x width (in.)		12 x 12
	***Factory Installed Drives	Nominal motor horsepower	2
		Maximum usable horsepower	2.30
		Voltage & phase	208/230/460v-3ph
		RPM range	740 — 1010
Evaporator Coil	Net face area (sq. ft.)	7.75	
	Tube diameter (in.) & No. of rows	3/8 — 3	
	Fins per inch	14	
Condenser Coil	Net face area (sq. ft.)	15.67	
	Tube diameter (in.) & No. of rows	3/8 — 2	
	Fins per inch	20	
Condenser Fans	Diameter (in.) & No. of blades		24 — 4
	Air volume (cfm)	4800	5300
	Motor horsepower	1/2	3/4
	Motor watts	620	660
Two Stage Heating Capacity (Natural Gas Only)	Btuh Input (low)	84,000	126,000
	Btuh Output (low)	66,500	98,000
	Btuh Input (High)	135,000	200,000
	Btuh Output (High)	106,000	160,000
	A.G.A. Thermal Efficiency	79%	80%
Two Stage Heating Capacity (**LPG Gas Only)	Btuh Input (low)	95,000	126,000
	Btuh Output (low)	76,000	98,000
	Btuh Input (High)	130,000	175,000
	Btuh Output (High)	103,000	142,000
	A.G.A. Thermal Efficiency	80%	81.5%
Gas Supply Connections fpt (in.)	Natural	3/4	
	**LPG		
Recommended Gas Supply Pressure (wc. in.)	Natural	7	
	**LPG	11	
Condensate drain size mpt (in.)		1	
No. & size of filters (in.)		(4) 16 x 20 x 2	
Electrical characteristics		208/230v or 460v — 60 hertz — 3 phase	

★Sound Rating Number in accordance with ARI Standard 270.

\*Rated in accordance with ARI Standard 210/240; 95°F outdoor air temperature and 80°F db/67°F wb entering evaporator air.

\*\*For LPG units a field conversion kit is required and must be ordered extra. See Optional Accessories table.

\*\*\*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.

**SPECIFICATIONS — GCS16-1353 & GCS16-1603**

Model No.		GCS16-1353	GCS16-1603	
*ARI Standard 210/240 Ratings or Standard ☆360 Ratings	Total cooling capacity (btuh)	119,000	☆142,000	
	Total unit watts	13,220	16,820	
	EER (Btuh/Watts)	9.0	8.50	
	Integrated Part Load Value	----	8.8	
★ARI Standard 270 SRN (Bels)		8.8	----	
Refrigerant (22) Charge	Stage 1	7 lbs. 4 oz.	10 lbs. 12 oz.	
	Stage 2		7 lbs. 12 oz.	
Evaporator Blower and Drive Selection	Blower wheel nominal diameter x width (in.)		15 x 15	
	**Factory Installed Drives	Nominal motor horsepower	2	3
		Maximum usable horsepower	2.30	3.45
		Voltage & phase	208/230/460v-3ph	
		RPM range	730 — 950	
	**Optional Factory Installed Drives	Nominal motor horsepower	3	----
		Maximum usable horsepower	3.45	----
		Voltage & phase	208/230/460v-3ph	
RPM range		730 — 950		
Evaporator Coil	Net face area (sq. ft.)		9.46	11.9
	Tube diameter (in.) & No. of rows		3/8 — 4	3/8 — 3
	Fins per inch		12	
Condenser Coil	Net face area (sq. ft.)		20.0	24.4
	Tube diameter (in.) & No. of rows		3/8 — 2	
	Fins per inch		20	20
Condenser Fans	Diameter (in.) & No. of blades		(2) 20 — 5	(2) 22 — 4
	Air volume (cfm)		6400 Total	7700 Total
	Motor horsepower		(2) 1/3	(2) 1/2
	Motor watts		875 Total	1050 Total
Two Stage Heating Capacity (Natural Gas Only)	Btuh Input (low)		170,000	
	Btuh Output (low)		132,500	
	Btuh Input (High)		270,000	
	Btuh Output (High)		216,000	
	A.G.A. Thermal Efficiency		80%	
Two Stage Heating Capacity (**LPG Gas Only)	Btuh Input (low)		170,000	
	Btuh Output (low)		132,500	
	Btuh Input (High)		236,250	
	Btuh Output (High)		192,500	
	A.G.A. Thermal Efficiency		81.5%	
Gas Supply Connections fpt (in.)	Natural	3/4		
	***LPG			
Recommended Gas Supply Pressure (wc. in.)	Natural	7		
	***LPG	11		
Condensate drain size mpt (in.)		1		
No. & size of filters (in.)		(4) 16 x 25 x 2	(4) 20 x 25 x 2	
Electrical characteristics		208/230v or 460v — 60 hertz — 3 phase		

\*Sound Rating Number in accordance with ARI Standard 270.

\*Rated in accordance with ARI Standard 210/240 or 360; 95°F outdoor air temperature and 80°F db/67°F wb entering evaporator air.

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

\*\*\*For LPG units a field conversion kit is required and must be ordered extra. See Optional Accessories table.

**SPECIFICATIONS — GCS16-1853**

Model No.		GCS16-1853-235	GCS16-1853-330
*ARI Standard 360 Ratings	Total cooling capacity (btuh)	178,000	
	Total unit watts	20,300	
	EER (Btuh/Watts)	8.8	
	Integrated Part Load Value	9.6	
Refrigerant (22) Charge	Stage 1	7 lbs. 9 oz.	
	Stage 2		
	Stage 3		
Evaporator Blower and Drive Section	Blower wheel nominal diameter x width (in.)		18 x 18
	**Factory Installed Drives	Nominal motor horsepower	3
		Maximum useable horsepower	3.45
		Voltage & Phase	208/230/460v-3ph
		RPM Range	610 - 780
	**Factory Installed Drives	Nominal motor horsepower	5
		Maximum useable horsepower	5.75
		Voltage & Phase	208/230/460v-3ph
RPM Range		770 - 980	
Evaporator Coil	Net face area (sq. ft.)		16.0
	Tube diameter (in.) & No. of rows		3/8 — 3
	Fins per inch		13
Condenser Coil	Net face area (sq. ft.)		30.5
	Tube diameter (in.) & No. of rows		3/8 - 2
	Fins per inch		20
Condenser Fan(s)	Diameter (in.) & No. of blades		(2) 26 — 4
	Air volume (cfm)		12,000 Total
	Motor horsepower		(2) 1
	Motor watts		2200 Total
Two Stage Heating Capacity (Natural Gas Only)	Btuh Input (Low)	145,000	205,000
	Btuh Output (Low)	116,000	159,900
	Btuh Input (high)	235,000	330,000
	Btuh Output (High)	188,000	264,000
	A.G.A. Thermal Efficiency	80%	80%
Two Stage Heating Capacity (**LPG Gas Only)	Btuh Input (Low)	164,000	237,000
	Btuh Output (Low)	131,200	189,600
	Btuh Input (High)	235,000	330,000
	Btuh Output (High)	188,000	264,000
	A.G.A. Thermal Efficiency	80%	80%
Gas Supply Connections fpt (in.)	Natural	3/4	
	***LPG	3/4	
Recommended Gas Supply Pressure (wc. in.)	Natural	7	
	***LPG	11	
Condensate Drain Size mpt (in.)		1	
No. & Size of filters (in.)		(4) 24 x 24 x 2	
Electrical characteristics		208/230 to 460 volt - 60 hertz - 3 phase	

\*Rated in accordance with ARI Standard 360; 95°F outdoor air temperature and 80°F db/ 67°F wb entering evaporator air; minimum external duct static pressure.

\*\*Using total air volume and system static pressure requirements determine from blower 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.

\*\*\*For LPG models a field conversion kit is required and must be ordered extra. See Optional Accessories table.

## SPECIFICATIONS — GCS16-2553

Model No.		GCS16-2553-235	GCS16-2553-470
*ARI Standard 360 Ratings	Total Cooling Capacity (btuh)		●210,000
	Total Unit Watts		21,400
	EER (Btuh/Watts)		●9.8
	Integrated Part Load Value		10.4
Refrigerant (22) Charge	Stage 1	18 lbs. 8 oz.	
	Stage 2		
Evaporator Blower and Drive Selection	Blower wheel nominal diameter x width (in.)		20 x 18
	**Factory Installed Drives	Nominal motor horsepower	5
		Maximum usable horsepower	5.75
		Voltage & phase	208/230v-3ph or 460v-3ph
		RPM range	660 — 840
	**Optional Factory Installed Drives	Nominal motor horsepower	7.5
		Maximum usable horsepower	8.60
		Voltage & phase	208/230v-3ph or 460v-3ph
RPM range		750 — 905	
Evaporator Coil	Net face area (sq. ft.)		21.0
	Tube diameter (in.) & No. of rows		3/8 — 3
	Fins per inch		13
Condenser Coil	Net face area (sq. ft.)		48.5
	Tube diameter (in.) & No. of rows		3/8 — 2
	Fins per inch		20
Condenser Fans	Diameter (in.) & No. of blades		(2) 26 — 4
	Air volume (cfm)		14,000 (Total)
	Motor horsepower		(2) 1
	Motor watts		2100 (Total)
Two Stage Heating Capacity (Natural Gas Only)	Btuh Input (low)	145,000	290,000
	Btuh Output (low)	116,000	232,000
	Btuh Input (High)	235,000	470,000
	Btuh Output (High)	188,000	376,000
	A.G.A. Thermal Efficiency	80%	80%
Two Stage Heating Capacity (***LPG Gas Only)	Btuh Input (low)	164,000	376,000
	Btuh Output (low)	131,200	262,400
	Btuh Input (High)	235,000	470,000
	Btuh Output (High)	188,000	328,000
	A.G.A. Thermal Efficiency	80%	
Gas Supply Connections fpt (in.)	Natural	3/4	1
	***LPG		
Recommended Gas Supply Pressure (wc. in.)	Natural	7	
	***LPG	11	
Condensate drain size mpt (in.)		(2) 1	
No. & size of filters (in.)		(6) 20 x 25 x 2	
Electrical characteristics		208/230v or 460v — 60 hertz — 3 phase	

\* Rated in accordance with ARI Standard 360; 95°F outdoor air temperature and 80°F db/67°F wb entering evaporator air; minimum external duct static pressure.  
 \*\*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.

\*\*\*For LPG units a field conversion kit is required and must be ordered extra. See Optional Accessories table.

●208,000 Btuh and 9.6 EER at 208 volts.

**SPECIFICATIONS — GCS16-2753**

Model No.		GCS16-2753-235	GCS16-2753-470	
*ARI Standard 360 Ratings	Total Cooling Capacity (btuh)	●240,000		
	Total Unit Watts	26,700		
	EER (Btuh/Watts)	●9.0		
	Integrated Part Load Value	9.7		
Refrigerant (22) Charge	Stage 1	19 lbs. 0 oz.		
	Stage 2			
Evaporator Blower and Drive Selection	Blower wheel nom. diameter x width (in.)		20 x 18	
	**Factory Installed Drives	Nominal motor horsepower	5	
		Max. usable horsepower	5.75	
		Voltage & phase	208/230v-3ph or 460v-3ph	
		RPM range	660 — 840	
	**Optional Factory Installed Drives	Nominal motor horsepower	7.5	
		Max. usable horsepower	8.60	
		Voltage & phase	208/230v-3ph or 460v-3ph	
RPM range		750 — 905		
Evaporator Coil	Net face area (sq. ft.)		21.0	
	Tube diameter (in.) & No. of rows		3/8 — 3	
	Fins per inch		13	
Condenser Coil	Net face area (sq. ft.)		48.5	
	Tube diameter (in.) & No. of rows		3/8 — 2	
	Fins per inch		20	
Condenser Fans	Diameter (in.) & No. of blades		(2) 26 — 4	
	Air volume (cfm)		14,000 (Total)	
	Motor horsepower		(2) 1	
	Motor watts		2100 (Total)	
Two Stage Heating Capacity (Natural Gas Only)	Btuh Input (low)		145,000	
	Btuh Output (low)		116,000	
	Btuh Input (High)		235,000	
	Btuh Output (High)		188,000	
	A.G.A. Thermal Efficiency		80%	
Two Stage Heating Capacity (**LPG Gas Only)	Btuh Input (low)		164,000	
	Btuh Output (low)		131,200	
	Btuh Input (High)		235,000	
	Btuh Output (High)		188,000	
	A.G.A. Thermal Efficiency		80%	
Gas Supply Connections fpt (in.)	Natural	3/4	1	
	***LPG			
Recommended Gas Supply Pressure (wc. in.)	Natural	7		
	***LPG	11		
Condensate drain size mpt (in.)		(2) 1		
No. & size of filters (in.)		(6) 20 x 25 x 2		
Electrical characteristics		208/230v or 460v — 60 hertz — 3 phase		

\* Rated in accordance with ARI Standard 360; 95°F outdoor air temperature and 80°F db/67°F wb entering evaporator air; minimum external duct static pressure.

\*\*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.

\*\*\*For LPG units a field conversion kit is required and must be ordered extra. See Optional Accessories table.

●238,000 Btuh and 8.9 EER at 208 volts.

**SPECIFICATIONS — GCS16-3003**

Model No.		GCS16-3003-235	GCS16-3003-470	
*ARI Standard 360 Ratings	Total Cooling Capacity (btuh)	●284,000		
	Total Unit Watts	33,400		
	EER (Btuh/Watts)	8.5		
	Integrated Part Load Value	9.1		
Refrigerant (22) Charge	Stage 1	20 lbs. 0 oz.		
	Stage 2			
Evaporator Blower and Drive Selection	Blower wheel nom. diameter x width (in.)		20 x 18	
	**Factory Installed Drives	Nominal motor horsepower	7.5	
		Max. usable horsepower	8.6	
		Voltage & phase	208/230v-3ph or 460v-3ph	
		RPM range	610 — 780	
	Optional **Factory Installed Drives	Nominal motor horsepower	10	
		Max. usable horsepower	11.5	
		Voltage & phase	208/230v-3ph or 460v-3ph	
RPM range		770 — 980		
Evaporator Coil	Net face area (sq. ft.)		21.0	
	Tube diameter (in.) & No. of rows		3/8 — 3	
	Fins per inch		13	
Condenser Coil	Net face area (sq. ft.)		48.5	
	Tube diameter (in.) & No. of rows		3/8 — 3	
	Fins per inch		16	
Condenser Fans	Diameter (in.) & No. of blades		(2) 26 — 4	
	Air volume (cfm)		14,500 (Total)	
	Motor horsepower		(2) 1	
	Motor watts		2200 (Total)	
Two Stage Heating Capacity (Natural Gas Only)	Btuh Input (low)		145,000	
	Btuh Output (low)		116,000	
	Btuh Input (High)		235,000	
	Btuh Output (High)		188,000	
	A.G.A. Thermal Efficiency		80%	
Two Stage Heating Capacity (**LPG Gas Only)	Btuh Input (low)		164,000	
	Btuh Output (low)		131,200	
	Btuh Input (High)		235,000	
	Btuh Output (High)		188,000	
	A.G.A. Thermal Efficiency		80%	
Gas Supply Connections fpt (in.)	Natural	3/4	1	
	***LPG			
Recommended Gas Supply Pressure (wc. in.)	Natural	7		
	***LPG	11		
Condensate drain size mpt (in.)		(2) 1		
No. & size of filters (in.)		(6) 20 x 25 x 2		
Electrical characteristics		208/230v or 460v — 60 hertz — 3 phase		

●Rated at ARI Standard 360 Test Conditions.

\* Rated in accordance with ARI Standard 360; 95F outdoor air temperature and 80F db/67F wb entering evaporator air; minimum external duct static pressure.

\*\*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.

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

**OPTIONAL ACCESSORIES GCS16-823 & GCS16-953 (Ordered Extra)**

Unit Model No.		GCS16-823 & GCS16-953
**LPG Conversion Kit		LB-83188A (-823) <b>67H33</b> LB-55755DA (-953) <b>32G88</b>
Roof Mounting Frame		RMF16-95 ( <b>32G90</b> )
Economizer Dampers No. & size of filters (in.)		REMD16M-95 ( <b>74G22</b> ) (2) 16 x 25 x 1
Horizontal Economizer Dampers No. & size of filters (in.)		EMDH16M-95 ( <b>24H03</b> ) (2) 16 x 25 x 1
Exhaust Dampers (Net Face Area)		GED16-95/135/160 (0.43 sq. ft.) ( <b>34G80</b> )
Differential Enthalpy Control		<b>54G44</b>
Horizontal Supply and Return Air Kit (LB-55756BA)		<b>34G71</b>
Bottom Power Entry Kit (LB-55757CA)		<b>34G70</b>
Ceiling Supply and Return Air Diffusers (Net Weight)	Step-Down	RTD11-95 ( <b>29G04</b> )
	Flush	FD11-95 ( <b>29G05</b> )
	Transition	SRT16-95 ( <b>33G96</b> )
Outdoor Air Dampers No. & size of filters (in.)		OAD16-95 ( <b>35G26</b> ) (1) 16 x 20 x 1
Automatic OAD16 Damper Kit		<b>35G21</b>
Low Ambient Control Kit (LB-57113BG)		<b>15J80</b>
Timed-Off Control (2) LB-50709BA		<b>40G20</b>

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

**OPTIONAL ACCESSORIES — GCS16-1353 & GCS16-1603 (Ordered Extra)**

Unit Model No.		GCS16-1353	GCS16-1603
**LPG Conversion Kit		LB-55755BA ( <b>32G88</b> )	
Roof Mounting Frame		RMF16-135/160 ( <b>32G91</b> )	
Economizer Dampers No. & size of filters (in.)		REMD16M-135 (2) 16 x 25 x 1 ( <b>74G23</b> )	REMD16M-160 (2) 20 x 25 x 1 ( <b>51G25</b> )
Horizontal Economizer Dampers No. & size of filters (in.)		EMDH16M-135 (2) 16 x 25 x 1 ( <b>24H04</b> )	EMDH16M-160 (2) 20 x 25 x 1 ( <b>24H05</b> )
Exhaust Dampers (Net Face Area)		GED16-95/135/160 (0.43 sq. ft.) ( <b>34G80</b> )	
Differential Enthalpy Control		<b>54G44</b>	
Horizontal Supply and Return Air Kit		LB-55756BB ( <b>35G42</b> )	LB-55756BC ( <b>51G27</b> )
Bottom Power Entry Kit (LB-55757CA)		<b>34G70</b>	Furnished
Ceiling Supply and Return Air Diffusers	Step-Down	RTD11-135 ( <b>29G05</b> )	RTD11-185 ( <b>29G06</b> )
	Flush	FD11-135 ( <b>29G09</b> )	FD11-185 ( <b>29G10</b> )
	Transition	SRT16-135 ( <b>97H10</b> )	SRT16-160 ( <b>97H11</b> )
Outdoor Air Dampers No. & size of filters (in.)		OAD16-135 ( <b>35G25</b> ) (1) 16 x 20 x 1	OAD16-160 ( <b>51G30</b> ) (1) 16 x 20 x 1
Automatic OAD16 Damper Kit		<b>35G21</b>	
Low Ambient Control Kit		LB-57113BH ( <b>16J86</b> )	LB-57113BJ ( <b>16J87</b> )
Timed-Off Control (2) LB-50709BA		<b>40G20</b>	

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



**OPTIONAL ACCESSORIES — GCS16-1853 (Ordered Extra)**

Unit Model No.		GCS16-1853	
**LPG Conversion Kit		LB-81509DA (12H31)	
Roof Mounting Frame		RMF16-185 (12H05)	
Economizer Dampers with Gravity Exhaust— No. & size of filters (in.)		REMD16M-185 (40H14) (2) 25 x 25 x 1	
Differential Enthalpy Control		54G44	
Power Exhaust Fans (Down-Flo Only)	Model No.	208/230 volt	PED16-185 (12H16)
		460 volt	PED16-185 (12H17)
	Diameter (in.) & No. of Blades		(2) 16 — 5
	Total air volume (cfm)		4200
	Motor Horsepower		(2) 1/4
	Watts Input (total)		500
Horizontal Supply and Return Air Kit (LB-55756BD)		12H04	
Ceiling Supply and Return Air Diffusers (Net Weight)	Step-Down		RTD11-185 (29G06)
	Flush		FD11-185 (29G10)
	Transition		SRT16-185 (97H12)
Outdoor Air Dampers — No. & size of filters (in.)		OAD16-185 (12H03) (1) 25 x 27 x 1	
Automatic OAD16 Damper Kit		35G21	
Low Ambient Control Kit (LB-57113BK)		16J88	

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

**OPTIONAL ACCESSORIES — GCS16-2553, GCS16-2753 & GCS16-3003 (Ordered Extra)**

Unit Model No.		GCS16-2553, GCS162753 & GCS16-3003	
**LPG Conversion Kit		LB-81509DA (12H31) (2 required on -470)	
Roof Mounting Frame		RMF16-300 (41H04)	
Economizer Dampers with Gravity Exhaust— No. & size of filters (in.)		REMD16M-300 (44H47) (3) 20 x 25 x 1	
Differential Enthalpy Control		54G44	
Power Exhaust Fans (Down-Flo Only)	Model No.	208/230v	PED16-300 (44H79)
		460v	PED16-300 (44H80)
	Diameter (in.) & No. of Blades		(3) 16 — 5
	Total air volume (cfm)		6300
	Motor Horsepower		(3) 1/4
	Watts Input (total)		750
Horizontal Supply and Return Air Kit (LB-55756BE)		41H23	
Ceiling Supply and Return Air Diffusers	Step-Down		RTD11-275 (29G07)
	Flush		FD11-275 (29G11)
	Transition		SRT16-300 (97H13)
Outdoor Air Dampers — No. & size of filters (in.)		OAD16-300 (1) 26 x 31 x 1 (40H47)	
Automatic OAD16 Damper Kit		35G21	
Low Ambient Control Kit (LB-57113BL)		16J89	

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

**ELECTRICAL DATA — GCS16-823, -953, -1353 & -1603**

Model No.		GCS16-823		GCS16-953		GCS16-1353				GCS16-1603	
Line voltage data — 60 hz — 3 phase		208/230v	460v	208/230v	460v	208/230v	460v	208/230v	460v	208/230v	460v
Compressors (2)	Rated load amps — each (total)	11.4/11.4 (22.8)	5.3/5.3 (10.6)	14.8/14.1 (28.9)	7.7/7.1 (14.8)	17.3/17.3 (34.6)	9.6/9.6 (19.2)	27.1/17.9 (45.0)	14.2/10.0 (24.2)		
	Locked rotor amps — each (total)	66/66 (132.0)	35/35 (70.0)	130/130 (260.0)	64/64 (128.0)	150/150 (300.0)	73/73 (146.0)	183/150 (323.0)	91/73 (164)		
Condenser Fan Motor(s)	Full load amps (total)	2.6	1.6	3.7	1.9	2.1/2.1 (4.2)	1.2/1.2 (2.4)	3.0/3.0 (6.0)	1.5/1.5 (3.0)		
	Locked rotor amps (total)	5.9	3.3	7.3	3.7	5.1/5.1 (10.2)	2.7/2.7 (5.4)	6.2/6.2 (12.4)	3.4/3.4 (6.8)		
Evaporator Blower Motor	Horsepower	2	2	2	2	2	3	2	3	3	3
	Full load amps	7.5	3.4	7.5	3.4	7.5	10.6	3.4	4.8	10.6	4.8
	Locked rotor amps	41.0	20.4	41.0	20.4	41.0	58.0	20.4	26.8	58.0	26.8
**Recommended maximum fuse size (amps)		45	20	50	25	60	60	35	35	90	45
*Minimum Circuit Ampacity		36.0	17.0	44.0	23.0	51.0	54.0	28.0	29.0	69.0	36.0
Unit power factor		.88	.88	.88	.88	.88	.88	.88	.88	.88	.88

\*Refer to National Electrical Code manual to determine wire, fuse and disconnect size requirements.  
 NOTE — Extremes of operating range are plus and minus 10 % of line voltage.  
 \*\*Where current does not exceed 100 amps, HACR type circuit breaker may be used in place of fuse.

**ELECTRICAL DATA — GCS16-1853, -2553 & -2753**

Model No.		GCS16-1853				GCS16-2553				GCS16-2753				GCS16-3003				
Line voltage data — 60 hz — 3 phase		208/230v		460v		208/230v		460v		208/230v		460v		208/230v		460v		
Compressors	Rated load amps	each	(3) 19.2	(3) 9.6	(2) 31.0	(2) 16.8	(2) 37.1	(2) 17.8	(2) 46.5	(2) 22.2								
		total	57.6	28.8	62.0	33.6	74.2	35.6	93.0	44.4								
	Locked rotor amps	each	(3) 124	(3) 62	(2) 205.0	(2) 104.0	(2) 239.0	(2) 120.0	(2) 269.0	(2) 135.0								
		total	372.0	186.0	410.0	208.0	478.0	240.0	538.0	270.0								
Condenser Fan Motors (2)	Full load amps (total)	9.6		4.8		9.6		4.8		9.6		4.8		9.6		4.8		
	Locked rotor amps (total)	24.0		12.0		46.0		23.0		46.0		23.0		46.0		23.0		
Evaporator Blower Motor	Horsepower	3	5	3	5	5	7-1/2	5	7-1/2	5	7-1/2	5	7-1/2	7-1/2	10	7-1/2	10	
	Full load amps	10.6	16.7	4.8	7.6	16.7	24.2	7.6	11.0	16.7	24.2	7.6	11.0	24.2	30.8	11.0	14.0	
	Locked rotor amps	58.0	91.0	26.8	45.6	105.0	152.0	45.6	66.0	105.0	152.0	45.6	66.0	152.0	193.0	66.0	84.0	
Optional Power Exhaust Fans	(No.) Horsepower	(2) — 1/4		(2) — 1/4		(3) — 1/4		(3) — 1/4		(3) — 1/4		(3) — 1/4		(3) — 1/4		(3) — 1/4		
	Full load amps (total)	2.8		1.4		4.2		2.2		4.2		2.2		4.2		2.2		
	Locked rotor amps (total)	6.5		3.3		8.7		3.9		8.7		3.9		8.7		3.9		
**Recommended max. fuse size (amps)	Less exhaust fans	100	110	50	50	125	125	60	70	150	150	70	70	175	175	90	90	
	With exhaust Fans	100	110	50	50	125	125	60	70	125	150	70	70	175	175	90	90	
Unit power factor	Less exhaust fans	.84	.84	.84	.84	.88	.88	.88	.88	.88	.88	.88	.88	.87	.87	.87	.87	
	With exhaust Fans	.84	.84	.84	.84	.88	.88	.88	.88	.88	.88	.88	.88	.87	.87	.87	.87	
*Minimum Circuit Ampacity	Less exhaust fans	82.0	92.0	43.0	48.0	97.0	104.0	51.0	54.0	110.0	118.0	53.0	56.0	139.0	146.0	66.0	69.0	
	With exhaust Fans	85.0	95.0	45.0	50.0	101.0	108.0	53.0	56.0	114.0	122.0	55.0	58.0	143.0	150.0	68.0	71.0	

\*Refer to National Electrical Code manual to determine wire, fuse and disconnect size requirements.  
 NOTE — Extremes of operating range are plus and minus 10 % of line voltage.  
 \*\*Where current does not exceed 100 amps, HACR type circuit breaker may be used in place of fuse.

**GCS16-823 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																			
	.20		.40		.60		.70		.80		.90		1.00		1.10		1.30		1.50	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2200	----	----	----	----	790	.75	835	.85	880	.90	920	1.00	960	1.10	1000	1.15	1075	1.35	1145	1.55
2400	----	----	----	----	815	.85	860	.95	900	1.05	940	1.15	975	1.20	1015	1.30	1085	1.50	1160	1.70
2600	----	----	755	.80	840	1.00	880	1.10	920	1.20	960	1.30	995	1.40	1030	1.50	1100	1.70	1170	1.90
2800	----	----	790	.95	870	1.15	910	1.25	945	1.35	980	1.45	1020	1.55	1055	1.70	1120	1.90	1190	2.10
3000	740	.95	825	1.15	900	1.35	935	1.45	970	1.55	1005	1.65	1040	1.75	1075	1.90	1140	2.10	----	----
3200	780	1.10	855	1.30	930	1.55	965	1.65	1000	1.75	1035	1.85	1065	2.00	1100	2.10	----	----	----	----
3400	820	1.30	895	1.55	960	1.75	995	1.85	1030	2.00	1060	2.10	1095	2.25	----	----	----	----	----	----

NOTE — All data is measured external to the unit with dry coil and with the air filters in place. See Page 23 for Accessory Air Resistance data.

**GCS16-953 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																			
	.20		.40		.60		.70		.80		.90		1.00		1.10		1.30		1.50	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2400	----	----	----	----	860	.95	905	1.05	955	1.55	1000	1.25	1050	1.40	1100	1.55	1195	1.95	1285	2.25
2600	----	----	----	----	885	1.10	930	1.20	970	1.30	1015	1.40	1060	1.55	1105	1.70	1200	2.15	----	----
2800	----	----	830	1.05	910	1.25	955	1.35	995	1.45	1035	1.60	1075	1.70	1115	1.85	1210	2.25	----	----
3000	----	----	860	1.20	945	1.45	980	1.55	1020	1.65	1060	1.80	1095	1.90	1135	2.05	----	----	----	----
3200	835	1.20	905	1.40	975	1.60	1010	1.75	1050	1.90	1085	2.00	----	----	----	----	----	----	----	----
3400	880	1.40	945	1.60	1010	1.85	1045	2.00	1080	2.10	----	----	----	----	----	----	----	----	----	----
3600	920	1.65	985	1.85	1050	2.10	1080	2.25	----	----	----	----	----	----	----	----	----	----	----	----
3800	965	1.90	1025	2.15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

NOTE — All data is measured external to the unit with dry coil and with the air filters in place. See Page 23 for Accessory Air Resistance data.

**GCS16-1353 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																			
	.20		.40		.60		.70		.80		.90		1.00		1.10		1.30		1.50	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3600	----	----	672	1.14	740	1.36	772	1.47	802	1.60	831	1.74	860	1.87	887	2.00	940	2.30	985	2.60
3800	----	----	690	1.27	760	1.48	790	1.64	820	1.78	850	1.93	878	2.06	905	2.20	950	2.46	994	2.76
4000	642	1.18	715	1.43	778	1.67	809	1.81	838	1.95	866	2.09	895	2.24	920	2.38	968	2.66	1013	2.96
4200	670	1.35	736	1.50	798	1.87	828	2.00	856	2.13	885	2.28	913	2.43	938	2.56	984	2.86	1030	3.19
4400	693	1.52	760	1.79	821	2.06	850	2.29	878	2.36	905	2.50	930	2.63	955	2.77	1003	3.08	----	----
4600	718	1.70	785	2.00	843	2.29	872	2.44	900	2.59	923	2.71	948	2.84	974	3.00	1021	3.32	----	----
4800	747	1.93	807	2.22	865	2.41	892	2.66	918	2.82	940	2.93	970	3.09	995	3.25	----	----	----	----
5000	772	2.16	830	2.46	887	2.76	915	2.92	940	3.07	965	3.24	989	3.43	----	----	----	----	----	----
5200	800	2.41	860	2.75	915	2.92	940	3.22	965	3.42	----	----	----	----	----	----	----	----	----	----

NOTE — All data is measured external to the unit with dry coil and with the air filters in place. See Page 23 for Accessory Air Resistance data.

NOTE — Data in shaded area denotes optional 3 hp drive kit.

**GCS16-1603 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																			
	.20		.40		.60		.70		.80		.90		1.00		1.10		1.30		1.50	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4200	----	----	750	1.67	810	1.91	840	2.05	870	2.17	900	2.31	930	2.45	955	2.60	1010	2.90	1045	3.14
4400	710	1.59	770	1.83	830	2.10	860	2.24	890	2.39	915	2.51	945	2.67	970	2.83	1025	3.12	1060	3.39
4600	735	1.78	795	2.13	855	2.33	880	2.45	910	2.60	935	2.75	960	2.89	990	3.06	1040	3.38	1075	3.62
4800	760	2.00	820	2.27	875	2.54	905	2.70	930	2.85	955	3.01	980	3.26	1010	3.33	1055	3.63	1090	3.87
5000	790	2.26	845	2.53	900	2.80	925	2.96	950	3.11	975	3.27	1000	3.41	1025	3.58	1075	3.94	1110	4.16
5200	815	2.50	870	2.80	920	3.07	950	3.25	975	3.42	1000	3.56	1025	3.75	1045	3.88	1095	4.23	1125	4.46
5400	840	2.79	895	3.07	950	3.41	970	3.55	995	3.70	1020	3.87	1045	4.09	1070	4.22	1110	4.53	1145	4.81
5600	865	3.08	920	3.39	970	3.72	995	3.88	1020	4.05	1045	4.22	1065	4.37	1090	4.57	1130	4.89	1165	5.16
5800	895	3.38	945	3.73	995	4.05	1020	4.25	1045	4.42	1065	4.57	1090	4.76	1110	4.93	1150	5.25	1185	5.59

NOTE — All data is measured external to the unit with dry coil and with the air filters in place. See Page 23 for Accessory Air Resistance data.

NOTE — Data in shaded area requires field furnished motor and drive.

**GCS16-1853-235 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																			
	.20		.40		.60		.70		.80		.90		1.00		1.10		1.30		1.50	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5000	520	1.50	580	1.75	640	2.00	670	2.30	690	2.45	715	2.65	745	2.75	770	2.95	820	3.15	865	3.45
5200	540	1.60	590	1.90	650	2.30	680	2.45	705	2.60	725	2.75	755	2.90	780	3.20	830	3.35	875	3.55
5400	550	1.70	605	2.00	665	2.45	690	2.65	710	2.75	735	2.85	760	3.05	790	3.30	840	3.50	885	3.75
5600	565	1.80	615	2.25	675	2.60	700	2.85	720	2.90	745	3.10	770	3.20	800	3.40	850	3.65	890	3.95
5800	580	2.10	625	2.40	685	2.80	710	3.00	730	3.10	760	3.25	780	3.40	810	3.55	855	3.75	900	4.05
6000	600	2.30	650	2.65	695	3.05	720	3.20	745	3.35	770	3.45	795	3.60	820	3.75	870	4.05	910	4.25
6200	610	2.45	660	2.85	705	3.25	730	3.40	755	3.50	780	3.65	805	3.85	830	3.95	875	4.30	915	4.75
6400	625	2.70	675	3.15	715	3.45	740	3.60	765	3.70	790	3.95	815	4.00	840	4.15	885	4.45	930	4.90
6600	640	2.95	690	3.45	730	3.65	755	3.75	775	3.95	805	4.10	825	4.25	850	4.40	895	4.70	935	5.10
6800	655	3.10	700	3.65	748	3.90	765	4.00	790	4.20	815	4.35	835	4.45	860	4.65	905	4.95	945	5.35
7000	670	3.50	710	3.85	755	4.10	780	4.35	800	4.45	825	4.65	845	4.75	870	4.95	910	5.25	-----	-----
7200	685	3.60	735	3.90	770	4.45	790	4.60	815	4.75	835	4.90	860	5.10	880	5.25	925	5.65	-----	-----
7400	700	3.80	750	4.15	780	4.55	805	4.65	825	4.85	850	5.00	875	5.25	890	5.60	-----	-----	-----	-----
7600	710	4.00	760	4.30	790	4.65	815	4.80	835	5.00	850	5.25	880	5.50	-----	-----	-----	-----	-----	-----

NOTE — All data is measured external to the unit with dry coil and with the air filters in place. See Page 23 for Accessory Air Resistance data.

NOTE — Data in shaded area denotes optional 5 hp drive kit.

**GCS16-1853-330 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																			
	.20		.40		.60		.70		.80		.90		1.00		1.10		1.30		1.50	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5200	580	1.75	620	1.95	680	2.40	705	2.55	725	2.70	750	2.85	775	3.00	795	3.30	840	3.45	880	3.65
5400	590	1.90	640	2.15	695	2.55	715	2.75	740	2.85	765	2.95	785	3.10	810	3.35	850	3.55	890	3.80
5600	605	2.00	655	2.35	710	2.75	730	2.90	755	2.95	775	3.15	759	3.25	815	3.45	860	3.70	900	4.00
5800	615	2.20	670	2.50	720	2.90	740	3.10	765	3.15	785	3.30	810	3.50	830	3.60	870	3.80	910	4.10
6000	630	2.35	690	2.70	730	3.10	755	3.25	775	3.40	795	3.60	820	3.65	840	3.80	880	4.10	920	4.30
6200	650	2.55	705	2.95	750	3.35	770	3.50	790	3.55	810	3.75	830	3.90	850	4.00	890	4.35	930	4.80
6400	670	2.75	720	3.25	760	3.50	780	3.65	800	3.75	820	4.00	845	4.10	865	4.20	900	4.50	940	4.95
6600	690	3.15	730	3.55	775	3.75	795	3.85	810	4.05	835	4.15	855	4.30	875	4.45	910	4.75	950	5.15
6800	705	3.20	750	3.75	790	4.00	805	4.10	825	4.30	845	4.45	865	4.55	885	4.70	925	5.05	965	5.45
7000	720	3.60	760	3.95	800	4.30	820	4.45	840	4.55	860	4.75	880	4.95	895	5.05	935	5.35	-----	-----
7200	740	3.85	775	4.10	810	4.50	830	4.65	850	4.80	870	4.95	890	5.05	905	5.35	945	5.70	-----	-----
7400	755	3.95	790	4.25	825	4.65	845	4.75	865	4.90	885	5.15	900	5.35	930	5.65	-----	-----	-----	-----
7600	765	4.20	800	4.40	830	4.80	850	4.90	870	5.15	890	5.40	905	5.60	-----	-----	-----	-----	-----	-----

NOTE — All data is measured external to the unit with dry coil and with the air filters in place. See Page 23 for Accessory Air Resistance data.

NOTE — Data in shaded area denotes optional 5 hp drive kit.

**GCS16-2553-235 & GCS16-2753-235 BLOWER PERFORMANCE**

**STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																	
	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00
	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	RPM BHP	RPM BHP	RPM BHP	RPM BHP
6000	445 1.45	470 1.60	490 1.70	515 1.85	540 2.05	560 2.15	585 2.35	605 2.50	625 2.65	645 2.80	665 2.95	685 3.15	700 3.25	720 3.45	735 3.55	755 3.75	770 3.90	785 4.05
6250	455 1.55	480 1.75	500 1.85	525 2.05	550 2.20	570 2.35	595 2.55	615 2.70	635 2.85	655 3.05	670 3.15	690 3.35	710 3.50	725 3.65	745 3.85	760 4.00	775 4.10	790 4.25
6500	465 1.70	490 1.90	510 2.00	535 2.20	560 2.40	580 2.55	600 2.70	620 2.85	640 3.05	660 3.20	680 3.40	700 3.60	715 3.70	735 3.90	750 4.05	765 4.20	780 4.35	800 4.60
6750	475 1.85	500 2.05	520 2.20	545 2.40	570 2.60	590 2.75	610 2.90	630 3.10	650 3.25	670 3.45	685 3.60	705 3.80	725 4.00	740 4.15	755 4.30	775 4.50	790 4.65	805 4.85
7000	485 2.00	510 2.20	530 2.35	555 2.55	575 2.75	600 2.95	620 3.15	640 3.30	660 3.50	675 3.65	695 3.85	715 4.05	730 4.20	750 4.45	765 4.60	780 4.75	795 4.95	810 5.10
7250	495 2.20	520 2.40	545 2.60	565 2.75	585 2.95	610 3.15	630 3.35	650 3.55	665 3.70	685 3.90	705 4.10	720 4.30	740 4.50	755 4.65	770 4.85	790 5.05	805 5.25	820 5.45
7500	505 2.35	530 2.55	555 2.80	575 2.95	600 3.20	620 3.40	640 3.60	655 3.75	675 3.95	695 4.20	710 4.35	730 4.55	745 4.75	765 5.00	780 5.15	795 5.35	810 5.55	825 5.70
7750	520 2.60	545 2.80	565 3.00	585 3.20	610 3.45	630 3.65	650 3.85	665 4.00	685 4.25	705 4.45	720 4.65	740 4.85	755 5.05	770 5.25	785 5.40	805 5.70	820 5.85	835 6.05
8000	530 2.80	555 3.00	575 3.20	600 3.45	620 3.70	640 3.90	660 4.10	675 4.30	695 4.50	710 4.70	730 4.95	745 5.10	765 5.35	780 5.55	795 5.75	810 5.95	825 6.15	840 6.35
8250	545 3.05	565 3.25	590 3.50	610 3.70	630 3.95	650 4.15	665 4.35	685 4.55	705 4.80	720 5.00	740 5.25	755 5.45	770 5.65	790 5.90	805 6.10	820 6.30	835 6.55	850 6.75
8500	555 3.25	580 3.50	600 3.75	620 3.95	640 4.20	660 4.45	675 4.60	695 4.85	715 5.10	730 5.30	750 5.55	765 5.75	780 6.00	795 6.20	810 6.40	825 6.60	840 6.85	855 7.05
8750	570 3.55	590 3.75	610 4.00	630 4.20	650 4.45	670 4.70	690 4.95	705 5.15	725 5.40	740 5.65	755 5.85	775 6.10	790 6.35	805 6.55	820 6.75	835 7.00	850 7.25	865 7.45
9000	580 3.75	605 4.05	625 4.30	645 4.55	660 4.75	680 5.00	700 5.25	715 5.45	735 5.75	750 5.95	765 6.20	785 6.45	800 6.70	815 6.95	830 7.15	845 7.40	860 7.65	875 7.90
9250	595 4.10	615 4.35	635 4.60	655 4.85	675 5.10	690 5.30	710 5.60	725 5.80	745 6.10	760 6.30	775 6.55	790 6.75	810 7.10	825 7.30	840 7.55	855 7.80	865 7.95	880 8.25
9500	605 4.35	625 4.60	645 4.85	665 5.15	685 5.40	700 5.65	720 5.90	735 6.15	755 6.45	770 6.65	785 6.90	800 7.15	815 7.40	830 7.65	845 7.90	860 8.15	875 8.40	----
9750	620 4.70	640 4.95	660 5.25	675 5.45	695 5.75	715 6.05	730 6.25	745 6.50	765 6.80	780 7.05	795 7.30	810 7.55	825 7.80	840 8.05	855 8.30	870 8.60	----	----
10,000	630 5.00	650 5.25	670 5.55	690 5.85	705 6.05	725 6.40	740 6.60	760 6.95	775 7.20	790 7.45	805 7.70	820 7.95	835 8.20	850 8.50	----	----	----	----

NOTE — All data is measured external to the unit with dry coil and air filters in place. See Page 23 for Accessory Air Resistance data.  
 Shaded area denotes optional 7-1/2 hp drive kit.

**GCS16-2553-470 & GCS16-2753-470 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																	
	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00
	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	RPM BHP	RPM BHP	RPM BHP	RPM BHP
6000	450 1.50	470 1.60	495 1.75	520 1.90	545 2.10	570 2.25	590 2.45	615 2.65	635 2.80	655 3.00	675 3.20	695 3.45	715 3.65	730 3.85	750 4.05	765 4.25	785 4.55	800 4.75
6250	460 1.60	480 1.75	505 1.90	530 2.05	555 2.25	580 2.45	600 2.60	620 2.80	640 3.00	660 3.15	680 3.40	700 3.60	720 3.85	740 4.05	755 4.25	775 4.50	790 4.70	805 4.95
6500	470 1.75	495 1.90	515 2.05	540 2.25	565 2.45	585 2.60	610 2.80	630 3.00	650 3.20	670 3.40	690 3.60	710 3.85	725 4.00	745 4.25	760 4.45	780 4.70	795 4.90	815 5.20
6750	480 1.90	505 2.10	525 2.25	550 2.40	575 2.60	595 2.80	615 3.00	640 3.20	660 3.40	675 3.55	695 3.80	715 4.05	735 4.25	750 4.45	770 4.70	785 4.90	805 5.20	820 5.45
7000	490 2.10	515 2.25	540 2.45	560 2.60	585 2.85	605 3.00	625 3.20	645 3.40	665 3.60	685 3.80	705 4.05	725 4.30	740 4.45	760 4.75	775 4.95	790 5.15	810 5.45	825 5.65
7250	500 2.25	525 2.45	550 2.65	570 2.80	595 3.05	615 3.25	635 3.40	655 3.65	675 3.85	695 4.05	710 4.25	730 4.50	750 4.75	765 4.95	785 5.20	800 5.45	815 5.65	830 5.90
7500	515 2.50	540 2.70	560 2.85	580 3.05	605 3.25	625 3.45	645 3.65	665 3.90	685 4.10	705 4.35	720 4.50	740 4.75	755 4.95	775 5.25	790 5.45	805 5.70	825 6.00	840 6.20
7750	525 2.70	550 2.90	570 3.10	595 3.30	615 3.50	635 3.70	655 3.90	675 4.15	695 4.35	710 4.55	730 4.80	745 5.00	765 5.25	780 5.50	800 5.75	815 6.00	830 6.25	845 6.50
8000	540 2.95	560 3.10	585 3.35	605 3.55	625 3.75	645 3.95	665 4.20	685 4.40	700 4.60	720 4.85	740 5.10	755 5.30	770 5.50	790 5.80	805 6.05	820 6.25	835 6.50	855 6.85
8250	550 3.15	575 3.40	595 3.60	615 3.80	635 4.00	655 4.25	675 4.45	695 4.70	710 4.90	730 5.15	745 5.35	765 5.60	780 5.85	795 6.05	815 6.35	830 6.60	845 6.85	860 7.10
8500	565 3.45	585 3.65	605 3.85	625 4.05	645 4.30	665 4.50	685 4.75	705 5.00	720 5.20	740 5.45	755 5.65	775 5.95	790 6.15	805 6.40	820 6.65	835 6.90	855 7.20	870 7.50
8750	575 3.70	600 3.95	620 4.15	640 4.40	660 4.60	675 4.80	695 5.05	715 5.30	730 5.50	750 5.80	765 6.00	780 6.20	800 6.55	815 6.75	830 7.00	845 7.25	860 7.50	875 7.80
9000	590 4.00	610 4.25	630 4.45	650 4.70	670 4.90	690 5.15	705 5.35	725 5.65	740 5.85	760 6.10	775 6.35	790 6.60	805 6.80	825 7.15	840 7.40	855 7.65	870 7.90	885 8.20
9250	605 4.35	625 4.55	645 4.80	660 5.00	680 5.25	700 5.50	715 5.70	735 5.95	750 6.20	770 6.50	785 6.70	800 6.95	815 7.20	830 7.45	850 7.80	865 8.05	880 8.35	890 8.50
9500	615 4.65	635 4.85	655 5.10	675 5.35	690 5.55	710 5.80	725 6.05	745 6.30	760 6.55	780 6.85	795 7.10	810 7.35	825 7.60	840 7.85	855 8.10	870 8.40	----	----
9750	630 5.00	650 5.25	665 5.45	685 5.70	705 5.95	720 6.15	740 6.45	755 6.70	770 6.90	790 7.25	805 7.50	820 7.75	835 8.00	850 8.25	865 8.55	----	----	----
10,000	640 5.30	660 5.55	680 5.85	700 6.10	715 6.30	730 6.55	750 6.85	765 7.05	780 7.30	800 7.65	815 7.90	830 8.15	845 8.40	----	----	----	----	----

NOTE — All data is measured external to the unit with dry coil and air filters in place. See Page 23 for Accessory Air Resistance data.  
 Shaded area denotes optional 7-1/2 hp drive kit.

**GCS16-3003-235 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																			
	.20		.40		.60		.80		1.00		1.20		1.40		1.60		1.80		2.00	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6750	450	1.50	505	2.00	560	2.50	600	2.80	640	3.20	680	3.50	710	4.00	740	4.50	770	4.85	800	5.15
7000	465	1.70	515	2.20	565	2.70	610	3.05	650	3.40	685	3.80	720	4.30	745	4.70	775	5.05	810	5.35
7250	480	2.00	525	2.30	575	2.80	620	3.15	660	3.55	690	4.00	725	4.55	750	4.90	780	5.30	820	5.50
7500	490	2.20	540	2.55	585	3.00	625	3.35	665	3.80	700	4.20	730	4.75	760	5.15	790	5.55	825	5.80
7750	505	2.40	550	2.80	590	3.15	635	3.55	670	4.00	705	4.40	740	5.00	770	5.40	800	5.75	835	6.05
8000	515	2.60	580	3.00	605	3.40	640	3.70	680	4.20	715	4.75	745	5.30	780	5.80	810	6.00	840	6.40
8250	530	2.80	575	3.25	615	3.60	650	4.00	685	4.50	725	5.15	755	5.55	790	6.05	820	6.25	850	6.70
8500	540	3.10	585	3.45	625	3.90	660	4.35	695	4.75	730	5.40	765	5.90	800	6.30	825	6.55	855	6.90
8750	560	3.30	600	3.75	635	4.10	670	4.60	705	5.10	740	5.75	775	6.25	805	6.50	835	6.80	860	7.25
9000	570	3.60	610	3.95	645	4.40	680	4.90	715	5.45	750	6.10	785	6.60	810	6.80	840	7.20	865	7.60
9250	580	3.85	625	4.25	650	4.70	690	5.25	725	5.90	760	6.45	795	6.90	820	7.10	850	7.60	875	7.90
9500	600	4.25	635	4.55	665	5.20	700	5.60	740	6.25	770	6.85	805	7.15	825	7.40	855	7.85	880	8.75
9750	610	4.40	640	4.90	675	5.35	710	5.90	745	6.60	780	7.20	810	7.45	840	7.75	860	8.25	890	8.75
10,000	625	4.80	655	5.20	690	5.75	720	6.40	760	6.90	790	7.50	815	7.70	845	8.15	870	8.60	905	9.20
10,250	635	5.10	665	5.60	700	6.10	735	6.75	770	7.40	800	7.80	820	8.00	855	8.50	880	9.00	-----	-----
10,500	645	5.50	680	6.00	710	6.60	745	7.20	780	7.85	810	8.20	830	8.40	860	8.90	890	9.50	-----	-----
10,750	660	5.80	690	6.40	725	7.00	755	7.60	790	8.15	815	8.30	840	8.60	870	9.40	900	9.90	-----	-----
11,000	670	6.20	705	6.75	735	7.40	765	8.00	800	8.50	820	8.70	850	9.25	880	9.75	-----	-----	-----	-----
11,250	685	6.60	720	7.35	745	7.85	780	8.50	810	7.85	830	9.15	860	9.50	890	10.30	-----	-----	-----	-----
11,500	700	7.15	730	7.75	760	8.35	790	8.80	815	9.10	840	9.60	870	10.25	900	10.90	-----	-----	-----	-----
11,750	710	7.40	740	8.20	770	8.75	800	9.20	820	9.55	850	10.10	880	10.80	-----	-----	-----	-----	-----	-----
12,000	725	8.10	755	8.75	785	9.25	810	9.60	835	10.00	860	10.60	-----	-----	-----	-----	-----	-----	-----	-----
12,250	740	8.60	765	9.20	800	9.70	820	10.00	845	10.60	870	11.20	-----	-----	-----	-----	-----	-----	-----	-----
12,500	750	9.15	780	9.70	810	10.10	830	10.50	860	11.10	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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

**GCS16-3003-470 BLOWER PERFORMANCE**

Air Volume (cfm)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge																			
	.20		.40		.60		.80		1.00		1.20		1.40		1.60		1.80		2.00	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6750	465	1.90	510	2.00	550	2.40	590	2.70	630	3.10	660	3.35	700	3.80	730	4.20	760	4.55	790	4.85
7000	475	1.90	520	2.20	560	2.60	600	2.90	640	3.25	670	3.60	705	4.00	740	4.40	770	4.75	800	5.25
7250	490	2.00	535	2.40	580	2.80	610	3.10	650	3.50	680	4.10	715	4.25	750	4.65	780	5.10	810	5.60
7500	500	2.20	540	2.60	585	3.00	620	3.25	660	3.70	690	4.20	725	4.55	760	4.90	785	5.40	820	6.00
7750	515	2.40	560	2.80	600	3.20	640	3.60	670	4.00	700	4.40	735	4.75	765	5.20	795	5.75	830	6.40
8000	530	2.70	570	3.10	610	3.40	645	3.80	680	4.25	710	4.70	745	5.10	775	5.50	805	6.10	840	6.70
8250	545	2.90	585	3.30	620	3.65	660	4.00	690	4.50	720	4.95	755	5.40	785	5.80	815	6.40	845	7.00
8500	560	3.20	600	3.50	635	3.85	670	4.40	700	4.85	735	5.30	765	5.75	795	6.25	825	6.80	855	7.30
8750	570	3.40	610	3.80	645	4.20	680	4.70	710	5.20	745	5.60	775	6.10	805	6.60	835	7.10	865	7.70
9000	585	3.70	625	4.10	660	4.50	690	5.05	720	5.50	755	5.90	785	6.50	820	7.05	845	7.55	875	8.05
9250	600	3.90	640	4.40	675	4.90	705	5.40	740	5.85	770	6.40	800	6.80	830	7.50	855	7.90	880	8.50
9500	615	4.25	650	4.70	685	5.30	720	5.75	750	6.25	780	6.80	810	7.30	840	7.80	865	8.30	890	8.90
9750	630	4.60	665	5.10	700	5.70	730	6.20	760	6.60	790	7.20	820	7.75	850	8.25	885	8.90	905	9.40
10,000	645	4.60	680	5.50	710	6.00	745	6.60	775	7.20	800	7.60	830	8.20	860	8.60	890	9.20	915	9.85
10,250	660	5.30	695	5.90	720	7.40	760	6.95	785	7.55	820	8.10	845	8.60	870	9.05	900	9.75	935	10.60
10,500	675	5.75	705	6.30	740	6.85	770	7.40	800	7.90	830	8.60	855	8.90	880	9.50	915	10.35	940	10.90
10,750	690	6.25	720	6.70	755	7.30	780	7.80	810	8.40	840	8.95	865	9.40	890	9.90	920	10.75	945	11.30
11,000	705	6.65	735	7.20	765	7.70	795	8.25	825	8.90	850	9.35	880	9.80	905	10.50	930	11.20	-----	-----
11,250	715	7.00	750	7.70	780	8.30	810	8.85	840	9.35	860	9.80	890	10.40	915	11.00	-----	-----	-----	-----
11,500	730	7.50	760	8.20	795	8.75	820	9.35	850	9.85	875	10.35	900	11.00	-----	-----	-----	-----	-----	-----
11,750	745	8.10	775	8.65	810	9.25	840	9.80	880	10.25	885	10.80	-----	-----	-----	-----	-----	-----	-----	-----
12,000	760	8.55	790	9.20	820	9.75	850	10.35	875	10.80	900	11.50	-----	-----	-----	-----	-----	-----	-----	-----
12,250	775	9.10	805	9.70	835	10.25	860	10.80	885	11.40	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
12,500	790	9.75	820	10.25	845	10.75	870	11.30	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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



**ACCESSORY AIR RESISTANCE**

Unit Model No.	Air Volume (cfm)	Total Resistance (inches water gauge)						
		Wet Evaporator Coil	REMD16M Down-flo Economizer	EMDH16M Horizontal Economizer	RTD11 Step-Down Diffuser			FD11 Flush Diffuser
					2 Ends Open	1 Side 2 Ends Open	All Ends & Sides Open	
GCS16-823 GCS16-953	2400	.12	.03	.03	.21	.18	.15	.14
	2600	.13	.04	.04	.24	.21	.18	.17
	2800	.14	.04	.04	.27	.24	.21	.20
	3000	.16	.05	.05	.32	.29	.25	.25
	3200	.18	.05	.05	.41	.37	.32	.31
	3400	.19	.06	.06	.50	.45	.39	.37
	3600	.21	.06	.06	.61	.54	.48	.44
	3800	.23	.07	.07	.73	.63	.57	.51
GCS16-1353	3600	.12	.03	.03	.36	.28	.23	.15
	3800	.13	.04	.04	.40	.32	.26	.18
	4000	.14	.04	.04	.44	.36	.29	.21
	4200	.15	.05	.05	.49	.40	.33	.24
	4400	.16	.05	.05	.54	.44	.37	.27
	4600	.17	.06	.06	.60	.49	.42	.31
	4800	.18	.07	.07	.65	.53	.46	.35
	5000	.19	.09	.09	.69	.58	.50	.39
5200	.20	.10	.10	.75	.62	.54	.43	
GCS16-1603	4200	.10	.06	.06	.22	.19	.16	.10
	4400	.11	.07	.07	.28	.24	.20	.12
	4600	.12	.07	.07	.34	.29	.24	.15
	4800	.13	.08	.08	.40	.34	.29	.19
	5000	.14	.08	.08	.46	.39	.34	.23
	5200	.15	.09	.09	.52	.44	.39	.27
	5400	.16	.10	.10	.58	.49	.43	.31
	5600	.17	.12	.12	.64	.54	.47	.35
5800	.18	.13	.13	.70	.59	.51	.39	
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	----	1.20	1.02	.88	.74	
GCS16-2553 GCS16-2753 GCS16-3003	6000	.06	.01	----	.36	.31	.27	.29
	6500	.07	.02	----	.42	.36	.31	.34
	7000	.08	.02	----	.49	.41	.36	.40
	7500	.09	.04	----	.51	.46	.41	.45
	8000	.10	.06	----	.59	.49	.43	.50
	8500	.11	.08	----	.69	.58	.50	.57
	9000	.12	.10	----	.79	.67	.58	.66
	9500	.13	.12	----	.89	.75	.65	.74
10,000	.15	.14	----	1.00	.84	.73	.81	

**PED16-185 & PED16-300  
POWER EXHAUST FANS PERFORMANCE**

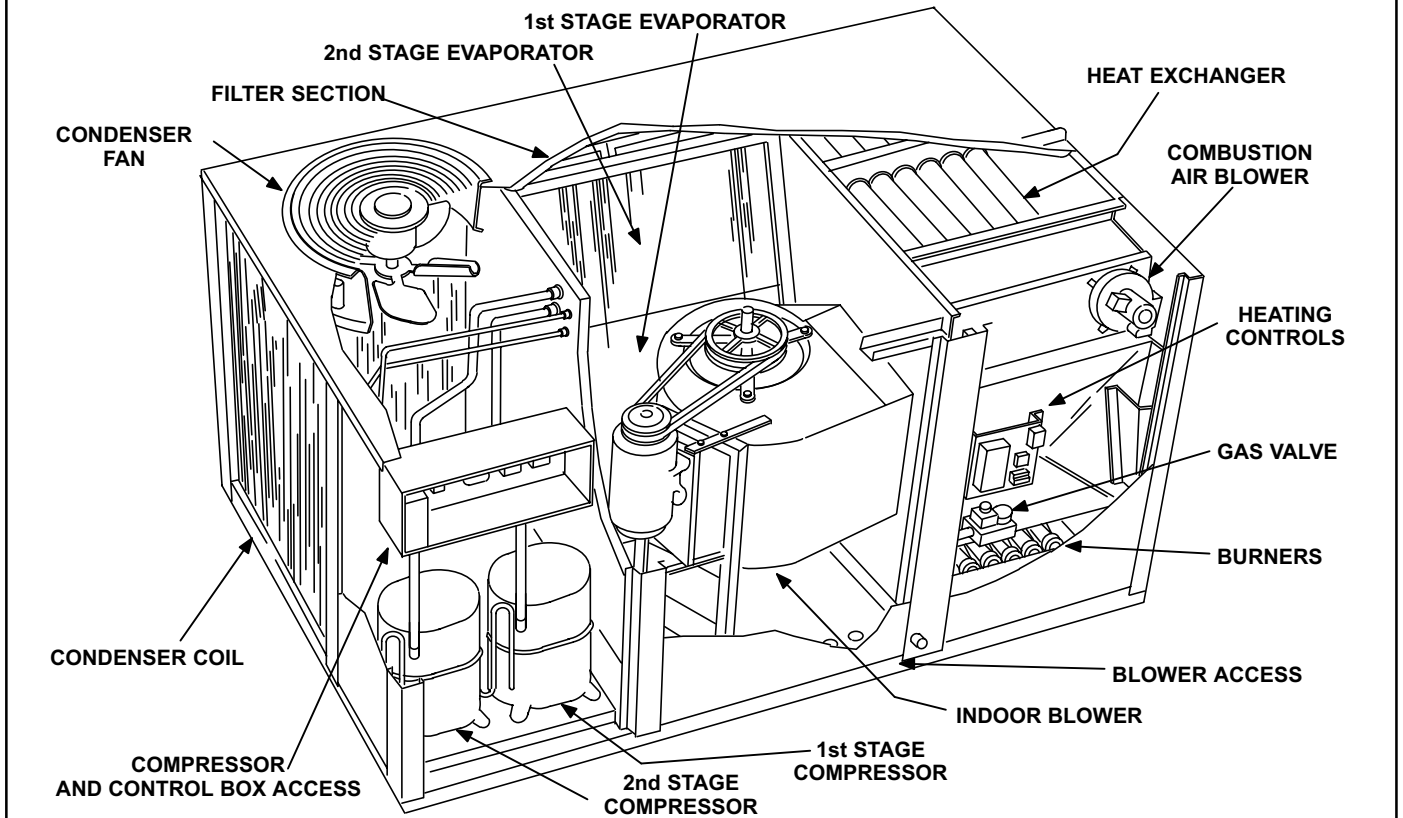
Model No.	Air Volume (cfm Exhausted)	Return Air System Static Pressure (Inches Water Gauge)
PED16-185	4200	0
	3800	.05
	3500	.10
	3200	.15
	2700	.20
	2200	.25
PED16-300	6300	0
	5750	.05
	5200	.10
	4625	.15
	4050	.20

**CEILING DIFFUSER AIR THROW DATA**

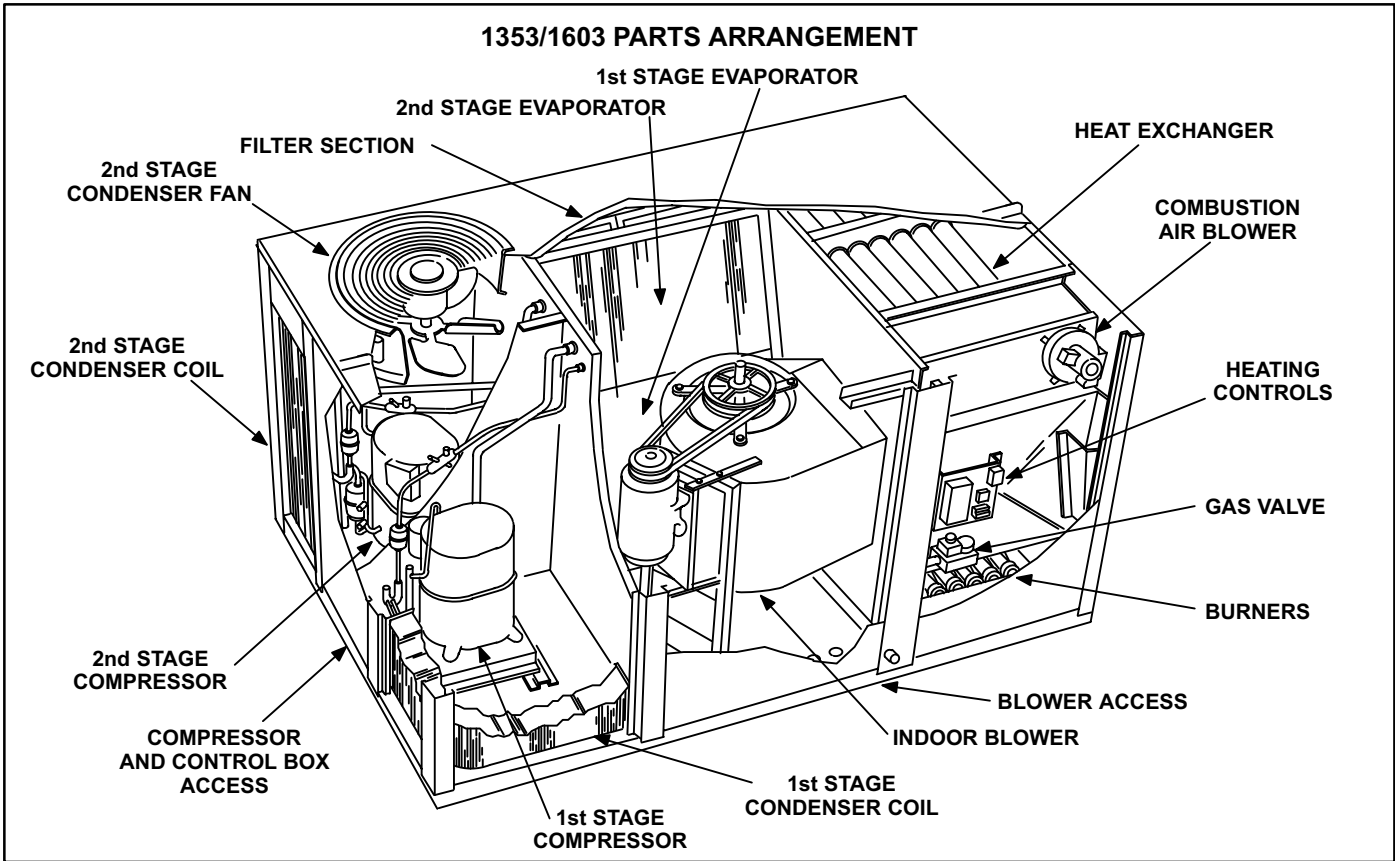
Model No.	Air Volume (cfm)	*Effective Throw Range (feet)	
		RTD11 Step-Down	FD11 Flush
GCS16-823 GCS16-953	3000	27 — 33	25 — 30
	3375	30 — 37	28 — 34
	3750	34 — 41	31 — 38
GCS16-1353	4400	34 — 42	32 — 40
	4950	38 — 47	36 — 45
	5500	43 — 52	40 — 50
GCS16-1603	4200	39 — 46	40 — 48
	5000	41 — 50	43 — 52
	5800	43 — 52	45 — 54
GCS16-1853	6000	45 — 55	48 — 55
	6750	47 — 56	50 — 58
	7500	49 — 58	55 — 66
GCS16-2553 GCS16-2753 GCS16-3003	8000	39 — 44	53 — 62
	9000	47 — 56	55 — 64
	10,000	49 — 58	57 — 67

\*Throw is the horizontal or vertical distance an airstream travels on leaving the outlet or diffuser before the maximum velocity is reduced to 50 ft. per minute. Four sides open.

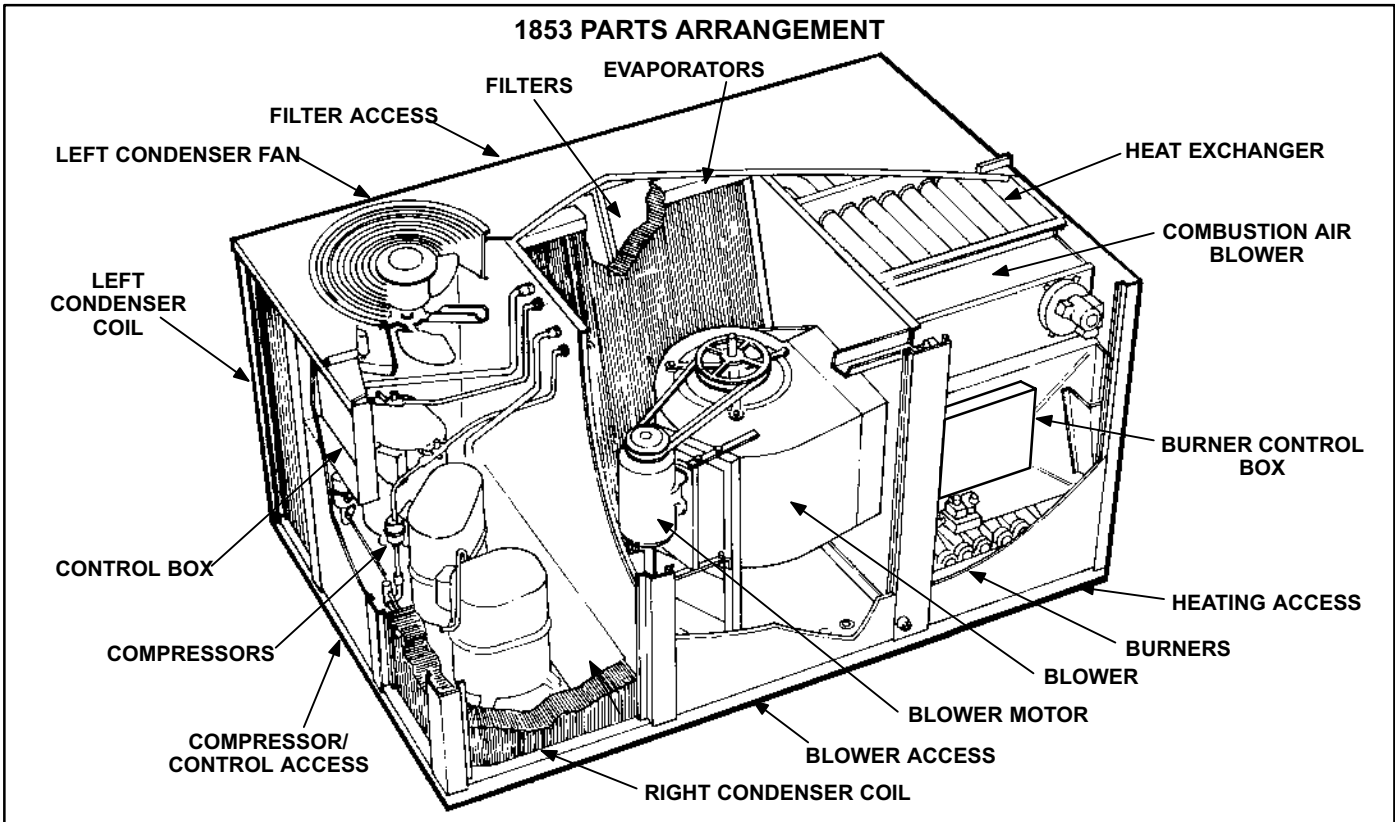
**823/953 PARTS ARRANGEMENT**



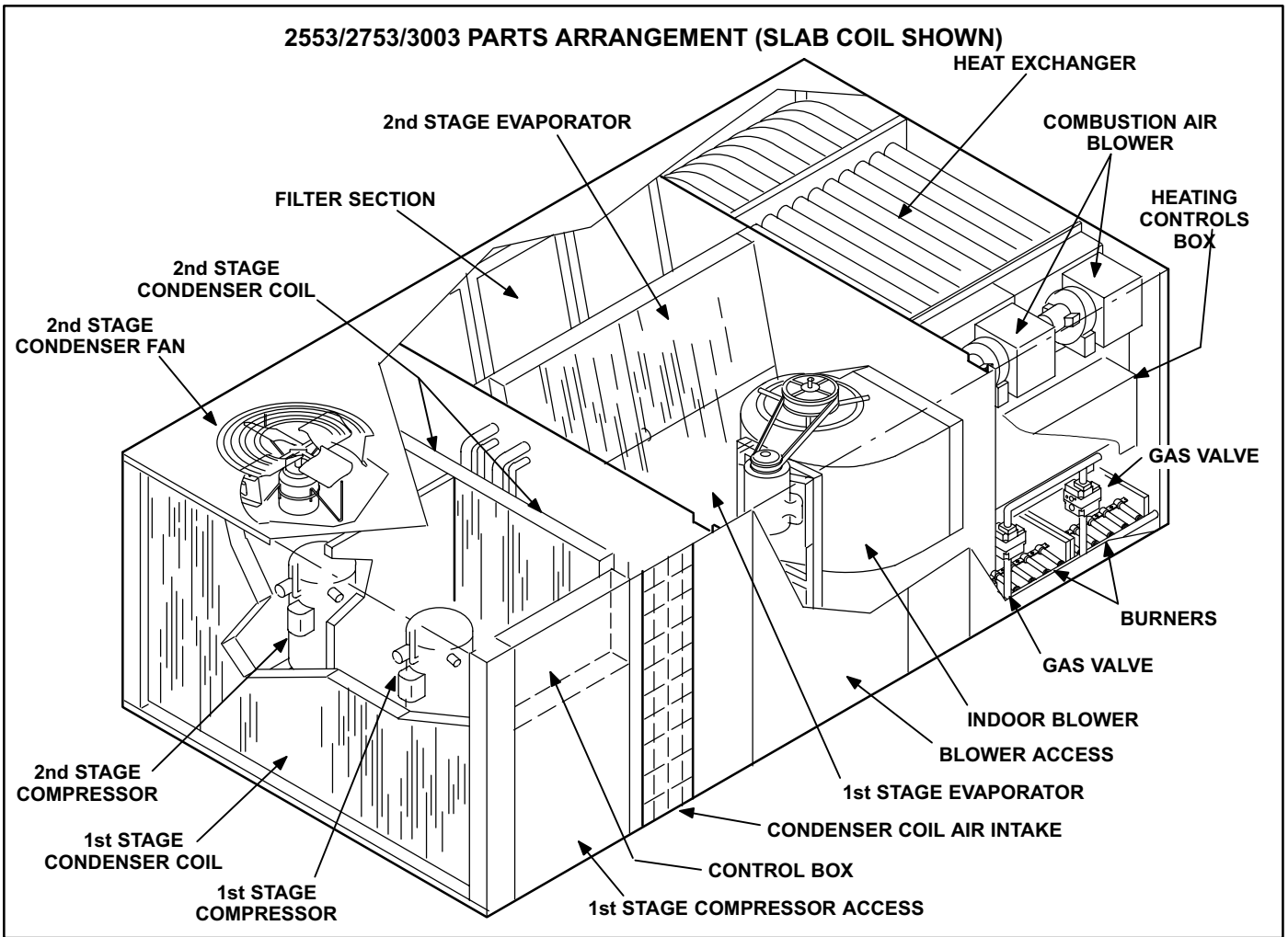
**FIGURE 1**



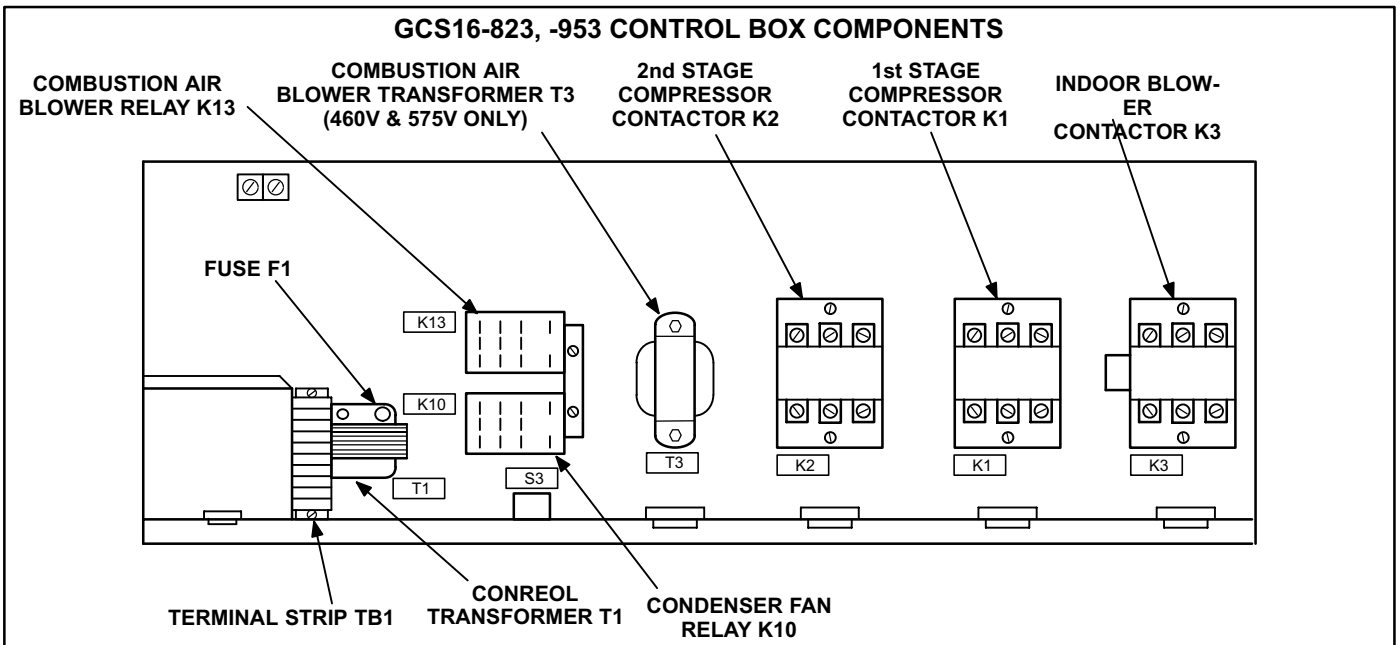
**FIGURE 2**



**FIGURE 3**



**FIGURE 4**



**FIGURE 5**

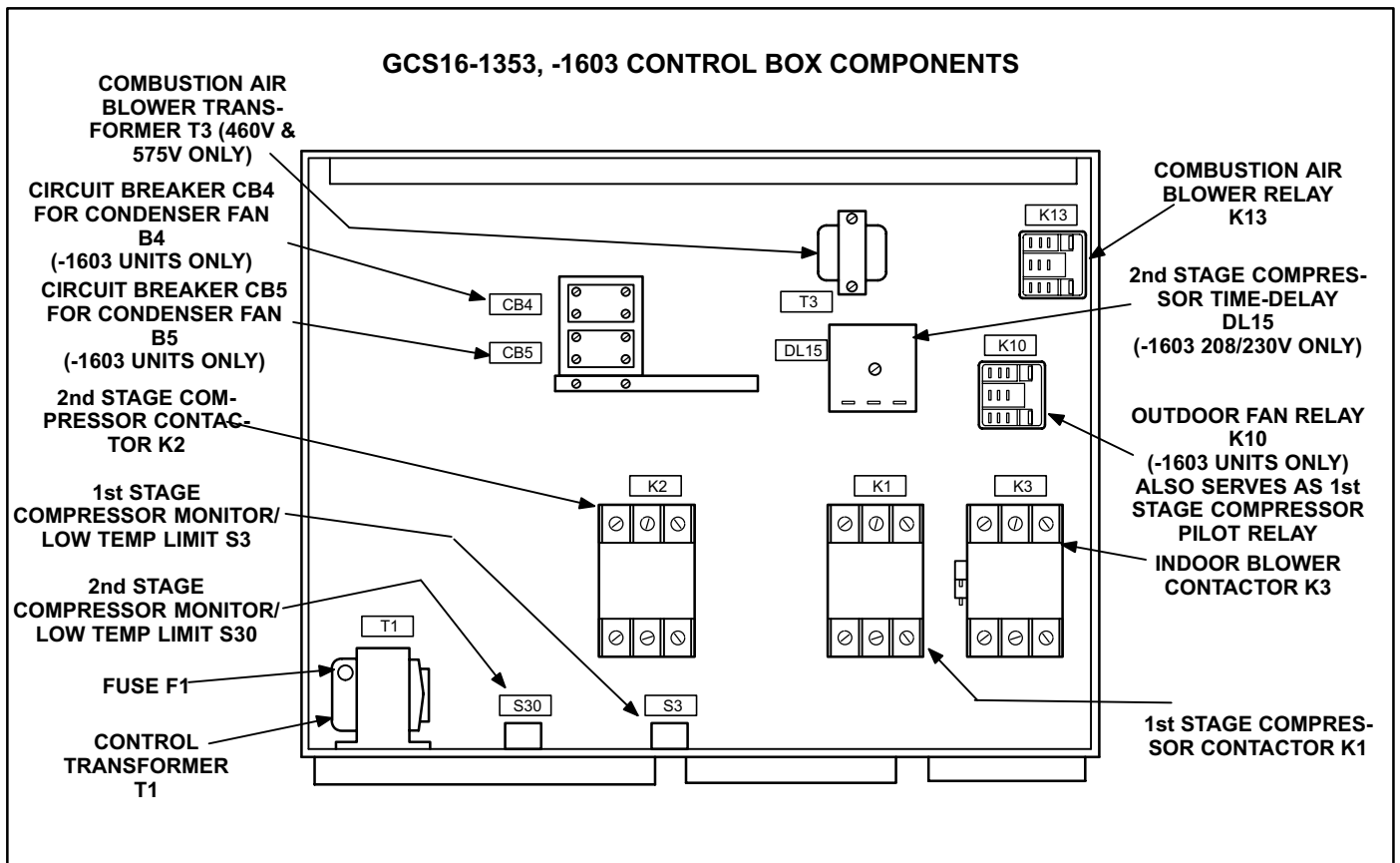


FIGURE 6

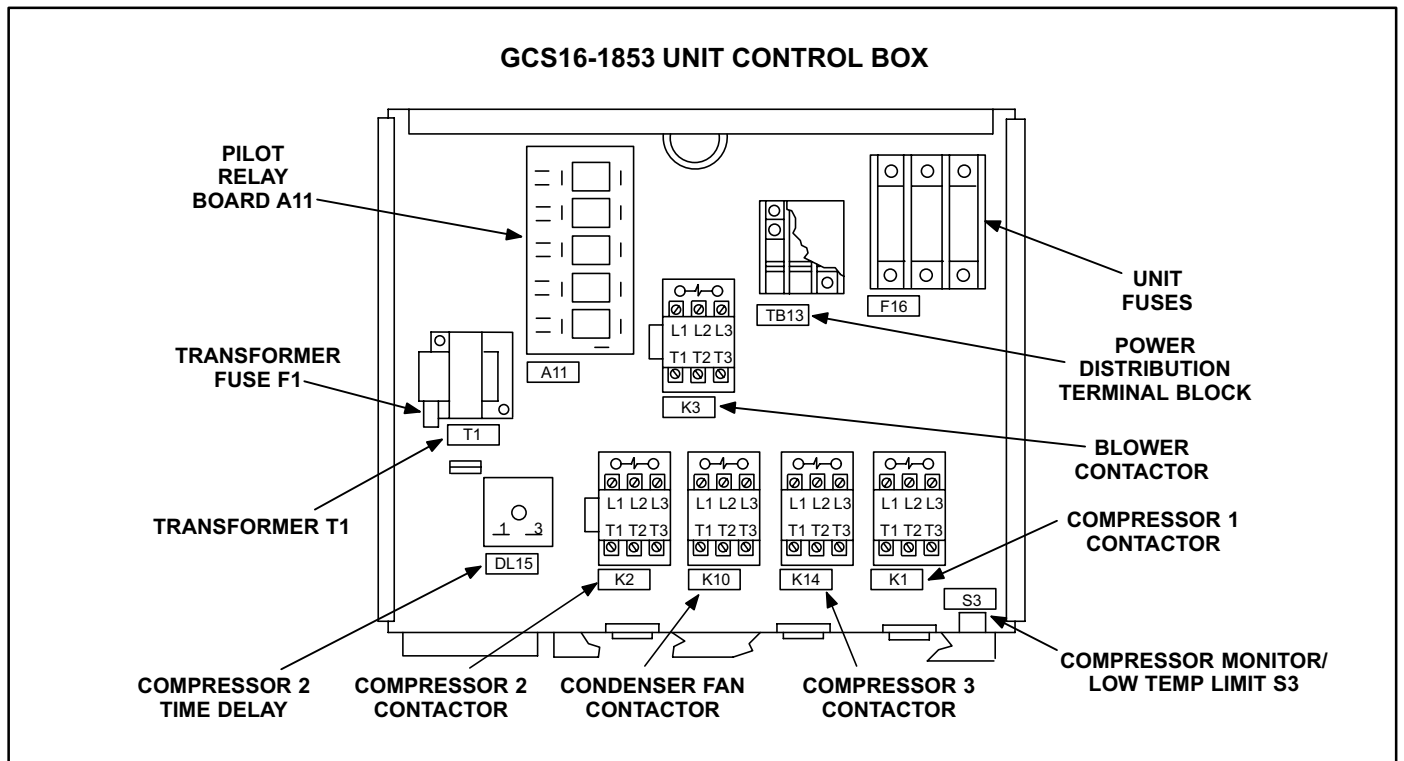


FIGURE 7

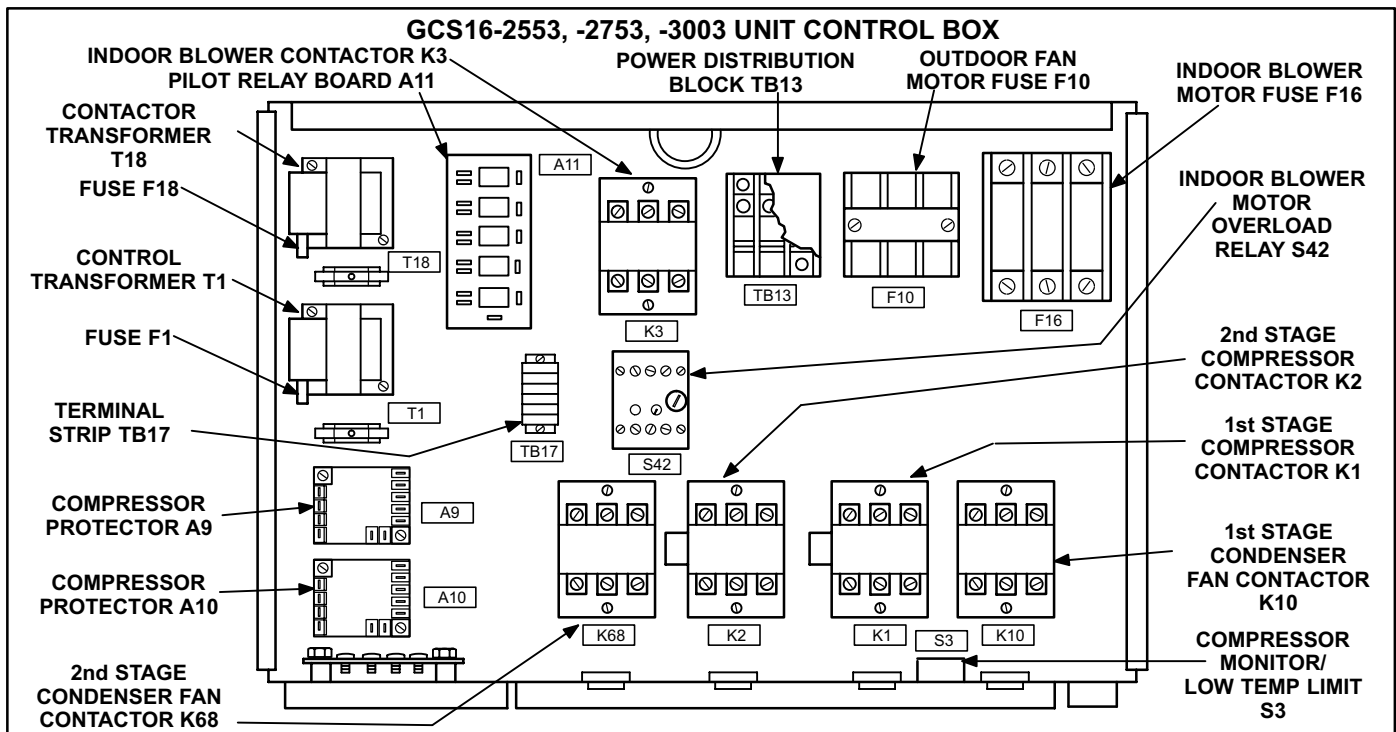


FIGURE 8

## I-APPLICATION

Refer to the Engineering Handbook for specific application data. All units are factory equipped with the hardware required for installation of Lennox' optional thermostat control systems. Lennox' control systems are the same controls, harnesses, and harness plugs used in all 11, 15 and 16 series commercial units (except for early 11 series units which were equipped with integral control system). 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 components is shown in figures 1, 2, 3 and 4.

### A-Lifting Brackets

Each unit is equipped with factory installed lifting brackets as shown in figure 9. Brackets are used for lifting the unit during installation or when servicing. Lifting lugs can be removed from the unit and reused.

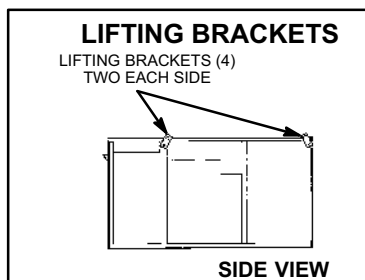


FIGURE 9

If unit must be lifted for service, use only lifting brackets to lift unit.

### B-Control Box Components

GCS16 control box is shown in figures 5, 6, 7 and 8. The control box is located in the upper portion of the compressor compartment behind the compressor compartment access panel. In larger units, a hinged door with magnetic latch located behind the compressor access panel, provides access to control components.

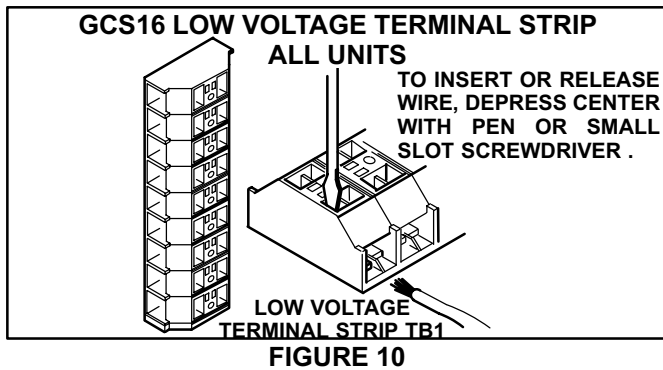
#### 1-Power Distribution Terminal Block TB13 (-1853, -2553, -2753, -3003)

Larger 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-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 10 and 38). In 10 ton and smaller units, TB1 is located in the unit control box. In 12.5 ton and larger units, the terminal strip is located in the blower compartment. A separate access panel is provided adjacent to the blower access panel.

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



### 3-Terminal Block TB17 (-2553, -2753, -3003)

TB17 is a low voltage terminal block located in the control box of 18.5 ton and larger units. The terminal strip is designed for diagnostic troubleshooting and test running the unit from the control box area. TB17 terminals are designated as shown in table 1:

TABLE 1

TERMINAL NUMBER	TB17 TERMINAL DESIGNATIONS
1	24 VAC Power
2	First stage thermostat Y1
3	Input to pilot relay K66 (24VAC applied here will energize 1st stage cooling)
4	Second stage thermostat Y2
5	Input to pilot relay K67 (24VAC applied here will energize 2nd stage cooling)
6	24 VAC Common

### 4-Transformer T1 (all units)

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).

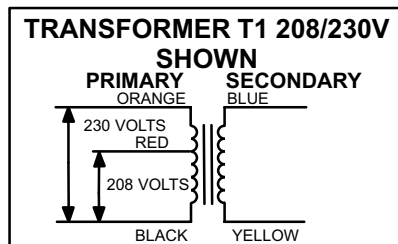


FIGURE 11

Transformer is rated at 70VA. 208/230 (P) voltage transformers use two primary voltage taps as shown in figure 11.

In 18.5 ton and larger units, T1 is used only to supply 24VAC power to the pilot control circuit and all 24VAC devices other than the contactors and transformer T18 is used to supply 24VAC power to the contactors.

### 5-Transformer Fuse F1 (all units)

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.

### 6-Transformer T18 (-2553, -2753, -3003 only)

T18 is a line voltage to 24VAC transformer used in 18.5 ton and larger units. T18 is identical to transformer T1 and is used to supply 24VAC power to contactors.

### 7-Transformer T3 (all 460V and 575V units)

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. In units over 12.5 ton capacity, T3 is located in the heating control box in the heating section.

### 8-Condenser Fan Motor Fuse F10 (-2553, -2753, -3003 only)

Line voltage fuses F10 are used to provide overcurrent protection to all condenser fans (and optional power exhaust fans) in the unit. The fuses are rated at 20A in 208/230V units and 15A in all others.

### 9-Unit Line Voltage Fuses F16 (-1853, -2553, -2753, -3003)

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

### 10-Circuit Breaker CB4, CB5 (-1603 Y voltage only)

Circuit breaker CB4 provides overcurrent protection to condenser fan B4 in 12.5 ton units and CB5 provides overcurrent protection to condenser fan B5. Both circuit breakers are two-pole 240V manual reset switches with a 15A rating.

### 11-Compressor Contactor K1 (all units)

K1 is a 24V to line voltage contactor used to energize the first compressor (B1) in response to first stage cooling demand. All units use three-pole-double-break contactors for three-phase operation with a 24VAC coil.

*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.*

### 12-Blower Motor Overload Relay S42 (5 & 10 HP Motors only)

Units equipped with 5 and 10 horsepower indoor blower motors are also equipped with a thermal overload relay connected inline with the blower motor. The relay monitors the current flowing to the blower motor. When the relay senses an overload condition, a set of N.C. contacts in the relay open to de-energize all control voltage in the unit.

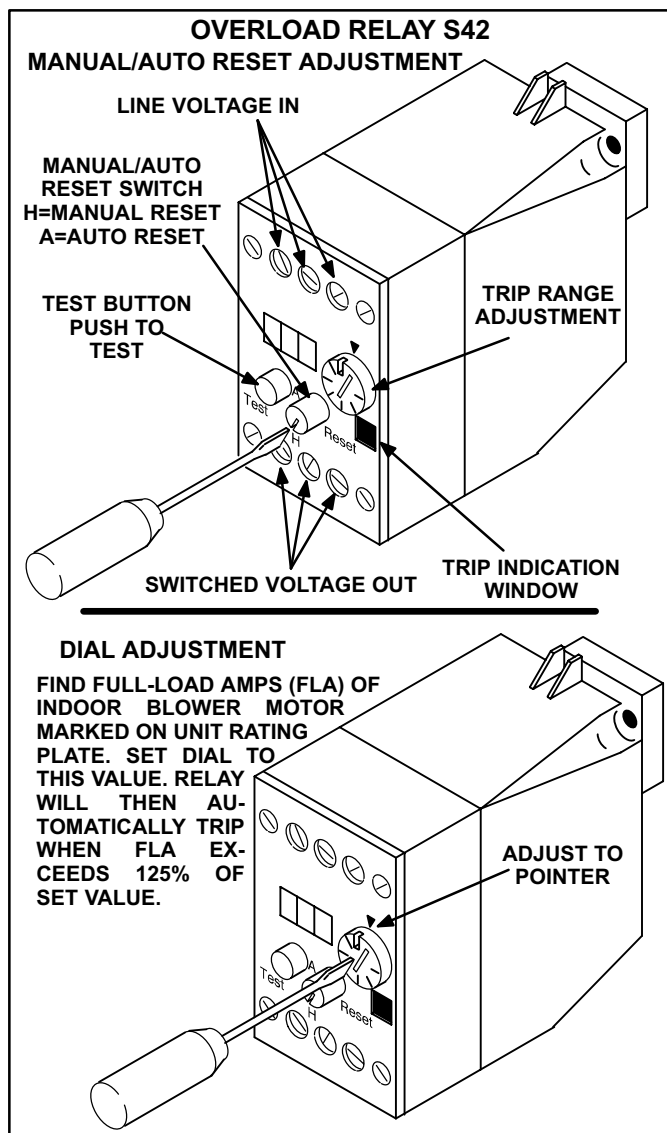


FIGURE 12

### 13-Compressor Contactor K2 (all units)

K2 is a 24V to line voltage contactor used to energize the second compressor (B2) in response to cooling demand. All units use three-pole-double-break contactors for three-phase operation with a 24VAC coil. In -1853 units, contactor K2 is used for the second first stage compressor. In all other units, K2 is used to energize the second stage compressor.

In -1603 and -1853 units, K2 is energized after a 30 second delay is 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.

### 14-Compressor Contactor K14 (-1853 only)

K14 is a 24V to line voltage contactor used to energize the 3rd compressor (B13) in response to second stage cooling demand. Contactor K14 is identical to contactor K1. All units use three-pole-double-break contactors.

### 15-Indoor Blower Contactor K3 (all units)

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.

### 16-Condenser Fan Contactor K10 (all units except -1353)

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

### 17-Combustion Air Blower Relay K13 (all units)

Relay K13 is a DPDT relay located inside the control box of 12.5 ton and smaller units. K13 is energized by 1st stage heating demand from thermostat 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. In 15 ton and larger units, K13 is located in the heating controls section of the unit.

### 18-Condenser Outdoor Fan Contactor K68 (-2553, -2753, -3003 only)

CHA16 18.5 ton and larger units are equipped with separate condenser fan contactors for each stage of cooling. K68 is identical to K10. In units equipped with two condenser fan contactors, K10 operates with the first stage circuit on a call for first stage cooling and K68 operates with the second stage circuit on a call for second stage cooling.

### 19-Pilot Relay Board A11 (-1853, -2553, -2753, -3003 only)

A11 is a pilot relay board (figure 13) used in all GCS1615 ton and larger 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.

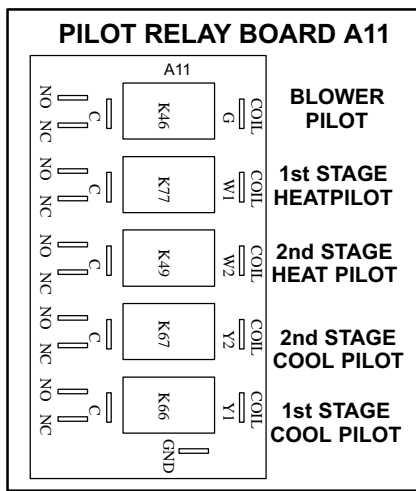


FIGURE 13

**WARNING**

Do not remove or bypass the pilot relay board. Control damage or failure could result.

**20-Compressor Motor Protector A9, A10 (-2553, -2753, -3003 only) 575 Volt Only**

Motor protectors A9 and A10 are used in all GCS16 18.5 ton and larger units to provide compressor over-temperature sensing which helps protect the compressors. Compressors in these units have thermistors imbedded in the motor windings. The motor protectors monitor the sensors in each compressor and shuts off the compressor when resistance increases above a preset limit. As the compressor windings cool, the resistance through the sensors drops and the control resets. Table 2 shows the resistance values for the winding temperature sensors.

TABLE 2

Compressor Winding Temperature Sensor	Trip Ohms Temp. Rise	Reset Ohms Tem. Fall
	16K to 24K	5.5K to 6.9K

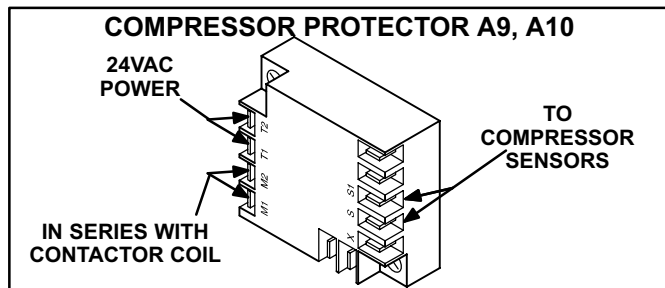


FIGURE 14

**21- Low Ambient Lockout Switch (Compressor Monitor) S3 (all units)**

GCS16 units are equipped with a single compressor monitor located in the unit control box. The compressor monitor is a SPST bimetal thermostat which opens on a temperature drop. It is connected inline with the 24VAC compressor control circuits. When outdoor temperature drops below 40°F the compressor monitor opens to electrically disconnect all compressors. When the compressors are disconnected, cooling demand is handled by optional REMD16 economizer (if installed). The monitor automatically resets when outdoor temperature rises above 50°F.

NOTE-Compressor monitors must be disconnected if optional low ambient kit is used.

**22- Low Ambient Lockout Switch (Compressor Monitor) S30 (-1353, -1603 only)**

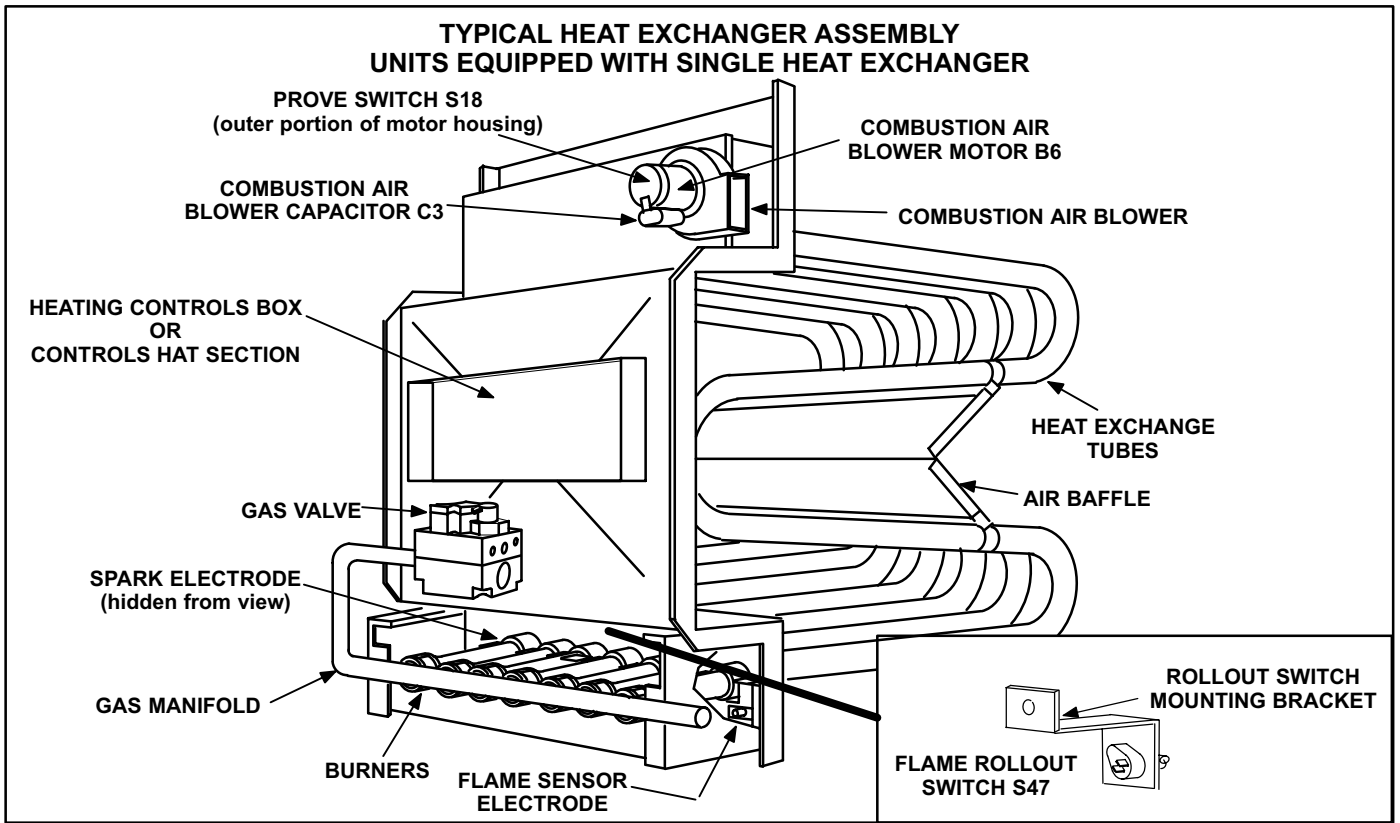
CHA16-1353 and -1603 (10 and 12.5 ton) units are equipped with a second compressor monitor (S30) used in addition to compressor monitor S3. S3 is identical to S30. In units equipped with two compressor monitors, S3 protects the first stage compressors and S30 protects the second stage compressors.

**23-Compressor Delay DL15 (-1603 Y voltage, -1853 all voltages)**

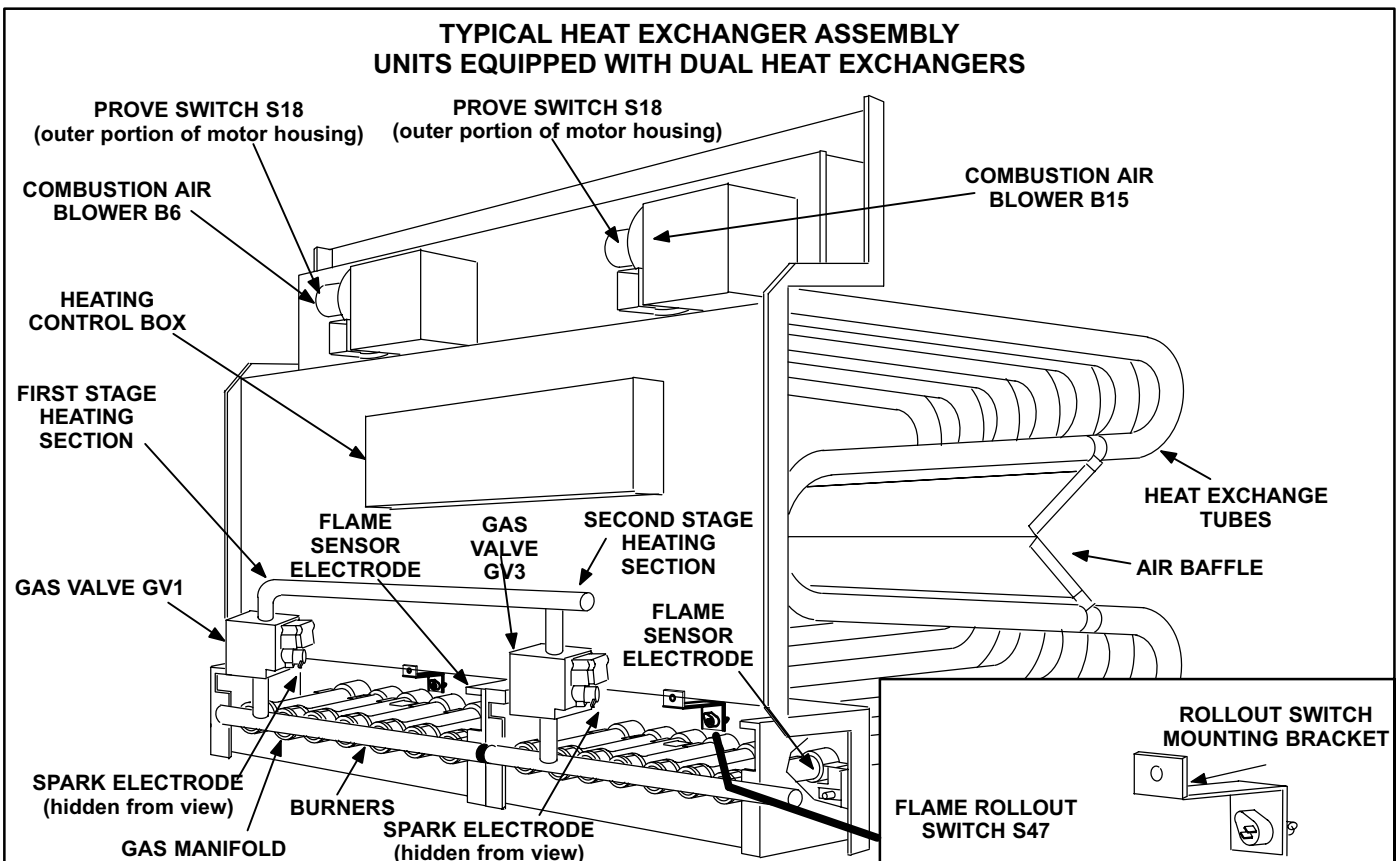
Time delay DL15 is a SPST N.O. time-delay switch. Once energized, the delay waits 30 seconds + 3 seconds before closing. The purpose of the delay is to prevent voltage drop at the contactor coil due to (the possibility of) multiple contactors being energized at the same time. With the delay added, only two contactors (K1 and K10) can energize at the same time while the third contactor (K2) must wait 30 seconds before energizing. When thermostat demand stops, DL15 immediately opens and resets.

In both units, the delay is wired in series with compressor contactor coil (K2). In GCS16-1603 units, the delay is energized upon receiving a call for second stage cooling. In CHA16-1853 units the delay is energized simultaneously with compressor 1 contactor K1 and condenser outdoor-fan contactor K10.

In GCS16-1853 units, 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 the load added by the time delay (allows K2 to receive full voltage).

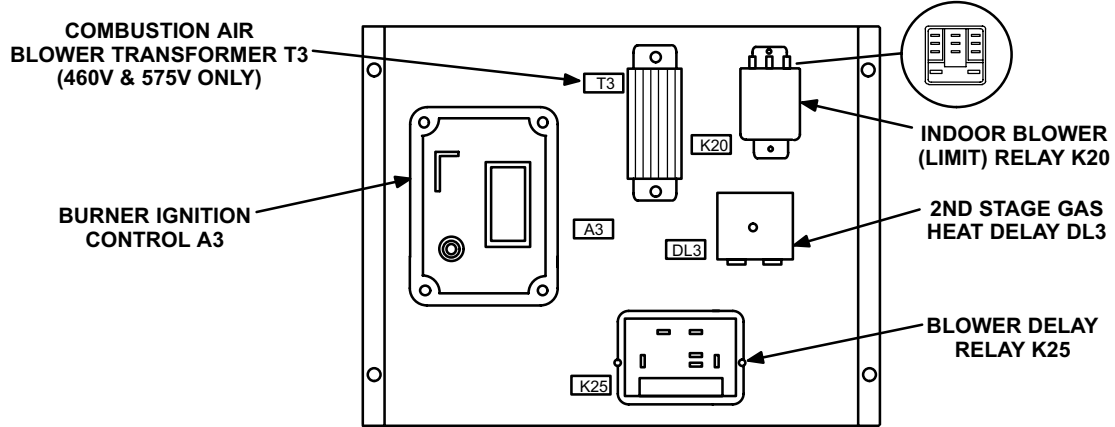


**FIGURE 15**



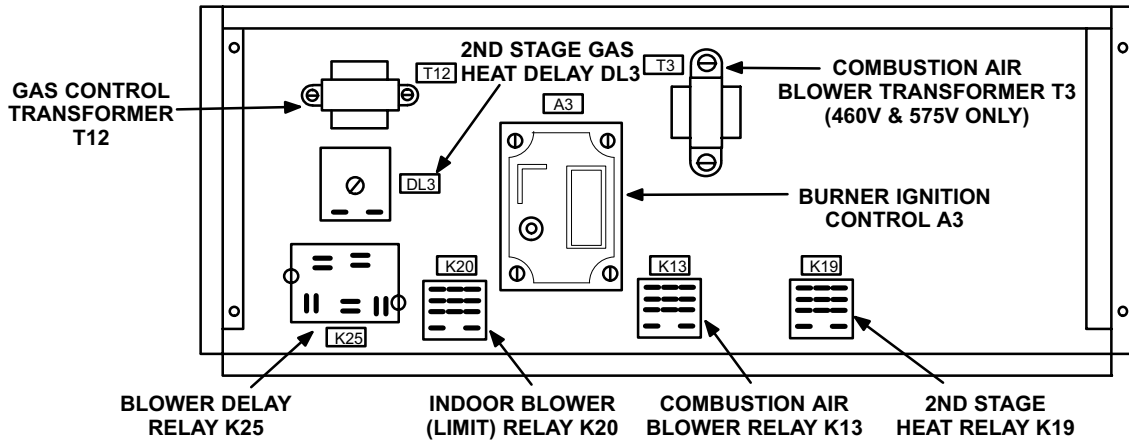
**FIGURE 16**

**GCS16-823, -953, -1353, -1603 HEATING CONTROL COMPONENTS**



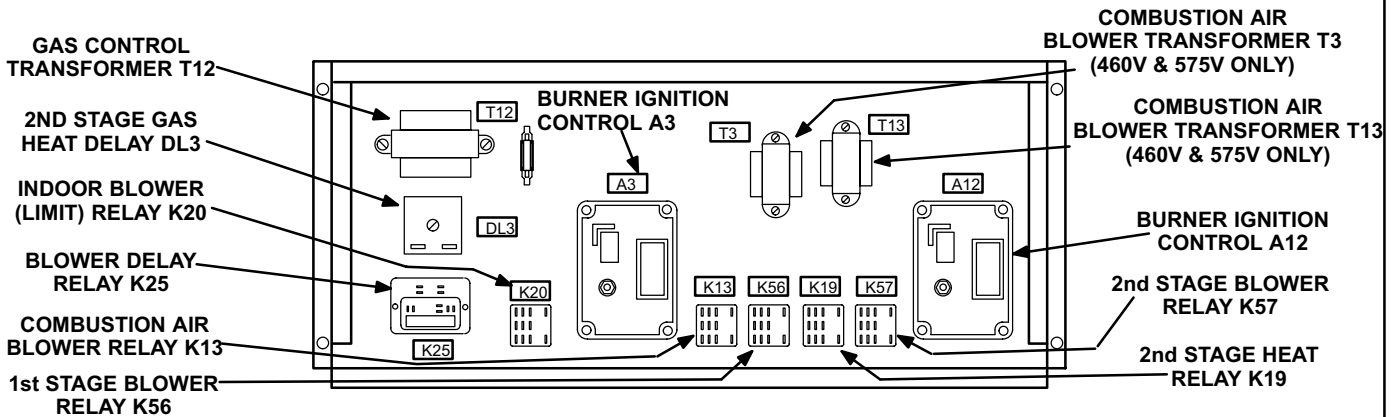
**FIGURE 17**

**HEATING CONTROL COMPONENTS GCS16-1853, -2553, -2753, -3003 UNITS EQUIPPED WITH SINGLE HEAT EXCHANGER**



**FIGURE 18**

**HEATING CONTROL COMPONENTS GCS16-1853, -2553, -2753, -3003 UNITS EQUIPPED WITH DUAL HEAT EXCHANGERS**



**FIGURE 19**

## **C-Heating Control Box Components Figures 17, 18 and 19.**

### **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 In units equipped with two heat exchangers, T3 supplies power to the first stage combustion air blower (B6). T3 is located in the unit control box in units with 12.5 ton and under capacity. T3 is located in the heating control box in all other units.

### **2-Transformer T12 (1853, 2553, 2753, 3003)**

All 15 ton and larger 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-Transformer T13**

Transformer T13 is used in 460 (G) and 575 (J) voltage units to step-down line voltage to 230V to power the second stage combustion air blower (B15). The autotransformer is connected directly to line voltage and is powered at all times. It has an output rating of 0.5A T13 is only used on the second stage of units equipped with two heat exchangers.

### **4-Combustion Air Blower Relay K13 (1st Stage Heat Relay)**

Relay K13 is a DPDT relay located inside the heating control box of 15 ton and larger units. 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.

### **5-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 energized and indoor blower starts.

### **6-2nd Stage Heat Relay K19**

Relay K19 is also a SPDT relay located in the heating control box of fifteen ton and larger units. Relay K19 is energized by 2nd stage heating demand (pilot relay K49) and is energized throughout 2nd stage heating demand. When the thermostat calls for second stage heating, heat delay relay DL3 is energized. When time has elapsed, DL3 closes to energize K19.

Relay K19 functions differently depending on whether the unit is equipped with single or dual heat exchangers. In single heat exchanger models, K19 normally open contacts close 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.

In dual heat exchanger models, K19 normally open contacts close to energize the second stage combustion air blower (B15). Once B15 is energized, the second stage heat exchanger begins a normal ignition sequence (identical to first stage ignition sequence).

### **7-1st Stage Heat Blower Relay K56**

Relay K56 is used only in dual heat exchanger models. K56 is a SPST 24V relay connected in parallel with the first stage operator of the first stage gas valve (GV1-W1). The contacts of K56 are connected in parallel with the contacts of relay K57 so that if either gas valve is energized, the indoor blower will automatically be energized. When K56-1 closes, blower delay relay K25 is energized and the indoor blower is powered after a time delay.

### **8-2nd Stage Heat Blower Relay K57**

Relay K57 is used only in dual heat exchanger models. K57 is a SPST 24V relay connected in parallel with the first stage operator of the second stage gas valve (GV3-W1). The contacts of K57 are connected in parallel with the contacts of relay K56 so that if either gas valve is energized, the indoor blower will automatically be energized. When K57-1 closes, blower delay relay K25 is energized and the indoor blower is powered after a time delay.

### **9-2nd 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.

### 10-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.

### 11-Burner Ignition Controls A3, A12

All models use direct spark, multiple try ignition. Units using a single heat exchanger are equipped with a single ignition control, spark and flame sensor (A3). Units equipped with dual heat exchangers are equipped with separate ignition controls, spark electrodes and flame sensors (A3-first stage, A12-second stage).

The ignition control 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 the first stage operator of the gas valve (W1), the spark electrode, the flame sensing electrode and blower relay (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.

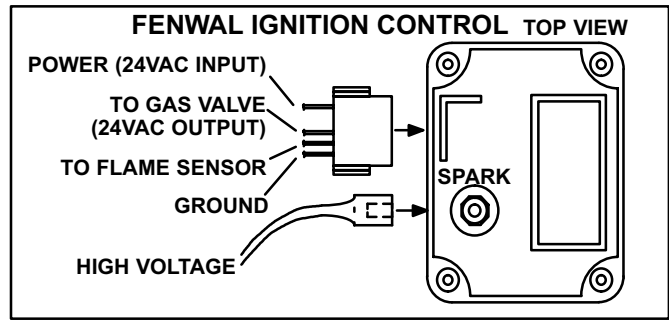


FIGURE 20

- b- The Fenwal control is illustrated in figure 20. 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 21 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 re-making thermostat demand. See figure 22 for the ignition attempt sequence with retries (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 23.

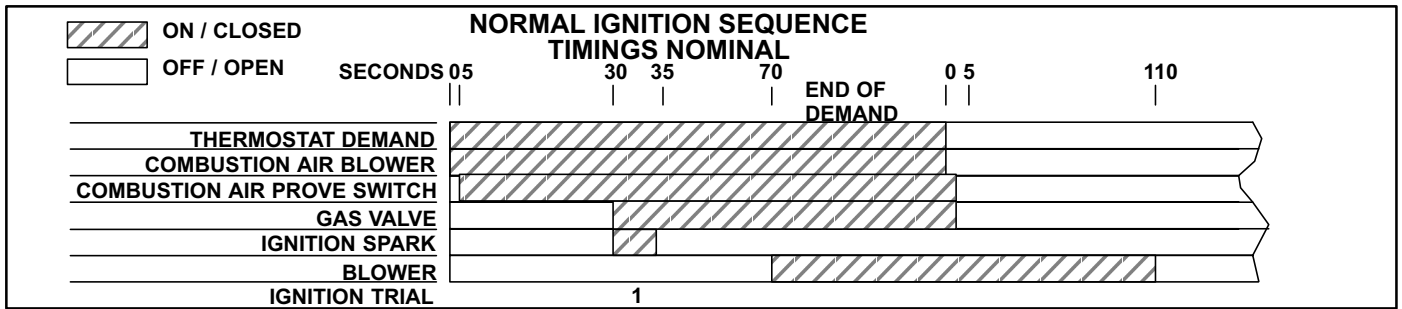


FIGURE 21

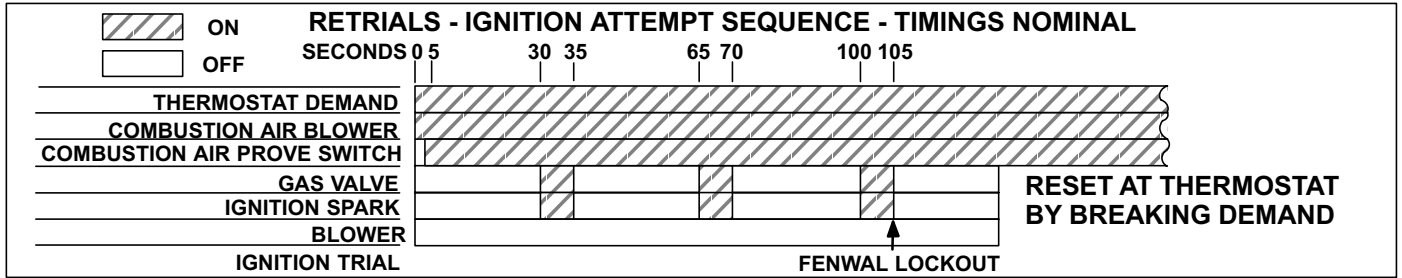


FIGURE 22

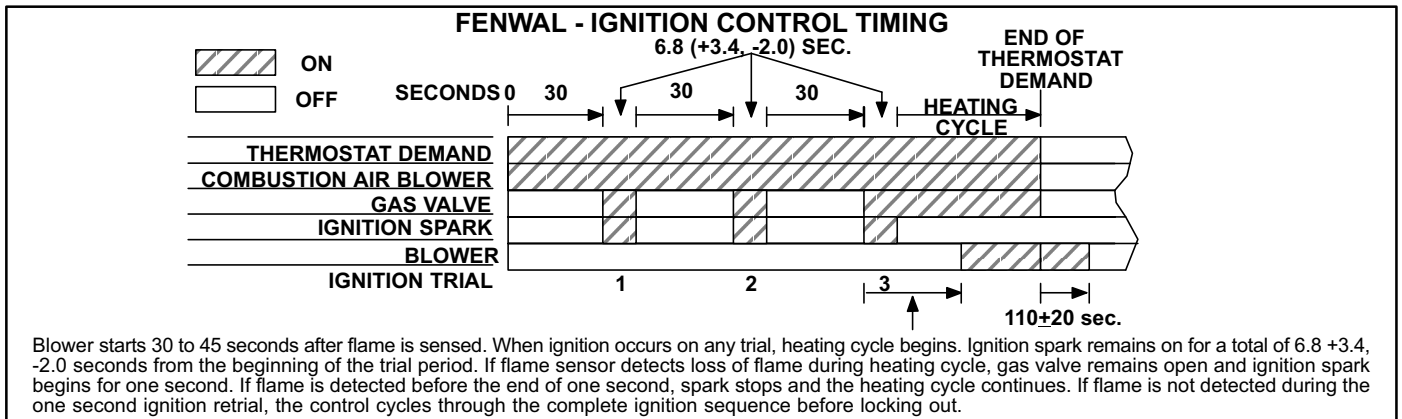


FIGURE 23

## 12-Heat Exchanger (Figure 15)

The GCS16 uses aluminized steel inshot burners with matching tubular aluminized steel heat exchangers. Models may be equipped with single or dual heat exchangers depending on heating capacity. The second heat exchanger in dual heat exchanger models is identical to the first. Each heat exchanger uses multiplenum burner assemblies 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. Single heat exchanger models accomplish staging by cycling the second stage operator of the gas valve. When thermostat demand calls for more heat, the second operator of the gas valve opens to allow more gas to the burners.

Dual heat exchanger models are factory equipped to provide two stages of heat in four increments. The first and second stage operators of the first stage gas valve are connected in parallel. The first stage operator of the gas valve opens quickly but the second stage operator opens

slowly. On a heating call, the first stage operator opens immediately to begin first stage heating operation (first increment). At the same time, the second stage operator begins opening slowly (second increment). The second stage operator reaches full open after approximately 90 seconds.

The second heat exchanger is identical to the first heat exchanger. The second heat exchanger operates in response to second stage (W2) demand. The first stage operator of the second gas valve (GV3-W1) provides second stage (third increment) heat and the second operator opens slowly (fourth increment).

### 13-Burner Assembly (Figure 24)

The burners are controlled by the spark electrode, flame sensing electrode, gas valve GV1 and combustion air blower. The spark electrode, flame sensing electrode and gas valve are directly controlled by the ignition control. The ignition control is controlled by the combustion air blower. The combustion air blower is controlled by heating demand from the thermostat or control system.

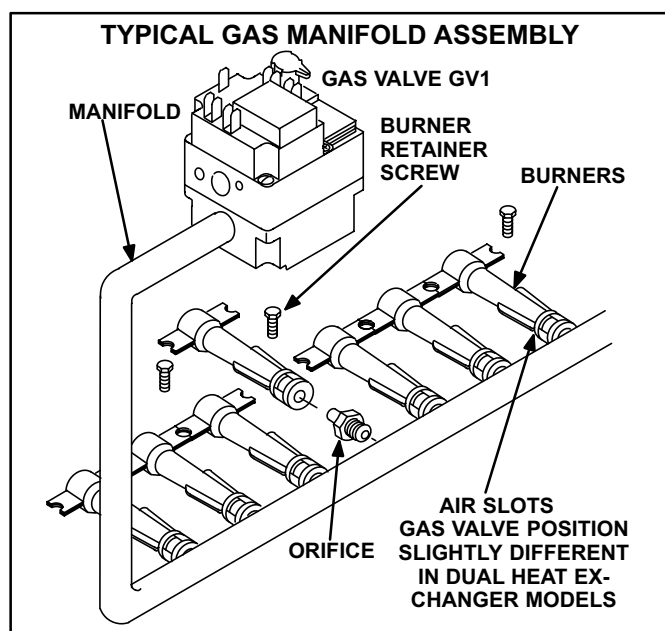


FIGURE 24

#### a-Burners

All units use inshot burners (see figures 24 and 25 ). 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.

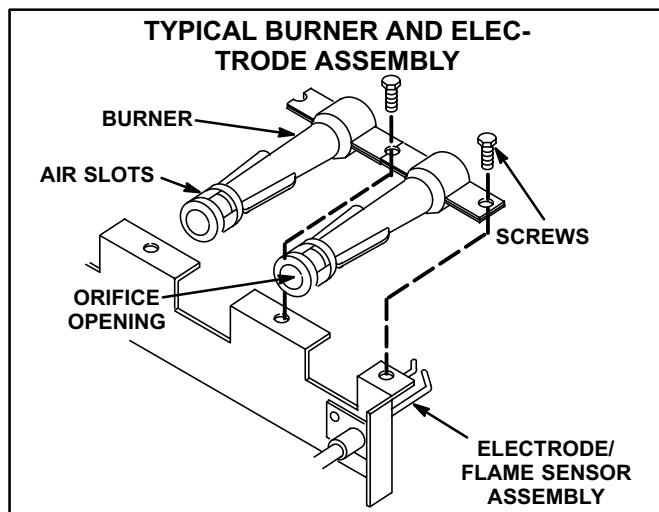


FIGURE 25

#### D-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 ±6°F on a temperature rise and automatically reset at 125°F ±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.

In dual heat exchanger models, both heat exchangers are disabled when S10 opens. In fifteen ton and larger units, the combustion air blower(s) continue to operate when S10 opens.

#### E-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.

In dual heat exchanger models, both heat exchangers are disabled when S21 opens. In fifteen ton and larger units, the combustion air blower(s) continue to operate when S21 opens.

### F-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.

In units equipped with dual heat exchangers, S47 is located in the first stage heat exchanger. Both heat exchangers are disabled when S47 opens. In fifteen ton and larger units, the combustion air blower(s) continue to operate when S47 opens.

### G-Flame Rollout Switch S69

Rollout switch S69 is only used in units equipped with dual heat exchangers. S69 is identical to rollout switch S47 but is located in the second stage heat exchanger. Both heat exchangers are disabled when S69 opens. In fifteen ton and larger units, the combustion air blower(s) continue to operate when S69 opens.

### H-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 startup, 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. In dual heat exchanger models, S18 proves combustion air blower operation in the first stage heat exchanger.

### I-Combustion Air Prove Switch S45

Prove switch S45 is only used in units equipped with dual heat exchangers. S45 is identical to S18. S45 proves combustion air blower operation in the second stage heat exchanger.

### J-Combustion Air Blower B6, B15

The combustion air blower provides fresh air to the burner while clearing the combustion chamber of exhaust gases. The blower begins operating immediately upon receiving a thermostat demand and is de-energized immediately when thermostat demand is satisfied. In dual heat exchanger models, B6 provides combustion air removal in the first stage heat exchanger and B15 serves the second heat exchanger.

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

**TABLE 3**

<b>COMBUSTION AIR BLOWER</b>			
<b>Unit</b>	<b>Electrical</b>	<b>Wheel (in.)</b>	<b>Misc.</b>
GCS16-823-Y GCS16-953-Y	208/230v/ 1ph/60Hz. PSC	4.5 x 1.25	Requires T3 When used on 460v or 575v units
GCS16-823-G,J GCS16-953-G,J	460v/ 1ph/60Hz. PSC	4.5 x 1.25	Requires T3 When used on 575v units
GCS16-1353-Y GCS16-1603-Y GCS16-1853-235-Y,G,J	208/230v/ 1ph/60Hz. PSC	4.81 x 1.25	Requires T3 When used on 460v or 575v units
GCS16-1353-G,J GCS16-1603-G,J	460v/ 1ph/60Hz. PSC	4.81 x 1.25	Requires T3 When used on 575v units
GCS16-1853-330-Y,G,J GCS16-2553-235-Y,G,J GCS16-2753-235-Y,G,J GCS16-3003-235-Y,G,J GCS16-2553-470-Y,G,J GCS16-2753-470-Y,G,J GCS16-3003-470-Y,G,J	208/230v/ 1ph/60 Hz. PSC	5.33 x 1.50	Requires T3 When used on 460v or 575v units

The combustion air blower uses a single-phase PSC motor which requires a run capacitor (C3). All motors operate at 3200RPM. All have automatic reset overload protection. Blowers are supplied by various manufacturers. Combustion Air Blower Ratings may vary by manufacturer. Specific blower electrical ratings can be found on the unit rating plate. Table 3 shows other important specifications.

Combustion air blower B15 is only used in units equipped with dual heat exchangers. B15 is identical to B6. B15 provides combustion air removal in the second stage heat exchanger.



## K-Combustion Air Motor Capacitor C3, C11

The Combustion air blower in all GCS16 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. Capacitor C3 is connected to combustion air blower B6. In dual heat exchanger models, C11 is connected to combustion air blower C11. C3 and C11 are identical.

## L-Gas Valve GV1, GV3

GV1 and GV3 are gas valves used in GCS16 series units. All units are equipped with gas valve GV1. Gas valve GV3 is only used in units equipped with dual heat exchangers. GV3 is identical to to gas valve GV1 but is located in the second stage heat exchanger.

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 26 shows Honeywell gas valve components and figure 27 shows White-Rodgers gas valve components. Table 4 shows factory gas valve regulation for GCS16 series units.

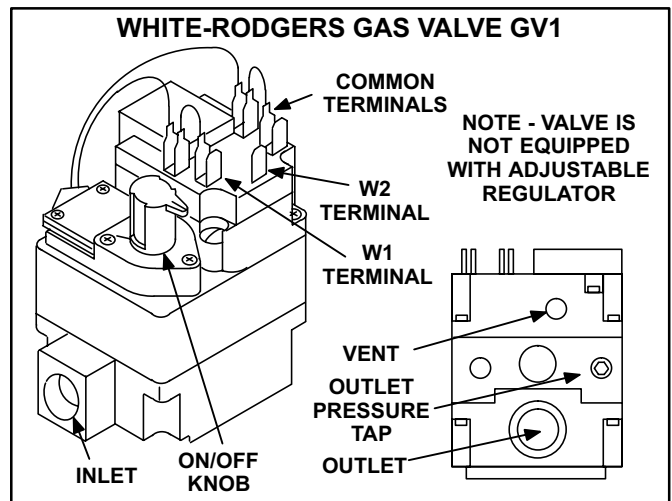


FIGURE 27

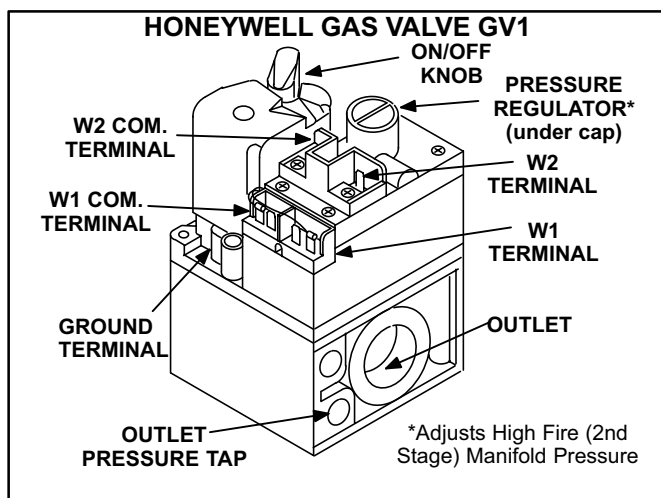


FIGURE 26

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
All Units	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.

## M-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.

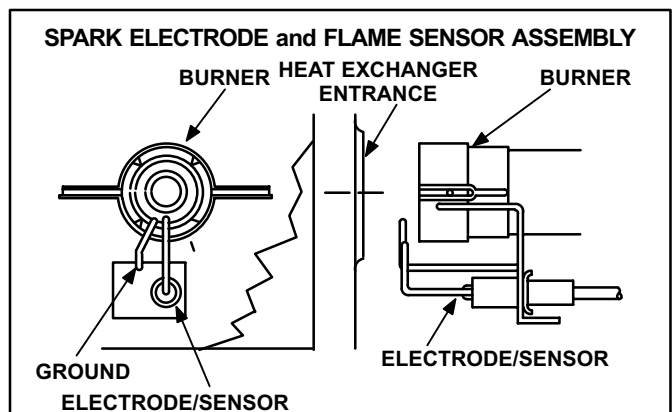


FIGURE 28

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.

## N-Cooling Components

### Summary of Features

Every GCS16-1853 uses three independent cooling circuits consisting of three compressors, condenser coils and evaporator coils. Vapor circuitry is shown in figure 31 and liquid circuitry is shown in figure 32. 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 35. 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 circuits. Compressor 1 uses an independent circuit in the right condenser coil (figure 31), compressor 2 uses an independent circuit in the left condenser coil and compressor 3 uses an independent circuit split between 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). Each cooling circuit is equipped with a thermometer well for charging.

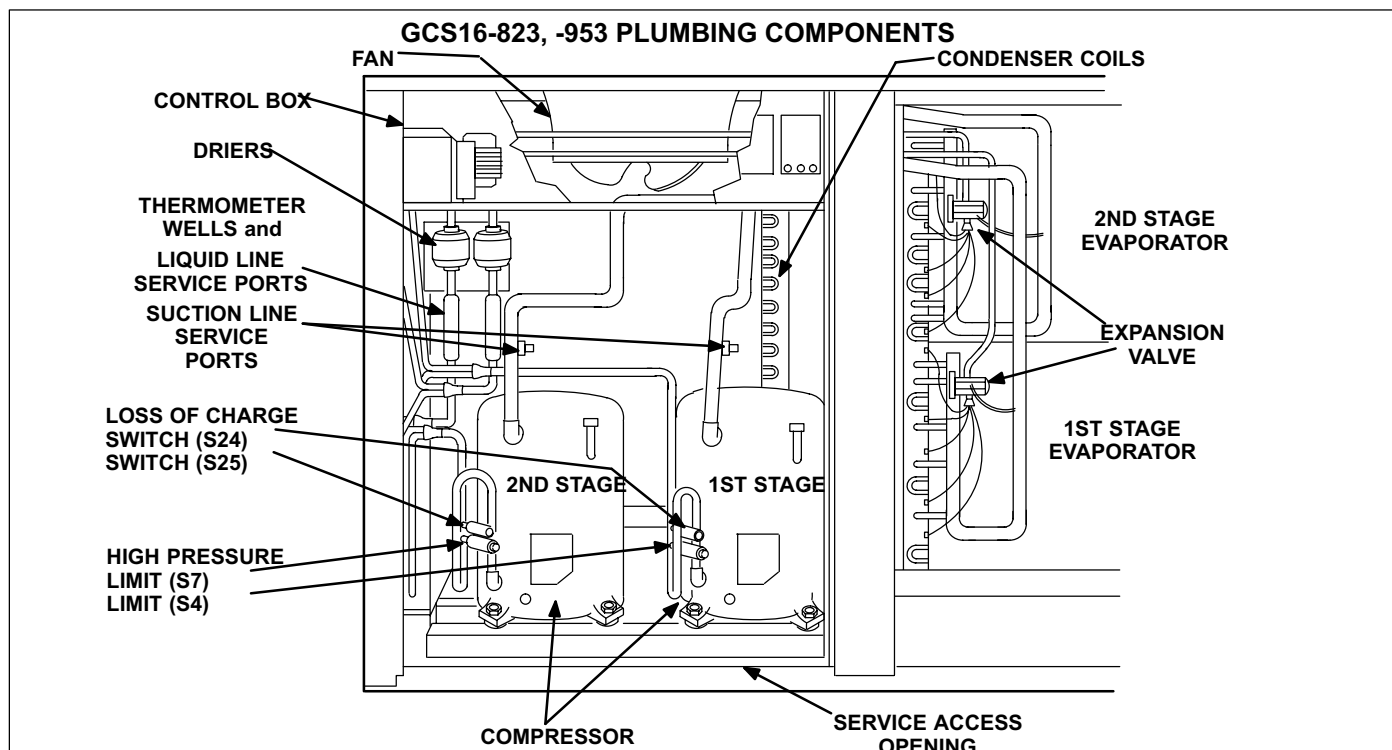
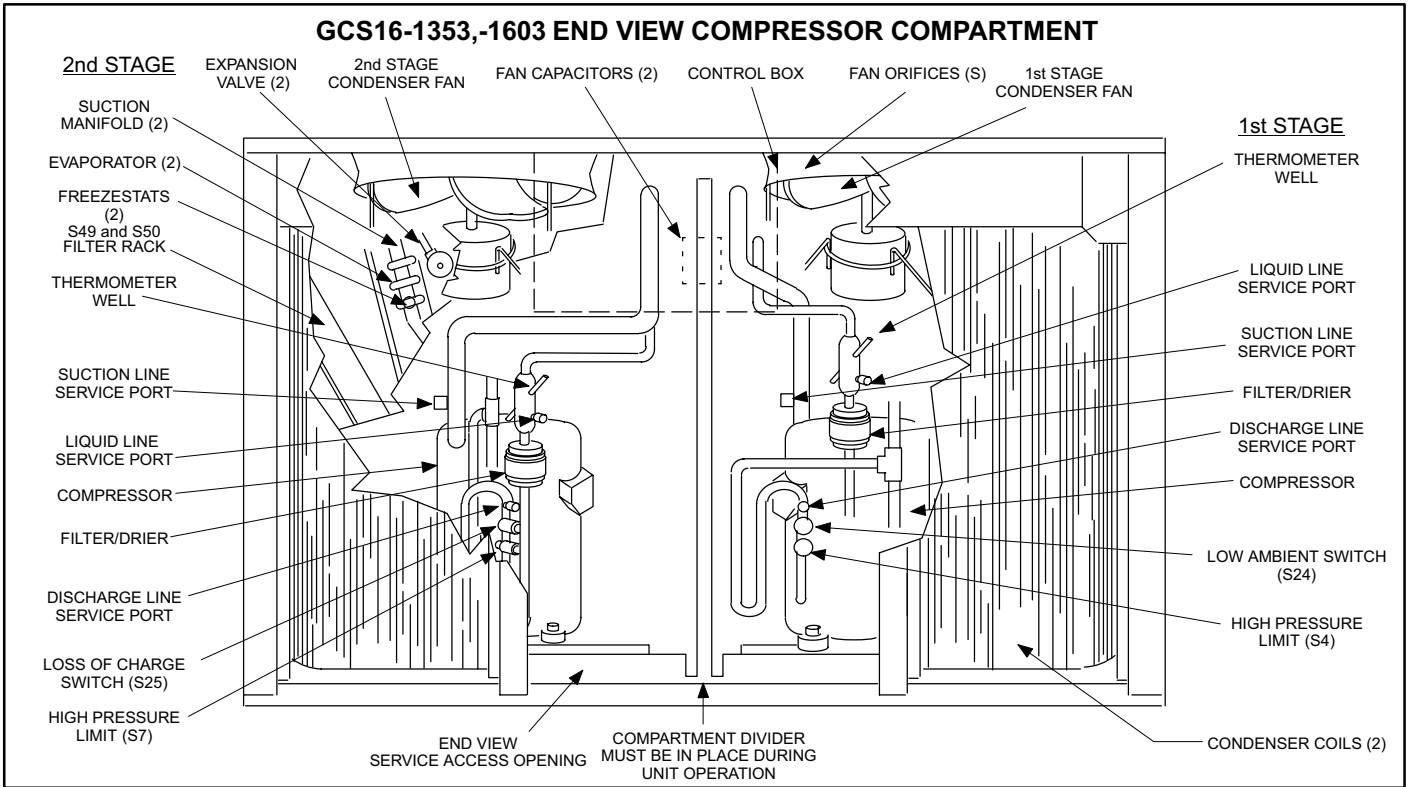


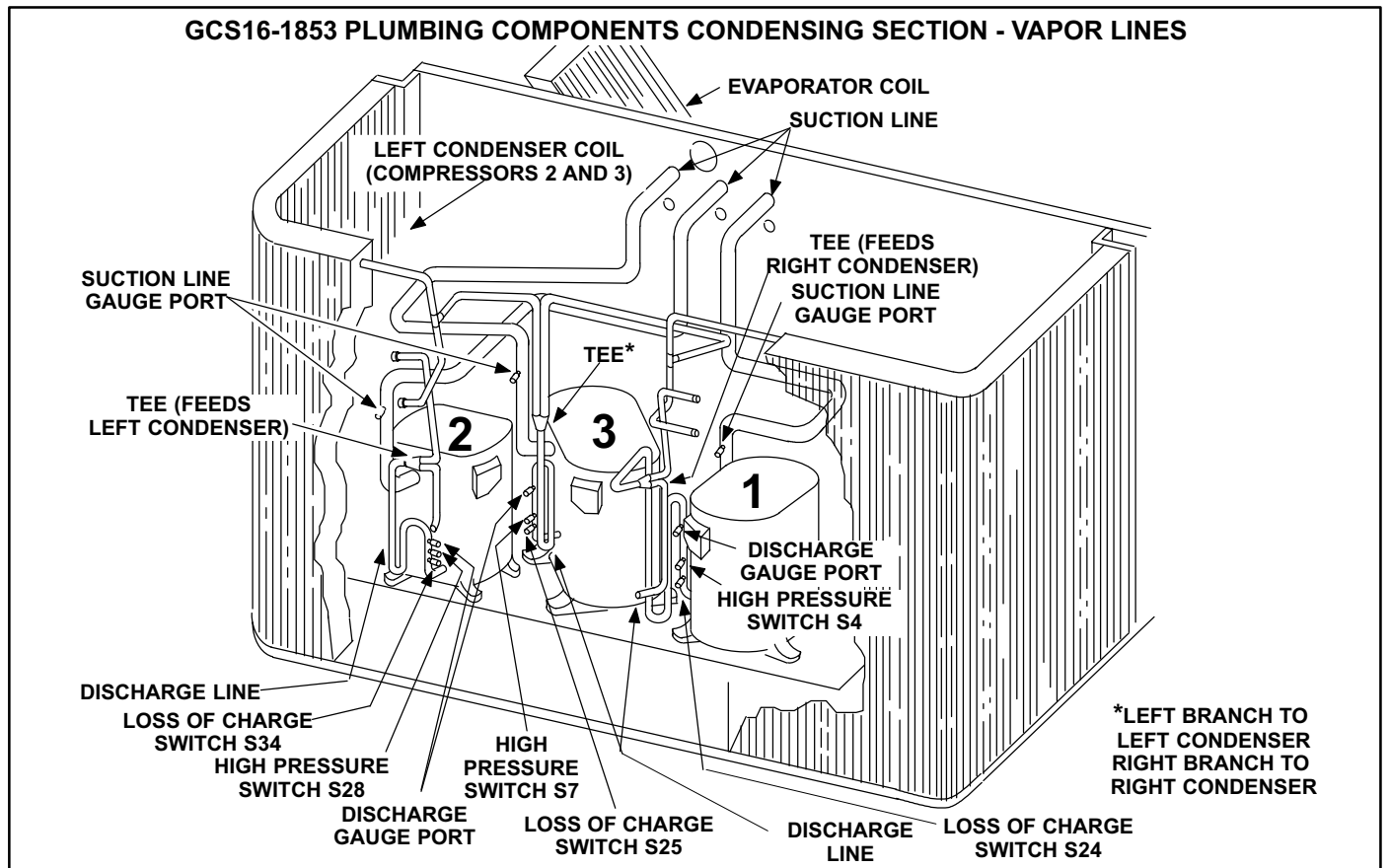
FIGURE 29

**GCS16-1353,-1603 END VIEW COMPRESSOR COMPARTMENT**

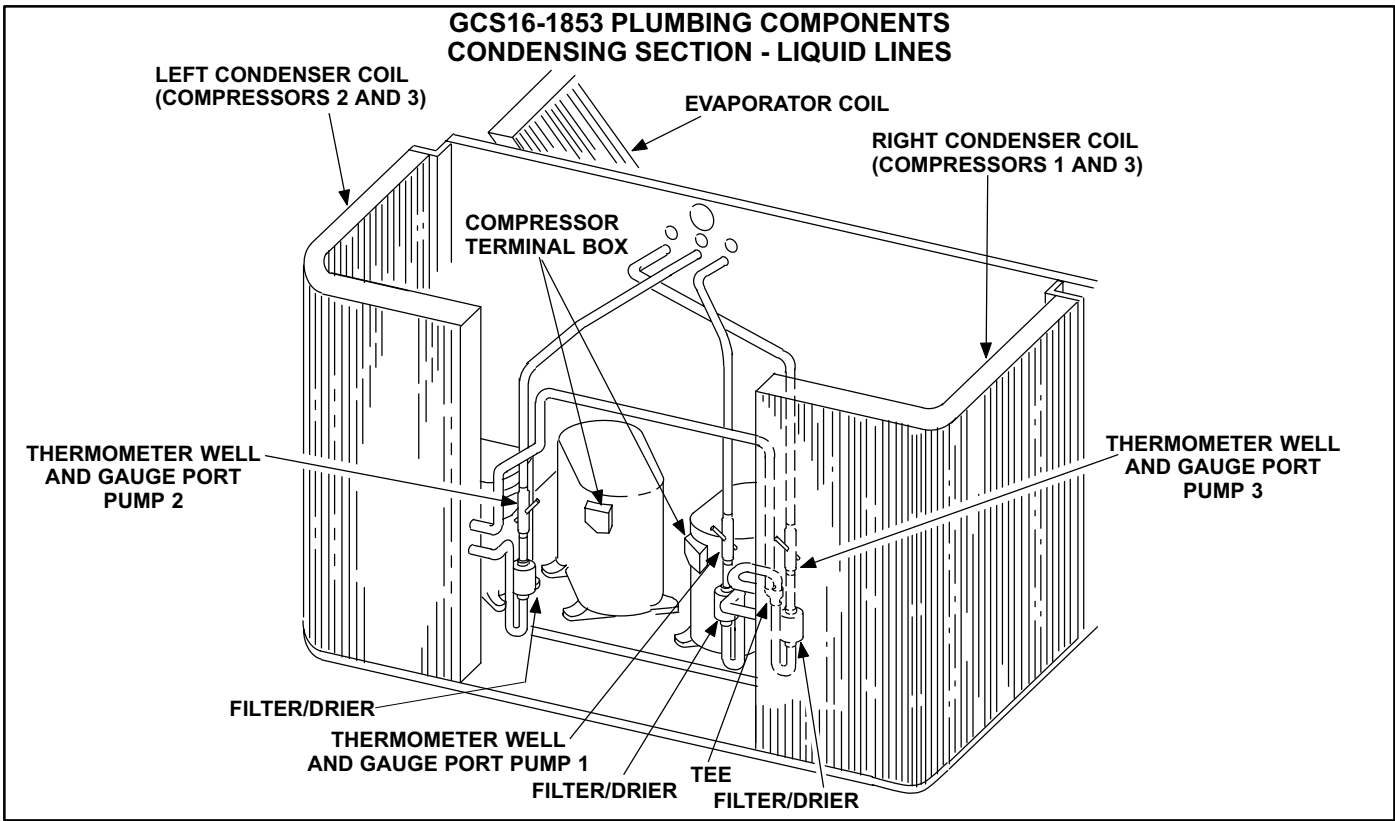


**FIGURE 30**

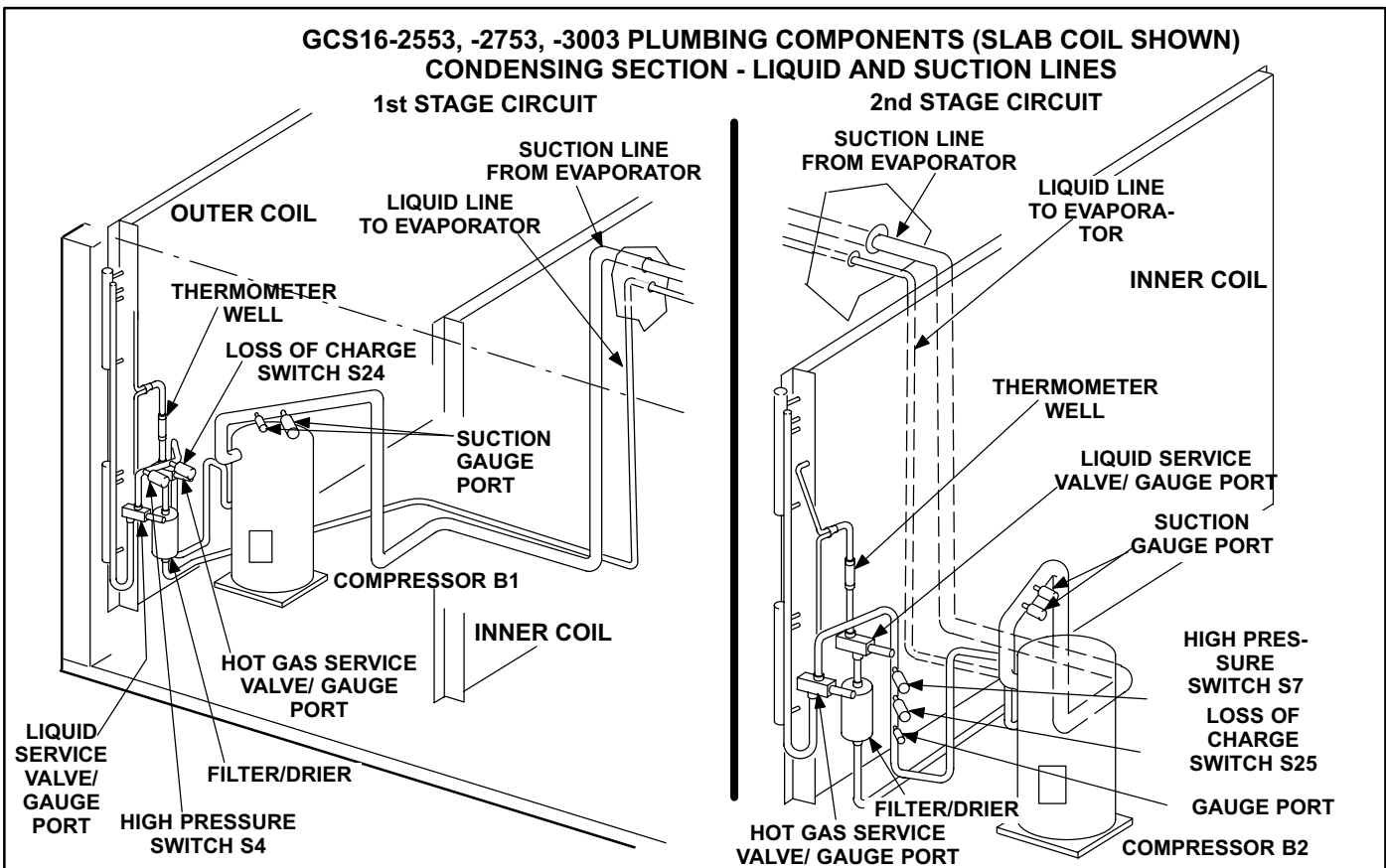
**GCS16-1853 PLUMBING COMPONENTS CONDENSING SECTION - VAPOR LINES**



**FIGURE 31**



**FIGURE 32**



**FIGURE 33**

GCS16-823, -953, -1353, -1603 EVAPORATOR PLUMBING

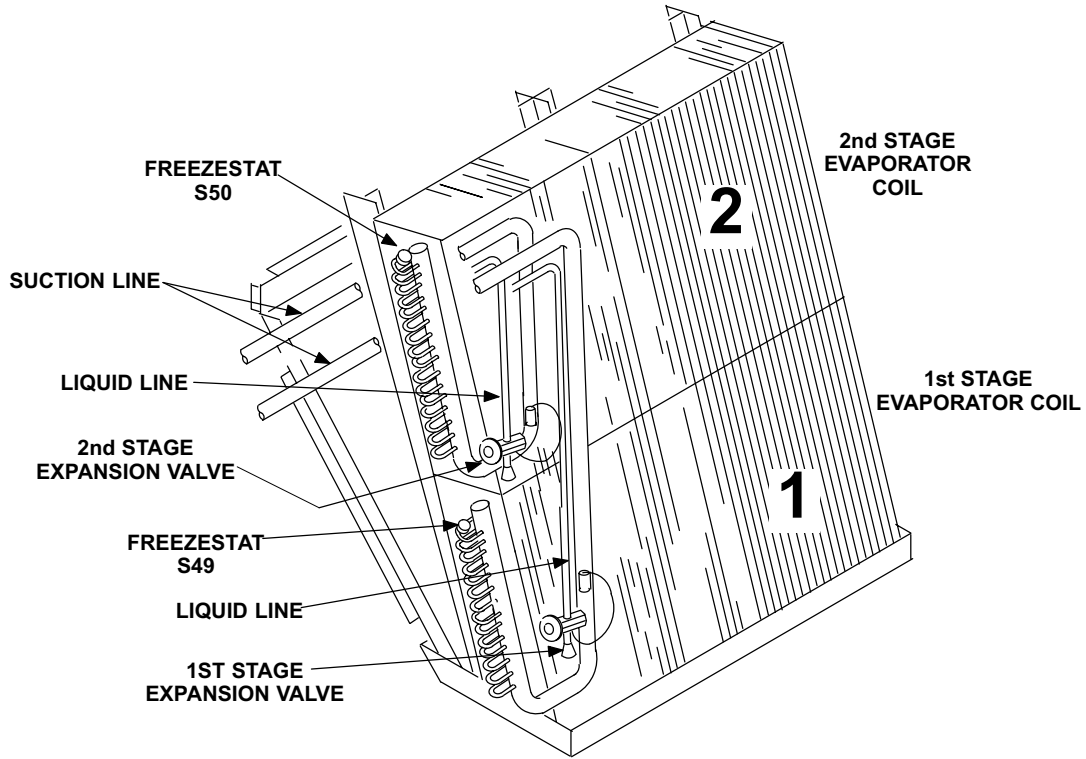


FIGURE 34

GCS16-1853 PLUMBING COMPONENTS EVAPORATOR SECTION

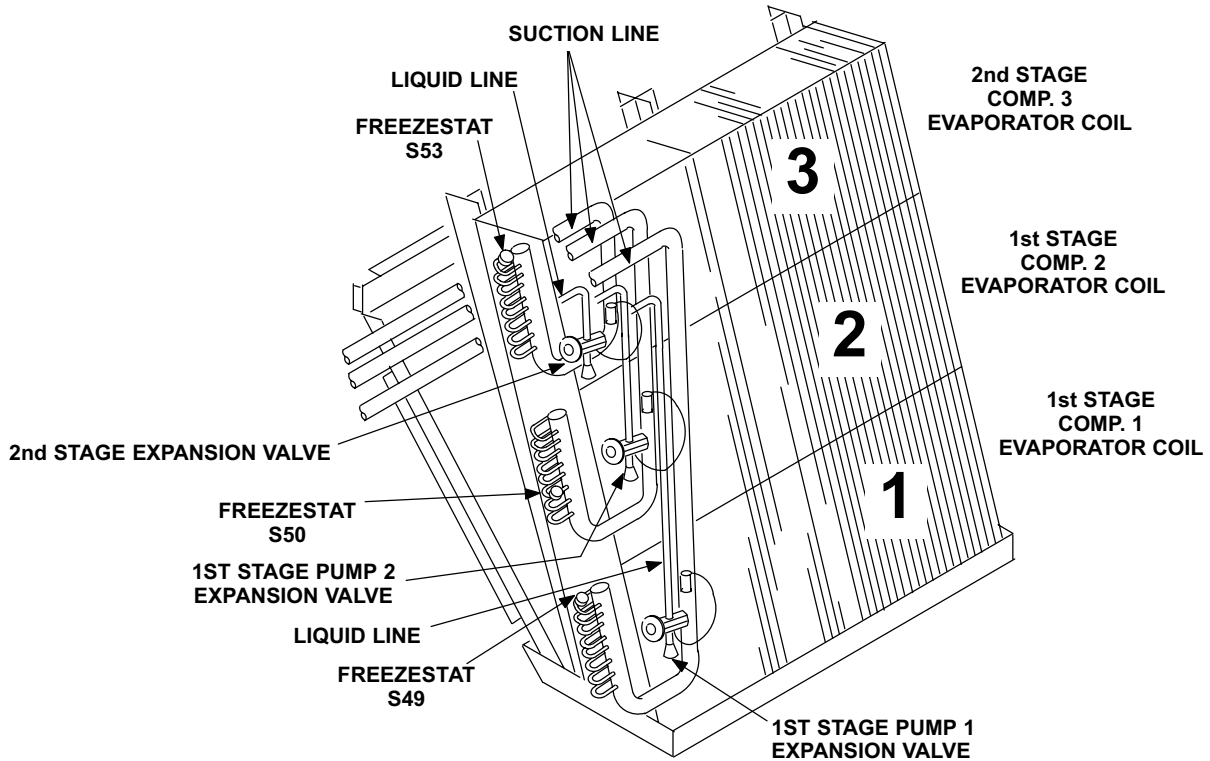


FIGURE 35

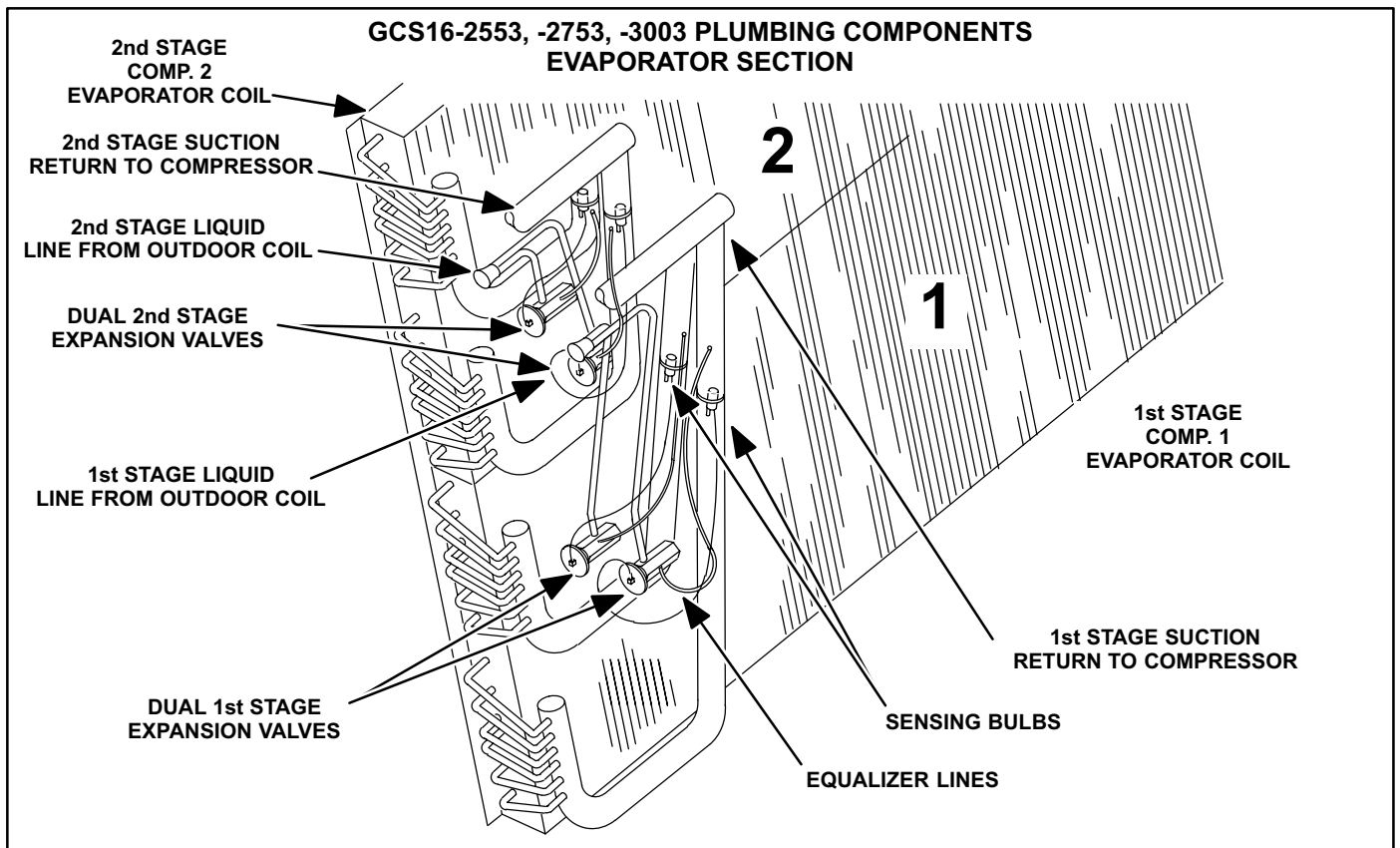


FIGURE 36

### 1-Compressors B1, B2 and B13

Compressors are supplied by various manufacturers. All units are equipped with two independent cooling circuits except 15 ton units which are equipped with three independent cooling circuits. Compressor electrical specifications vary by manufacturer. Likewise, compressor capacity may vary from first stage to second stage. In all cases, the capacity of each compressor is added to reach the total capacity of the unit. See unit rating plate for specific compressor capacity ratings and electrical data.

#### Units with two cooling circuits:

Compressor B1 is compressor 1. It operates during all cooling demand and is energized by contactor K1 upon receiving a first stage demand. Compressor B2 is compressor 2. It operates only during second stage cooling demand and is energized by contactor K2 upon receiving a second stage demand.

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

#### Units with three cooling circuits:

Compressor B1 is compressor 1. It operates during all cooling demand and is energized by contactor K1 upon receiving a first stage demand. Compressor B2 is compressor 2. It operates only during first stage cooling demand and is en-

energized by contactor K2 upon receiving a first stage demand (after time delay DL15 closes). Compressor B13 is compressor 3. It is energized by contactor K14 upon receiving a second stage demand.

Each compressor used in GCS16 units is equipped with a self-regulating crankcase heater. All compressors are protected by internal overload protection circuitry.

### **⚠ WARNING**

**Electrical shock hazard. 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**

**Self-regulating crankcase heaters are connected to line voltage at all times (not switched by unit circuitry.)**

All compressors are equipped with self-regulating type crankcase heaters. Fifteen ton and smaller units use insertion type heaters while 18.5 ton and larger units use belly-band style heaters. Heater HR1 is installed in compressor B1, heater HR2 is installed in compressor B2 and heater HR5 is installed in compressor B13 (if unit is equipped with three compressors). Crankcase heater wattage varies by compressor manufacturer. See unit rating plate for specific electrical data.

### 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 units are equipped with this limit. The switch is located in the compressor discharge line and is wired in series with the compressor contactor.

In three pump systems, S4 is wired in series with the first stage compressor 1 contactor, S7 is wired in series with the first stage compressor 2 contactor and S28 is wired in series with the second stage compressor 3 contactor. In two pump systems, S4 is wired in series with the first stage compressor contactor and S7 is wired in series with the second stage compressor 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 (almost complete loss of charge). All GCS16 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.

In three pump systems, S24 is wired in series with first stage (compressor #1) contactor K1, S25 is wired in series with first stage (compressor #2) contactor K2 and S34 is wired in series with the second stage (compressor #3) contactor K14. In two pump systems, S24 is wired in series with first stage compressor contactor and S25 is wired in series with second stage compressor contactor.

When discharge pressure drops below  $25 \pm 5$  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  $55 \pm 5$  psig.

### 5-Thermometer Well (Figure 37)

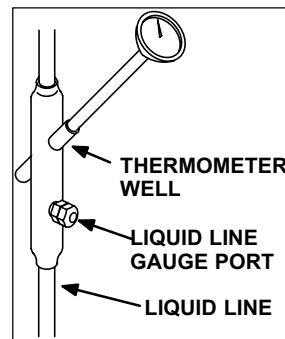


FIGURE 37

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. Thermometer wells are equipped with a gauge port for high pressure gauge connection.

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.

### 6-Freezestats S49, S50 and S53

Each evaporator is equipped with a low temperature limit located on a suction feeder. In three pump systems, S49 is located on the first stage compressor 1 coil, S50 is located on the first stage compressor 2 coil and S53 is located on the second stage coil. In two pump systems, S49 is located on the first stage evaporator coil and S50 is located on the second stage evaporator coil.

Each freezestat is wired in series with its respective compressor contactor coil. Each freezestat is a SPST auto-reset limit which opens at  $29^\circ\text{F} \pm 3^\circ\text{F}$  on a temperature drop and closes at  $58^\circ\text{F} \pm 4^\circ\text{F}$  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.

## 7-Condenser Fans B4 and B5

The specifications tables on pages 2-6 in this manual shows the specifications of condenser fans used in GCS16 series units. Condenser fans in all GCS16 units (all voltages) use three-phase motors which do not require a run capacitor. GCS16-823 and GCS16-953 units are equipped with a single condenser fan which operates during all compressor operation. All other GCS16 units are equipped with two condenser fans. In GCS16-1603 and GCS16-1853 units, both condenser fans are energized upon receiving a first stage cooling demand. Condenser fans draw air across both condenser coils during all compressor operation. In all other GCS16 series units, the condenser fans operate independently and are staged with the compressors.

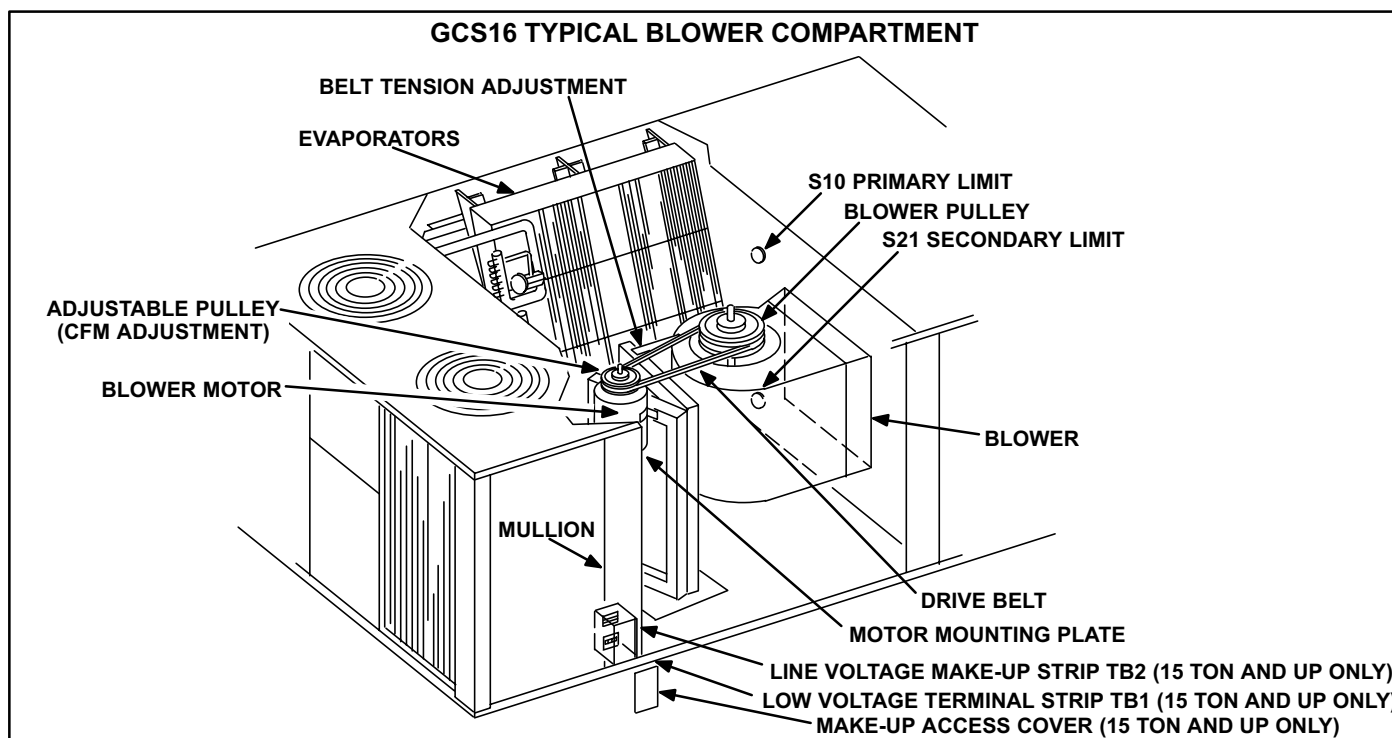
## O-Blower Compartment Components

### 1-Indoor Blower Motor B3

All GCS16 units use three-phase single-speed blower motors. CFM adjustments are made by adjusting the motor pulley (sheave). Blower motor ratings are shown in table 5. Motors are equipped with sealed ball bearings. All motors and operate at 1725 to 1760 RPM and all are internally overload protected. Units may be equipped with motors manufactured by Century, G.E., Emerson, Marathon or other manufacturer. Electrical FLA and LRA specifications vary by manufacturer. See unit rating plate for information specific to your unit.

**TABLE 5**

BLOWER MOTOR				
Drive		Units	Electrical Characteristics	
HP	Usage		Volts	Phase
2	Standard	GCS16-823-Y,G GCS16-953-Y,G GCS16-1353-Y,G	208/230 switchable to 460	3
2	Standard	GCS16-823-J GCS16-953-J GCS16-1353-J	575	3
3	Optional	GCS16-1353-Y,G	208/230 switchable to 460	3
	Standard	GCS16-1603-Y,G GCS16-1853-Y,G		
3	Optional	GCS16-1353-J	575	3
	Standard	GCS16-1603-J GCS16-1853-J		
5	Optional	GCS16-1853-Y,G	208/230 switchable to 460	3
	Standard	GCS16-2553-Y,G		
5	Optional	GCS16-1853-J	575	3
	Standard	GCS16-2553-J		
7.5	Optional	GCS16-2553-Y,G GCS16-2753-Y,G	208/230 switchable to 460	3
	Standard	GCS16-3003-Y,G		
7.5	Optional	GCS16-2553-J GCS16-2753-J	575	3
	Standard	GCS16-3003-J		
10	Optional	GCS16-3003-Y,G	208/230 switchable to 460	3
10	Optional	GCS16-3003-J	575	3



**FIGURE 38**



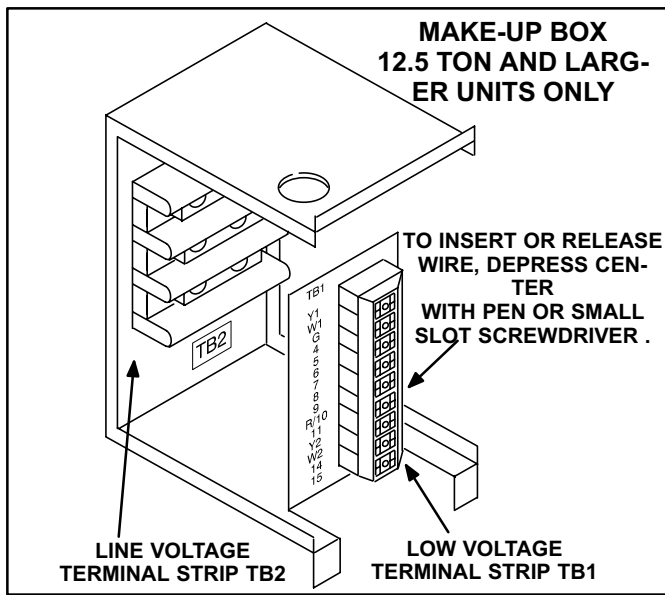


FIGURE 39

## 2-Line Voltage Make-Up Strip TB2

Line voltage terminal strip TB2 (figure 39) is provided in all GCS16 series 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. In 10 ton and smaller units, TB2 is located in the unit control box. In 12.5 ton and larger units, TB2 is located in the blower compartment.

## 3-Low Voltage Terminal Strip TB1

All GCS16 units are equipped with a low voltage terminal strip TB1. In 10 ton and smaller units, TB1 is located in the unit control box. In 12.5 ton and larger units, TB1 is located in the blower compartment (figure 39). Most low voltage (thermostat) electrical connections can be made to this terminal strip. Knock-outs provided in the base pan of the unit cabinet allow for passage of wires into conduit and roof mounting frame. Special instructions are provided where needed for low voltage connections that cannot be made to the terminal strip. A detail drawing of TB1 is also shown in figure 10.

## III-ELECTRICAL CONNECTIONS

### A-Power Supply

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

## IV-PLACEMENT AND INSTALLATION

Make sure 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-STARTUP - OPERATION

### A-Preliminary and Seasonal Checks

- 1- Make sure the unit is installed in accordance with the installation instructions and applicable codes.
- 2- Inspect all electrical wiring, both field and factory installed for loose connections. Tighten as required. Refer to unit diagram located on inside of unit control box cover.
- 3- Check to ensure that refrigerant lines are in good condition and do not rub against the cabinet or other refrigerant lines.
- 4- Check voltage at the disconnect switch. Voltage must be within the range listed on the nameplate. If not, consult the power company and have the voltage 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 VIII-C-Blower Belt Adjustment).

### B-Cooling Startup

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

## ⚠ WARNING

**Crankcase heaters 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 charge amount.
- 3- Refer to Cooling Operation and Adjustment section for proper method of checking charge.

## C-Heating Startup

- 1- Set thermostat to OFF position. Close manual knob on gas valve(s).
- 2- Wait five minutes.
- 3- Open manual knob on gas valve(s), 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 burners do not light the first time, it will attempt up to two more times before locking out.
- 7- If lockout occurs, repeat the previous steps.

## D-Safety or Emergency Shutdown

Turn off power to the unit.

## VI-COOLING SYSTEM SERVICE CHECKS

GCS16 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 31 and 32. Attach high pressure line to liquid line gauge port on thermometer well. Attach low pressure line to suction line service port.

## 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 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. Compressor damage will result.**

- 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 compressors) for at least five minutes until pressures stabilize.

**TABLE 6**

UNIT	APPROACH TEMPERATURE	
	Degrees F Liquid Line Warmer Than Outdoor Air	
	1st Stage	2nd Stage
GCS16-823	7°F ± 1 (3.9°C ± 0.5)	
GCS16-953	8°F ± 1 (4.5°C ± 0.5)	
GCS16-1353	6°F ± 1 (3.3°C ± 0.5)	
GCS16-1603	6°F ± 1 (3.3°C ± 0.5)	
GCS16-1853	7°F ± 1 (3.9°C ± 0.5)	
GCS16-2553*	7°F ± 1 (3.9°C ± 0.5)	
GCS16-2753*	7°F ± 1 (3.9°C ± 0.5)	
GCS16-3003*	7°F ± 1 (3.9°C ± 0.5)	
GCS16-2553†	7°F ± 1 (3.9°C ± 0.5)	8°F ± 1 (4.5°C ± 0.5)
GCS16-2753†	8°F ± 1 (4.5°C ± 0.5)	10°F ± 1 (5.6°C ± 0.5)
GCS16-3003†	9°F ± 1 (5.1°C ± 0.5)	10°F ± 1 (5.6°C ± 0.5)

\*Round cornered condenser coils.

†Slab type condenser coils.

- 4- Check each stage separately with all stages operating. Compare liquid temperatures to outdoor ambient temperature. Liquid line temperature should be a few degrees warmer than the outdoor air temperature. Table 6 shows how much warmer the liquid line should be. For best results use same thermometer for both readings.  
Add refrigerant to make the liquid line cooler. Recover refrigerant to make the liquid line warmer.

## VII-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.

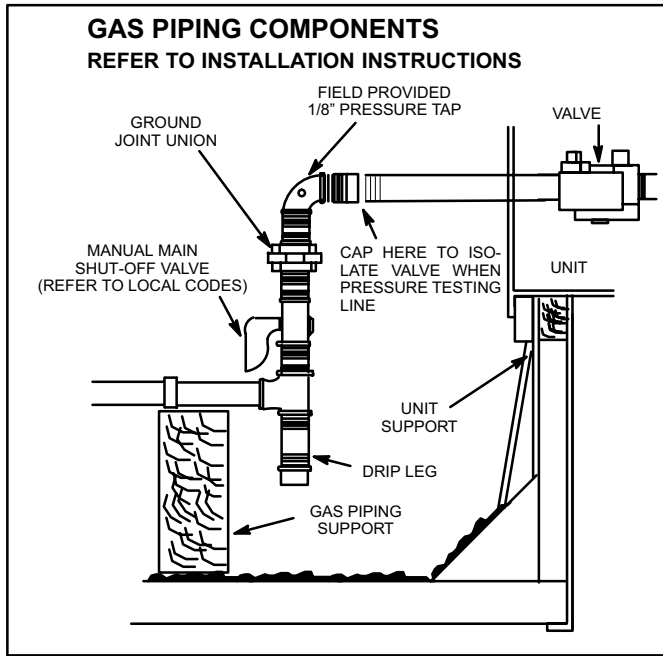


FIGURE 40

## 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 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 40.

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 unit from gas supply system.

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 piping joints 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 40). 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 26 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 26 for location of Honeywell gas valve (manifold pressure) adjustment screw.

All gas valves are factory regulated as shown in table 7. 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.**

### Manifold Adjustment Procedure:

- 1- Connect 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.

**TABLE 7**

MANIFOLD PRESSURE ALL GCS16 SERIES UNITS*		
Stage	Operating Pressure (outlet) in. W.C.	
	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
First (Low Fire)††	3.7 + 0.3	10.5 + 0.5
Second (High Fire)††	3.7 + 0.3	10.5 + 0.5

\*Maximum inlet pressure for all gas valves is 13" W.C.  
 †Single heat exchanger models.  
 ††Dual heat exchanger models.

- 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.
- After allowing the unit to stabilize for five minutes, record the manifold pressure and compare to the values given in table 7.

**⚠ CAUTION**

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

**TABLE 8**

Unit	Fuel	Stage	Input Btuh	Output Btuh	Input (ft. <sup>3</sup> /hr.)
GCS16 823-135	Nat.	1st	84,000	66,500	
		2nd	135,000	106,000	
GCS16 823-135	L.P.G.	1st	95,000	76,000	
		2nd	130,000	103,000	
GCS16 953-200	Nat.	1st	126,000	98,000	
		2nd	200,000	160,000	
GCS16 953-200	L.P.G.	1st	126,000	98,000	
		2nd	175,000	142,000	
GCS16 1353-270 1603-270	Nat.	1st	170,000	132,500	
		2nd	270,000	216,000	
GCS16 1353-270 1603-270	L.P.G.	1st	170,000	132,500	
		2nd	236,250	192,500	
GCS16 1853-235 2553-235 2753-235	Nat.	1st	145,000	116,000	
		2nd	235,000	188,000	
1853-330	Nat.	1st	205,000	159,900	
		2nd	330,000	257,400	
GCS16 1853-235 2553-235 2753-235	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	
GCS16 2553-470 2753-470 3003-470	Nat.	1st	240,000	232,000	
		2nd	470,000	376,000	
GCS16 2553-470 2753-470 3003-470	L.P.G.	1st	328,000	262,400	
		2nd	470,000	328,000	

**F-Proper Gas Flow**

To check for proper gas flow to burners, determine Btuh input from the unit rating plate or table 8. 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.*

**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 9.

To derate the unit use the following instructions. If high altitude conditions are present, also follow the instructions in table 9.

**Derate Procedure:**

- Check manifold pressure at the gas valve pressure tap with unit operating at high fire (2nd stage).
- To reduce maximum input, turn regulator adjusting screw (figure 26) counterclockwise.
- Re-check manifold pressure.

**TABLE 9**

**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**

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

Figure 41 shows how to remove burner assembly.

- Turn off power to unit and shut off gas supply.
- Remove screws as shown in figure 41.
- Slide each burner off its orifice.
- Clean and reassemble (reverse steps 1-3).
- 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 increase 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 it from falling 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.

### 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 locks out.

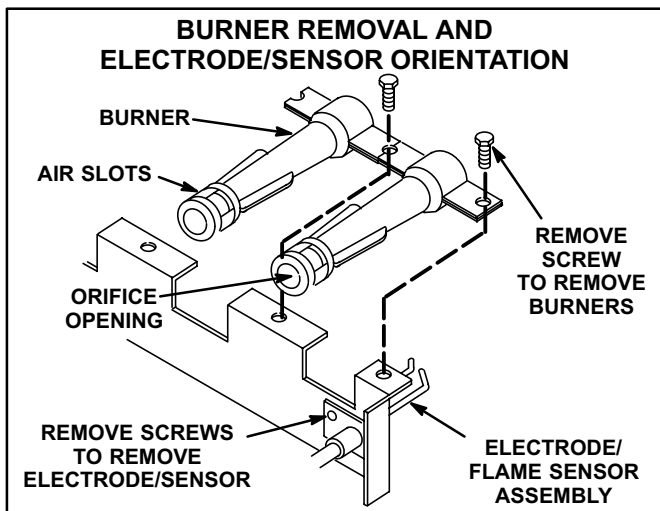


FIGURE 41

## ⚠ DANGER

**Shock hazard. Spark related components contain high voltage. Disconnect power before servicing.**

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

## ⚠ 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 42.

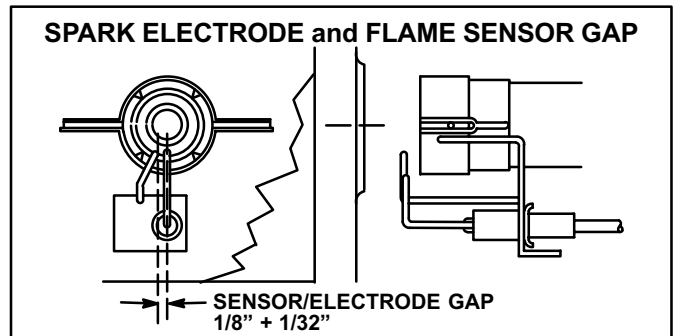


FIGURE 42

### 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:

## ⚠ DANGER

**Electrodes are not field adjustable. Any alterations to the electrode may create a hazardous condition that can cause property damage or personal injury.**

- 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- 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

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.

## VIII-INDOOR BLOWER OPERATION / ADJUSTMENT

### A-Blower Operation

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

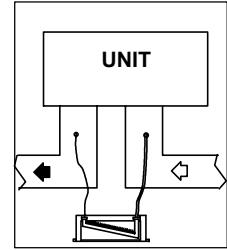
- 1- Blower operation is dependent on the thermostat control system option that has been installed in the GCS16. Refer to the operation sequence for the control system installed for detailed descriptions of blower operation.
- 2- Generally, blower operation is set at the thermostat fan switch. With the fan switch in "ON" position, the blower operates continuously. With the fan switch in "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).

#### To Measure Discharge Static Pressure:

- a- Locate taps as shown in figure 43.
- b- Punch a 1/4" diameter hole. Insert manometer hose flush with the inside edge of hole or insulation. Seal around the hole with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. Connect the other end of the manometer to the return duct as above.



**FIGURE 43**

- c- With only the blower motor running, observe manometer reading.
- d- Seal around the hole when the check is complete.
- 3- Measure indoor blower wheel RPM (figure 44).
- 4- Refer to unit nameplate to determine the blower motor horsepower.
- 5- 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 panel above filter and connect to negative (low) pressure side of gauge.
- 4- Turn on blower and determine draft gauge reading.
- 5- Adjust blower speed as required (see section C-Blower Belt Adjustment).

### C-Blower Belt Adjustment

Proper pulley alignment and belt tension must be maintained for maximum belt life.

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

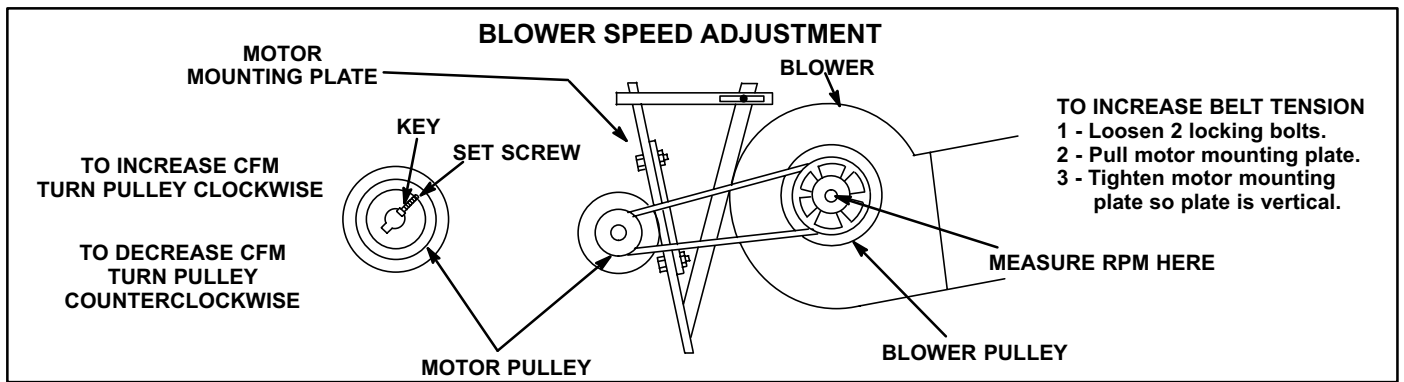


FIGURE 44

### 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 44.
- 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 three turns open.*

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

## IX-MAINTENANCE

### ⚠ CAUTION

**Electrical shock hazard. Turn off power to unit before performing any maintenance, cleaning or service operation on the unit.**

### A-Filters (Figure 45)

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 re-installing.

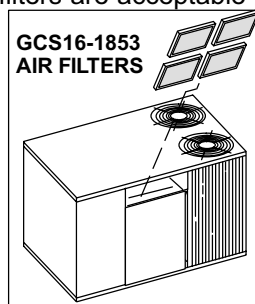


FIGURE 45

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

### ⚠ CAUTION

**Be careful when servicing unit to avoid accidental contact with sharp metallic edges which may cause personal injury.**

### B-Lubrication

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

### C-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.

### D-Evaporator Coil

Inspect and clean coil at beginning of each 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.

### E-Condenser Coil

Clean condenser coil annually with detergent or commercial coil cleaner and inspect monthly during the cooling season. Check connecting lines and coil for evidence of oil leaks.

Condenser coils are made of individual coil slabs. Dirt and debris may become trapped between the slabs. To clean between slabs, carefully separate slabs and wash thoroughly.

*NOTE-If owner complains of insufficient cooling, refrigerant charge should be checked. Refer to Charging section in this manual.*

### F-Electrical

- 1- Check all wiring for loose connections.
- 2- Check for correct voltage at unit (unit operating).
- 3- Check amp-draw on both condenser fan motor and blower motor.

Fan Motor Rating Plate \_\_\_\_ Actual \_\_\_\_\_

Indoor Blower Motor Rating Plate \_\_\_\_ Actual \_\_\_\_\_

## X-ACCESSORIES

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

### A-RMF16 Mounting Frame

When installing a unit on a combustible surface for down-flow discharge applications, the Lennox RMF16 roof mounting (figure 46) frame is used. Otherwise, the RMF16 is recommended but not required. The , 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 MUST be mounted level within 1/16" per linear foot in any direction.

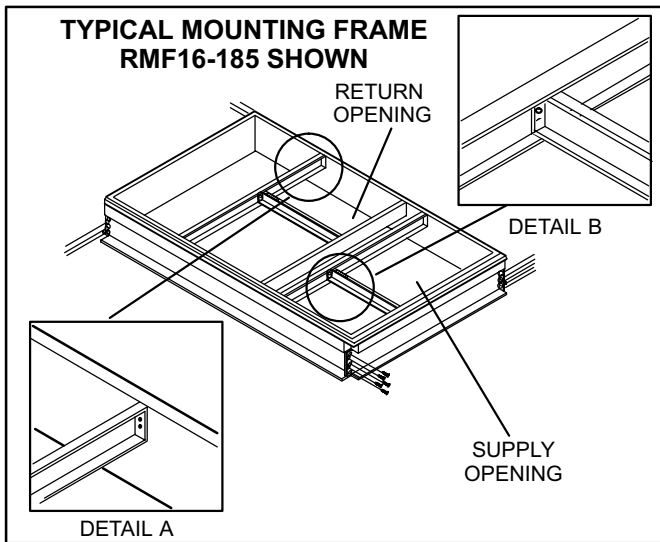


FIGURE 46

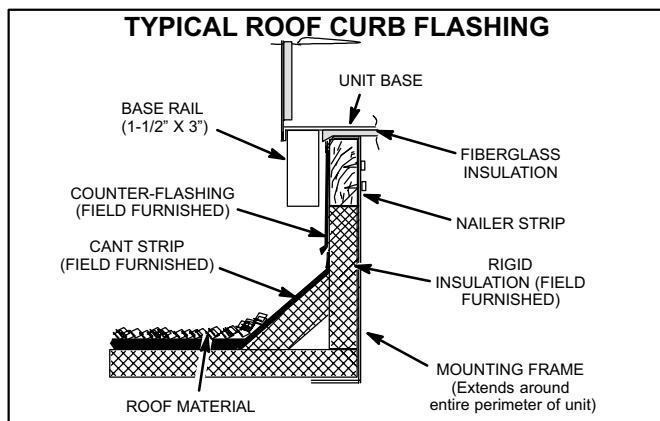


FIGURE 47

The assembled RMF16 mounting frame is shown in figure 46. 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 47. Refer to the RMF16 installation instructions for proper plenum construction and attachment.

### B-OAD16 Outdoor Air Damper

OAD16 is a manual outdoor air damper section (figure 48) which installs in 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 addition of an electric spring-return three-position damper actuator. Refer to OAD16 installation instructions for specific installation procedure. Washable filter supplied with the OAD16 can be cleaned with water and a mild detergent. It should be sprayed with Filter Handicoater when dry prior to reinstallation. Filter Handicoater is R.P. Products coating no. 418 and is available as Lennox Part No. P-8-5069.

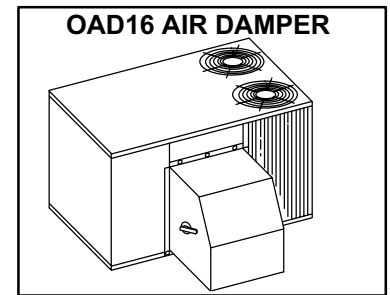


FIGURE 48

### C-Economizer

Optional economizer dampers can be applied directly to . An economizer consists of a mechanically linked recirculated air and outdoor air damper assembly, an enthalpy sensor and damper motor installed in the economizer. An enthalpy control assembly is also furnished and may be installed in the filter access area of the unit or in the economizer (depending on model). An exhaust damper assembly installed in the economizer provides return air exhaust.

Several accessories are available and may be used with any economizer. Optional Warm Up Kit may be added to any economizer if electromechanical or simple electronic control thermostat is used with night setback. Warm Up Kit forces outdoor air dampers closed during initial morning warm up. Optional GED16 gravity exhaust dampers may be installed on any economizer to provide automatic pressure relief in return air duct. Optional PED16 power exhaust damper may be added to larger size economizers in place of gravity exhaust dampers to provide forced air exchange during economizer operation. The PED16 installs between the economizer and the gravity exhaust damper assembly.

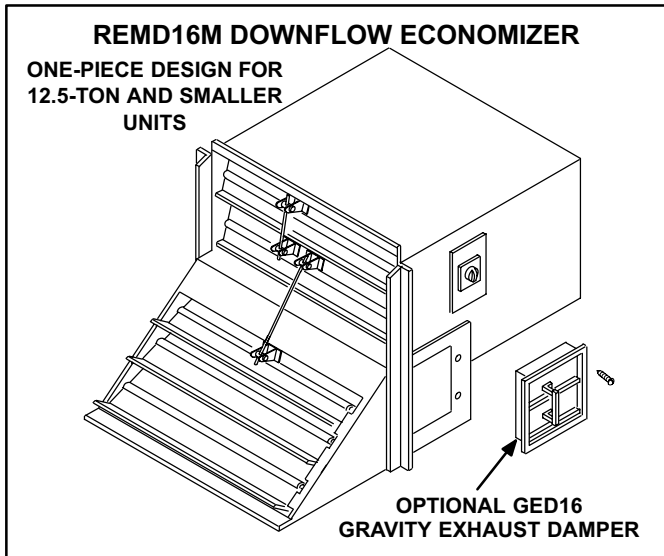


Optional differential enthalpy control may be added to any economizer to monitor both indoor and outdoor air conditions. With differential enthalpy installed, the economizer selects the lowest of the two enthalpy conditions to satisfy cooling demand.

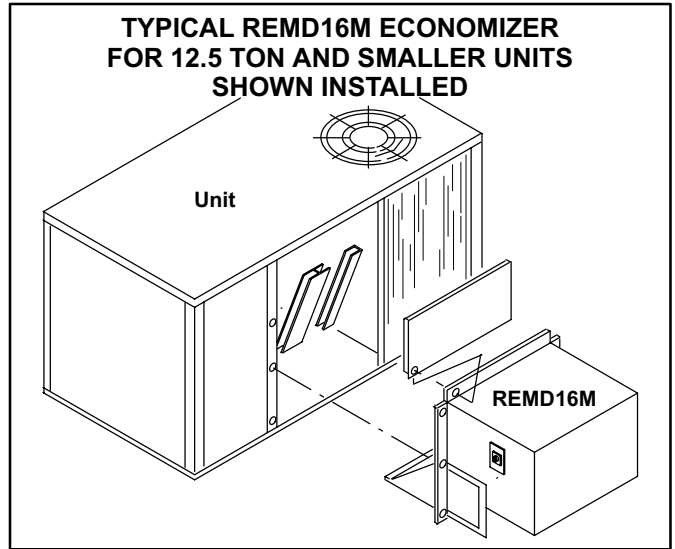
**1-REMD16M Downflow Economizer  
(all units)**

The REMD16M economizer is designed for standard (downflow) use with units. In 15 ton and larger units, the economizer can also be adapted to horizontal discharge. In 12.5 ton and smaller units, the REMD16M cannot be converted to horizontal discharge and a separate horizontal economizer (EMDH16M) is used for horizontal applications. Both applications are shown in figure 51. The economizer monitors outdoor air conditions and opens the outdoor air dampers to allow 0 to 100 percent outdoor air to be used for cooling when outdoor humidity and temperature are acceptable. Damper position continually adjusts to outdoor conditions. Additional (second stage) cooling demand is shifted to the first stage compressor while the dampers remain open to provide first stage cooling. If outdoor air becomes unacceptable, the outdoor air dampers close to a predetermined minimum position while the compressor cooling circuit cycles as needed. First stage cooling is shifted back to the first stage compressor and second stage cooling is directed to the second stage compressor.

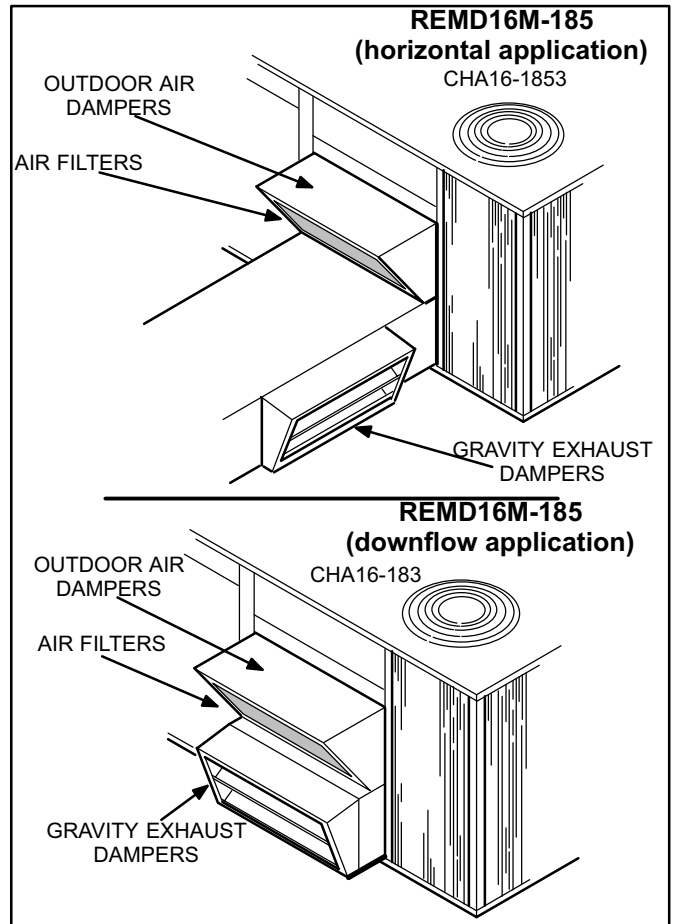
Refer to the REMD16M installation instruction for specific installation details. Refer to the operation sequence (in back of this manual) for detailed economizer operation. Operation sequence flowcharts also describe how the economizer interacts with the GCS16 and the control system being used.



**FIGURE 49**



**FIGURE 50**



**FIGURE 51**

## 2-EMDH16M Horizontal Economizer (-823, -953, -1353, -1603 only)

A separate horizontal economizer is available for 12.5 ton and smaller units which require the use of an economizer in combination with horizontal air discharge. Although the EMDH16M is physically different than the REMD16M (figure 52) both economizers are wired the same and are identical in terms of function.

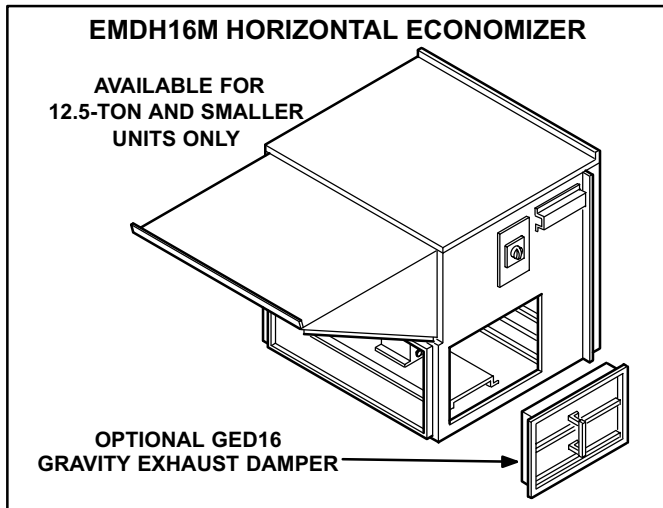


FIGURE 52

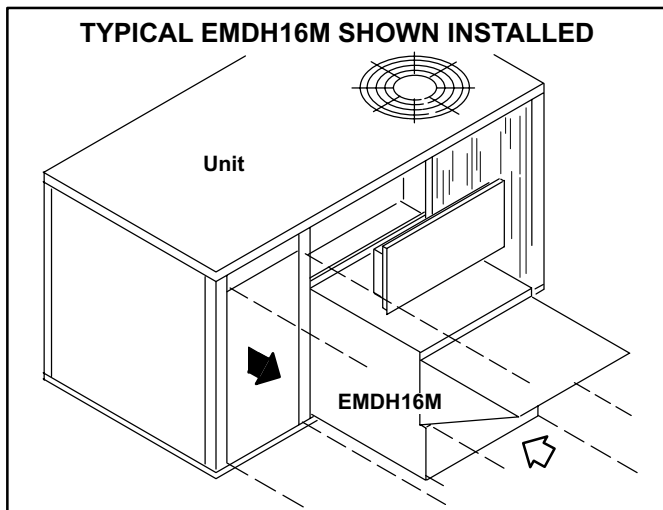


FIGURE 53

## 3-Economizer Accessories

### a-GED16 Gravity Exhaust Dampers (economizers not equipped with PED16)

Optional GED16 gravity exhaust dampers may be connected to REMD16M or EMDH16M economizers. Automatic exhaust dampers provide positive pressure relief in return air duct. See figure 52.

## b-PED16 Power Exhaust Damper (-1853, -2553, -2753, -3003 only)

TABLE 10

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

Optional PED16 power exhaust fans (figure 54) are used in conjunction with REMD16M economizer to provide forced exhaust of return air. PED16 consists of two fans (figure 54) 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 55) located in the unit filter access section. A mercury switch located on the damper blades senses economizer operation. As the damper blades open the mercury switch (figure 58) 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 55) and the economizer enthalpy control (figure 63) 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 56.

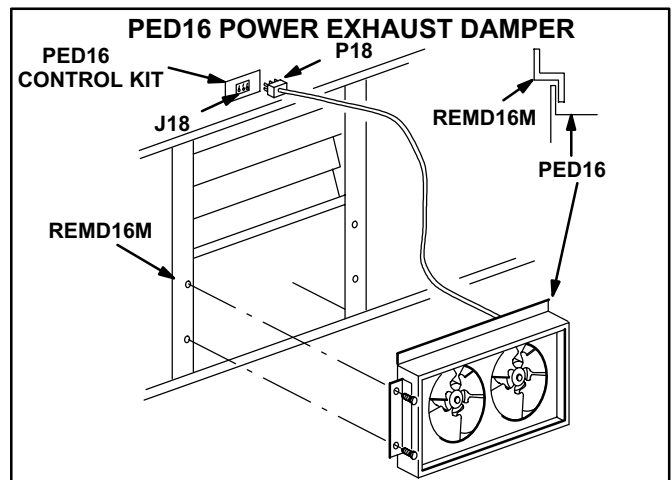


FIGURE 54

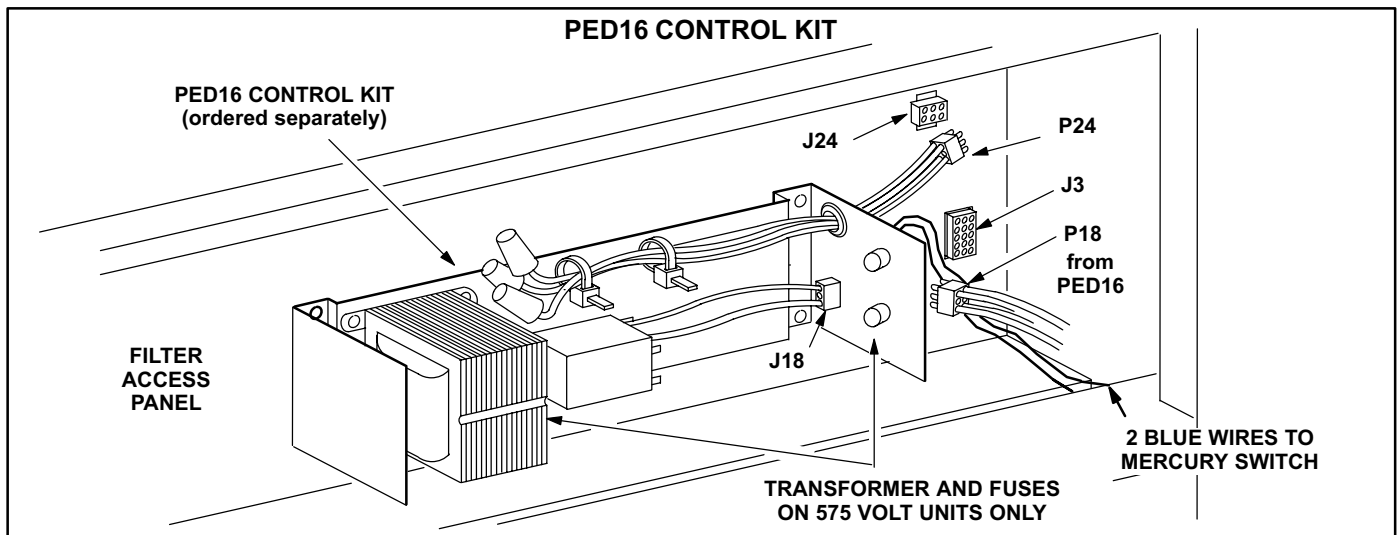


FIGURE 55

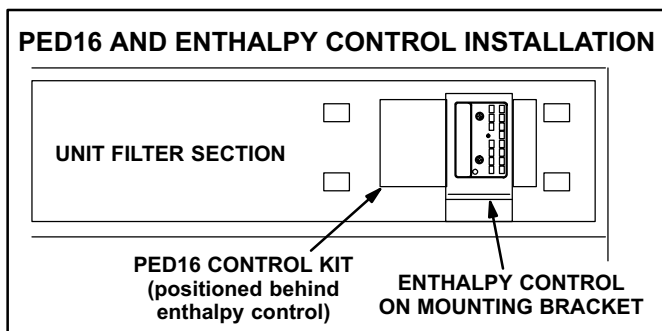


FIGURE 56

**c-Warm Up Kit  
(units equipped with standard or electronic thermostat and night setback function)**

An optional warm up kit may be added to the REMD16M 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 kit holds the outdoor dampers closed during setback, de-energizes the indoor thermostat and energizes the setback thermostat.

**d-Differential Enthalpy  
(all economizers)**

Optional differential enthalpy control may be added to any economizer to monitor both indoor and outdoor air conditions. With differential enthalpy installed, the economizer selects the lowest of the two enthalpy conditions to satisfy cooling demand.

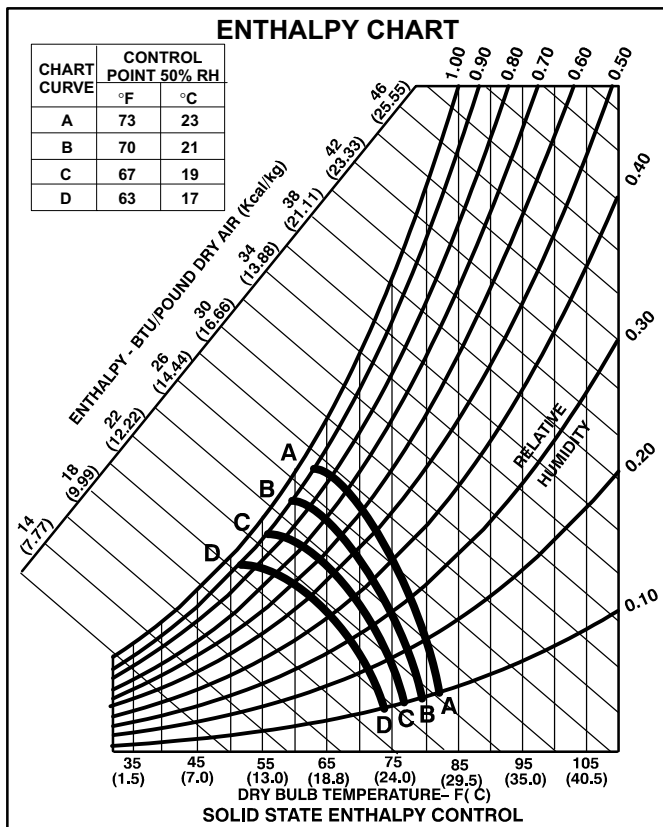
When differential enthalpy is installed, the second enthalpy sensor is installed in the retrain air duct while the original enthalpy sensor remains installed on the outdoor air dampers.

Refer to the wiring diagram section of this manual for wiring.

**4-Economizer Operation and Controls  
(all economizers)**

**a-Enthalpy Control: Setpoint Control**

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



Two types of adjustment may be made at the control. The first is the control setpoint. The setpoint determines the temperature and humidity conditions at which the outdoor air dampers will open and close. The recommended setpoint is "A." If the economizer is allowing air which is too warm or too humid into the system, the control may be changed to a lower setpoint (B, C or D). Refer to enthalpy chart figure 57.

**Example:**

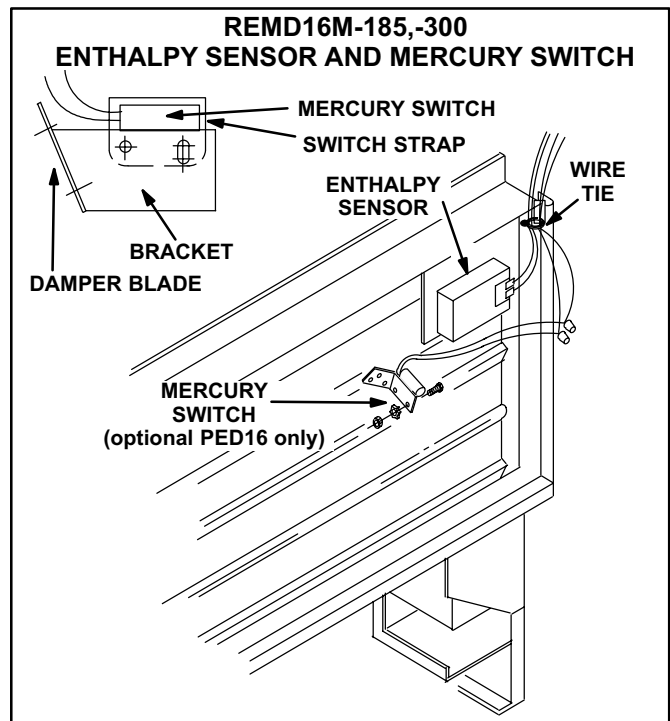
*If the enthalpy control is set at setpoint "A" as shown in figure 57, the following situation could occur. A cooling demand when the outside air is at 75° and 20 percent humidity would drive the economizer outdoor air dampers open to utilize outdoor air for cooling. The compressor cooling circuit would 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 deactivate the damper motor to the preset minimum position. If cooling demand is still present when the total heat of the outside air rises above the control setpoint, cooling demand is routed from the economizer to the compressor cooling circuit.*

**b-Minimum Positioner**

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

**c-Enthalpy Sensor**

The enthalpy sensor is located on the outside portion of the outdoor damper blades (as shown in figure 58). 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 mixed air sensor measures the resultant temperature of the mixed air downstream from the evaporator coil. Temperature is measured in the heating compartment (figure 59). The mixed air temperature is used by the enthalpy control when outdoor dampers are open to help determine outdoor air damper position. The economizer is factory equipped with a single mixed air sensor which fits through a factory supplied hole in the panel dividing unit return and supply air (see figure 59).

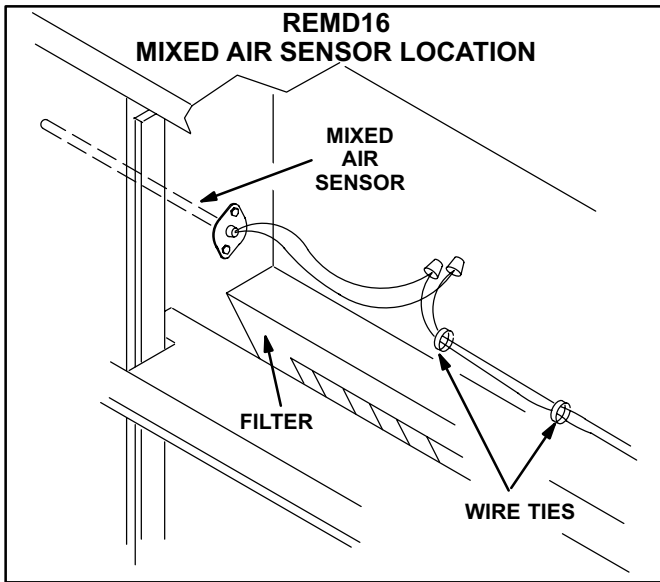


FIGURE 59

**e-Wiring, Installation, Maintenance**

The economizer uses harness plugs to connect to the unit harness connector located in the filter access compartment. Unlike smaller 16 series economizers which are unitary in construction (all one piece), the REMD16M-185 economizer has a control relay kit (consists of enthalpy control and relays) installed in the unit filter access section. The damper section (consists of dampers and damper motor) is installed separately in the return air section. Figure 60 shows economizer control installation and wiring. Figures 61 and 62 show REMD16M installation. Although harness connectors are used to connect the to the economizer, the economizer electrically connects to the 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.

Figures 61 and 62 show how an REMD16M is installed in a GCS16 cabinet (downflow application shown). For detailed installation and maintenance instructions, refer to the REMD16-185M installation instructions.

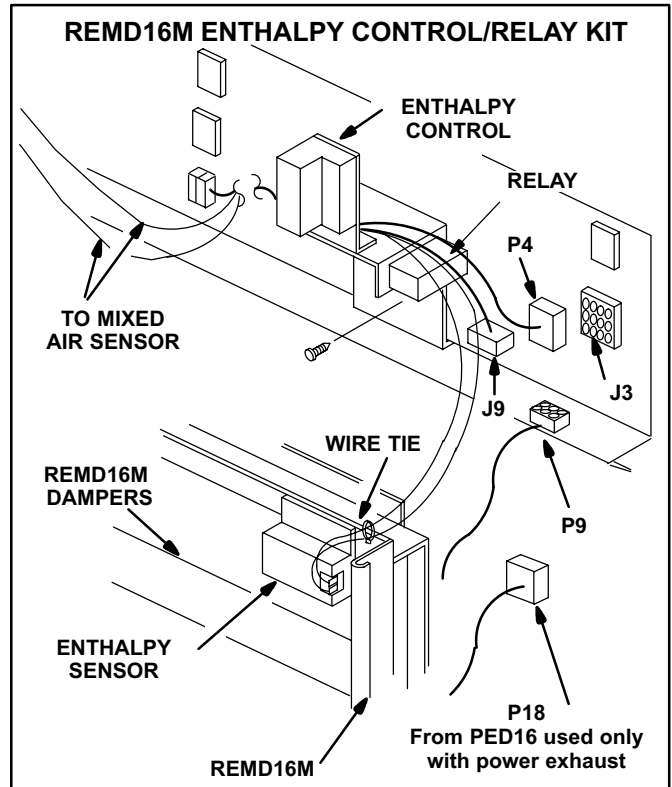


FIGURE 60

**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.

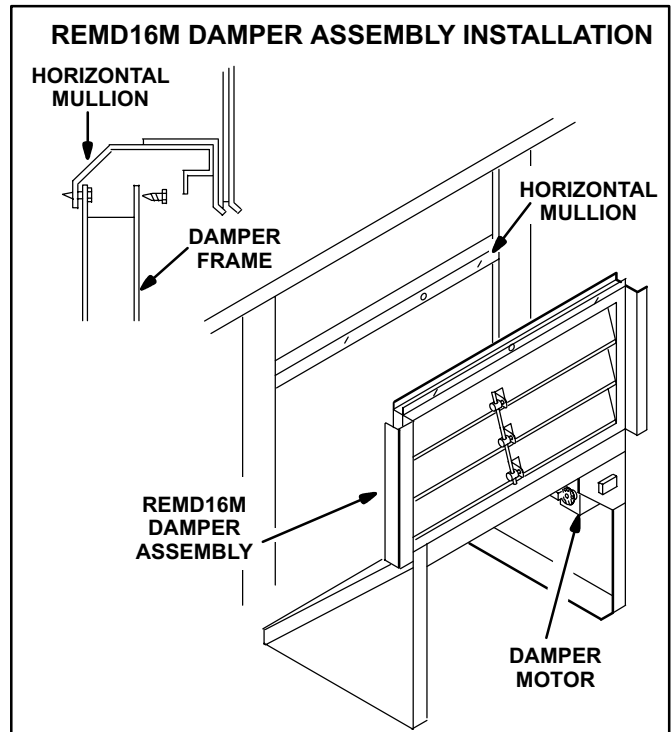


FIGURE 61

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

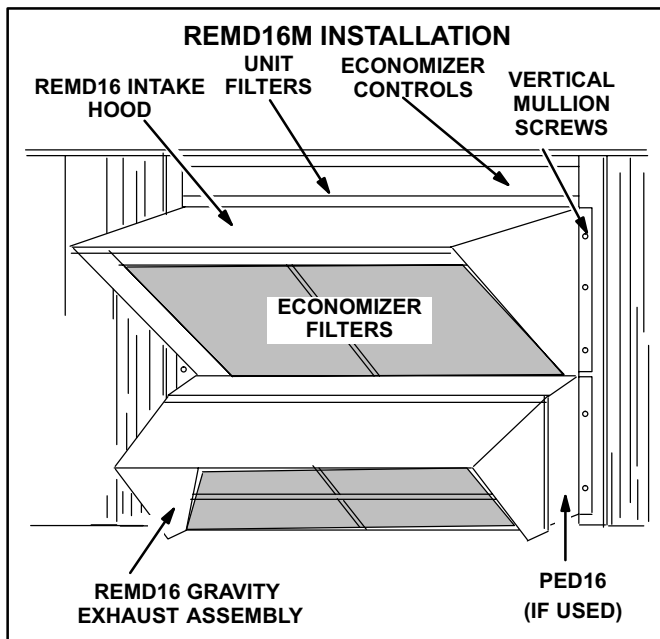


FIGURE 62

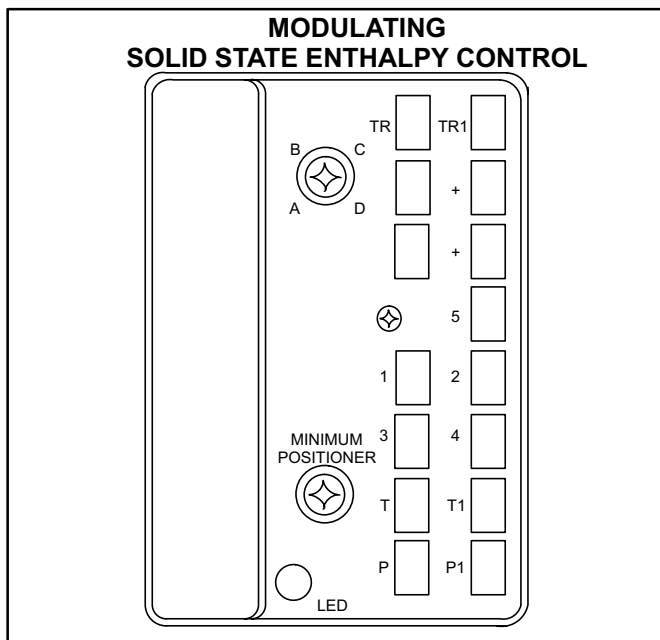


FIGURE 63

- 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 63 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 63.
- 6- Disconnect power to unit and remove jumper on blower relay terminals 6-9. Replace all panels. Restore power to unit.

### D-Transitions

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

### E-Supply and Return Diffusers

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

### F-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.

Firestat wiring is shown on the unit wiring digrams in back of this manual.

## G-Cycle Control Kit (Figure 64)

When applied to unit with electromechanical thermostat, prevents frequent cycling caused by thermostat diddling or thermostat bulb vibration. The cycle controls require minimum on and minimum off times before compressors can be energized or de-energized. The cycle controls plug-in to the No field wiring is required. The kit consists of two cycle control delays DL8 and DL9. Once installed, DL8 prevents the first stage compressors from being energized until the first stage thermostat bulb has been closed for at least 30 seconds. First

stage thermostat bulb must be open for at least 240 seconds before first stage compressors can be de-energized. DL9 prevents second stage compressors from being energized until second stage thermostat bulb has been closed for at least 60 seconds. Second stage thermostat bulb must be open for at least 240 seconds before second stage compressors can be de-energized.

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

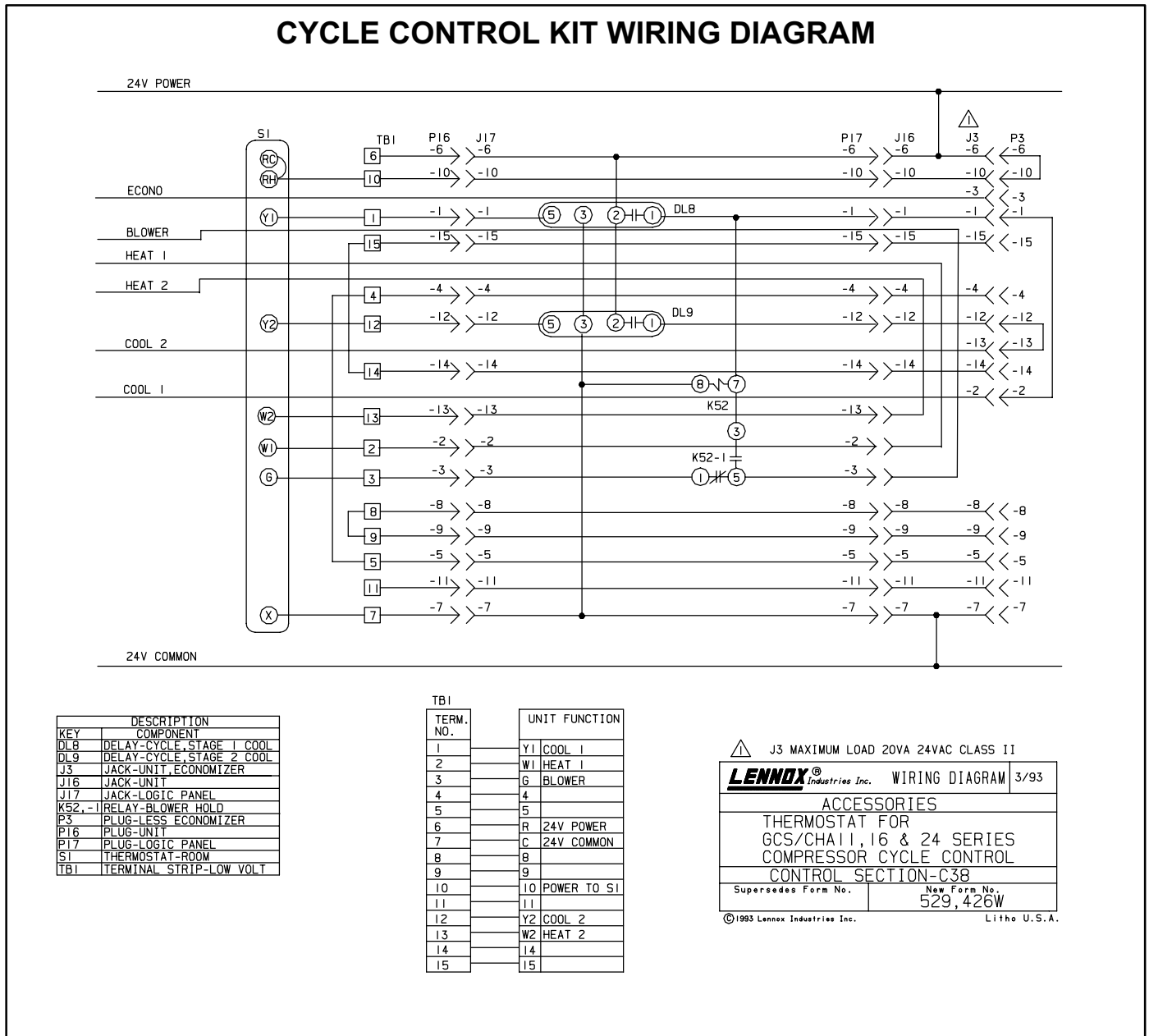


FIGURE 64

## H-Low Ambient Kit (all units)

The optional low ambient kit (figure 65) 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.*

The components included in the low ambient kit vary from unit to unit. Low ambient kits may include any combination of a pressure switch, a low ambient thermostat or a relay.

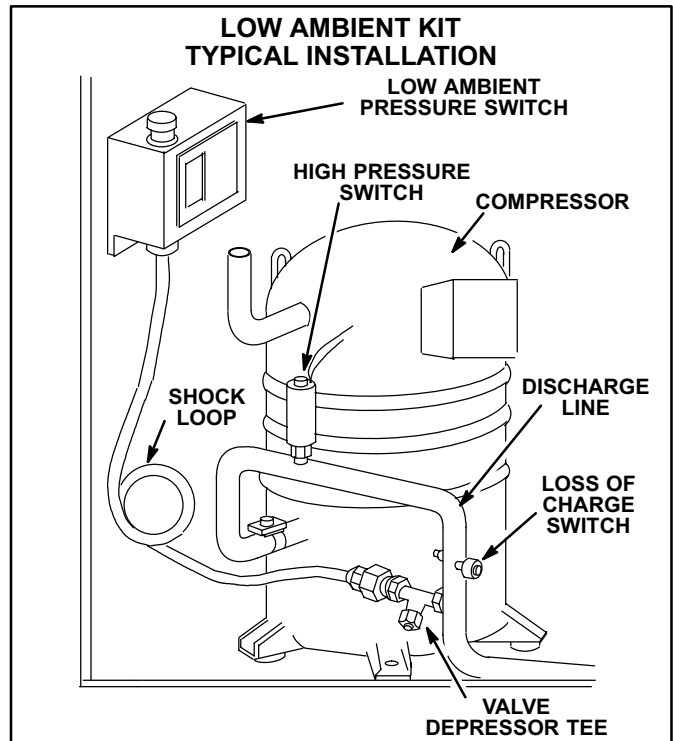
### ⚠ WARNING

*Electrical shock hazard. Low ambient kit wiring changes depending on unit size. Depending on the application, low ambient controls may be wired to low voltage or line voltage. Be sure to disconnect power to unit before servicing. Then check unit wiring diagram and become familiar with low ambient wiring before proceeding.*

The pressure switch, if used, is connected to the condenser fan and the compressor discharge line. The pressure switch senses a drop in outdoor temperature by monitoring the pressure of the discharge line. When discharge line pressure drops below a preset limit, the pressure switch opens the circuit to the condenser fan. With the condenser fan de-energized, the discharge pressure will slowly increase. When discharge pressure increases above a preset limit the pressure switch closes the circuit to the condenser fan and the fan resumes operation. The pressure switch will continue to cycle the fan in this fashion as long as low ambient conditions exist.

The low ambient thermostat, if used, is connected to the second stage compressor. The switch monitors outdoor temperature conditions and opens the circuit to the second stage compressor when outdoor temperature drops below a preset limit. The second stage compressor remains disconnected from the circuit until outdoor temperature rises above the preset limit.

The low ambient kit relay, if used, is typically used to sense a call for compressor demand. When the relay coil is energized, the contacts switch to complete a circuit through the low ambient pressure switch.

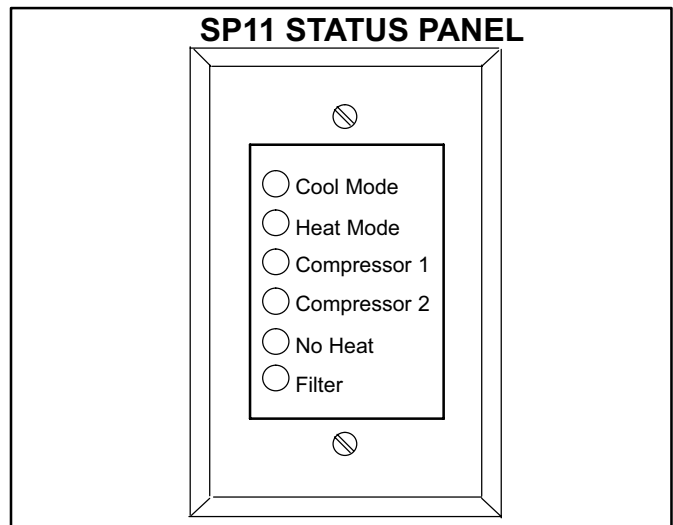


**FIGURE 65**

Refer to low ambient kit installation instructions for detailed installation and operation information. Low ambient kit wiring is shown on the unit wiring diagrams in back of this manual.

## I-Status Panels SP11 and SSP11

Optional status panels allow remote monitoring of system operation. Two types of panels are available. The SP11 (figure 66) provides system readout only. The SSP11 switching status panel (figure 67) 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).



**FIGURE 66**



## 1-SP11 Application

The SP11 may be applied to any control system. To operate an SP11, a readout relay kit including an electric heat current sensing relay is required to interface the ECH16 to the SP11. Optional filter switch kit must be added in order to make the filter light functional.

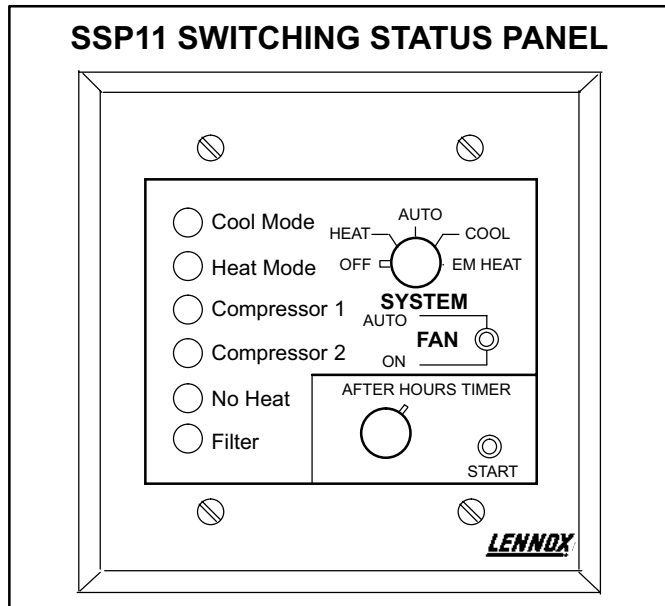


FIGURE 67

## 2-SSP11 Application

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

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

## 3-Indications and Functions

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

- 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 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.

## J-Commercial Controls Hardware

All GCS16 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, a control system wiring harness and associated jackplugs. The economizer and control harnesses are pre-wired to facilitate economizer, controls and/or warm-up connections.

Each unit is equipped with marked jackplugs at various locations throughout the unit. Each jack is marked with a "J" number on the jack (for example J5) and a corresponding "P" number on the plug (for example P5). The J16/P16 jackplug and the J3/P3 jackplug are used as connection points for commercial control systems in all Lennox commercial equipment. Lennox supplied control systems are supplied pre-wired with plugs which match the corresponding jackplugs in the unit.

Following is a list of important jackplugs found in Lennox commercial equipment and the function of each:

### 1- Jack J2 / (opt. Plug P2)

**Jack J2** is located in the heating section of the unit and is wired to the unit wiring harness. It is used for the connection of the heating section. GCS16 and CHA16 units are identical on the J2 side of the harness.

The matching **plug P2** is located in the heating control box (if unit is furnished with a heating section). The only difference between GCS16 (gas heating) units and CHA16 (electric heating) units is the wiring on the P2 side of the harness (see unit wiring diagrams).

In GCS16 equipment 12.5 tons and smaller, the gas heating section is considered an integral part of the unit. Jackplugs are not included between the unit and the heating section.

### 2- Jack J3 / Plug P3

**Jack J3** is located in the unit filter section of all units. It is wired to the unit wiring harness and is used for the connection of an economizer or any of the relay kits which are used to interface optional controls to the unit.

The mating **plug P3** is a jumper plug which is necessary to complete circuits internal to the unit when the unit is operated without accessories. When the unit is operated with accessories, P3 is removed and discarded.

### 3- Jack J16 / Plug P16

**Jackplug J16/P16** is located in the unit control box. Jackplug J16/P16 is used exclusively as a connection point for the control portion of optional control systems. Plug P16 is wired to the unit low voltage terminal strip and jack J16 is wired to the unit wiring harness.

### 4- Jack J18 / Plug P18

*(used in 15 ton and larger units only)*

**Jackplug J18/P18** is used as an extension harness to connect power exhaust damper fans in the economizer to the PED16 relay kit located in the unit filter section.

### 5- Jack J24 / (opt. Plug P24)

*(used in 15 ton and larger units only)*

**Jack J24** is located in the filter section. It is wired to the unit wiring harness and is used for the connection of an optional power exhaust damper (PED16) control kit.

The matching **plug P24** is located in the optional PED16 control kit. The PED16 control kit installs in the filter access area of the unit.

### 6- Jack J25 / (opt. Plug P25)

*(used in 15 ton and larger units only)*

**Jack J25** is located in the unit control box. It is wired to the unit wiring harness and is used for the connection of an optional SP11 or SSP11 status panel.

The matching **plug P25** is located in the optional status panel relay kit.

### 7- Jack J33 / (opt. Plug P34)

*(used in 15 ton and larger units only)*

**Jack J33** is located in the heating section of the unit and is wired to the unit wiring harness. It is used for the connection of an optional third stage (W3) heating relay.

The matching **plug P34** is provided in the optional third stage heating relay kit.

### 8- Jack J35 / Plug P35

*(used in 12.5 ton and smaller units only)*

**Jackplug J35/P35** is located in the unit control box is used for assembly line tests only. J35/P35 is not used for the connection of any control or control system.

### 9- Jack J36 / Plug P36

*(used in 15 ton and larger units only)*

**Jackplug J36/P36** is located in the unit control box is used for assembly line tests only. J36/P36 is not used for the connection of any control or control system.

10- Jack J57 / (opt. Plug P57)

(used in 15 ton and larger units only)

**Jack J57** is located in the unit control box. It is wired to the unit wiring harness and to jack J25 and is used for the connection of an optional “dirty filter” indicator switch to the optional status panel.

The matching **plug P57** is located in “dirty filter” switch assembly. Note that this switch assembly does not perform any function unless the optional status panel is installed.

In 12.5 ton and smaller units, access to the unit filter section is gained by removing the filter access panel. In 15 ton and larger, an access door is provided. Access to the unit filter section is gained by loosening the two quarter-turn fasteners on the access door (figure 68) with a slot screwdriver. The quarter-turn fasteners hold the access door shut with a spiral spring. Once the fasteners are loosened, the filter access door hinges open.

### K-Optional Commercial Controls Systems

Optional “16 Series Commercial Controls” may be connected to any GCS16 series commercial unit. These are the same controls which are optional in all 16 series 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.

All wiring connections are made by jackplug connections to the commercial controls harness in the unit.

**Plug P4** in the economizer connects to Jack J3 in the unit to make this connection.

2- *Warm-Up Kit*

Warm-up kit is shown in Figure 69. 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.

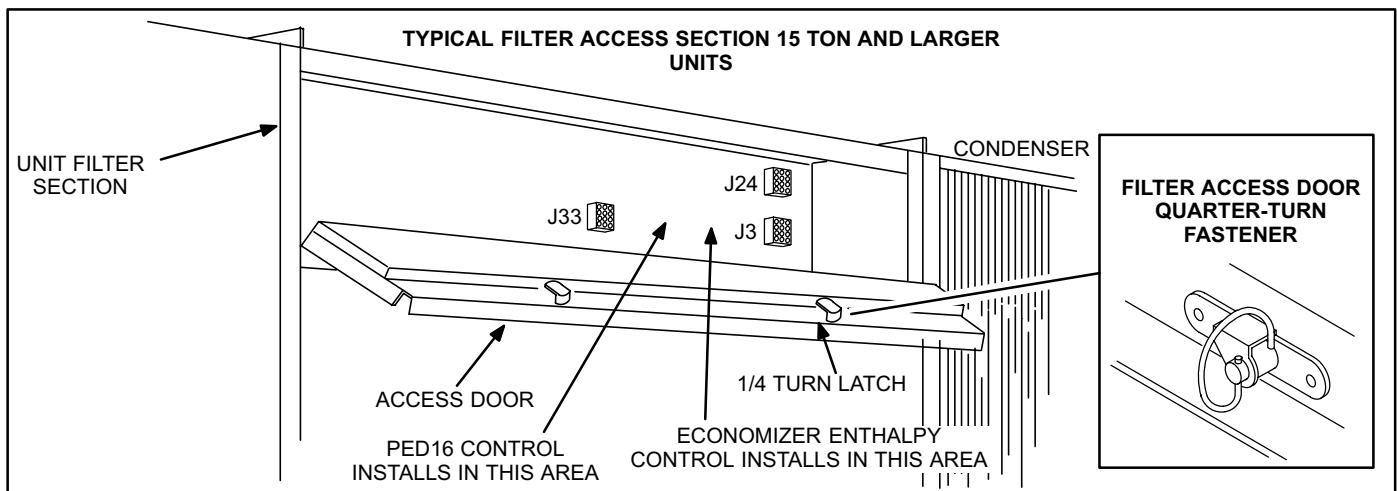


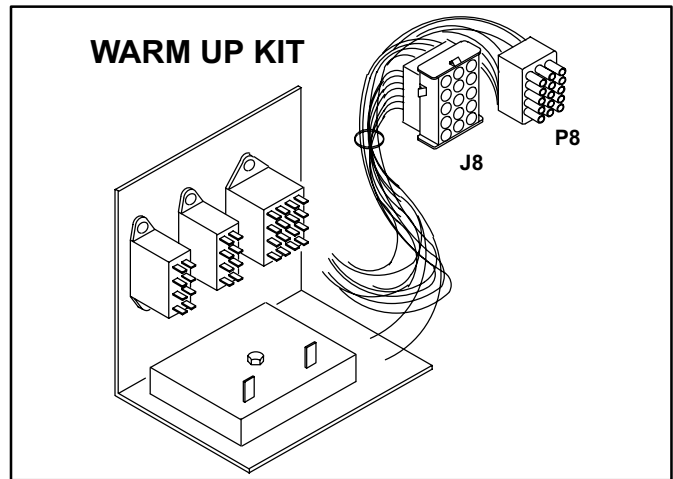
FIGURE 68

All wiring connections are made by jackplug connections to the commercial controls harness in the unit. **Plug P8** in the warm up kit connects to Jack J3 in the unit to make this connection. **Jack J8** in the warm up kit connects to Plug P4 in the economizer. Thermostat wiring connections are made to the unit low voltage terminal strip.

Some of the following optional thermostat control systems have built-in warm up capabilities and the warm up kit (figure 69) cannot be added due to wiring incompatibility.

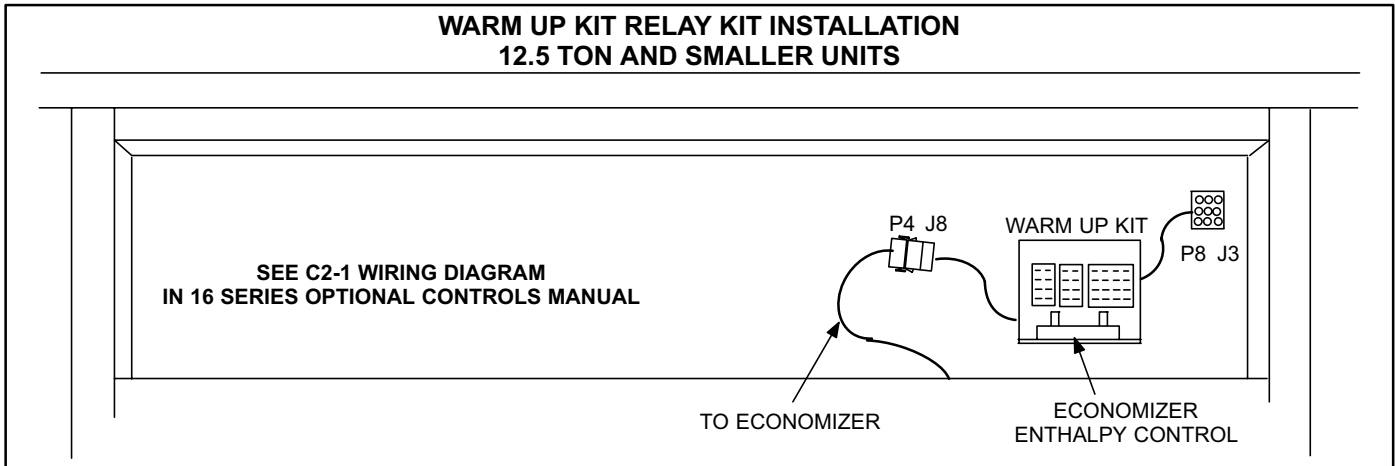
The warm-up kit is an option to the REMD16M economizer. The warm-up kit may be applied to any economizer (except units using W7400 control system or T7300 control system). If W973 control system is being used, CMC3-1 time clock must also be used. If electromechanical control system is being used,

CMC3-1 time clock and night thermostat must be used.



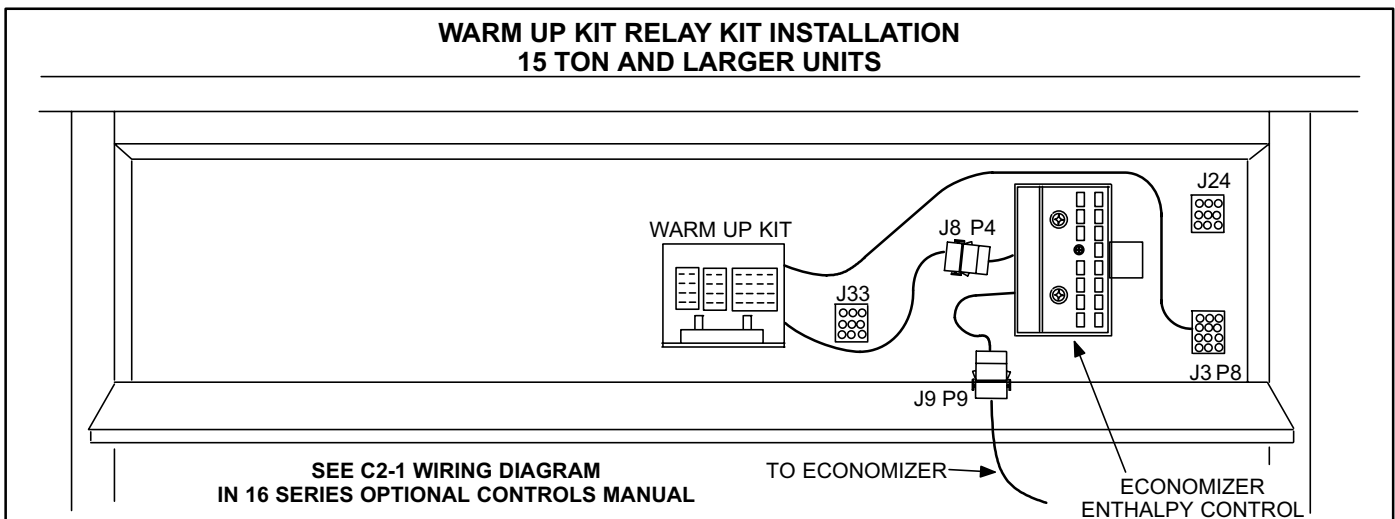
**FIGURE 69**

**WARM UP KIT RELAY KIT INSTALLATION  
12.5 TON AND SMALLER UNITS**



**FIGURE 70**

**WARM UP KIT RELAY KIT INSTALLATION  
15 TON AND LARGER UNITS**



**FIGURE 71**

## ⚠ 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 figures 70 and 71). 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.

### 3- C1 Wiring Diagram

Standard 2heat/2cool thermostat for all units without economizer or warm-up. All wiring connections are made to the unit low voltage terminal strip.

### 4- C2-1 Wiring Diagram

Standard 2heat/2cool thermostat for all units with economizer and warm-up. CMC3-1 clock and night thermostat must be added for night setback. Night relay must also be added to economizer for night setback. The warm up kit “plugs-in” to the unit with **plug P8**. Warm up kit **jack J8** connects to unit jumper plug P3 or economizer plug P4. The thermostat connects to the unit’s low voltage terminal strip.

### 5- C11-1 Wiring Diagram

Standard 2heat/2cool thermostat for all units without economizer or warm-up. C11 Night Kit adds a relay facilitating night setback function (see figure 72). CMC3-1 clock and night thermostat must also be added to make setback relay functional.

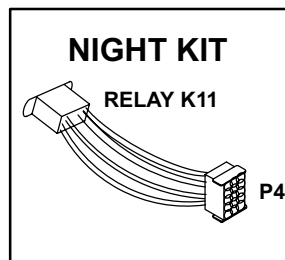


FIGURE 72

## ⚠ 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.

All wiring connections are made by jackplug connections to the commercial controls harness in the unit (see figures 73 and 74). **Plug P4** in the economizer connects to Jack J3 in the unit to make this connection.

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.

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.

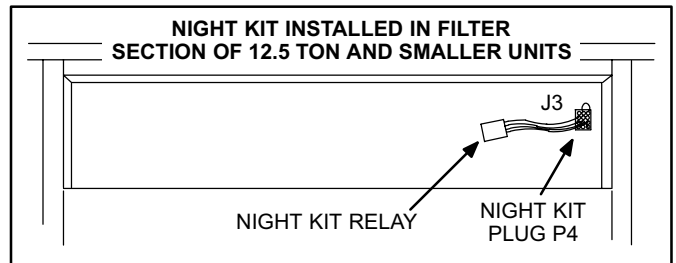


FIGURE 73

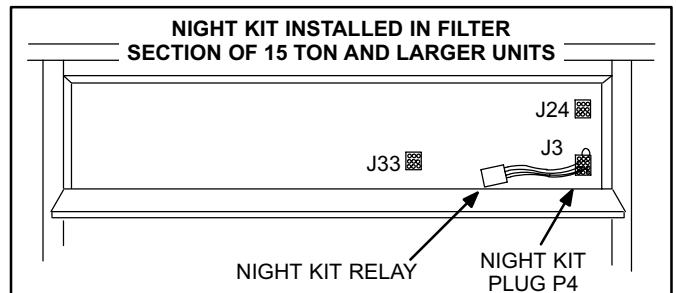


FIGURE 74

6- C3 Wiring Diagram

Flexstat L2F-N for units without economizer or warm-up. Setback is built in. Wiring connections are made to the unit's low voltage terminal strip.

*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.*

7- C4 Wiring Diagram

Flexstat L2F-N for units with economizer and warm-up. Setback is built in. Thermostat wiring connections are made to the unit's low voltage terminal strip while the warm up kit "plugs-in" to the unit's control harness.

8- C5 Wiring Diagram

Prostat T5010 for units without economizer or warm-up. Setback is built in. Wiring connections are made to the unit's low voltage terminal strip.

9- C6 Wiring Diagram

Prostat T5010 for units with economizer and warm-up. Setback is built in. Thermostat wiring connections are made to the unit's low voltage terminal strip while the warm up kit "plugs-in" to the unit's control harness

10- C7-3 Wiring Diagram

W7400 control system for units. See figure 75. Requires W7400 relay kit and economizer. Warm up and setback are built in. Thermostat T7400 wiring connections are made to the unit's low voltage terminal strip. W7400 control module **jackplugs J17/P17** connect to the unit control harness at jackplug J16/P16. W7400 relay kit **plug P5** connects to unit jack J3 and relay kit **jack J5** connects to warm up kit plug P8. Another plug equipped in the W7400 relay kit, **Jackplug J23/P23**, is used in LVAV applications only.

**⚠ 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.**

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.

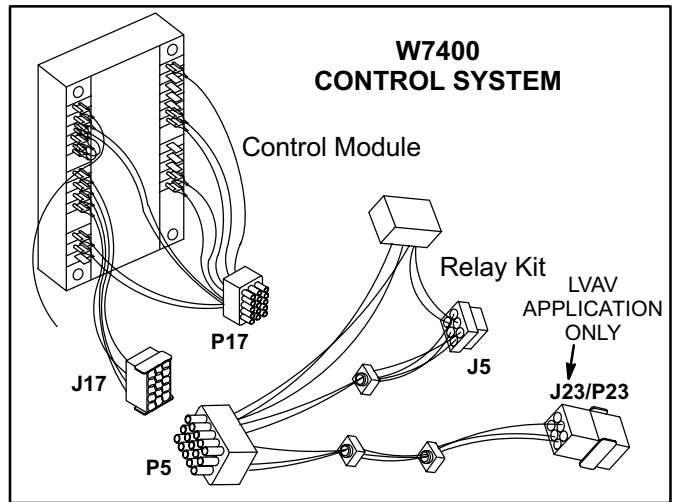


FIGURE 75

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.

**⚠ 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.**

11- C8-1 Wiring Diagram

W973 control system for units without economizer or warm-up. See figure 76. Requires W973 relay kit and CMC3-1 clock for night setback. W973 control module **jackplugs J17/P17** connect to the unit control harness at jackplug J16/P16. W973 relay kit **plug P6** connects to unit jack J3 and relay kit **jack J6** connects to unit plug P3 or economizer plug P4. Room temperature sensor connections are made to the unit's low voltage terminal strip.

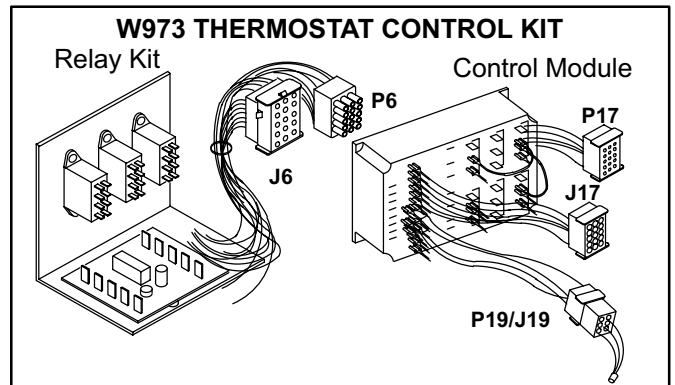


FIGURE 76

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.

#### 12- C14-1 Wiring Diagram

W973 control system for units with economizer and warm-up. Requires W973 relay kit. Also requires CMC3-1 clock and night relay for night setback. Wiring connections are similar to C8-1 diagram except with addition of warm up kit. Warm up kit plug P8 connects to W973 relay Kit jack J5 and all other jackplug connections are made as described in previous sections. Room temperature sensor connections are made to the unit’s low voltage terminal strip.

#### 13- C12 Wiring Diagram

T7300 electronic thermostat for units without economizer. T7300 thermostat wiring connections are made to the unit’s low voltage terminal strip.

#### 14- C12-2 Wiring Diagram

T7300 electronic thermostat for units with economizer. Warm-up is built in.

### L-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.

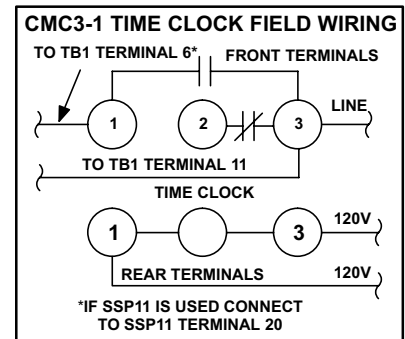
Other CHA16 control system options (W7400, T7300, Pro-stat, etc.) are equipped with built-in clocks for this purpose and do not need CMC3-1.

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

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

Wiring connections should be made to N.O. terminal 1 and 3 (see figure 77). Refer to the sequence of operation for the control system being used (back of this manual) for correct wiring connections.

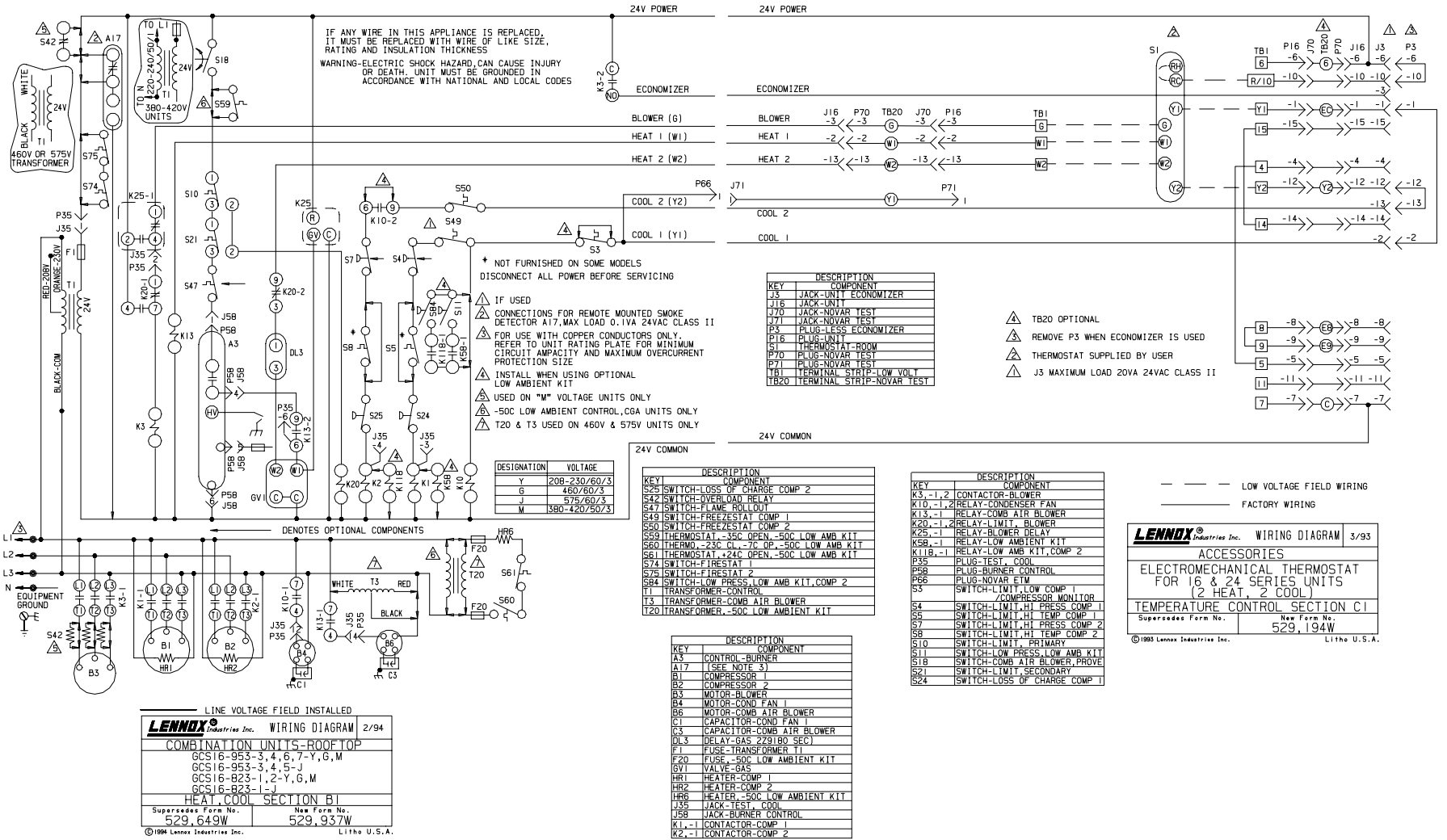
Refer to the manufacturer’s operation and installation instructions printed inside the front cover of each clock.



**FIGURE 77**

**XI-WIRING DIAGRAMS AND OPERATING SEQUENCE**

**B1 diagram with C1 diagram GCS16-823 or -953 with basic standard thermostat**



Page 64



## C1 DIAGRAM WITH B1 DIAGRAM

### Electromechanical Thermostat Connected to GCS16-823 or GCS16-953 (Without Economizer)

The diagrams in this section are used to represent the relationship of GCS16 electrical components and to show the step by step sequence that takes place when thermostat demand is sent to the GCS16. The operating sequence describes the actions of devices in the unit which control blowers, fans and other components in the system.

#### A-GCS16-823, AND GCS16-953

#### Operation Sequence: C1 and B1 Sections (electromechanical thermostat wired to GCS16-823 or GCS16-953)

##### Power:

- 1- When the unit disconnect closes, line voltage energizes transformer T1 and the compressor crankcase heaters. Transformer T1 provides 24VAC power to unit cooling, heating and blower controls and thermostat. The crankcase heaters are powered at all times but are self-regulating
- 2- Transformer T3 (460V and 575V units) is also energized when power is applied to the unit.

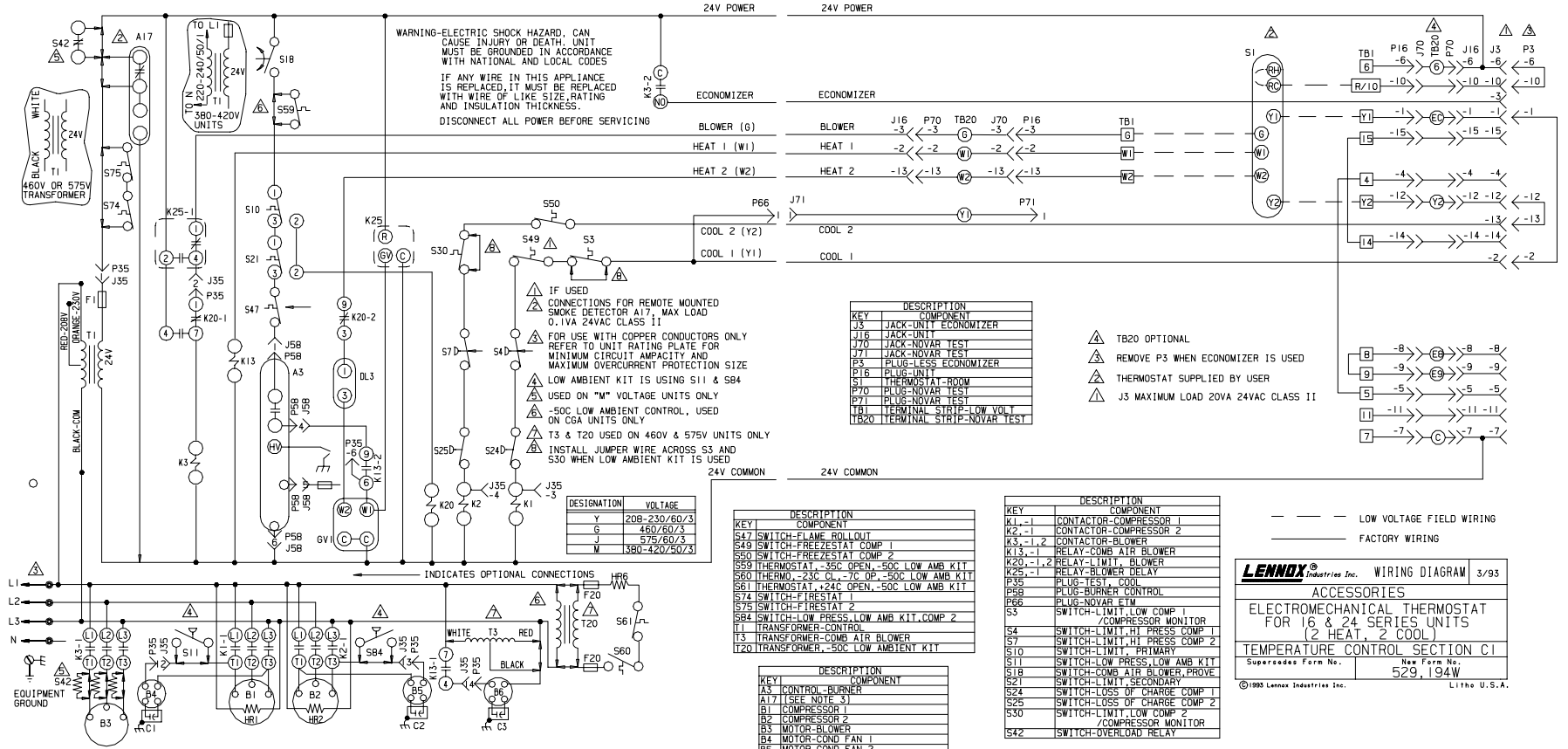
##### Cooling Demand:

- 3- On a call for first stage cooling (Y1), demand passes through the first stage safety limits and energizes contactors K10 and K1. Both contactors immediately switch. At the same time, the indoor thermostat energizes the indoor blower circuit (G). Blower demand passes through blower relays K20 and K25 to energize indoor blower contactor K3. K3 immediately switches.
- 4- When contacts K1-1 close, compressor B1 is energized immediately begins operating.
- 5- When contacts K10-1 close, condenser fan B4 is energized and the condenser fan immediately begins operating. When K10-2 closes, the second stage cooling circuit is enabled. The purpose of the K10-2 circuit is to prevent the second stage compressor from operating without a fan. Each circuit is equipped with its own safety limits. The safety limits are placed in the circuit so that when actuated, they only de-energize the compressor they are connected to. An exception to this rule is compressor monitor S3. When S3 opens, both compressors and the condenser fan are de-energized.
- 6- When contacts K3-1 close, the indoor blower is energized immediately begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 7- On a call for increased cooling (Y2), demand is passed through the second stage safety limits to energize contactor K2. K2 immediately switches.
- 8- When contacts K2-2 close, compressor B2 is energized and immediately begins operating.

##### Heating Demand:

- 9- On a call for first stage heating (W1), demand energizes combustion air blower relay K13.
- 10- When contacts K13-1 close, combustion air blower B6 is energized and immediately begins operating. When contacts K13-2 close, the gas valve is enabled.
- 11- As the combustion air blower approaches full speed, combustion air blower prove switch (S18) closes.
- 12- When S18 closes a 24VAC circuit is completed through the heating safety switches to energize burner ignition control A3.
- 13- When ignition control A3 determines that ignition can begin, A3 simultaneously sends 24VAC to the first stage operator of the gas valve and to the indoor blower delay relay (K25) and also sends spark to the spark electrode. The gas valve immediately opens and blower delay K25 immediately begins timing.
- 14- When flame is sensed by the ignition control, spark is stopped and the gas valve remains open. If flame is not sensed within the time allowed, spark is stopped, the gas valve is closed and the ignition control begins its retrial timing sequence.
- 15- When blower delay K25 ends its timing period, K25-1 switches. A 24VAC circuit is completed through K20-1 to energize blower contactor K3.
- 16- When contacts K3-1 close, the indoor blower is energized immediately begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 17- On a call for increased heating (W2), demand passes through K20-2 to energize time delay DL3. DL3 immediately begins its timing sequence.
- 18- When DL3 time delay has elapsed, DL3 closes internally to complete a circuit to the second stage operator of the gas valve (W2). When gas valve operator W2 is energized, the gas valve begins to slowly open for second stage operation.
- 19- If either heating limit S10 or S21 open during heating operation, ignition control A3 is immediately de-energized and blower limit relay K20 is immediately energized.
- 20- When A3 is de-energized, the gas valve (W1) and blower delay (K25) are both de-energized.
- 21- When K20-1 switches, blower contactor K3 is energized to continue blower operation during the time that safety limits are open. When K20-2 opens, second stage thermostat demand is prevented from reaching the second stage operator of the gas valve (W2).

# B2 diagram with C1 diagram GCS16-1353 with basic standard thermostat



WARNING-ELECTRIC SHOCK HAZARD. CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUNDED IN ACCORDANCE WITH NATIONAL AND LOCAL CODES. IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING AND INSULATION THICKNESS. DISCONNECT ALL POWER BEFORE SERVICING

- ⚠ IF USED CONNECTIONS FOR REMOTE MOUNTED SMOKE DETECTOR A17, MAX LOAD 0.1VA 24VAC CLASS II
- ⚠ FOR USE WITH COPPER CONDUCTORS ONLY REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE
- ⚠ LOW AMBIENT KIT IS USING S11 & S84 USED ON "M" VOLTAGE UNITS ONLY
- ⚠ -50C LOW AMBIENT CONTROL, USED ON CGA UNITS ONLY
- ⚠ T3 & T20 USED ON 460V & 575V UNITS ONLY
- ⚠ INSTALL JUMPER WIRE ACROSS S3 AND S30 WHEN LOW AMBIENT KIT IS USED

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

KEY	DESCRIPTION	COMPONENT
J3	JACK-UNIT ECONOMIZER	
J16	JACK-UNIT TEST	
P70	PLUG-LESS ECONOMIZER	
S1	THERMOSTAT-ROOM	
P71	PLUG-NOVAR TEST	
TB1	TERMINAL STRIP-LOW VOLT	
TB20	TERMINAL STRIP-NOVAR TEST	

- ⚠ TB20 OPTIONAL
- ⚠ REMOVE P3 WHEN ECONOMIZER IS USED
- ⚠ THERMOSTAT SUPPLIED BY USER
- ⚠ J3 MAXIMUM LOAD 20VA 24VAC CLASS II

KEY	DESCRIPTION	COMPONENT
S47	SWITCH-FLAME ROLL-OUT	
S49	SWITCH-FREESTAT COMP 1	
S50	SWITCH-FREESTAT COMP 2	
S59	THERMOSTAT, -55C OPEN, -50C LOW AMB KIT	
S60	THERMO, +24C CL, -7C OP, -50C LOW AMB KIT	
S61	THERMOSTAT, +24C OPEN, -50C LOW AMB KIT	
S74	SWITCH-FIRESTAT 1	
S75	SWITCH-FIRESTAT 2	
S84	SWITCH-LOW PRESS, LOW AMB KIT, COMP 2	
T1	TRANSFORMER-CONTROL	
T3	TRANSFORMER-COMB AIR BLOWER	
T20	TRANSFORMER, -50C LOW AMBIENT KIT	

KEY	DESCRIPTION	COMPONENT
K1-1	CONTACTOR-COMPRESSOR 1	
K2-1	CONTACTOR-COMPRESSOR 2	
K3-1,2	CONTACTOR-BLOWER	
K13-1	RELAY-COMB AIR BLOWER	
K20-1,2	RELAY-LIMIT, BLOWER	
K25-1	RELAY-BLOWER DELAY	
P35	PLUG-TEST, COOL	
P68	PLUG-BURNER CONTROL	
P69	PLUG-NOVAR ETM	
S3	SWITCH-LIMIT, LOW COMP 1 /COMPRESSOR MONITOR	
S4	SWITCH-LIMIT, HI PRESS COMP 1	
S7	SWITCH-LIMIT, HI PRESS COMP 2	
S10	SWITCH-LIMIT, PRIMARY	
S11	SWITCH-LOW PRESS, LOW AMB KIT	
S18	SWITCH-COMB AIR BLOWER, PROVE	
S21	SWITCH-LIMIT, SECONDARY	
S24	SWITCH-LOSS OF CHARGE COMP 1	
S25	SWITCH-LOSS OF CHARGE COMP 2	
S30	SWITCH-LIMIT, LOW COMP 2	
S42	SWITCH-OVERLOAD RELAY	

KEY	DESCRIPTION	COMPONENT
A3	CONTROL BURNER	
A17	(SEE NOTE 3)	
B1	COMPRESSOR 1	
B2	COMPRESSOR 2	
B3	MOTOR-PI OWNER	
B4	MOTOR-COND FAN 1	
B5	MOTOR-COND FAN 2	
B6	MOTOR-COMB AIR BLOWER	
C1	CAPACITOR-COND FAN 2	
C2	CAPACITOR-COND FAN 2	
C3	CAPACITOR-COMB AIR BLOWER	
DL3	DELAY-GAS 2(10SEC)	
F1	FUSE-TRANSFORMER T1	
F20	FUSE, -50C LOW AMBIENT KIT	
GV1	VALVE-GAS	
HR1	HEATER-COMPRESSOR 1	
HR2	HEATER-COMPRESSOR 2	
HR6	HEATER, -50C LOW AMBIENT KIT	
J35	JACK-TEST, COOL	
J58	JACK-BURNER CONTROL	

**LENNOX** Industries Inc. WIRING DIAGRAM 3/93

ACCESSORIES

ELECTROMECHANICAL THERMOSTAT FOR 16 & 24 SERIES UNITS (2 HEAT, 2 COOL)

TEMPERATURE CONTROL SECTION C1

Supersedes Form No. 529, 650W New Form No. 529, 194W

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LINE VOLTAGE FIELD INSTALLED

**LENNOX** Industries Inc. WIRING DIAGRAM 2/94

COMBINATION UNITS-ROOFTOP

GCS16-1353-5, 6, 7, 8-Y, G, J, M

HEAT, COOL SECTION B2

Supersedes Form No. 529, 650W New Form No. 529, 938W

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## C1 DIAGRAM WITH B2 DIAGRAM

### Electromechanical Thermostat Connected to GCS16-1353 (Without Economizer)

#### B-GCS16-1353

#### Operation Sequence: C1 and B2 Sections (electromechanical thermostat wired to GCS16-1353)

##### Power:

- 1- When the unit disconnect closes, line voltage energizes transformer T1 and the compressor crankcase heaters. Transformer T1 provides 24VAC power to unit cooling, heating and blower controls and thermostat. The crankcase heaters are powered at all times but are self-regulating.
- 2- Transformer T3 (460V and 575V units) is also energized when power is applied to the unit.

##### Cooling Demand:

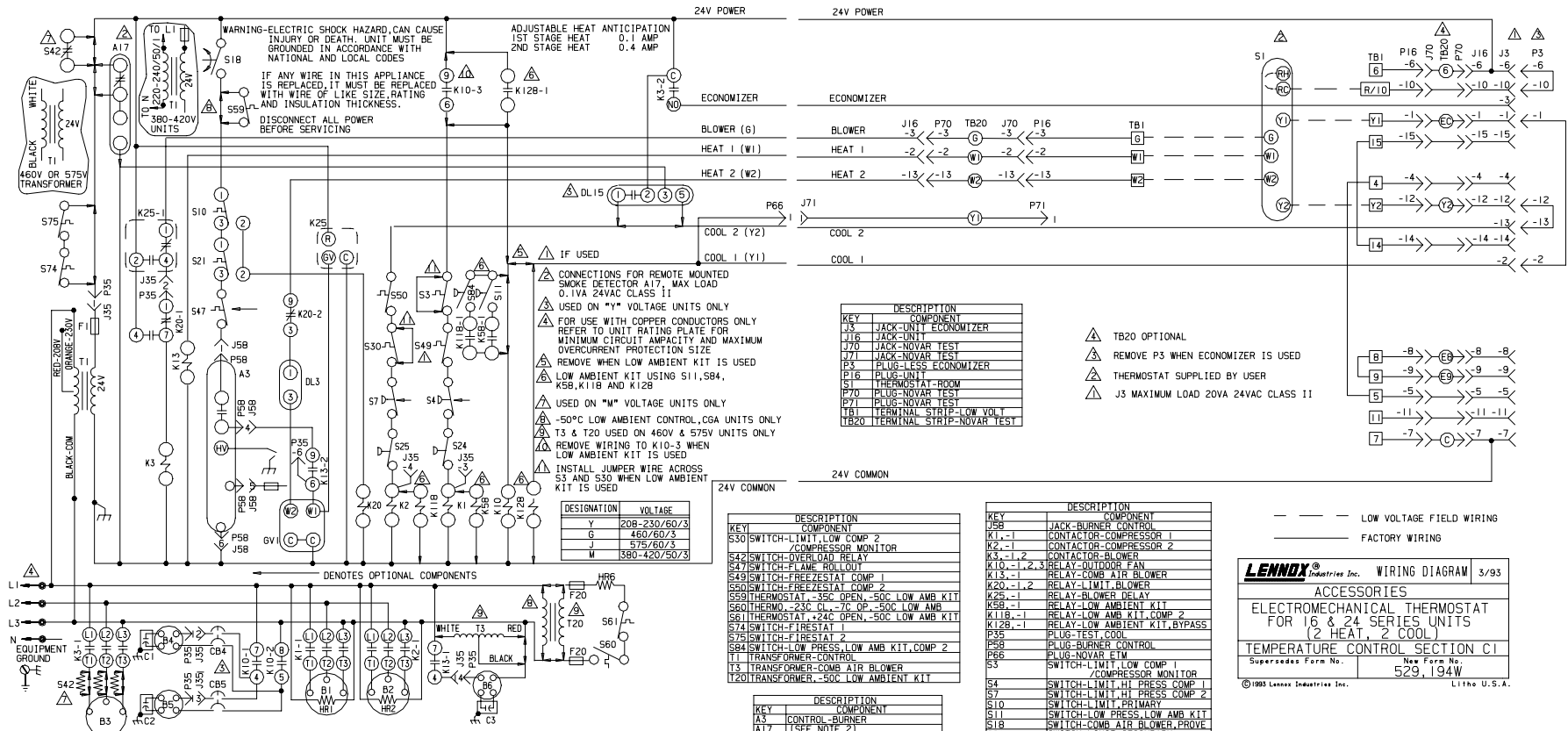
- 3- On a call for first stage cooling (Y1), demand passes through the first stage safety limits and energizes contactor K1. Contactor K1 immediately switches. At the same time, the indoor thermostat energizes the indoor blower circuit (G). Blower demand passes through blower relays K20 and K25 to energize indoor blower contactor K3. K3 immediately switches.
- 4- When contacts K1-1 close, compressor B1 and first stage condenser fan B4 are energized and immediately begin operating.
- 5- When contacts K3-1 close, the indoor blower is energized immediately and begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 6- On a call for increased cooling (Y2), demand is passed through the second stage safety limits to energize contactor K2. K2 immediately switches.
- 7- When contacts K2-1 close, compressor B2 and condenser fan B5 are energized and immediately begin operating.

##### Heating Demand:

- 8- On a call for first stage heating (W1), demand energizes combustion air blower relay K13.
- 9- When contacts K13-1 close, combustion air blower B6 is energized and immediately begins operating. When contactst K13-2 close, the gas valve is enabled.
- 10- As the combustion air blower approaches full speed, combustion air blower prove switch (S18) closes.

- 11- When S18 closes a 24VAC circuit is completed through the heating safety switches to energize burner ignition control A3.
- 12- When ignition control A3 determines that ignition can begin, A3 simultaneously sends 24VAC to the first stage operator of the gas valve and to the indoor blower delay relay (K25) and also sends spark to the spark electrode. The gas valve immediately opens and blower delay K25 immediately begins timing.
- 13- When flame is sensed by the ignition control, spark is stopped and the gas valve remains open. If flame is not sensed within the time allowed, spark is stopped, the gas valve is closed and the ignition control begins its retrial timing sequence.
- 14- When blower delay K25 ends its timing period, K25-1 switches. A 24VAC circuit is completed through K20-1 to energize blower contactor K3.
- 15- When contacts K3-1 close, the indoor blower is energized immediately begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 16- On a call for increased heating (W2), demand passes through K20-2 to energize time delay DL3. DL3 immediately begins its timing sequence.
- 17- When DL3 time delay has elapsed, DL3 closes internally to complete a circuit to the second stage operator of the gas valve (W2). When gas valve operator W2 is energized, the gas valve begins to slowly open for second stage operation.
- 18- If either heating limit S10 or S21 open during heating operation, ignition control A3 is immediately de-energized and blower limit relay K20 is immediately energized.
- 19- When A3 is de-energized, the gas valve (W1) and blower delay (K25) are both de-energized.
- 20- When K20-1 switches, blower contactor K3 is energized to continue blower operation during the time that safety limits are open. When K20-2 opens, second stage thermostat demand is prevented from reaching the second stage operator of the gas valve (W2).

# B2 diagram with C1 diagram GCS16-1603 with basic standard thermostat



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

IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING AND INSULATION THICKNESS.

DISCONNECT ALL POWER BEFORE SERVICING

ADJUSTABLE HEAT ANTICIPATION  
1ST STAGE HEAT 0.1 AMP  
2ND STAGE HEAT 0.4 AMP

CONNECTIONS FOR REMOTE MOUNTED SMOKE DETECTOR A17, MAX LOAD 0.1VA 24VAC CLASS II

USED ON "Y" VOLTAGE UNITS ONLY

FOR USE WITH COPPER CONDUCTORS ONLY REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE

REMOVE WHEN LOW AMBIENT KIT IS USED

LOW AMBIENT KIT USING S11, S84, K5B, K11B AND K12B

USED ON "M" VOLTAGE UNITS ONLY

-50°C LOW AMBIENT CONTROL, CGA UNITS ONLY

T3 & T20 USED ON 460V & 575V UNITS ONLY

REMOVE WIRING TO K10-3 WHEN LOW AMBIENT KIT IS USED

INSTALL JUMPER WIRE ACROSS S3 AND S30 WHEN LOW AMBIENT KIT IS USED

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

KEY	COMPONENT
J3	JACK-UNIT ECONOMIZER
J16	JACK-UNIT
J70	JACK-NOVAR TEST
J71	JACK-NOVAR TEST
P3	PLUG-LESS ECONOMIZER
P16	THERMOSTAT-ROOM
P70	PLUG-NOVAR TEST
P71	PLUG-NOVAR TEST
TB1	TERMINAL STRIP-LOW VOL I
TB20	TERMINAL STRIP-NOVAR TEST

- △ TB20 OPTIONAL
- △ REMOVE P3 WHEN ECONOMIZER IS USED
- △ THERMOSTAT SUPPLIED BY USER
- △ J3 MAXIMUM LOAD 20VA 24VAC CLASS II

KEY	COMPONENT
S50	SWITCH-LIMIT, LOW COMP 2 /COMPRESSOR MONITOR
S42	SWITCH-OVER-OAD RELAY
S47	SWITCH-FLAME ROLL-OUT
S49	SWITCH-FREEZE/STAT, COMP 1
S50	SWITCH-FREEZE/STAT, COMP 2
S59	THERMOSTAT, +25°C OPEN, -50°C LOW AMB KIT
S60	THERMO, -23°C CL -7°C OP, -50°C LOW AMB KIT
S61	THERMOSTAT, +24°C OPEN, -50°C LOW AMB KIT
S74	SWITCH-FIRE/STAT 1
S75	SWITCH-FIRE/STAT 2
S84	SWITCH-LOW PRESS, LOW AMB KIT, COMP 2
T1	TRANSFORMER-CONTROL
T3	TRANSFORMER-COMB AIR BLOWER
T20	TRANSFORMER, -50°C LOW AMBIENT KIT

KEY	COMPONENT
J5B	JACK-BURNER CONTROL
K1,-1	CONTACTOR-COMPRESSOR 1
K2,-1	CONTACTOR-COMPRESSOR 2
K3,-1,2	CONTACTOR-BLOWER
K10,-1,2,3	RELAY-OUTDOOR FAN
K13,-1	RELAY-COMB AIR BLOWER
K20,-1,2	RELAY-LIMIT BLOWER
K25,-1	RELAY-BLOWER DELAY
K5B,-1	RELAY-LOW AMBIENT KIT
K11B,-1	RELAY-LOW AMB KIT, COMP 2
K12B,-1	RELAY-LOW AMBIENT KIT, BYPASS
P35	PLUG-TEST, COOL
P58	PLUG-NOVAR CONTROL
P66	PLUG-NOVAR RTM
S3	SWITCH-LIMIT, LOW COMP 1 /COMPRESSOR MONITOR
S4	SWITCH-LIMIT, HI PRESS COMP 1
S7	SWITCH-LIMIT, HI PRESS COMP 2
S10	SWITCH-LIMIT, PRIMARY
S11	SWITCH-LOW PRESS, LOW AMB KIT
S18	SWITCH-COMB AIR BLOWER, PROVE
S21	SWITCH-LIMIT, SECONDARY
S24	SWITCH-LOSS OF CHARGE, COMP 1
S25	SWITCH-LOSS OF CHARGE, COMP 2

KEY	COMPONENT
A3	CONTROL-BURNER
A17	(SEE NOTE 2)
B1	COMPRESSOR
B2	COMPRESSOR 2
B3	MOTOR-BLOWER
B4	MOTOR-CONDENSER FAN 1
B5	MOTOR-CONDENSER FAN 2
B6	MOTOR-COMBUSTION AIR BLOWER
C1	CAPACITOR-CONDENSER FAN 1
C2	CAPACITOR-CONDENSER FAN 2
C3	CAPACITOR-COMB AIR BLOWER
CB4	CIRCUIT BRKR-COND FAN MTR 1
CB5	CIRCUIT BRKR-COND FAN MTR 2
DL3	DELAY-6S (180 SEC)
DL15	DELAY-COMPRESSOR 2(30 SEC)
F1	FUSE-TRANSFORMER T1
F20	FUSE,-50°C LOW AMBIENT KIT
GV1	VALVE-GAS
HR1	HEATER-COMPRESSOR 1
HR2	HEATER-COMPRESSOR 2
HR6	HEATER,-50°C LOW AMBIENT KIT
J35	JACK-TEST, COOL

**LENNOX** Industries Inc. WIRING DIAGRAM 3/93

ACCESSORIES

ELECTROMECHANICAL THERMOSTAT FOR 16 & 24 SERIES UNITS (2 HEAT, 2 COOL)

TEMPERATURE CONTROL SECTION C1

Supersedes Form No. 529, 651W New Form No. 529, 194W

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LINE VOLTAGE FIELD INSTALLED

**LENNOX** Industries Inc. WIRING DIAGRAM 2/94

COMBINATION UNITS-ROOFTOP

GCS16-1603-3, 4, 5-Y, G, J, M

HEAT, COOL SECTION B2

Supersedes Form No. 529, 651W New Form No. 529, 940W

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## C1 DIAGRAM WITH B2 DIAGRAM

### Electromechanical Thermostat Connected to GCS16-1603 (Without Economizer)

#### C-GCS16-1603

#### Operation Sequence: C1 and B2 Sections (electromechanical thermostat wired to GCS16-1603)

##### Power:

- 1- When the unit disconnect closes, line voltage energizes transformer T1 and the compressor crankcase heaters. Transformer T1 provides 24VAC power to unit cooling, heating and blower controls and thermostat. The crankcase heaters are powered at all times but are self-regulating
- 2- Transformer T3 (460V and 575V units) is also energized when power is applied to the unit.

##### Cooling Demand:

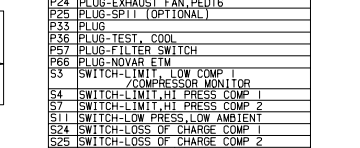
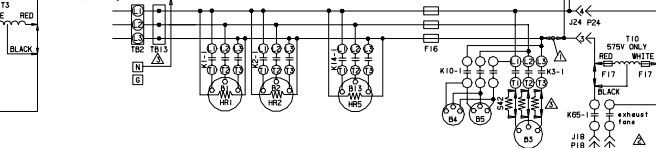
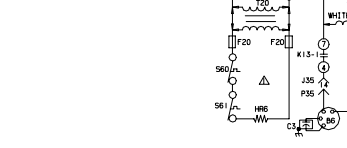
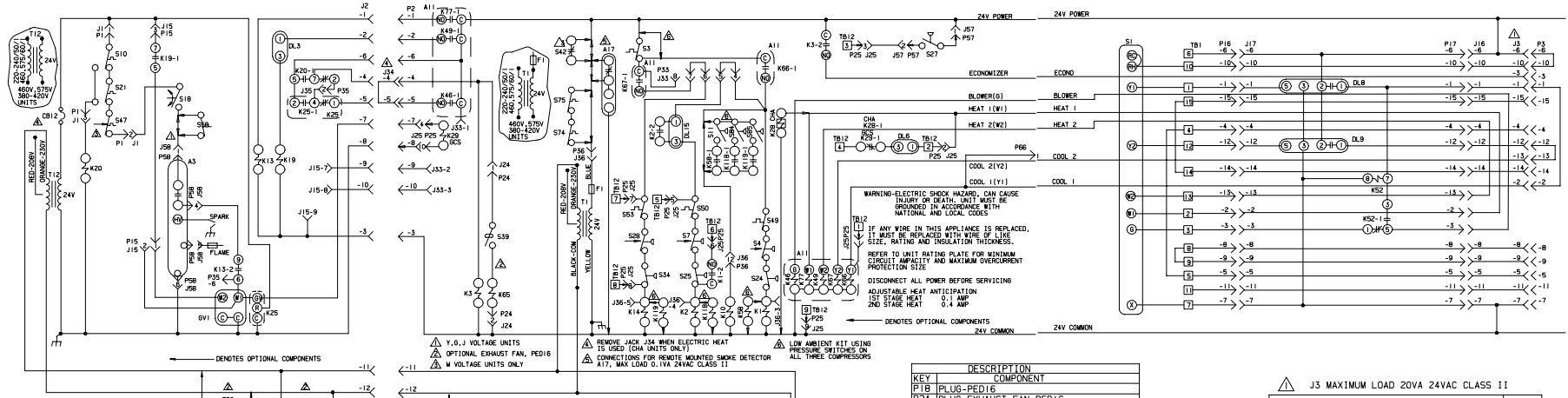
- 3- On a call for first stage cooling (Y1), condenser fan relay K10 is energized. At the same time, the indoor thermostat energizes the indoor blower circuit (G). Blower demand passes through blower relays K20 and K25 to energize indoor blower contactor K3. K3 immediately switches.
- 4- When contacts K3-1 close, the indoor blower is energized immediately and begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 5- When contacts K10-1 and K10-2 close, condenser fans B4 and B5 are energized and immediately begin operating. When contacts K10-3 closes, a 24VAC circuit is completed through the first stage safety limits to energize contactor K1. Contactor K1 immediately switches.
- 6- When contacts K1-1 close, compressor B1 is energized and immediately begins operating.
- 7- On a call for increased cooling (Y2), demand is passed through the second stage safety limits to energize contactor K2. In 208/230 voltage units only, demand is passed through DL15 which delays the demand for 30 seconds before passing through the second stage safety limits.
- 8- When contacts K2-1 close, compressor B2 is energized and immediately begins operating.

##### Heating Demand:

- 9- On a call for first stage heating (W1), demand energizes combustion air blower relay K13.
- 10- When contacts K13-1 close, combustion air blower B6 is energized and immediately begins operating. When contacts K13-2 close, the gas valve is enabled.

- 11- As the combustion air blower approaches full speed, combustion air blower prove switch (S18) closes.
- 12- When S18 closes a 24VAC circuit is completed through the heating safety switches to energize burner ignition control A3.
- 13- When ignition control A3 determines that ignition can begin, A3 simultaneously sends 24VAC to the first stage operator of the gas valve and to the indoor blower delay relay (K25) and also sends spark to the spark electrode. The gas valve immediately opens and blower delay K25 immediately begins timing.
- 14- When flame is sensed by the ignition control, spark is stopped and the gas valve remains open. If flame is not sensed within the time allowed, spark is stopped, the gas valve is closed and the ignition control begins its retrial timing sequence.
- 15- When blower delay K25 ends its timing period, K25-1 switches. A 24VAC circuit is completed through K20-1 to energize blower contactor K3.
- 16- When contacts K3-1 close, the indoor blower is energized immediately begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 17- On a call for increased heating (W2), demand passes through K20-2 to energize time delay DL3. DL3 immediately begins its timing sequence.
- 18- When DL3 time delay has elapsed, DL3 closes internally to complete a circuit to the second stage operator of the gas valve (W2). When gas valve operator W2 is energized, the gas valve begins to slowly open for second stage operation.
- 19- If either heating limit S10 or S21 open during heating operation, ignition control A3 is immediately de-energized and blower limit relay K20 is immediately energized.
- 20- When A3 is de-energized, the gas valve (W1) and blower delay (K25) are both de-energized.
- 21- When K20-1 switches, blower contactor K3 is energized to continue blower operation during the time that safety limits are open. When K20-2 opens, second stage thermostat demand is prevented from reaching the second stage operator of the gas valve (W2).

# B9 and A8 diagrams with C1 diagram GCS16-1853 with basic standard thermostat



KEY	DESCRIPTION	COMPONENT
A3	CONTROL-BURNER	
B6	MOTOR-COMBUSTION AIR BLOWER	
C3	CAPACITOR-MOTOR-COMB AIR BLOWER	
CB12	CIRCUIT BREAKER-TRANS T12	
DL3	DELAY-GAS 2 (180 SEC)	
F20	FUSE-LOW AMBIENT KIT (-50C)	
GV1	VALVE-GAS	
HR6	HEATER -50C LOW AMBIENT KIT	
J1	JACK-GAS LIMIT	
J15	JACK-ELECTRIC HEAT	
J35	JACK-GAS	
J59	JACK-TEST, HEAT	
J59	JACK-BURNER CONTROL	
K13, -1,2	RELAY-COMBUSTION AIR BLOWER	
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	
P58	PLUG-BURNER CONTROL	
S10	SWITCH-LIMIT, PRIMARY GAS	
S18	SWITCH-COMB AIR BLOWER PROVE	
S21	SWITCH-LIMIT, SEC GAS HEAT	
S47	SWITCH-FLAME ROLL-OUT	
S59	THERMOSTAT, -35C OPEN, -50C LOW AMB KIT	
S60	THERMOSTAT, -23C CL, -7C OP, -50C LOW AMB KIT	
S61	THERMOSTAT, -24C OPEN, -50C LOW AMB KIT	
T13	TRANSFORMER-COMBUSTION AIR BLOWER	
T12	TRANSFORMER-GAS CONTROL	
T20	TRANSFORMER, -50C LOW AMBIENT KIT	

- △ CGA (-50C) LOW AMBIENT KIT (OPT)
- △ T3 & T20 USED ON 460V & 575V UNITS ONLY
- △ MANUAL RESET NOT USED ON 1853 UNITS
- △ FUSED TRANSFORMER USED ON EARLY PRODUCTION UNITS

**LENNOX Industries Inc. WIRING DIAGRAM 4/94**

**COMBINATION UNIT-ROOFTOP**

**GAS HEAT FOR**

GCS16, GCS24-1853, 2553-235, 330  
 GCS16, GCS24-2753, 3003-235, 330

**HEAT, COOL SECTION AB**

Supersedes Form No. 529,211W New Form No. 529,961W  
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LETTER DESIGNATION	VOLTAGE
Y	208-230/60/3
G	460/60/3
J	575/60/3
M	380-420/50/3

KEY	DESCRIPTION	COMPONENT
A11	PANEL-RELAY	
A17	(SEE NOTE 5)	
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	
CB	CAPACITOR-EXHAUST FAN 1	
CB	CAPACITOR-EXHAUST FAN 2	
DL6	DELAY-READOUT KIT	
DL15	DELAY-COMPRESSOR 2 (30 SEC)	
F1	FUSE-TRANSFORMER T1	
F16	FUSE-UNIT	
F17	FUSE-TRANSFORMER T10	
HRT	HEATER-COMPRESSOR 1	
HRT	HEATER-COMPRESSOR 2	
HRT	HEATER-COMPRESSOR 3	
J18	JACK-PED16	

KEY	DESCRIPTION	COMPONENT
P18	PLUG-PED16	
P24	PLUG-EXHAUST FAN, PED16	
P25	PLUG-SP11 (OPTIONAL)	
P35	PLUG	
P36	PLUG-TEST, COOL	
P57	PLUG-FILTER SWITCH	
P66	PLUG-NOVAR ETM	
S3	SWITCH-LIMIT, LOW COMP 1	COMPRESSOR MONITOR
S4	SWITCH-LIMIT, HI PRESS COMP 1	
S7	SWITCH-LIMIT, HI PRESS COMP 2	
S11	SWITCH-LOW PRESS, LOW AMBIENT	
S24	SWITCH-LOSS OF CHARGE COMP 1	
S25	SWITCH-LOSS OF CHARGE COMP 2	
S27	SWITCH-FILTER (OPTIONAL)	
S28	SWITCH-LIMIT, HI PRESS COMP 3	
S4	SWITCH-LOSS OF CHARGE COMP 3	
S53	SWITCH-EXHAUST FAN, MERCURY	
S42	SWITCH-OVERLOAD, RELAY	
S49	SWITCH-FREEZE/STAT COMP 1	
S50	SWITCH-FREEZE/STAT COMP 2	
S53	SWITCH-FREEZE/STAT COMP 3	
S74	SWITCH-FIRE/STAT 1	
S75	SWITCH-FIRE/STAT 2	
S84	SWITCH-LOW PRESS, LOW AMB KIT, COMP 2	
S85	SWITCH-LOW PRESS, LOW AMB KIT, COMP 3	
T1	TRANSFORMER-CONTROL	
T10	TRANSFORMER-EXHAUST FAN	
T82	TERMINAL STRIP-UNIT	
TB12	TERMINAL STRIP-SP11(OPTIONAL)	
TB13	TERMINAL STRIP-POWER DISTR	

**LENNOX Industries Inc. WIRING DIAGRAM 2/93**

**COMBINATION-PACKAGED/ROOFTOP**

**GCS16-1853-1,2,3-Y,G,J**  
**CHA16-1853-1,2,3-Y,G,J,M**

**COOLING SECTION B9**

Supersedes Form No. 529,500W New Form No. 529,753W  
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△ J3 MAXIMUM LOAD 20VA 24VAC CLASS II

**LENNOX Industries Inc. WIRING DIAGRAM 3/93**

**ACCESSORIES**

**THERMOSTAT FOR**  
 GCS/CHA11, 16 & 24 SERIES  
**COMPRESSOR CYCLE CONTROL**  
**CONTROL SECTION-C38**

Supersedes Form No. New Form No. 529,426W  
 Litho U.S.A.

TERM. NO.	UNIT FUNCTION
1	Y1 COOL 1
2	W1 HEAT 1
3	9 BLOWER
4	4
5	5
6	R 24V POWER
7	C 24V COMMON
8	B
9	9
10	10 POWER TO S1
11	11
12	Y2 COOL 2
13	W2 HEAT 2
14	14
15	15

KEY	DESCRIPTION	COMPONENT
DL8	DELAY-CYCLE STAGE 1 COOL	
DL9	DELAY-CYCLE STAGE 2 COOL	
J3	JACK-UNIT, ECONOMIZER	
J16	JACK-UNIT	
J17	JACK-LOGIC PANEL	
K52, -1	RELAY-BLOWER HOLD	
P5	PLUG-LESS ECONOMIZER	
P17	PLUG-UNIT	
P17	PLUG-LOGIC PANEL	
S1	THERMOSTAT-ROOM	
TB1	TERMINAL STRIP-LOW VOLT	

KEY	DESCRIPTION	COMPONENT
J24	JACK-EXHAUST FAN, PED16	
J25	JACK-SP11	
J35	JACK	
J34	JACK-NO HEAT, CHA	
J36	JACK-TEST, COOL	
J57	JACK-FILTER SWITCH	
K1, -1,2	CONTACTOR-COMPRESSOR 1	
K2, -1,2	CONTACTOR-COMPRESSOR 2	
K3, -1,2	CONTACTOR-BLOWER	
K10, -1	CONTACTOR-COND FAN	
K14, -1	CONTACTOR-COMPRESSOR 3	
K28	RELAY-CURRENT SENSING(OPT)	
K29, -1	RELAY-NO HEAT(OPTIONAL)	
K46, -1	RELAY-BLOWER	
K49, -1	RELAY-HEAT 1	
K58, -1	RELAY-LOW AMBIENT KIT	
K65, -1	RELAY-EXHAUST FAN	
K66, -1	RELAY-STAGE 1, COOL	
K67, -1	RELAY-STAGE 2, COOL	
K77, -1	RELAY-HEAT 1	
K118, -1	RELAY-LOW AMBIENT KIT, COMP 2	
K119, -1	RELAY-LOW AMBIENT KIT, COMP 3	
P2	PLUG-HEAT	

## C1 DIAGRAM WITH B9 and A8 DIAGRAMS

### Electromechanical Thermostat Connected to GCS16-1853 with 235,000 or 330,000 BTUH Input Heat (Without Economizer)

#### D-GCS16-1853

#### Operation Sequence: C1 and B9 and A8 Sections (electromechanical thermostat wired to GCS16-1853)

The GCS16-1853 and CHA16-1853 are the only units in the Lennox 16-series product line which feature three compressors and three independent cooling circuits. Two compressors operate during first stage demand separated by a time delay. The third compressor only operates during second stage cooling demand.

The GCS16-1853 and CHA16-1853 are also the smallest units in the 16-series lineup to come factory equipped with a pilot relay board. The board is used to reduce contactor chattering caused by long runs of undersized thermostat wire. The relays on the pilot relay board have a comparatively smaller inrush than the contactors they serve thereby reducing the potential for contactor chattering.

Finally, all -1853 and larger units are designed with a "modular" heating section which may be easily changed in the factory to larger or smaller BTUH input sizes. Each different heat section is represented by a unique heating section wiring diagram which mates to the unit diagram as shown on the facing page (diagram A8). In the GCS16-1853, both BTUH input size use the same wiring diagram. And, the same heating diagram is used in larger GCS16 units. Look for the (A8) diagram on the following pages.

In the -1853, both condenser fans operate during first stage cooling operation.

#### Power:

- 1- When the unit disconnect closes, line voltage energizes transformer T1 and the compressor crankcase heaters. Transformer T1 provides 24VAC power to unit cooling, heating and blower controls and thermostat. The crankcase heaters are powered at all times but are self-regulating
- 2- Transformer T3 (460V and 575V units) is also energized when power is applied to the unit.
- 3- Transformer T10 (units equipped with power exhaust fans) is also energized when power is applied to the unit.

#### Cooling Demand:

- 4- On a call for first stage cooling (Y1), pilot relay K66 is energized after DL8 completes a 30 second on delay.
- 5- At the same time, the indoor thermostat energizes the indoor blower circuit (G). Blower demand energizes pilot relay K46.
- 6- When K66-1 closes, a 24VAC circuit is completed through the first stage safety limits to energize contactor K1. Contactor K1 immediately switches. At the same time, K66-1 also energizes condenser fan contactor K10 and time delay DL15. DL15 begins timing sequence.
- 7- When K46-1 closes, a 24VAC circuit is completed through blower relays K20 and K25 to energize indoor blower contactor K3. K3 immediately switches.
- 8- When contacts K3-1 close, the indoor blower is energized immediately and begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 9- When contacts K10-1 close, condenser fans B4 and B5 are both energized and immediately begin operating.
- 10- When contacts K1-1 close, compressor B1 is energized and immediately begins operating.

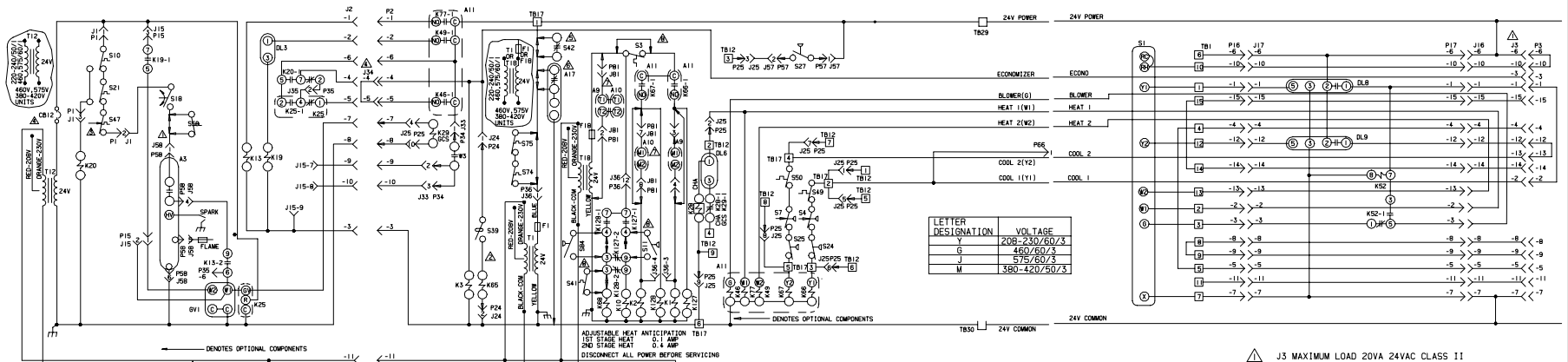
- 11- When time delay DL15 has elapsed, a first stage demand is passed through the second compressor safety circuits to energize compressor contactor K2. K2 immediately switches.
- 12- When K2-1 closes, compressor B2 is energized and immediately begins operating.
- 13- On a call for increased cooling (Y2), pilot relay K67 is energized after DL9 completes a 30 second on delay.
- 14- When K67-1 closes, a 24VAC circuit is completed through the second stage safety limits to energize contactor K14. K14 immediately switches.
- 15- When contacts K14-1 close, compressor B13 is energized and immediately begins operating.

#### Heating Demand:

- 16- On a call for first stage heating (W1), pilot relay K77 is energized.
- 17- When K77-1 closes, a 24VAC circuit is completed into the heating section to energize combustion air blower relay K13.
- 18- When contacts K13-1 close, combustion air blower B6 is energized and immediately begins operating. When contactst K13-2 close, the gas valve is enabled.
- 19- As the combustion air blower approaches full speed, combustion air blower prove switch (S18) closes.
- 20- When S18 closes a 24VAC circuit is completed through the heating safety switches to energize burner ignition control A3.
- 21- When ignition control A3 determines that ignition can begin, A3 simultaneously sends 24VAC to the first stage operator of the gas valve and to the indoor blower delay relay (K25) and also sends spark to the spark electrode. The gas valve immediately opens and blower delay K25 immediately begins timing.
- 22- When flame is sensed by the ignition control, spark is stopped and the gas valve remains open. If flame is not sensed within the time allowed, spark is stopped, the gas valve is closed and the ignition control begins its retrial timing sequence.
- 23- When blower delay K25 ends its timing period, K25-1 switches. A 24VAC circuit is completed through K20-1 to energize blower contactor K3.
- 24- When contacts K3-1 close, the indoor blower is energized immediately begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 25- On a call for increased heating (W2), pilot relay K49 is energized.
- 26- When K49-1 closes, a 24VAC circuit is completed into the heating compartment to energize time delay DL3. DL3 immediately begins its timing sequence.
- 27- When DL3 time delay has elapsed, DL3 closes internally to complete a circuit to energize the second stage heat pilot relay K19.
- 28- When K19-1 closes, a 24VAC circuit is completed to the second stage operator of the gas valve (W2). When gas valve operator W2 is energized, the gas valve begins to slowly open for second stage operation.
- 29- If either heating limit S10 or S21 open during heating operation, ignition control A3 is immediately de-energized and blower limit relay K20 is immediately energized.
- 30- When A3 is de-energized, the gas valve (W1) and blower delay (K25) are both de-energized.
- 31- When K20-1 switches, blower contactor K3 is energized to continue blower operation during the time that safety limits are open.
- 32- When gas valve (W1) is de-energized, it prevents second stage gas valve (W2) from operating.

# B41 and A8 diagrams with C1 diagram

GCS16-2553-235, GCS16-2753-235  
or GCS16-3003-235  
with basic standard thermostat



LETTER DESIGNATION	VOLTAGE
T08	208-250/60/3
G	460/60/3
M	380-420/50/3

⚠ DENOTES OPTIONAL COMPONENTS

- ⚠ C6A (-50C) LOW AMBIENT KIT (OPT)
- ⚠ T3 & T20 USED ON 460V & 575V UNITS ONLY
- ⚠ MANUAL RESET NOT USED ON 1853 UNITS
- ⚠ FUSED TRANSFORMER USED ON EARLY PRODUCTION UNITS

**LENNOX** Industries Inc. WIRING DIAGRAM 4/94  
COMBINATION UNIT-ROOFTOP  
GAS HEAT FOR  
GCS16, GCS24-1853, 2553-235, 330  
GCS16, GCS24-2753, 3003-235, 330  
HEAT, COOL SECTION AB  
Supersedes Form No. 529,211W New Form No. 529,961W  
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**LENNOX** Industries Inc. WIRING DIAGRAM 9/93  
COMBINATION-PACKAGED/ROOFTOP  
GCS16, CHA16-2553, 2753-3, 4-Y, G, J, M  
CHA16-3003-3-Y, G, J, M  
GCS16-3003-3-Y, G, J, M  
(WITH SPTII INTERFACE)  
COOLING SECTION-B41  
Supersedes Form No. 529,754W New Form No. 529,907W  
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- ⚠ Y, G, J VOLTAGE UNITS
- ⚠ OPTIONAL EXHAUST FAN, PED16
- ⚠ M VOLTAGE UNITS ONLY
- ⚠ REMOVE JACK J34 WHEN ELECTRIC HEAT IS USED (CHA UNITS ONLY)
- ⚠ Y, G, J 7.5 & 10 HP MOTORS ONLY; M ALL MOTORS
- ⚠ CONNECTIONS FOR REMOTE MOUNTED SMOKE DETECTOR X17, MAX LOAD 0.1VA 24VAC CLASS II
- ⚠ A9, A10, J81 & P81 USED ON -3J UNITS ONLY
- ⚠ LOW AMBIENT KIT USING S11 & S84 SWITCHES ON BOTH COMPRESSORS
- ⚠ CIRCUIT BREAKERS ARE OPTIONAL
- ⚠ OPTIONAL

IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING AND INSULATION THICKNESS.  
REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE  
WARNING-ELECTRIC SHOCK HAZARD, CAN CAUSE INJURY OR DEATH. UNIT MUST BE GROUND IN ACCORDANCE WITH NATIONAL AND LOCAL CODES

⚠ J3 MAXIMUM LOAD 20VA 24VAC CLASS II  
**LENNOX** Industries Inc. WIRING DIAGRAM 3/93  
ACCESSORIES  
THERMOSTAT FOR  
GCS/CHA11, 16 & 24 SERIES  
COMPRESSOR CYCLE CONTROL  
CONTROL SECTION-C3B  
Supersedes Form No. 529,426W New Form No. 529,426W  
Litho U.S.A.

TERM. NO.	UNIT FUNCTION
1	Y1 COOL 1
2	W1 HEAT 1
3	S BLOWER
4	
5	R 24V POWER
6	C 24V COMMON
7	
8	
9	
10	I0 POWER TO S1
11	I1
12	Y2 COOL 2
13	W2 HEAT 2
14	
15	

KEY	DESCRIPTION	COMPONENT
Y1	DELAY-CYCLE STAGE 1	COOL
Y2	DELAY-CYCLE STAGE 2	COOL
J3	JACK-UNIT, ECONOMIZER	
J16	JACK-UNIT	
J17	JACK-LOGIC PANEL	
K52	RELAY-BLOWER HOLD	
P5	PLUG-LESS ECONOMIZER	
P16	PLUG-UNIT	
P17	PLUG-LOGIC PANEL	
S1	THERMOSTAT-ROOM	
T81	TERMINAL STRIP-LOW VOLT	

KEY	DESCRIPTION	COMPONENT
A3	CONTROL-BURNER	
A5	MOTOR-COMBUSTION AIR BLOWER	
B6	CAPACITOR-MOTOR-COMB AIR BLOWER	
CB12	CIRCUIT BREAKER-TRANS T12	
DL3	DELAY-GAS 2 (TBO SEC)	
F60	FUSE-LOW AMBIENT KIT (-50C)	
GVI	VALVE-GAS	
HH6	HEATER, -50C LOW AMBIENT KIT	
J1	JACK-GAS LIMIT	
J2	JACK-ELECTRIC HEAT	
J15	JACK-GAS	
J35	JACK-TEST, HEAT	
J58	JACK-BURNER CONTROL	
K13, -1, 2	RELAY-COMBUSTION AIR BLOWER	
K19, -1	RELAY-STAGE 2, HEAT	
K20, -1	RELAY-LIMIT, BLOWER	
K25, -1	RELAY-BLOWER DELAY	
P15	PLUG-GAS LIMIT	
P16	PLUG-GAS	
P35	PLUG-TEST, HEAT	
PS8	PLUG-BURNER CONTROL	
S10	SWITCH-LIMIT, PRIMARY GAS	
S18	SWITCH-COMB AIR BLOWER PROVE	
S21	SWITCH-LIMIT, SEC GAS HEAT	
S67	SWITCH-FLAME ROLL-OUT	
S59	THERMOSTAT, -50C OPEN, -50C LOW AMB KIT	
S60	THERMOSTAT, -23C CL -70 OP, -50C LOW AMB KIT	
S61	THERMOSTAT, +24C OPEN, -50C LOW AMB KIT	
T19	TRANSFORMER-COMBUSTION AIR BLOWER	
T12	TRANSFORMER-GAS CONTROL	
T20	TRANSFORMER, -50C LOW AMBIENT KIT	

KEY	DESCRIPTION	COMPONENT
K3, -1	CONTACTOR-BLOWER	
K10, -1	CONTACTOR-COND FAN 1	
K28, -1	RELAY-CURRENT SENSING KIT(OPT)	
K29, -1	RELAY-NO HEAT KIT (OPTIONAL)	
K46, -1	RELAY-BLOWER	
K49, -1	RELAY-HEAT 2	
K55, -1	RELAY-EXHAUST FAN 1	
K66, -1	RELAY-STAGE 1, COOL	
K67, -1	RELAY-STAGE 2, COOL	
K69, -1	CONTACTOR-COND FAN 2	
K127, -1, 2	RELAY-COND FAN START	
K128, -1, 2	RELAY-LOW AMBIENT BYPASS	
P18	PLUG-HEAT	
P19	PLUG-PED16 (OPTIONAL)	
F14	FUSE-EXHAUST FAN PED (OPT)	
P25	PLUG-SPTII (OPTIONAL)	
P34	PLUG-3 STAGE (OPTIONAL)	

KEY	DESCRIPTION	COMPONENT
A9	PROTECTOR-COMPRESSOR 1	
A10	PROTECTOR-COMPRESSOR 2	
A11	PANEL-RELAY	
A17	(SEE NOTE 6)	
B1	COMPRESSOR 1	
B2	COMPRESSOR 2	
B3	MOTOR-BLOWER	
B4	MOTOR-COND FAN 1	
B5	MOTOR-COND FAN 2	
B6	MOTOR-EXHAUST FAN 1	
B10	MOTOR-EXHAUST FAN 1	
B11	MOTOR-EXHAUST FAN 2	
B12	MOTOR-EXHAUST FAN 3	
B17, -1	RELAY-HEAT 1	
CB	CAPACITOR-EXHAUST FAN 2	
CB	CAPACITOR-EXHAUST FAN 3	
CB10	CIRCUIT BREAKER-DISCONN	
F10	FUSE-EXHAUST FAN 1	
F11	FUSE-TRANSFORMER T1	
F16	FUSE-OUTDOOR FAN MOTOR	
F17	FUSE-BLOWER MOTOR, FANS	
F17	FUSE-TRANSFORMER T10	
F18	FUSE-TRANSFORMER T18	
H1	HEATER-COMPRESSOR 1	
H2	HEATER-COMPRESSOR 2	
J18	JACK-PED16	
J24	JACK-EXHAUST FAN, PED16	
J25	JACK-SPTII	
J33	JACK	
J36	JACK-TEST, COOL	
J57	JACK-FILTER SWITCH	
J81	JACK-MOTOR PROTECTOR	
K2, -1	CONTACTOR-COMPRESSOR 2	

KEY	DESCRIPTION	COMPONENT
P36	PLUG-TEST, COOL	
P57	PLUG-FILTER SWITCH (OPTIONAL)	
P66	PLUG-NOVAR ETW	
P81	PLUG-MOTOR PROTECTOR	
S3	SWITCH-LIMIT, LOW COMP 1 /COMPRESSOR MONITOR	
S4	SWITCH-LIMIT, HI PRESS COMP 1	
S24	SWITCH-LOSS OF CHARGE COMP 1	
S25	SWITCH-LIMIT, HI PRESS COMP 2	
S27	SWITCH-FILTER (OPTIONAL)	
S39	SWITCH-EXHAUST FAN, MERCURY	
S41	THERMOSTAT-LOW AMBIENT KIT	
S42	SWITCH-OVERLOAD RELAY	
S49	SWITCH-FREEZE/STAGE 1 COMP 1	
S50	SWITCH-FREEZE/STAGE 2 COMP 2	
S74	SWITCH-FIRE/STAGE 1	
S75	SWITCH-FIRE/STAGE 2	
S84	SWITCH-LOW PRESS, LOW AMB KIT, COMP 2	
T1	TRANSFORMER-EXHAUST FAN 1	
T10	TRANSFORMER-EXHAUST FAN 2	
T18	TRANSFORMER-CONTACTOR	
T82	TERMINAL STRIP-UNIT	
T812	TERMINAL STRIP-SPTII (OPTIONAL)	
T813	TERMINAL STRIP-POWER DISTR	
T817	TERMINAL STRIP-MULTI COLOR	
T820	TERMINAL STRIP-24VAC POWER	
T830	TERMINAL STRIP-24VAC COMMON	
W3	CONTROL-TEMPERATURE (OPTIONAL)	



## C1 DIAGRAM WITH B41 and A8 DIAGRAMS

### Electromechanical Thermostat Connected to GCS16-2553, -2753 or -3003 with 235,000 BTUH Input Heat (Without Economizer)

#### E-GCS16-2553-235, GCS16-2753-235 or GCS16-3003-235

#### Operation Sequence: C1 and B9 and A8 Sections (electromechanical thermostat wired to GCS16)

The GCS16-2553 and CHA16-2553 and larger units use two compressors and two independent cooling circuits. However, each evaporator slab is split circuited effectively placing two evaporators and two expansion valves on each cooling circuit (four expansion valves per unit).

A pilot relay board is factory installed in all models of this size range. The board is used to reduce contactor chattering caused by long runs of undersized thermostat wire. The relays on the pilot relay board have a comparatively smaller inrush than the contactors they serve thereby reducing the potential for contactor chattering.

All models of this size range use a "modular" heating section which may be easily changed in the factory to larger or smaller BTUH input sizes. Each different heat section is represented by a unique heating section wiring diagram which mates to the unit diagram as shown on the facing page (diagram A8). Different wiring diagrams are used to represent the different BTUH input sections. The 235,000 BTUH version is shown here.

In the -2553, -2753 and -3003 models, the condenser fans operate independently. During normal operation, one fan operates during first stage demand and both fans operate during second stage demand.

#### Power:

- 1- When the unit disconnect closes, line voltage energizes transformer T1 and the compressor crankcase heaters. Transformer T1 provides 24VAC power to most unit cooling, heating and blower controls and thermostat. The crankcase heaters are powered at all times but are self-regulating
- 2- Transformer T18 provides 24VAC power to the unit contactors
- 3- Transformer T3 (460V and 575V units) is also energized when power is applied to the unit.
- 4- Transformer T10 (units equipped with power exhaust fans) is also energized when power is applied to the unit.

#### Cooling Demand:

- 5- On a call for first stage cooling (Y1), demand is routed through DL8 (30 second on delay, 240 second off delay) and the first stage safety limits to energize pilot relay K66.
- 6- At the same time, the indoor thermostat energizes the indoor blower circuit (G). Blower demand energizes pilot relay K46.
- 7- When K66-1 closes, a 24VAC circuit is completed to energize contactors K1 and K127. Both contactors immediately switch. K127 closes to energize K10 and K68.
- 8- When K46-1 closes, a 24VAC circuit is completed through blower relays K20 and K25 to energize indoor blower contactor K3 and optional economizer (which opens the outdoor air dampers to minimum position).
- 9- When contacts K3-1 close, the indoor blower is energized immediately and begins operating.
- 10- When contacts K10-1 and K68-1 close, condenser fan B4 and B5 are energized and immediately begins operating.
- 11- When contacts K1-1 close, compressor B1 is energized and immediately begins operating.

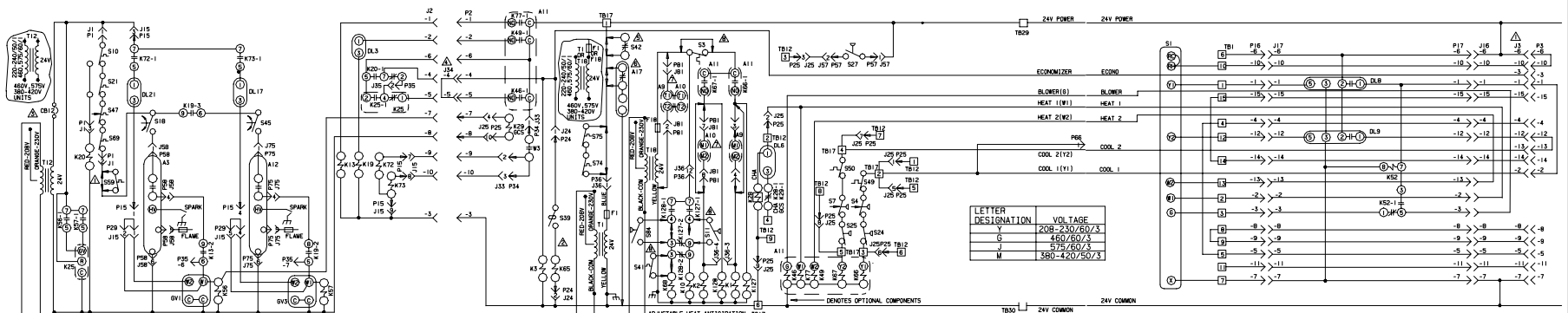
- 12- On a call for increased cooling (Y2), pilot relay K67 is energized after DL9 completes a 30 second on delay.
- 13- When K67-1 closes, a 24VAC circuit is completed through the second stage safety limits to energize contactor K14. K14 immediately switches.
- 14- When contacts K14-1 close, compressor B13 is energized and immediately begins operating.

#### Heating Demand:

- 15- On a call for first stage heating (W1), pilot relay K77 is energized.
- 16- When K77-1 closes, a 24VAC circuit is completed into the heating section to energize combustion air blower relay K13.
- 17- When contacts K13-1 close, combustion air blower B6 is energized and immediately begins operating. When contactst K13-2 close, the gas valve is enabled.
- 18- As the combustion air blower approaches full speed, combustion air blower prove switch (S18) closes.
- 19- When S18 closes a 24VAC circuit is completed through the heating safety switches to energize burner ignition control A3.
- 20- When ignition control A3 determines that ignition can begin, A3 simultaneously sends 24VAC to the first stage operator of the gas valve and to the indoor blower delay relay (K25) and also sends spark to the spark electrode. The gas valve immediately opens and blower delay K25 immediately begins timing.
- 21- When flame is sensed by the ignition control, spark is stopped and the gas valve remains open. If flame is not sensed within the time allowed, spark is stopped, the gas valve is closed and the ignition control begins its retrial timing sequence.
- 22- When blower delay K25 ends its timing period, K25-1 switches. A 24VAC circuit is completed through K20-1 to energize blower contactor K3 and optional economizer (which opens the outdoor air dampers to minimum position).
- 23- When contacts K3-1 close, the indoor blower is energized immediately begins operating.
- 24- On a call for increased heating (W2), pilot relay K49 is energized.
- 25- When K49-1 closes, a 24VAC circuit is completed into the heating compartment to energize time delay DL3. DL3 immediately begins its timing sequence.
- 26- When DL3 time delay has elapsed, DL3 closes internally to complete a circuit to energize the second stage heat pilot relay K19.
- 27- When K19-1 closes, a 24VAC circuit is completed to the second stage operator of the gas valve (W2). When gas valve operator W2 is energized, the gas valve begins to slowly open for second stage operation.
- 28- If either heating limit S10 or S21 open during heating operation, ignition control A3 is immediately de-energized and blower limit relay K20 is immediately energized.
- 29- When A3 is de-energized, the gas valve (W1) and blower delay (K25) are both de-energized.
- 30- When K20-1 switches, blower contactor K3 is energized to continue blower operation during the time that safety limits are open.
- 31- When gas valve (W1) is de-energized, it prevents second stage gas valve (W2) from operating.

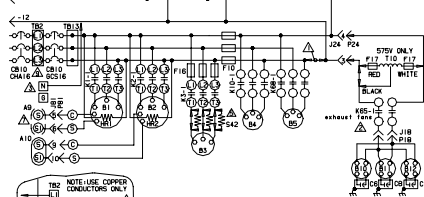
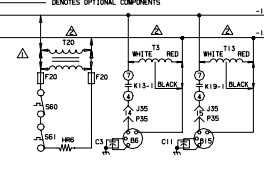
# B41 and A9 diagrams with C1 diagram

GCS16-2553-470, GCS16-2753-470  
or GCS16-3003-470  
with basic standard thermostat



LETTER	DESIGNATION	VOLTAGE
Y		208-230/60/3
G		460/50/3
M		580-420/50/3

- △ GSA(-50C) LOW AMBIENT KIT (OPTIONAL)
- △ T3, T15 & T20 USED ON 460V & 575V UNITS ONLY
- △ FUSED TRANSFORMER USED ON EARLY PRODUCTION UNITS



KEY	COMPONENT
P36	PLUS-TEST, COOL
P67	PLUS-FILTER SWITCH (OPTIONAL)
P68	PLUS-NOVAR FTM
P81	PLUS-MOTOR PROTECTOR
S3	SWITCH-LIMIT, LOW COMP 1 /COMPRESSOR MONITOR
S4	SWITCH-LIMIT, HI PRESS COMP 1
S7	SWITCH-LIMIT, HI PRESS COMP 2
S11	SWITCH-LOW PRESS, LOW AMB KIT
S24	SWITCH-LOSS OF CHARGE COMP 1
S25	SWITCH-LOSS OF CHARGE COMP 2
S27	SWITCH-FILTER (OPTIONAL)
S39	SWITCH-EXHAUST FAN, MERCURY
S42	SWITCH-OVERLOAD RELAY
S49	SWITCH-FREESTAT COMP 1
S50	SWITCH-FREESTAT COMP 2
S74	SWITCH-FIRESTAT 1
S75	SWITCH-FIRESTAT 2
S84	SWITCH-LOW PRESS, LOW AMB KIT, COMP 2
T1	TRANSFORMER-CONTROL
T10	TRANSFORMER-EXHAUST FAN
T18	TRANSFORMER-CONTACTOR
T82	TERMINAL STRIP-UNIT
TB1	TERMINAL STRIP-SP11 (OPTIONAL)
TB11	TERMINAL STRIP-POWER DISTB
TB17	TERMINAL STRIP-MULTI COLOR
TB29	TERMINAL STRIP-24VAC POWER
TB30	TERMINAL STRIP-24VAC COMMON
MS	CONTROL-TEMPERATURE (OPTIONAL)

△ J3 MAXIMUM LOAD 20VA 24VAC CLASS II

**LENNOX** Industries Inc. WIRING DIAGRAM 3/93

ACCESSORIES

THERMOSTAT FOR  
GCS/CHA11, 16 & 24 SERIES  
COMPRESSOR CYCLE CONTROL  
CONTROL SECTION-C38

Supersedes Form No. 529,022W New Form No. 529,426W

Litho U.S.A.

TERM. NO.	UNIT FUNCTION
1	Y1 COOL 1
2	W1 HEAT 1
3	G BLOWER
4	4
5	5
6	R 24V POWER
7	C 24V COMMON
8	B
9	9
10	10 POWER TO S1
11	11
12	Y2 COOL 2
13	W2 HEAT 2
14	14
15	15

KEY	COMPONENT	DESCRIPTION
DL8	DELAY-CYCLE STAGE 1 COOL	
DL9	DELAY-CYCLE STAGE 2 COOL	
J1	JACK-UNIT ECONOMIZER	
J16	JACK-LIMIT	
J17	JACK-LOGIC PANEL	
K52	RELAY-BLOWER HOLD	
P5	PLUS-LESS ECONOMIZER	
P16	PLUS-UNIT	
P17	PLUS-LOGIC PANEL	
S1	THERMOSTAT-ROOM	
TB1	TERMINAL STRIP-LOW VOLT	

**LENNOX** Industries Inc. WIRING DIAGRAM 4/94

COMBINATION UNIT-ROOFTOP

GAS HEAT FOR  
GCS16-2553, 2753, 3003-470  
GCS24-2553, 2753, 3003-470

HEATING SECTION-A9

Supersedes Form No. 529,022W New Form No. 529,960W

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- △ Y, G, J VOLTAGE UNITS
- △ OPTIONAL EXHAUST FAN, PED16
- △ M VOLTAGE UNITS ONLY
- △ REMOVE JACK J54 WHEN ELECTRIC HEAT IS USED (CHA UNITS ONLY)
- △ Y, G, J, 7.5 & 10 HP MOTORS ONLY, M ALL MOTORS CONNECTIONS FOR REMOTE MOUNTED SMOKE DETECTOR A17, MAX LOAD 0.1VA 24VAC CLASS II
- △ A9, A10, J81 & P81 USED ON -3J UNITS ONLY
- △ LOW AMBIENT KIT USING S11 & S84 SWITCHES ON BOTH COMPRESSORS
- △ CIRCUIT BREAKERS ARE OPTIONAL
- △ OPTIONAL

IF ANY WIRE IN THIS APPLIANCE IS REPLACED, IT MUST BE REPLACED WITH WIRE OF LIKE SIZE, RATING AND INSULATION THICKNESS.

REFER TO UNIT RATING PLATE FOR MINIMUM CIRCUIT AMPACITY AND MAXIMUM OVERCURRENT PROTECTION SIZE.

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

KEY	COMPONENT
K5-1	CONTACTOR-BLOWER
K10-1	CONTACTOR-COND FAN 1
K28-1	RELAY-CURRENT SENSING KIT (OPT)
K29-1	RELAY-NO HEAT KIT (OPTIONAL)
K45-1	RELAY-BLOWER
K46-1	RELAY-HEAT 2
K68-1	RELAY-EXHAUST FAN
K69-1	RELAY-STAGE 1 COOL
K88-1	RELAY-STAGE 2 COOL
K89-1	CONTACTOR-COND FAN 2
K77-1	RELAY-HEAT
K121-1, 2	RELAY-COND FAN START
K128-1, 2	RELAY-LOW AMBIENT BYPASS
P18	PLUS-HEAT
P24	PLUS-EXHAUST FAN PED (OPT)
P31	PLUS-UNIT (OPTIONAL)
P34	PLUS-5 STAGE (OPTIONAL)

**LENNOX** Industries Inc. WIRING DIAGRAM 9/93

COMBINATION-PACKAGED/ROOFTOP

GCS16, CHA16-2553, 2753-3, 4-Y, G, J, M  
CHA16-3003-3-Y, G, J, M  
GCS16-3003-3-Y, G, J

(WITH SP11 INTERFACE)

COOLING SECTION-B41

Supersedes Form No. 529,754W New Form No. 529,907W

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KEY	COMPONENT
A3	PROTECTOR-COMPRESSOR 1
A10	PROTECTOR-COMPRESSOR 2
A11	PANEL-RELAY
A17	(SEE NOTE 6)
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
B12	MOTOR-EXHAUST FAN 3
C6	CAPACITOR-EXHAUST FAN 1
C7	CAPACITOR-EXHAUST FAN 2
C8	CAPACITOR-EXHAUST FAN 3
DL6	CIRCUIT BREAKER-DISCONN
F1	FUSE-TRANSFERMER T1
F10	FUSE-OUTDOOR FAN MOTOR
F16	FUSE-BLOWER MOTOR, FANS
F17	FUSE-TRANSFERMER T10
F18	FUSE-TRANSFERMER T18
H81	HEATER-COMPRESSOR 1
H82	HEATER-COMPRESSOR 2
J18	JACK-PED16
J24	JACK-EXHAUST FAN, PED16
J25	JACK-SP11
J33	JACK-TEST, COOL
J57	JACK-FILTER SWITCH
P11	JACK-MOTOR PROTECTOR
K1-1	CONTACTOR-COMPRESSOR 1
K2-1	CONTACTOR-COMPRESSOR 2

KEY	COMPONENT
A3	CONTROL-BURNER
A12	CONTROL-BURNER 2
B5	MOTOR-COMBUSTION AIR BLOWER 1
B15	MOTOR-COMBUSTION AIR BLOWER 2
G3	CAPACITOR-COMB AIR BLOWER MOTOR 1
C11	CAPACITOR-COMB AIR BLOWER MOTOR 2
CM2	CIRCUIT BREAKER-TRANS T12
DL2	DELAY-GAS 2 (TRD SEC)
DL17	DELAY-GAS 4 (TRD SEC) OPTIONAL
DL21	DELAY-GAS 3 (TRD SEC) OPTIONAL
F20	FUSE-50C LOW AMBIENT KIT
G71	VALVE-GAS 1
G72	VALVE-GAS 2
H85	HEATER-50C LOW AMBIENT KIT
J15	JACK-GAS LIMIT
J2	JACK-UNIT
J15	JACK-GAS
J35	JACK-TEST HEAT
J58	JACK-BURNER CONTROL 1
J75	JACK-BURNER CONTROL 2
K13-1, 2	RELAY-COMBUSTION AIR BLOWER
K19-1, 2	RELAY-STAGE 2 HEAT
K28-1	RELAY-LIMIT BLOWER
K25-1	RELAY-BLOWER DELAY
K56-1	RELAY-HEAT BLOWER 1
K57-1	RELAY-HEAT BLOWER 2
K72-1	RELAY-GAS 3 OPTIONAL
K73-1	RELAY-GAS 3 OPTIONAL
P1	PLUS-GAS LIMIT
P15	PLUS-GAS
P29	PLUS-GAS 3
P35	PLUS-TEST HEAT
P58	PLUS-BURNER CONTROL 1
P75	PLUS-BURNER CONTROL 2
S10	SWITCH-LIMIT, PRIMARY GAS
S18	SWITCH-COMB AIR BLOWER, PROVE
S21	SWITCH-LIMIT, REAR GAS HEAT
S45	SWITCH-LIMIT, COMB AIR BWR, PROVE 2

## C1 DIAGRAM WITH B41 and A8 DIAGRAMS

### Electromechanical Thermostat Connected to GCS16-2553, -2753 or -3003 with 470,000 BTUH Input Heat (Without Economizer)

F-GCS16-2553-470, GCS16-2753-470 or GCS16-3003-470

Operation Sequence: C1 and B41 and A8 Sections (electromechanical thermostat wired to GCS16)

The GCS16-2553 and CHA16-2553 and larger units use two compressors and two independent cooling circuits. However, each evaporator slab is split circuited effectively placing two evaporators and two expansion valves on each cooling circuit (four expansion valves per unit).

A pilot relay board is factory installed in all models of this size range. The board is used to reduce contactor chattering caused by long runs of undersized thermostat wire. The relays on the pilot relay board have a comparatively smaller inrush than the contactors they serve thereby reducing the potential for contactor chattering.

All models of this size range use a "modular" heating section which may be easily changed in the factory to larger or smaller BTUH input sizes. Each different heat section is represented by a unique heating section wiring diagram which mates to the unit diagram as shown on the facing page (diagram A9). Different wiring diagrams are used to represent the different BTUH input sections. The 470,000 BTUH version is shown here.

The 470,000 BTUH heating section is composed of two identical 235,000 BTUH heat exchangers with a unique wiring arrangement. Each heat exchanger is equipped with a two stage gas valve. First stage heating is handled by the left gas valve and heat exchanger and second stage heating is handled by both gas valves and both heat exchangers.

In the -2553, -2753 and -3003 models, the condenser fans operate independently. During normal operation, one fan operates during first stage demand and both fans operate during second stage demand.

#### Power:

- 1- When the unit disconnect closes, line voltage energizes transformer T1 and the compressor crankcase heaters. Transformer T1 provides 24VAC power to most unit cooling, heating and blower controls and thermostat. The crankcase heaters are powered at all times but are self-regulating
- 2- Transformer T18 provides 24VAC power to the unit contactors
- 3- Transformer T3 (460V and 575V units) is also energized when power is applied to the unit.
- 4- Transformer T10 (units equipped with power exhaust fans) is also energized when power is applied to the unit.

#### Cooling Demand:

- 5- On a call for first stage cooling (Y1), demand is routed through DL8 (30 second on delay, 240 second off delay) and the first stage safety limits to energize pilot relay K66.
- 6- At the same time, the indoor thermostat energizes the indoor blower circuit (G). Blower demand energizes pilot relay K46.
- 7- When K66-1 closes, a 24VAC circuit is completed to energize contactors K1 and K127. Both contactors immediately switch. K127 closes to energize K10 and K68.
- 8- When K46-1 closes, a 24VAC circuit is completed through blower relays K20 and K25 to energize indoor blower contactor K3 and optional economizer (which opens the outdoor air dampers to minimum position).
- 9- When contacts K3-1 close, the indoor blower is energized immediately and begins operating. When K3-2 closes, a circuit is completed to the optional economizer to open the outdoor air dampers to minimum position.
- 10- When contacts K10-1 and K68-1 close, condenser fan B4 and B5 are energized and immediately begin operating.
- 11- When contacts K1-1 close, compressor B1 is energized and immediately begins operating.
- 12- On a call for increased cooling (Y2), pilot relay K67 is energized after DL9 completes a 30 second on delay.
- 13- When K67-1 closes, a 24VAC circuit is completed through the second stage safety limits to energize contactor K14. K14 immediately switches.

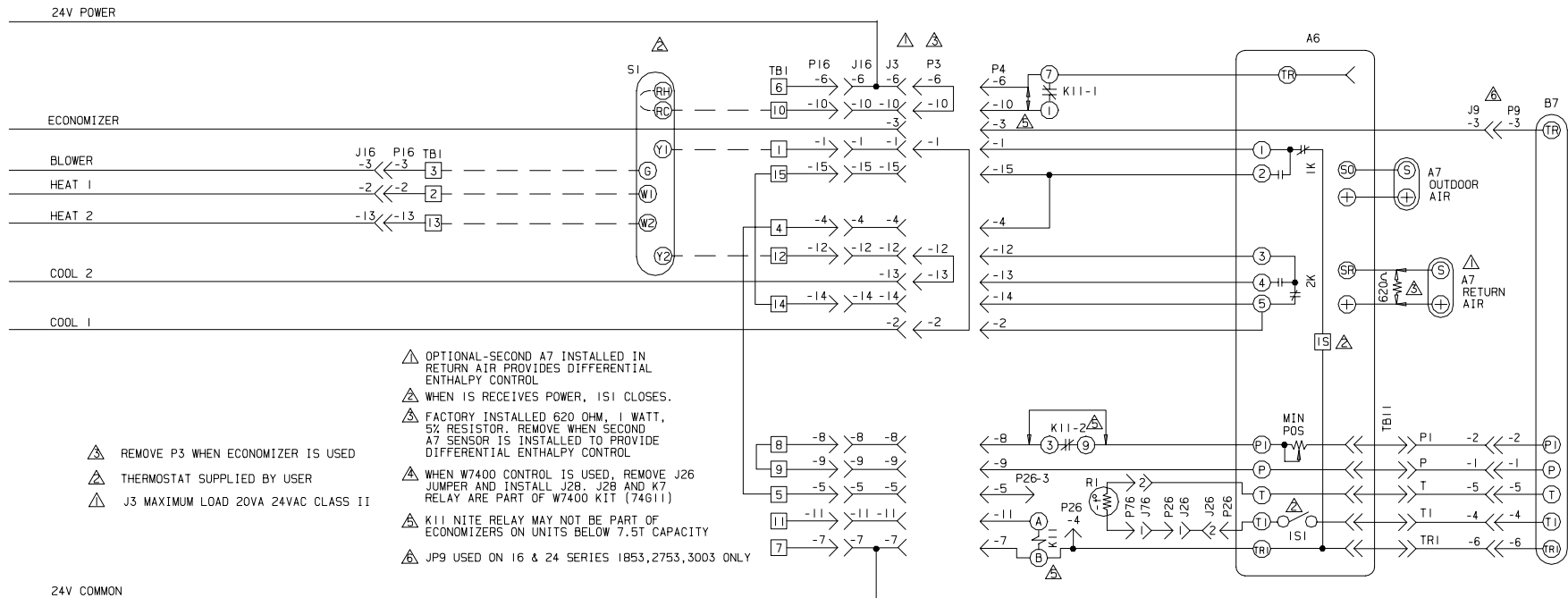
- 14- When contacts K14-1 close, compressor B13 is energized and immediately begins operating.

#### Heating Demand:

- 15- On a call for first stage heating (W1), pilot relay K77 is energized.
- 16- When K77-1 closes, a 24VAC circuit is completed into the heating section to energize combustion air blower relay K13.
- 17- When contacts K13-1 close, combustion air blower B6 is energized and immediately begins operating. When contacts K13-2 close, the gas valve GV1 is energized.
- 18- As the combustion air blower approaches full speed, combustion air blower prove switch (S18) closes.
- 19- When S18 closes a 24VAC circuit is completed through the heating safety switches to energize burner ignition control A3.
- 20- When ignition control A3 determines that ignition can begin, A3 simultaneously sends 24VAC to both operators of the gas valve (GV1 terminals W1 and W2) and to the indoor blower relay (K56) and also sends spark to the spark electrode. The gas valve immediately opens and blower relay K56 is immediately energized. The W1 operator of gas valve (GV1) opens immediately and the W2 operator opens slowly. This means that the burner starts in low-fire and slowly increases to high-fire.
- 21- When K56-1 closes, blower delay relay K25 is energized. K25 begins its timing sequence.
- 22- When flame is sensed by the ignition control, spark is stopped and the gas valve (GV1) remains open. If flame is not sensed within the time allowed, spark is stopped, the gas valve is closed and the ignition control begins its retrial timing sequence.
- 23- When blower delay K25 ends its timing period, K25-1 switches. A 24VAC circuit is completed through K20-1 to energize blower contactor K3 and optional economizer (which opens the outdoor air dampers to minimum position).
- 24- When contacts K3-1 close, the indoor blower is energized immediately begins operating.
- 25- On a call for increased heating (W2), pilot relay K49 is energized.
- 26- When K49-1 closes, a 24VAC circuit is completed into the heating compartment to energize time delay DL3. DL3 immediately begins its timing sequence.
- 27- When DL3 time delay has elapsed, DL3 closes internally to complete a circuit to energize the second stage heat pilot relay K19.
- 28- When K19-1 closes, combustion air blower B15 is energized and immediately begins operating. When contacts K19-2 close, gas valve (GV3) is enabled. When K19-3 closes, the second stage ignition circuit is enabled.
- 29- As the combustion air blower (B15) approaches full speed, combustion air blower prove switch (S45) closes.
- 30- When S45 closes a 24VAC circuit is completed through the heating safety switches to energize burner ignition control A12.
- 31- When ignition control A12 determines that ignition can begin, A12 simultaneously sends 24VAC to both operators of the gas valve (GV3 terminals W1 and W2) and to the indoor blower relay (K57) and also sends spark to the spark electrode. The gas valve immediately opens and blower relay K57 is immediately energized. The W1 operator of gas valve (GV3) opens immediately and the W2 operator opens slowly. This means that the burner starts in low-fire and slowly increases to high-fire.
- 32- When K57-1 closes, blower delay relay K25 is energized. This is a redundant safety circuit since K25 is already energized by first stage demand.
- 33- If either heating limit S10 or S21 open during heating operation, both ignition controls are immediately de-energized and blower limit relay K20 is immediately energized.
- 34- When the ignition controls are de-energized, both gas valves and blower relays (K56 and K57) are both de-energized.
- 35- When K20-1 switches, blower contactor K3 is energized to continue blower operation during the time that safety limits are open.

# C1 diagram with D5 diagram

## electromechanical thermostat with modulating economizer



- △ REMOVE P3 WHEN ECONOMIZER IS USED
- △ THERMOSTAT SUPPLIED BY USER
- △ J3 MAXIMUM LOAD 20VA 24VAC CLASS II
- △ OPTIONAL-SECOND A7 INSTALLED IN RETURN AIR PROVIDES DIFFERENTIAL ENTHALPY CONTROL
- △ WHEN IS RECEIVES POWER, IS1 CLOSES.
- △ FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR. REMOVE WHEN SECOND A7 SENSOR IS INSTALLED TO PROVIDE DIFFERENTIAL ENTHALPY CONTROL
- △ WHEN W7400 CONTROL IS USED, REMOVE J26 JUMPER AND INSTALL J28. J28 AND K7 RELAY ARE PART OF W7400 KIT (74611)
- △ K11 NITE RELAY MAY NOT BE PART OF ECONOMIZERS ON UNITS BELOW 7.5T CAPACITY
- △ JP9 USED ON 16 & 24 SERIES 1B53, 2753, 3003 ONLY

FOR UNITS WITHOUT A CONTROL BETWEEN P16 & J16

TERM. NO.	UNIT FUNCTION
1	Y1 COOL 1
2	W1 HEAT 1
3	G BLOWER
4	
5	5
6	R 24V POWER
7	C 24V COMMON
8	8
9	9
10	10 POWER TO S1
11	11
12	Y2 COOL 2
13	W2 HEAT 2
14	14
15	15

KEY	DESCRIPTION
J3	JACK-UNIT ECONOMIZER
J16	JACK-UNIT
P3	PLUG-LESS ECONOMIZER
P16	PLUG-UNIT
S1	THERMOSTAT-ROOM
TB1	TERMINAL STRIP-LOW VOLTAGE

--- LOW VOLTAGE FIELD WIRING  
 ——— FACTORY WIRING

**LENNOX** Industries Inc. WIRING DIAGRAM 3/93

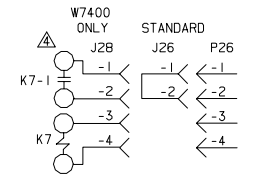
ACCESSORIES

ELECTROMECHANICAL THERMOSTAT FOR 11, 16 & 24 SERIES UNITS (2 HEAT, 2 COOL)

THERMOSTAT-SECTION C1

Supersedes Form No. \_\_\_\_\_ New Form No. 528,394W

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KEY	COMPONENT
A6	CONTROL-ENTHALPY W7459A
A7	SENSOR-ENTHALPY
B7	MOTOR-DAMPER
J9	JACK-ECONOMIZER
J26	JACK-ENTHALPY
J28	JACK-W7400
J76	JACK-SENSOR ECONOMIZER
K7,-1	RELAY-W7400
K11,-1,2	RELAY-NITE SETBACK
P4	PLUG-ECONOMIZER
P9	PLUG-ECONOMIZER
P26	PLUG-ENTHALPY
P76	PLUG-SENSOR ECONOMIZER
R1	SENSOR-SUPPLY AIR
TB11	TERMINAL STRIP

**LENNOX** Industries Inc. WIRING DIAGRAM 3/93

ACCESSORIES

EMD-14, 17-M EMDH-16, 24-M  
 REMD-11, 16, 24-M  
 (MODULATING ECONOMIZER)

ECONOMIZER-SECTION D5

Supersedes Form No. 529,063W New Form No. 529,485W

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## C1 DIAGRAM WITH D5 DIAGRAM

### Electromechanical Thermostat with Economizer

#### G-REMD16M

When a REMD16M economizer section is applied to the CHA16-1853 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 CHA16, you must first read and understand how all the CHA16 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 CHA16-1853 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.*

*NOTE-Relay K9 is part of the ECH16 Electric Heater used with the CHA16 unit for heating.*

- 1- Economizer outdoor air dampers drive full closed anytime blower B3 is not operating.
- 2- Damper motor terminal TR is powered by unit contactor K3 when there is a blower demand or by K9 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 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.

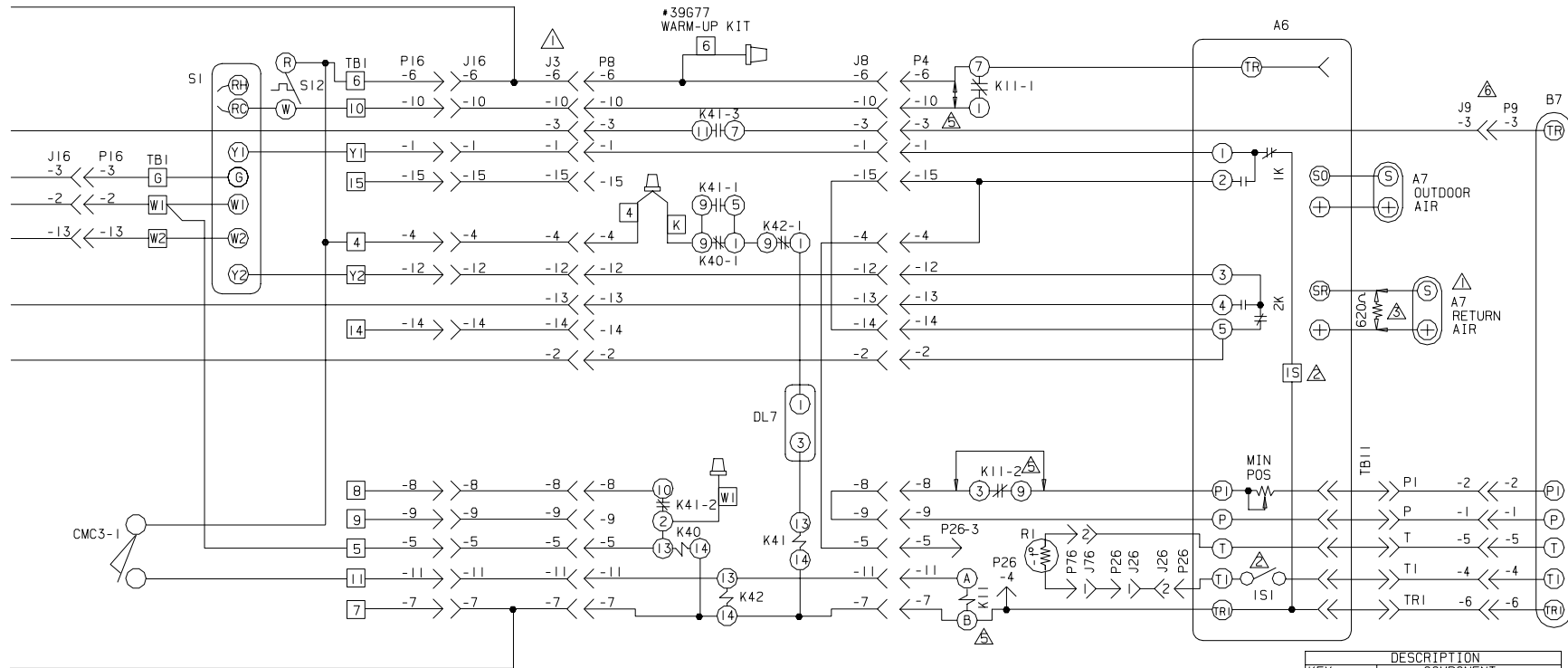
#### Night Setback (optional field installed)

*NOTE-Relay K11 is part of the REMD16M-185 economizer.*

- 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

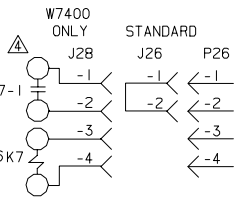
electromechanical thermostat with modulating economizer and warm-up



Page 78

KEY	DESCRIPTION	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-hi 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	
S1	thermostat-room	
S12	thermostat-nite	
TB1	block-terminal (low volt)	

- ⚠ OPTIONAL-SECOND A7 INSTALLED IN RETURN AIR PROVIDES DIFFERENTIAL ENTHALPY CONTROL
- ⚠ WHEN IS RECEIVES POWER, IS1 CLOSES.
- ⚠ FACTORY INSTALLED 620 OHM, 1 WATT, 5% RESISTOR. REMOVE WHEN SECOND A7 SENSOR IS INSTALLED TO PROVIDE DIFFERENTIAL ENTHALPY CONTROL
- ⚠ WHEN W7400 CONTROL IS USED, REMOVE J26 K7 JUMPER AND INSTALL J28. J28 AND K7 RELAY ARE PART OF W7400 KIT (74G11)
- ⚠ K11 NITE RELAY MAY NOT BE PART OF ECONOMIZERS ON UNITS BELOW 7.5T CAPACITY
- ⚠ JP9 USED ON 16 & 24 SERIES 1853,2753,3003 ONLY



KEY	DESCRIPTION	COMPONENT
A6	CONTROL - ENTHALPY	W7459A
A7	SENSOR - ENTHALPY	
B7	MOTOR - DAMPER	
J9	JACK - ECONOMIZER	
J26	JACK - ENTHALPY	
J28	JACK - W7400	
J76	JACK - SENSOR ECONOMIZER	
K7, -1	RELAY - W7400	
K11, -1,2	RELAY - NITE SETBACK	
P4	PLUG - ECONOMIZER	
P9	PLUG - ECONOMIZER	
P26	PLUG - ENTHALPY	
P76	PLUG - SENSOR ECONOMIZER	
R1	SENSOR - SUPPLY AIR	
TB11	TERMINAL STRIP	

**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. 528, 152W  
New Form No. 528, 152W

Litho U.S.A.

⚠ J3 MAXIMUM LOAD 20VA 24VAC CLASS II

**LENNOX** Industries Inc. WIRING DIAGRAM 3/93

ACCESSORIES

EMD-14, 17-M EMDH-16, 24-M  
REMD-11, 16, 24-M  
(MODULATING ECONOMIZER)

ECONOMIZER-SECTION D5

Supersedes Form No. 529, 063W  
New Form No. 529, 485W

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## C2-1 DIAGRAM WITH D5 DIAGRAM

### Electromechanical Thermostat Connected to CHA16-1853 with Economizer and Warm-Up

#### H-WARM-UP KIT

An optional feature of the REMD16M economizer is a warm-up kit which holds the economizer outdoor air dampers closed during night heat operation and while the CHA16 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 CHA16, you must first read and understand how all the CHA16 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 CHA16 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 CHA16 BLOWER COMPARTMENT. REFER TO WIRING DIAGRAM. IMPROPER CONNECTION WILL CAUSE CONTROL FAILURE.**

The warm-up kit installs in the control mounting area of the CHA16 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 ECH16 heat relay K9 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).

# NOTES