GCS/CHA16 SERIES UNITS

GCS16 series units in the 15 and 20 ton (52.8 and 70.3 kW) cooling size are packaged combination gas heat / dx cool units designed for commercial applications. Gas heat sections are available with Lennox' tubular heat exchanger in 235,000 and 375,000 (68.9 and 109.9 kW) Btuh input sizes. Optional electric heat sections with inputs of 15kW through 75kW, are available in the CHA16 series units and install inside the cabinet.

GCS/CHA16-180 units utilize reciprocating compressors. These compressors are hermeticaly sealed for leak free operation and long service life. A built in protection device assures protection from excessive current and temperatures.

GCS/CHA16-240 units utilize scroll compressors. The scroll compressor offers high volumetric efficiency and quiet operation. Continuous flank contact, maintained by centrifugal force, minimizes gas leakage and maximizes efficiency. The motor is internally protected from excessive current and temperature.

GCS/CHA16-180/240 units are designed for horizontal or down flow discharge application and may be fitted with RMF16 mounting frame, REMD16 economizer and RTD11 ceiling diffuser.

GCS/CHA16-180/240 models are designed to accept several different thermostat control systems such as the Honeywell T7300 or Honeywell T8621D with minimum field wiring. Control options such as economizer and warm up kit, 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 low voltage pigtails to facilitate thermostat field wiring.

Information in this manual is for use by a qualified service technician only. All specifications in this manual are subject to change. Procedures outlined in this manual are represented as a recommendation only and do not supersede or replace state or local codes.

GCS16-240

⚠WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a qualified installer or service agency.

⚠ WARNING

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

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

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SPECIFICATIONS

Model No.			GCS/CHA16-180	GCS/CHA16-240
Nominal Tonnage			15	20
Cooling Ratings	Gross cooling capacity - Btuh (kW)		183,200 (53.7)	226,600 (66.4)
	★Total cooling capacity - Btuh (kW)		176,000 (51.6)	216,000 (63.3)
	★Total unit kW		19.5	24.0
	★EER (Btuh/Watts)		9.0	9.0
	★Integrated Part Load Value		9.2	9.2
Refrigerant Charge Furnished (HCFC-22)	Circuit 1		7 lbs. 8 oz. (3.40 kg)	8 lbs. 8 oz. (3.86 kg)
	Circuit 2		7 lbs. 8 oz. (3.40 kg)	8 lbs. 8 oz. (3.86 kg)
	Circuit 3		7 lbs. 8 oz. (3.40 kg)	8 lbs. 8 oz. (3.86 kg)
Evaporator Blower and Drive Selection	Blower wheel nominal diameter x width - in. (mm)		18 x 18 (457 x 457)	
	3 hp Motor and Factory Installed [1] Drives	Nominal motor hp (kW)	3 (2.24)	- - - -
		Maximum usable hp (kW)	3.45 (2.57)	- - - -
		Voltage & phase	208/230/460v or 575v-3ph	- - - -
		RPM range	645-845	- - - -
	5 hp Motor and Factory Installed [1] Drives	Nominal motor hp (kW)	5 (3.73)	
		Maximum usable hp (kW)	5.75 (4.29)	
		Voltage & phase	208/230/460v or 575v-3ph	
		RPM range	765-965	
	7.5 hp Motor and Factory Installed [1] Drives	Nominal motor hp (kW)	- - - -	7.5 (5.60)
		Maximum usable hp (kW)	- - - -	8.6 (6.42)
		Voltage & phase	- - - -	208/230/460v or 575v-3ph
		RPM range	- - - -	895-1120
Evaporator Coil	Net face area - sq. ft. (m^2)		17.9 (1.66)	
	Tube diameter - in. (mm) & No. of rows		3/8 (9.5) - 3	3/8 (9.5) - 4
	Fins per inch (m)		14 (551)	
	Expansion device type		Thermostatic Expansion Valve	
	Drain connection size mpt - in. (mm)		1 (25.4)	
Condenser Coil	Net face area - sq. ft. (m^2)		29.5 (2.74)	
	Tube diameter - in. (mm) & No. of rows		3/8 (9.5) - 2	
	Fins per inch (m)		20 (787)	
Condenser Fans	Diameter - in. (mm) & No. of blades		(2) 24 (610) - 4	(2) 26 (660) - 4
	Air volume - cfm (L/s)		10,000 (4720)	13,500 (6370)
	Motor horsepower (W)		3/4 (560)	1 (746)
	Motor rpm		1075	1140
	Motor watts		1200	2050
-235 Heat Models	Low fire input - Btuh (kW) Natural Gas / LPG/Propane		154,000 (45.1) Nat. / 170,000 (49.8) LPG/Propane	
	Input - Btuh (kW) Natural Gas / LPG/Propane		235,000 (68.9)	
	Output - Btuh (kW) Natural Gas / LPG/Propane		188,000 (55.1) Nat. / 191,000 (56.0) LPG/Propane	
	CSA Thermal Efficiency Natural Gas / LPG/Propane		80.0% Nat. / 81.3% LPG/Propane	
-375 Heat Models	Low fire input - Btuh (kW) Natural Gas / LPG/Propane		246,000 (72.1) Nat. / 271,000 (79.4) LPG/Propane	
	Input - Btuh (kW) Natural Gas / LPG/Propane		375,000 (109.9)	
	Output - Btuh (kW) Natural Gas / LPG/Propane		300,000 (87.9) Nat. / 305,000 (89.4) LPG/Propane	
	CSA Thermal Efficiency Natural Gas / LPG/Propane		80.0% Nat. / 81.3% LPG/Propane	
Gas Supply Connections fpt - in. (mm)Natural and LPG/Propane			3/4	
Recommended Gas Supply Pressure - wc. in. (kPa)		Natural	7 (1.7)	
		LPG/Propane	11 (2.7)	
Filters (furnished)	Type of filter		Disposable, pleated	
	No. & size - in. (mm)		(6) 18 x 24 x 2 (457 x 610 x 51)	
Net weight of basic unit - lbs. (kg)			1700 (771)	1825 (828)
Shipping weight of basic unit - lbs. (kg) (1 Package)			1870 (848)	1990 (903)
Electrical characteristics			208/230v, 460v or 575v - 60 hertz - 3 phase	

★Rated in accordance with ARI Standard 340/360;
95°F (35°F) outdoor air temperature and 80°F (27°C) db/67°F (19°C) wb entering evaporator air.
NOTE - Integrated Part Load Value rated at 80°F (27°C) outdoor air temperature.

NOTE - ARI capacity is net and includes evaporator blower motor heat deduction. Gross capacity does not include evaporator blower motor heat deduction.

[1] Using total air volume and system static pressure requirements determine from blower performance tables rpm and motor output required. Maximum usable output of motors furnished by Lennox are shown. In Canada, nominal motor output is also maximum usable motor output. If motors of comparable output are used, be sure to keep within the service factor limitations outlined on the motor nameplate.

ELECTRICAL DATA

Model No.			GCS16-180					
Line voltage data - 60 Hz - 3 phase			208/230V		460V		575V	
Compressors (3)	Rated load amps - each (total)		16.7 (50.1)		8.6 (25.8)		6.0 (18.1)	
	Locked rotor amps - each (total)		110 (330)		55 (165)		44 (132)	
Condenser Fan Motors (2)	Full load amps (total)		7.4 (14.8)		3.8 (7.6)		3.2 (6.4)	
	Locked rotor amps (total)		14.6 (29.2)		7.4 (14.8)		5.8 (11.6)	
Evaporator Blower Motor	Motor Output	hp	3	5	3	5	3	5
		kW	2.2	3.7	2.2	3.7	2.2	3.7
	Full load amps		10.6	16.7	4.8	7.6	3.9	6.1
	Locked rotor amps		66	105	26.8	45.6	23.4	36.6
▶Recommended maximum fuse or circuit breaker size (amps)	**With Exhaust Fans**		**90**	**90**	**45**	**50**	**30**	**35**
	Less Exhaust Fans		**80**	**90**	**45**	**45**	**30**	**35**
†Minimum Circuit Ampacity	**With Exhaust Fans**		**78**	**84**	**40**	**42**	**29**	**31**
	Less Exhaust Fans		**73**	**79**	**37**	**40**	**27**	**29**
Optional Power Exhaust Fans	(No.) Motor Output - hp (kW)		(2) - 1/3					
	Full load amps (total)		4.8 (9.6)		2.6 (5.2)		2 (4)	
	Locked rotor amps (total)		9.4 (18.8)		4.8 (9.6)		3.8 (7.6)	

Model No.			GCS16-240					
Line voltage data - 60 Hz - 3 phase			208/230V		460V		575V	
Compressors (3)	Rated load amps - each (total)		18.8 (56.4)		9.1 (27.3)		7.5 (22.5)	
	Locked rotor amps - each (total)		156 (468)		70 (210)		54 (162)	
Condenser Fan Motors (2)	Full load amps (total)		9.6 (19.6)		4.8 (9.6)		4 (8)	
	Locked rotor amps (total)		46 (92)		23 (46)		17.8 (35.6)	
Evaporator Blower Motor	Motor Output	hp	5	7.5	5	7.5	5	7.5
		kW	3.7	5.6	3.7	5.6	3.7	5.6
	Full load amps		16.7	24.2	7.6	11	6.1	9
	Locked rotor amps		105	152	45.6	66	36.6	54
▶Recommended maximum fuse or circuit breaker size (amps)	**With Exhaust Fans**		**110**	**125**	**50**	**50**	**40**	**45**
	Less Exhaust Fans		**100**	**110**	**50**	**50**	**40**	**45**
†Minimum Circuit Ampacity	**With Exhaust Fans**		**93**	**100**	**45**	**48**	**37**	**40**
	Less Exhaust Fans		**88**	**95**	**42**	**46**	**35**	**38**
Optional Power Exhaust Fans	(No.) Motor Output - hp (W)		(2) - 1/3 (250)					
	Full load amps (total)		4.8 (9.6)		2.6 (5.2)		2 (4)	
	Locked rotor amps (total)		9.4 (18.8)		4.8 (9.6)		3.8 (7.6)	

†Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.
▶Where current does not exceed 100 amps, HACR type circuit breaker may be used in place of fuse (U.S. only).
NOTE - Extremes of operating range are plus and minus 10 % of line voltage.

Model No.			CHA16-180						CHA16-240					
Line voltage data - 60 Hz - 3 phase			208/230V		460V		575V		208/230V		460V		575V	
Compressors (3)	Rated load amps each (total)		16.7 (50.1)		8.6 (25.8)		6.0 (18.1)		18.8 (56.4)		9.1 (27.3)		7.5 (22.5)	
	Locked rotor amps each (total)		110.0 (330.0)		55.0 (165.0)		44.0 (132.0)		156.0 (468.0)		70.0 (210.0)		54.0 (162.0)	
Condenser Fan Motor (2)	Full load amps (total)		7.4 (14.8)		3.8 (7.6)		3.2 (6.4)		9.6 (19.6)		4.8 (9.6)		4.0 (8.0)	
	Locked rotor amps (total)		14.6 (29.2)		7.4 (14.8)		5.8 (11.6)		46 (92)		23 (46)		17.8 (35.6)	
Evaporator Blower Motor	Motor Output	hp	3	5	3	5	3	5	5	7.5	5	7.5	5	7.5
		kW	2.2	3.7	2.2	3.7	2.2	3.7	3.7	5.6	3.7	5.6	3.7	5.6
	Full load amps		10.6	16.7	4.8	7.6	3.9	6.1	16.7	24.2	7.6	11	6.1	9
	Locked rotor amps		66	105	26.8	45.6	23.4	36.6	105	152	45.6	66	36.6	54
Rec. max. fuse size (amps)	**With Exhaust Fan**		**90**	**90**	**45**	**50**	**30**	**35**	**110**	**125**	**50**	**50**	**40**	**45**
	Less Exhaust Fan		**80**	**90**	**45**	**45**	**30**	**35**	**100**	**110**	**50**	**50**	**40**	**45**
***Minimum Circuit Ampacity**	**With Exhaust Fan**		**78**	**84**	**40**	**42**	**29**	**31**	**93**	**100**	**45**	**48**	**37**	**40**
	Less Exhaust Fan		**73**	**79**	**37**	**40**	**27**	**29**	**88**	**95**	**42**	**46**	**35**	**38**
Optional Power Exhaust Fan	(No.) Horsepower (W)		(2) - 1/3 (250)											
	Full load amps (total)		4.8 (9.6)		2.6 (5.2)		2.0 (4.0)		4.8 (9.6)		2.6 (5.2)		2.0 (4.0)	
	Locked rotor amps (total)		9.4 (18.8)		4.8 (9.6)		3.8 (7.6)		9.4 (18.8)		4.8 (9.6)		3.8 (7.6)	

BLOWER DATA GCS16-180

GCS16-180 - DOWN-FLOW BLOWER PERFORMANCE (w/ 2 in. pleated filters)

Air Volume cfm (L/s)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge (Pa)									
	.20 (50)	.40 (100)	.60 (150)	.80 (200)	1.00 (250)	1.20 (300)	1.40 (350)	1.60 (400)	1.80 (450)	2.00 (495)
	RPM BHP (kW)	RPM BHP (kW)	RPM BHP (kW)	RPM BHP (kW)	RPM BHP (kW)	RPM BHP (kW)	RPM BHP (kW)	RPM BHP (kW)	RPM BHP (kW)	RPM BHP (kW)
4800 (2265)	450 0.90 (0.67)	510 1.10 (0.82)	575 1.35 (1.01)	630 1.55 (1.16)	680 1.75 (1.31)	730 2.00 (1.49)	775 2.25 (1.68)	820 2.50 (1.87)	860 2.75 (2.05)	900 3.05 (2.28)
4900 (2310)	455 0.95 (0.71)	515 1.15 (0.86)	580 1.40 (1.04)	635 1.60 (1.19)	685 1.85 (1.38)	735 2.10 (1.57)	780 2.35 (1.75)	820 2.55 (1.90)	865 2.85 (2.13)	900 3.10 (2.31)
5000 (2360)	460 1.00 (0.75)	520 1.20 (0.90)	585 1.45 (1.08)	640 1.70 (1.27)	690 1.90 (1.42)	735 2.15 (1.60)	780 2.40 (1.79)	825 2.65 (1.98)	865 2.90 (2.16)	905 3.20 (2.39)
5100 (2405)	465 1.05 (0.78)	530 1.30 (0.97)	590 1.50 (1.12)	645 1.75 (1.31)	695 2.00 (1.49)	740 2.20 (1.64)	785 2.45 (1.83)	830 2.75 (2.05)	870 3.00 (2.24)	910 3.30 (2.46)
5200 (2455)	470 1.10 (0.82)	535 1.35 (1.01)	595 1.55 (1.16)	645 1.80 (1.34)	700 2.05 (1.53)	745 2.30 (1.72)	790 2.55 (1.90)	830 2.80 (2.09)	870 3.05 (2.28)	910 3.35 (2.50)
5300 (2500)	475 1.15 (0.86)	540 1.40 (1.04)	600 1.65 (1.23)	650 1.85 (1.38)	700 2.10 (1.57)	750 2.40 (1.79)	795 2.65 (1.98)	835 2.90 (2.16)	875 3.15 (2.35)	915 3.45 (2.57)
5400 (2550)	480 1.20 (0.90)	545 1.45 (1.08)	605 1.70 (1.27)	655 1.95 (1.45)	705 2.20 (1.64)	755 2.45 (1.83)	795 2.70 (2.01)	840 3.00 (2.24)	880 3.25 (2.42)	915 3.55 (2.65)
5500 (2595)	490 1.30 (0.97)	550 1.50 (1.12)	610 1.75 (1.31)	660 2.00 (1.49)	710 2.25 (1.68)	755 2.50 (1.87)	800 2.80 (2.09)	840 3.05 (2.28)	880 3.35 (2.50)	920 3.65 (2.72)
5600 (2645)	495 1.35 (1.01)	555 1.60 (1.19)	615 1.85 (1.38)	665 2.10 (1.57)	715 2.35 (1.75)	760 2.60 (1.94)	805 2.90 (2.16)	845 3.15 (2.35)	885 3.45 (2.57)	925 3.75 (2.80)
5700 (2690)	500 1.40 (1.04)	560 1.65 (1.23)	620 1.90 (1.42)	670 2.15 (1.60)	720 2.45 (1.83)	765 2.70 (2.01)	810 3.00 (2.24)	850 3.25 (2.42)	890 3.55 (2.65)	925 3.80 (2.83)
5800 (2735)	505 1.45 (1.08)	570 1.75 (1.31)	625 2.00 (1.49)	675 2.25 (1.68)	725 2.50 (1.87)	770 2.80 (2.09)	810 3.05 (2.28)	850 3.30 (2.46)	890 3.60 (2.69)	930 3.90 (2.91)
5900 (2785)	515 1.55 (1.16)	575 1.80 (1.34)	630 2.05 (1.53)	680 2.30 (1.72)	725 2.60 (1.94)	775 2.90 (2.16)	815 3.15 (2.35)	855 3.40 (2.54)	895 3.70 (2.76)	935 4.05 (3.02)
6000 (2830)	520 1.60 (1.19)	580 1.85 (1.38)	635 2.15 (1.60)	685 2.40 (1.79)	730 2.65 (1.98)	775 2.95 (2.20)	820 3.25 (2.42)	860 3.55 (2.65)	900 3.85 (2.87)	935 4.10 (3.06)
6100 (2880)	525 1.65 (1.23)	585 1.95 (1.45)	640 2.20 (1.64)	690 2.50 (1.87)	735 2.75 (2.05)	780 3.05 (2.28)	825 3.35 (2.50)	865 3.65 (2.72)	900 3.90 (2.91)	940 4.25 (3.17)
6200 (2925)	530 1.75 (1.31)	590 2.00 (1.49)	645 2.30 (1.72)	695 2.60 (1.94)	740 2.85 (2.13)	785 3.15 (2.35)	830 3.45 (2.57)	870 3.75 (2.80)	905 4.00 (2.98)	945 4.35 (3.25)
6300 (2975)	540 1.85 (1.38)	595 2.10 (1.57)	650 2.40 (1.79)	700 2.65 (1.98)	745 2.95 (2.20)	790 3.25 (2.42)	830 3.50 (2.61)	870 3.80 (2.83)	910 4.15 (3.10)	945 4.45 (3.32)
6400 (3020)	545 1.90 (1.42)	605 2.20 (1.64)	655 2.45 (1.83)	705 2.75 (2.05)	750 3.05 (2.28)	795 3.35 (2.50)	835 3.65 (2.72)	875 3.95 (2.95)	915 4.25 (3.17)	950 4.55 (3.39)
6500 (3065)	550 2.00 (1.49)	610 2.30 (1.72)	660 2.55 (1.90)	710 2.85 (2.13)	755 3.15 (2.35)	800 3.45 (2.57)	840 3.75 (2.80)	880 4.05 (3.02)	915 4.35 (3.25)	955 4.70 (3.51)
6600 (3115)	560 2.10 (1.57)	615 2.35 (1.75)	665 2.65 (1.98)	715 2.95 (2.20)	760 3.25 (2.42)	805 3.55 (2.65)	845 3.85 (2.87)	885 4.20 (3.13)	920 4.45 (3.32)	960 4.80 (3.58)
6700 (3160)	565 2.15 (1.60)	620 2.45 (1.83)	670 2.75 (2.05)	720 3.05 (2.28)	765 3.35 (2.50)	810 3.65 (2.72)	850 4.00 (2.98)	890 4.30 (3.21)	925 4.60 (3.43)	960 4.90 (3.66)
6800 (3210)	575 2.25 (1.68)	625 2.55 (1.90)	680 2.85 (2.13)	725 3.15 (2.35)	770 3.45 (2.57)	815 3.80 (2.83)	855 4.10 (3.06)	890 4.40 (3.28)	930 4.75 (3.54)	965 5.05 (3.77)
6900 (3255)	580 2.35 (1.75)	635 2.65 (1.98)	685 2.95 (2.20)	730 3.25 (2.42)	775 3.55 (2.65)	815 3.85 (2.87)	855 4.20 (3.13)	895 4.50 (3.36)	935 4.85 (3.62)	970 5.20 (3.88)
7000 (3305)	585 2.45 (1.83)	640 2.75 (2.05)	690 3.05 (2.28)	735 3.35 (2.50)	780 3.70 (2.76)	820 4.00 (2.98)	860 4.30 (3.21)	900 4.65 (3.47)	935 4.95 (3.69)	975 5.35 (3.99)
7100 (3350)	590 2.50 (1.87)	645 2.85 (2.13)	695 3.15 (2.35)	740 3.45 (2.57)	785 3.80 (2.83)	825 4.10 (3.06)	865 4.45 (3.32)	905 4.75 (3.54)	940 5.10 (3.80)	975 5.40 (4.03)
7200 (3400)	600 2.65 (1.98)	650 2.95 (2.20)	700 3.25 (2.42)	745 3.60 (2.69)	790 3.90 (2.91)	830 4.20 (3.13)	870 4.55 (3.39)	910 4.90 (3.66)	945 5.25 (3.92)	980 5.55 (4.14)

BLOWER DATA CHA16-180

BLOWER TABLE INCLUDES RESISTANCE FOR BASE UNIT ONLY WITH DRY INDOOR COIL & AIR FILTERS IN PLACE.
FOR ALL UNITS ADD:
1 - Wet indoor coil air resistance of selected unit.
2 - Any field installed accessories air resistance (electric heat, economizer, duct resistance, diffuser, etc.)
Then determine from blower table blower motor output.
MINIMUM AIR VOLUME REQUIRED FOR USE WITH OPTIONAL ELECTRIC HEAT
●Units require 4900 cfm (2310 L/s) minimum air with electric heat.

BOLD ITALIC INDICATES FIELD FURNISHED DRIVE

Air Volume cfm (L/s)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge (Pa)																					
	.20 (50)		.40 (100)		.60 (150)		.80 (200)		1.00 (250)		1.20 (300)		1.40 (350)		1.60 (400)		1.80 (450)		2.00 (495)	
	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)
4800 (2265)	***455***	***0.90 (0.67)***	***515***	***1.10 (0.82)***	***570***	***1.25 (0.93)***	***620***	***1.45 (1.08)***	670	1.70 (1.27)	715	1.90 (1.42)	760	2.10 (1.57)	800	2.35 (1.75)	840	2.55 (1.90)	880	2.80 (2.09)
4900 (2310)	***460***	***0.95 (0.71)***	***520***	***1.10 (0.82)***	***575***	***1.30 (0.97)***	***625***	***1.55 (1.16)***	675	1.75 (1.31)	720	1.95 (1.45)	760	2.15 (1.60)	805	2.40 (1.79)	845	2.65 (1.98)	880	2.85 (2.13)
5000 (2360)	***470***	***1.00 (0.75)***	***525***	***1.15 (0.86)***	***580***	***1.40 (1.04)***	***630***	***1.60 (1.19)***	675	1.80 (1.34)	720	2.00 (1.49)	765	2.25 (1.68)	805	2.45 (1.83)	845	2.70 (2.01)	885	2.95 (2.20)
5100 (2405)	***475***	***1.05 (0.78)***	***530***	***1.25 (0.93)***	***585***	***1.45 (1.08)***	***635***	***1.65 (1.23)***	680	1.85 (1.38)	725	2.10 (1.57)	770	2.35 (1.75)	810	2.55 (1.90)	850	2.80 (2.09)	885	3.05 (2.28)
5200 (2455)	***480***	***1.10 (0.82)***	***535***	***1.30 (0.97)***	***590***	***1.50 (1.12)***	***640***	***1.70 (1.27)***	685	1.95 (1.45)	730	2.15 (1.60)	775	2.40 (1.79)	815	2.65 (1.98)	850	2.85 (2.13)	890	3.15 (2.35)
5300 (2500)	***485***	***1.15 (0.86)***	***545***	***1.35 (1.01)***	***595***	***1.55 (1.16)***	645	1.80 (1.34)	690	2.00 (1.49)	735	2.25 (1.68)	775	2.45 (1.83)	815	2.70 (2.01)	855	2.95 (2.20)	890	3.20 (2.39)
5400 (2550)	***495***	***1.20 (0.90)***	***550***	***1.40 (1.04)***	***600***	***1.60 (1.19)***	650	1.85 (1.38)	695	2.05 (1.53)	740	2.30 (1.72)	780	2.55 (1.90)	820	2.80 (2.09)	860	3.05 (2.28)	895	3.30 (2.46)
5500 (2595)	***500***	***1.25 (0.93)***	***555***	***1.45 (1.08)***	***605***	***1.70 (1.27)***	655	1.90 (1.42)	700	2.15 (1.60)	745	2.40 (1.79)	785	2.65 (1.98)	825	2.90 (2.16)	860	3.10 (2.31)	900	3.40 (2.54)
5600 (2645)	***505***	***1.30 (0.97)***	***560***	***1.55 (1.16)***	***610***	***1.75 (1.31)***	660	2.00 (1.49)	705	2.25 (1.68)	745	2.45 (1.83)	790	2.70 (2.01)	830	3.00 (2.24)	865	3.20 (2.39)	900	3.45 (2.57)
5700 (2690)	***515***	***1.40 (1.04)***	***570***	***1.60 (1.19)***	***620***	***1.85 (1.38)***	665	2.05 (1.53)	710	2.30 (1.72)	750	2.55 (1.90)	790	2.80 (2.09)	830	3.05 (2.28)	870	3.30 (2.46)	905	3.55 (2.65)
5800 (2735)	***520***	***1.45 (1.08)***	***575***	***1.65 (1.23)***	***625***	***1.90 (1.42)***	670	2.15 (1.60)	715	2.40 (1.79)	755	2.60 (1.94)	795	2.85 (2.13)	835	3.15 (2.35)	875	3.40 (2.54)	910	3.65 (2.72)
5900 (2785)	***530***	***1.50 (1.12)***	***580***	***1.75 (1.31)***	***630***	***2.00 (1.49)***	675	2.20 (1.64)	720	2.45 (1.83)	760	2.70 (2.01)	800	2.95 (2.20)	840	3.25 (2.42)	875	3.50 (2.61)	910	3.75 (2.80)
6000 (2830)	***535***	***1.60 (1.19)***	***585***	***1.80 (1.34)***	***635***	***2.05 (1.53)***	680	2.30 (1.72)	725	2.55 (1.90)	765	2.80 (2.09)	805	3.05 (2.28)	845	3.35 (2.50)	880	3.60 (2.69)	915	3.85 (2.87)
6100 (2880)	***545***	***1.65 (1.23)***	***595***	***1.90 (1.42)***	***640***	***2.15 (1.60)***	685	2.40 (1.79)	730	2.65 (1.98)	770	2.90 (2.16)	810	3.15 (2.35)	845	3.40 (2.54)	885	3.70 (2.76)	920	3.95 (2.95)
6300 (2975)	***560***	***1.80 (1.34)***	***605***	***2.05 (1.53)***	655	2.30 (1.72)	695	2.55 (1.90)	740	2.80 (2.09)	780	3.10 (2.31)	820	3.35 (2.50)	855	3.60 (2.69)	890	3.90 (2.91)	925	4.15 (3.10)
6200 (2925)	***550***	***1.75 (1.31)***	***600***	***1.95 (1.45)***	645	2.20 (1.64)	690	2.45 (1.83)	735	2.75 (2.05)	775	3.00 (2.24)	815	3.25 (2.42)	850	3.50 (2.61)	890	3.80 (2.83)	925	4.10 (3.06)
6400 (3020)	***565***	***1.90 (1.42)***	***615***	***2.15 (1.60)***	660	2.40 (1.79)	705	2.65 (1.98)	745	2.90 (2.16)	785	3.20 (2.39)	825	3.45 (2.57)	860	3.70 (2.76)	895	4.00 (2.98)	930	4.30 (3.21)
6500 (3065)	***570***	***1.95 (1.45)***	***620***	***2.20 (1.64)***	665	2.50 (1.87)	710	2.75 (2.05)	750	3.00 (2.24)	790	3.30 (2.46)	830	3.55 (2.65)	865	3.85 (2.87)	900	4.10 (3.06)	935	4.40 (3.28)
6600 (3115)	***580***	***2.05 (1.53)***	***625***	***2.30 (1.72)***	670	2.55 (1.90)	715	2.85 (2.13)	755	3.10 (2.31)	795	3.40 (2.54)	830	3.65 (2.72)	870	3.95 (2.95)	905	4.25 (3.17)	940	4.55 (3.39)
6700 (3160)	***585***	***2.15 (1.60)***	***635***	***2.40 (1.79)***	680	2.70 (2.01)	720	2.95 (2.20)	760	3.20 (2.39)	800	3.50 (2.61)	835	3.75 (2.80)	875	4.05 (3.02)	910	4.35 (3.25)	945	4.65 (3.47)
6800 (3210)	***595***	***2.25 (1.68)***	***640***	***2.50 (1.87)***	685	2.75 (2.05)	725	3.05 (2.28)	765	3.30 (2.46)	805	3.60 (2.69)	840	3.85 (2.87)	880	4.20 (3.13)	915	4.50 (3.36)	945	4.75 (3.54)
6900 (3255)	***600***	***2.30 (1.72)***	645	2.55 (1.90)	690	2.85 (2.13)	730	3.10 (2.31)	770	3.40 (2.54)	810	3.70 (2.76)	845	3.95 (2.95)	885	4.30 (3.21)	915	4.55 (3.39)	950	4.85 (3.62)
7000 (3305)	***610***	***2.40 (1.79)***	655	2.70 (2.01)	695	2.95 (2.20)	740	3.25 (2.42)	775	3.50 (2.61)	815	3.80 (2.83)	850	4.10 (3.06)	885	4.40 (3.28)	920	4.70 (3.51)	955	5.00 (3.73)
7100 (3350)	***615***	***2.50 (1.87)***	660	2.80 (2.09)	705	3.10 (2.31)	745	3.35 (2.50)	785	3.65 (2.72)	820	3.95 (2.95)	855	4.20 (3.13)	890	4.50 (3.36)	925	4.80 (3.58)	960	5.15 (3.84)
7200 (3400)	***625***	***2.60 (1.94)***	665	2.85 (2.13)	710	3.20 (2.39)	750	3.45 (2.57)	790	3.75 (2.80)	825	4.05 (3.02)	860	4.35 (3.25)	895	4.65 (3.47)	930	4.95 (3.69)	965	5.30 (3.95)

BLOWER DATA GCS16-240

BLOWER TABLE INCLUDES RESISTANCE FOR BASE UNIT ONLY WITH DRY INDOOR COIL & AIR FILTERS IN PLACE.
FOR ALL UNITS ADD:
1 - Wet indoor coil air resistance of selected unit.
2 - Any field installed accessories air resistance (economizer, duct resistance, diffuser, etc.)
Then determine from blower table blower motor output.

BOLD ITALIC INDICATES FIELD FURNISHED DRIVE

Air Volume cfm (L/s)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge (Pa)																			
	.20 (50)		.40 (100)		.60 (150)		.80 (200)		1.00 (250)		1.20 (300)		1.40 (350)		1.60 (400)		1.80 (450)		2.00 (495)	
	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)
6000 (2830)	***565***	***1.65 (1.23)***	***620***	***1.95 (1.45)***	***670***	***2.20 (1.64)***	***720***	***2.50 (1.87)***	765	2.75 (2.05)	810	3.05 (2.28)	850	3.35 (2.50)	890	3.65 (2.72)	930	3.95 (2.95)	965	4.25 (3.17)
6100 (2880)	***575***	***1.75 (1.31)***	***625***	***2.00 (1.49)***	***675***	***2.25 (1.68)***	***725***	***2.55 (1.90)***	770	2.85 (2.13)	815	3.15 (2.35)	855	3.45 (2.57)	895	3.75 (2.80)	930	4.05 (3.02)	970	4.40 (3.28)
6200 (2925)	***580***	***1.80 (1.34)***	***635***	***2.10 (1.57)***	***685***	***2.40 (1.79)***	***730***	***2.65 (1.98)***	775	2.95 (2.20)	820	3.25 (2.42)	860	3.55 (2.65)	900	3.85 (2.87)	935	4.15 (3.10)	975	4.50 (3.36)
6300 (2975)	***590***	***1.90 (1.42)***	***640***	***2.20 (1.64)***	***690***	***2.45 (1.83)***	***735***	***2.75 (2.05)***	780	3.05 (2.28)	825	3.35 (2.50)	865	3.65 (2.72)	900	3.95 (2.95)	940	4.25 (3.17)	975	4.60 (3.43)
6400 (3020)	***595***	***2.00 (1.49)***	***650***	***2.30 (1.72)***	***695***	***2.55 (1.90)***	***740***	***2.85 (2.13)***	785	3.15 (2.35)	830	3.45 (2.57)	870	3.75 (2.80)	905	4.05 (3.02)	945	4.40 (3.28)	980	4.70 (3.51)
6500 (3065)	***605***	***2.10 (1.57)***	***655***	***2.35 (1.75)***	***700***	***2.65 (1.98)***	***750***	***2.95 (2.20)***	790	3.25 (2.42)	835	3.55 (2.65)	875	3.85 (2.87)	910	4.15 (3.10)	950	4.50 (3.36)	985	4.85 (3.62)
6600 (3115)	***610***	***2.15 (1.60)***	***660***	***2.45 (1.83)***	***710***	***2.75 (2.05)***	***755***	***3.05 (2.28)***	795	3.35 (2.50)	840	3.65 (2.72)	880	4.00 (2.98)	915	4.30 (3.21)	955	4.65 (3.47)	990	4.95 (3.69)
6700 (3160)	***620***	***2.25 (1.68)***	***670***	***2.55 (1.90)***	***715***	***2.85 (2.13)***	***760***	***3.15 (2.35)***	805	3.45 (2.57)	845	3.75 (2.80)	885	4.10 (3.06)	920	4.40 (3.28)	960	4.75 (3.54)	995	5.10 (3.80)
6800 (3210)	***630***	***2.35 (1.75)***	***675***	***2.65 (1.98)***	***720***	***2.95 (2.20)***	765	3.25 (2.42)	810	3.55 (2.65)	850	3.90 (2.91)	890	4.20 (3.13)	925	4.50 (3.36)	965	4.90 (3.66)	1000	5.25 (3.92)
6900 (3255)	***635***	***2.45 (1.83)***	***685***	***2.75 (2.05)***	***730***	***3.05 (2.28)***	770	3.35 (2.50)	815	3.70 (2.76)	855	4.00 (2.98)	895	4.35 (3.25)	930	4.65 (3.47)	965	4.95 (3.69)	1005	5.35 (3.99)
7000 (3305)	***645***	***2.55 (1.90)***	***690***	***2.85 (2.13)***	***735***	***3.15 (2.35)***	780	3.50 (2.61)	820	3.80 (2.83)	860	4.10 (3.06)	900	4.45 (3.32)	935	4.75 (3.54)	970	5.10 (3.80)	1005	5.45 (4.07)
7100 (3350)	***650***	***2.65 (1.98)***	***700***	***2.95 (2.20)***	***740***	***3.25 (2.42)***	785	3.60 (2.69)	825	3.90 (2.91)	865	4.25 (3.17)	905	4.60 (3.43)	940	4.90 (3.66)	975	5.25 (3.92)	1010	5.60 (4.18)
7200 (3400)	***660***	***2.75 (2.05)***	***705***	***3.05 (2.28)***	***750***	***3.40 (2.54)***	790	3.70 (2.76)	830	4.00 (2.98)	870	4.35 (3.25)	910	4.70 (3.51)	945	5.05 (3.77)	980	5.35 (3.99)	1015	5.75 (4.29)
7300 (3445)	***665***	***2.85 (2.13)***	***710***	***3.15 (2.35)***	***755***	***3.50 (2.61)***	800	3.85 (2.87)	840	4.15 (3.10)	875	4.45 (3.32)	915	4.85 (3.62)	950	5.15 (3.84)	985	5.50 (4.10)	1020	5.90 (4.40)
7400 (3490)	***675***	***3.00 (2.24)***	***720***	***3.30 (2.46)***	765	3.65 (2.72)	805	3.95 (2.95)	845	4.30 (3.21)	885	4.65 (3.47)	920	4.95 (3.69)	955	5.30 (3.95)	990	5.65 (4.21)	1025	6.00 (4.48)
7500 (3540)	***680***	***3.05 (2.28)***	***725***	***3.40 (2.54)***	770	3.75 (2.80)	810	4.05 (3.02)	850	4.40 (3.28)	890	4.75 (3.54)	925	5.10 (3.80)	960	5.45 (4.07)	995	5.80 (4.33)	1030	6.15 (4.59)
7600 (3585)	***690***	***3.20 (2.39)***	***735***	***3.55 (2.65)***	775	3.85 (2.87)	820	4.20 (3.13)	855	4.50 (3.36)	895	4.90 (3.66)	930	5.20 (3.88)	965	5.55 (4.14)	1000	5.95 (4.44)	1035	6.35 (4.74)
7700 (3635)	***700***	***3.35 (2.50)***	***740***	***3.65 (2.72)***	785	4.00 (2.98)	825	4.35 (3.25)	865	4.70 (3.51)	900	5.00 (3.73)	935	5.35 (3.99)	970	5.70 (4.25)	1005	6.10 (4.55)	1040	6.50 (4.85)
7800 (3680)	***705***	***3.45 (2.57)***	***750***	***3.80 (2.83)***	790	4.10 (3.06)	830	4.45 (3.32)	870	4.80 (3.58)	905	5.15 (3.84)	945	5.55 (4.14)	980	5.90 (4.40)	1010	6.25 (4.66)	1045	6.65 (4.96)
7900 (3730)	***715***	***3.60 (2.69)***	***755***	***3.90 (2.91)***	800	4.25 (3.17)	835	4.60 (3.43)	875	4.95 (3.69)	910	5.30 (3.95)	950	5.70 (4.25)	985	6.05 (4.51)	1015	6.40 (4.77)	1050	6.80 (5.07)
8000 (3775)	***720***	***3.70 (2.76)***	765	4.05 (3.02)	805	4.40 (3.28)	845	4.75 (3.54)	880	5.10 (3.80)	920	5.45 (4.07)	955	5.85 (4.36)	990	6.20 (4.63)	1020	6.55 (4.89)	1055	6.95 (5.18)
8100 (3820)	***730***	***3.85 (2.87)***	770	4.15 (3.10)	810	4.50 (3.36)	850	4.90 (3.66)	890	5.25 (3.92)	925	5.60 (4.18)	960	6.00 (4.48)	995	6.35 (4.74)	1030	6.75 (5.04)	1060	7.10 (5.30)
8200 (3870)	***740***	***4.00 (2.98)***	780	4.30 (3.21)	820	4.70 (3.51)	855	5.00 (3.73)	895	5.40 (4.03)	930	5.75 (4.29)	965	6.15 (4.59)	1000	6.50 (4.85)	1035	6.95 (5.18)	1065	7.30 (5.45)
8300 (3915)	***745***	***4.10 (3.06)***	785	4.45 (3.32)	825	4.80 (3.58)	865	5.20 (3.88)	900	5.55 (4.14)	935	5.90 (4.40)	970	6.30 (4.70)	1005	6.70 (5.00)	1040	7.10 (5.30)	1070	7.45 (5.56)
8400 (3965)	***755***	***4.25 (3.17)***	795	4.60 (3.43)	835	5.00 (3.73)	870	5.30 (3.95)	910	5.75 (4.29)	945	6.10 (4.55)	980	6.50 (4.85)	1010	6.85 (5.11)	1045	7.25 (5.41)	1075	7.65 (5.71)
8500 (4010)	***760***	***4.40 (3.28)***	800	4.75 (3.54)	840	5.10 (3.80)	880	5.50 (4.10)	915	5.90 (4.40)	950	6.25 (4.66)	985	6.65 (4.96)	1015	7.00 (5.22)	1050	7.45 (5.56)	1080	7.80 (5.82)
8600 (4060)	***770***	***4.55 (3.39)***	810	4.90 (3.66)	850	5.30 (3.95)	885	5.65 (4.21)	920	6.00 (4.48)	955	6.40 (4.77)	990	6.80 (5.07)	1025	7.25 (5.41)	1055	7.60 (5.67)	1085	8.00 (5.97)
8700 (4105)	***780***	***4.70 (3.51)***	815	5.05 (3.77)	855	5.45 (4.07)	890	5.80 (4.33)	925	6.15 (4.59)	960	6.55 (4.89)	995	6.95 (5.18)	1030	7.40 (5.52)	1060	7.80 (5.82)	1090	8.15 (6.08)
8800 (4155)	***785***	***4.85 (3.62)***	825	5.20 (3.88)	860	5.60 (4.18)	900	6.00 (4.48)	935	6.40 (4.77)	970	6.80 (5.07)	1000	7.15 (5.33)	1035	7.55 (5.63)	1065	7.95 (5.93)	1095	8.35 (6.23)
8900 (4200)	***795***	***5.00 (3.73)***	830	5.35 (3.99)	870	5.75 (4.29)	905	6.15 (4.59)	940	6.55 (4.89)	975	6.95 (5.18)	1010	7.35 (5.48)	1040	7.75 (5.78)	1070	8.15 (6.08)	1105	8.60 (6.42)
9000 (4245)	***800***	***5.15 (3.84)***	840	5.55 (4.14)	875	5.90 (4.40)	910	6.30 (4.70)	950	6.75 (5.04)	980	7.10 (5.30)	1015	7.55 (5.63)	1045	7.90 (5.89)	1080	8.40 (6.27)	***1110***	***8.80 (6.56)***

BLOWER DATA CHA16-240

BLOWER TABLE INCLUDES RESISTANCE FOR BASE UNIT ONLY WITH DRY INDOOR COIL & AIR FILTERS IN PLACE.
FOR ALL UNITS ADD:

1 - Wet indoor coil air resistance of selected unit. 2 - Any field installed accessories air resistance (electric heat, economizer, duct resistance, diffuser, etc.)
Then determine from blower table blower motor output.

MINIMUM AIR VOLUME REQUIRED FOR USE WITH OPTIONAL ELECTRIC HEAT

- Units require 4900 cfm (2310 L/s) minimum air with electric heat.

BOLD ITALIC INDICATES FIELD FURNISHED DRIVE

Air Volume cfm (L/s)	STATIC PRESSURE EXTERNAL TO UNIT — Inches Water Gauge (Pa)																					
	.20 (50)		.40 (100)		.60 (150)		.80 (200)		1.00 (250)		1.20 (300)		1.40 (350)		1.60 (400)		1.80 (450)		2.00 (495)	
	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)	RPM	BHP (kW)
6000 (2830)	***560***	***1.70 (1.27)***	***610***	***1.95 (1.45)***	***660***	***2.20 (1.64)***	***710***	***2.45 (1.83)***	***755***	***2.75 (2.05)***	795	3.00 (2.24)	840	3.30 (2.46)	880	3.60 (2.69)	915	3.85 (2.87)	955	4.20 (3.13)
6100 (2880)	***565***	***1.75 (1.31)***	***620***	***2.05 (1.53)***	***670***	***2.30 (1.72)***	***715***	***2.55 (1.90)***	***760***	***2.85 (2.13)***	800	3.10 (2.31)	845	3.40 (2.54)	885	3.70 (2.76)	920	3.95 (2.95)	955	4.25 (3.17)
6200 (2925)	***575***	***1.85 (1.38)***	***625***	***2.10 (1.57)***	***675***	***2.35 (1.75)***	***720***	***2.65 (1.98)***	765	2.90 (2.16)	805	3.20 (2.39)	850	3.50 (2.61)	885	3.75 (2.80)	925	4.10 (3.06)	960	4.40 (3.28)
6300 (2975)	***580***	***1.90 (1.42)***	***635***	***2.20 (1.64)***	***680***	***2.45 (1.83)***	***725***	***2.75 (2.05)***	770	3.00 (2.24)	815	3.30 (2.46)	850	3.60 (2.69)	890	3.90 (2.91)	930	4.20 (3.13)	965	4.50 (3.36)
6400 (3020)	***590***	***2.00 (1.49)***	***640***	***2.30 (1.72)***	***685***	***2.55 (1.90)***	***735***	***2.85 (2.13)***	775	3.10 (2.31)	820	3.45 (2.57)	855	3.70 (2.76)	895	4.00 (2.98)	935	4.35 (3.25)	970	4.65 (3.47)
6500 (3065)	***595***	***2.10 (1.57)***	***645***	***2.35 (1.75)***	***695***	***2.65 (1.98)***	***740***	***2.95 (2.20)***	780	3.20 (2.39)	825	3.55 (2.65)	860	3.80 (2.83)	900	4.10 (3.06)	940	4.45 (3.32)	975	4.75 (3.54)
6600 (3115)	***605***	***2.20 (1.64)***	***655***	***2.45 (1.83)***	***700***	***2.75 (2.05)***	***745***	***3.05 (2.28)***	785	3.30 (2.46)	830	3.65 (2.72)	865	3.90 (2.91)	905	4.25 (3.17)	940	4.55 (3.39)	975	4.85 (3.62)
6700 (3160)	***610***	***2.25 (1.68)***	***660***	***2.55 (1.90)***	***705***	***2.85 (2.13)***	***750***	***3.15 (2.35)***	795	3.45 (2.57)	835	3.75 (2.80)	870	4.00 (2.98)	910	4.35 (3.25)	945	4.65 (3.47)	980	4.95 (3.69)
6800 (3210)	***620***	***2.35 (1.75)***	***665***	***2.65 (1.98)***	***715***	***2.95 (2.20)***	***755***	***3.25 (2.42)***	800	3.55 (2.65)	840	3.85 (2.87)	880	4.20 (3.13)	915	4.50 (3.36)	950	4.80 (3.58)	985	5.10 (3.80)
6900 (3255)	***625***	***2.45 (1.83)***	***675***	***2.75 (2.05)***	***720***	***3.05 (2.28)***	765	3.35 (2.50)	805	3.65 (2.72)	845	3.95 (2.95)	885	4.30 (3.21)	920	4.60 (3.43)	955	4.90 (3.66)	990	5.25 (3.92)
7000 (3305)	***635***	***2.55 (1.90)***	***680***	***2.85 (2.13)***	***725***	***3.15 (2.35)***	770	3.45 (2.57)	810	3.75 (2.80)	850	4.10 (3.06)	890	4.40 (3.28)	925	4.75 (3.54)	960	5.05 (3.77)	995	5.40 (4.03)
7100 (3350)	***640***	***2.65 (1.98)***	***690***	***3.00 (2.24)***	***735***	***3.30 (2.46)***	775	3.60 (2.69)	815	3.90 (2.91)	855	4.20 (3.13)	895	4.55 (3.39)	930	4.85 (3.62)	965	5.20 (3.88)	1000	5.55 (4.14)
7200 (3400)	***650***	***2.80 (2.09)***	***695***	***3.05 (2.28)***	***740***	***3.40 (2.54)***	780	3.70 (2.76)	820	4.00 (2.98)	860	4.35 (3.25)	900	4.70 (3.51)	935	5.00 (3.73)	970	5.35 (3.99)	1005	5.65 (4.21)
7300 (3445)	***655***	***2.85 (2.13)***	***705***	***3.20 (2.39)***	***745***	***3.50 (2.61)***	790	3.85 (2.87)	830	4.15 (3.10)	865	4.45 (3.32)	905	4.80 (3.58)	940	5.15 (3.84)	975	5.45 (4.07)	1010	5.80 (4.33)
7400 (3490)	***665***	***3.00 (2.24)***	***710***	***3.30 (2.46)***	***755***	***3.65 (2.72)***	795	3.95 (2.95)	835	4.30 (3.21)	870	4.60 (3.43)	910	4.95 (3.69)	945	5.25 (3.92)	980	5.60 (4.18)	1015	5.95 (4.44)
7500 (3540)	***675***	***3.10 (2.31)***	***715***	***3.40 (2.54)***	***760***	***3.75 (2.80)***	800	4.05 (3.02)	840	4.40 (3.28)	880	4.75 (3.54)	915	5.05 (3.77)	950	5.40 (4.03)	985	5.75 (4.29)	1020	6.10 (4.55)
7600 (3585)	***680***	***3.20 (2.39)***	***725***	***3.55 (2.65)***	765	3.85 (2.87)	805	4.20 (3.13)	845	4.50 (3.36)	885	4.90 (3.66)	920	5.20 (3.88)	955	5.55 (4.14)	990	5.90 (4.40)	1020	6.20 (4.63)
7700 (3635)	***690***	***3.35 (2.50)***	***730***	***3.65 (2.72)***	775	4.00 (2.98)	815	4.35 (3.25)	850	4.65 (3.47)	890	5.00 (3.73)	925	5.35 (3.99)	960	5.70 (4.25)	995	6.05 (4.51)	1025	6.40 (4.77)
7800 (3680)	***695***	***3.45 (2.57)***	***740***	***3.80 (2.83)***	780	4.15 (3.10)	820	4.45 (3.32)	860	4.80 (3.58)	895	5.15 (3.84)	930	5.50 (4.10)	965	5.85 (4.36)	1000	6.20 (4.63)	1030	6.55 (4.89)
7900 (3730)	***705***	***3.60 (2.69)***	***745***	***3.90 (2.91)***	785	4.25 (3.17)	825	4.60 (3.43)	865	4.95 (3.69)	900	5.30 (3.95)	935	5.65 (4.21)	970	6.00 (4.48)	1005	6.35 (4.74)	1035	6.70 (5.00)
8000 (3775)	***710***	***3.70 (2.76)***	***755***	***4.05 (3.02)***	795	4.40 (3.28)	835	4.75 (3.54)	870	5.10 (3.80)	905	5.45 (4.07)	940	5.80 (4.33)	975	6.15 (4.59)	1010	6.50 (4.85)	1040	6.85 (5.11)
8100 (3820)	***720***	***3.85 (2.87)***	***760***	***4.20 (3.13)***	800	4.55 (3.39)	840	4.90 (3.66)	875	5.25 (3.92)	915	5.60 (4.18)	950	6.00 (4.48)	980	6.30 (4.70)	1015	6.70 (5.00)	1045	7.05 (5.26)
8200 (3870)	***730***	***4.00 (2.98)***	770	4.35 (3.25)	810	4.70 (3.51)	845	5.05 (3.77)	885	5.40 (4.03)	920	5.75 (4.29)	955	6.15 (4.59)	985	6.45 (4.81)	1020	6.85 (5.11)	1050	7.20 (5.37)
8300 (3915)	***735***	***4.15 (3.10)***	775	4.45 (3.32)	815	4.85 (3.62)	855	5.20 (3.88)	890	5.55 (4.14)	925	5.90 (4.40)	960	6.30 (4.70)	995	6.65 (4.96)	1025	7.00 (5.22)	1055	7.35 (5.48)
8400 (3965)	***745***	***4.30 (3.21)***	785	4.65 (3.47)	825	5.00 (3.73)	860	5.35 (3.99)	895	5.70 (4.25)	930	6.05 (4.51)	965	6.45 (4.81)	1000	6.85 (5.11)	1030	7.20 (5.37)	1065	7.60 (5.67)
8500 (4010)	***750***	***4.40 (3.28)***	790	4.75 (3.54)	830	5.15 (3.84)	865	5.50 (4.10)	900	5.85 (4.36)	940	6.25 (4.66)	970	6.60 (4.92)	1005	7.00 (5.22)	1035	7.35 (5.48)	1070	7.80 (5.82)
8600 (4060)	***760***	***4.60 (3.43)***	800	4.95 (3.69)	835	5.30 (3.95)	875	5.70 (4.25)	910	6.05 (4.51)	945	6.45 (4.81)	975	6.75 (5.04)	1010	7.15 (5.33)	1040	7.55 (5.63)	1075	7.95 (5.93)
8700 (4105)	***765***	***4.70 (3.51)***	805	5.10 (3.80)	845	5.45 (4.07)	880	5.85 (4.36)	915	6.20 (4.63)	950	6.60 (4.92)	985	7.00 (5.22)	1015	7.35 (5.48)	1045	7.70 (5.74)	1080	8.15 (6.08)
8800 (4155)	775	4.90 (3.66)	815	5.25 (3.92)	850	5.60 (4.18)	885	6.00 (4.48)	920	6.35 (4.74)	955	6.75 (5.04)	990	7.15 (5.33)	1020	7.50 (5.60)	1055	7.95 (5.93)	1085	8.35 (6.23)
8900 (4200)	785	5.05 (3.77)	820	5.40 (4.03)	860	5.80 (4.33)	895	6.20 (4.63)	930	6.55 (4.89)	960	6.90 (5.15)	995	7.35 (5.48)	1025	7.70 (5.74)	1060	8.15 (6.08)	1090	8.55 (6.38)
9000 (4245)	790	5.20 (3.88)	830	5.60 (4.18)	865	5.95 (4.44)	900	6.35 (4.74)	935	6.75 (5.04)	970	7.15 (5.33)	1000	7.50 (5.60)	1035	7.95 (5.93)	1065	8.30 (6.19)	***1095***	***8.70 (6.49)***

BLOWER DATA GCS/CHA16

ACCESSORY AIR RESISTANCE

Unit Model No.	Air Volume		Total Resistance - inches water gauge (Pa)						
			Wet Evaporator Coil	Electric Heat	REMD16M Down-Flow Economizer	RTD11 Step-Down Diffuser			FD11 Flush Diffuser
	cfm	L/s				2 Ends Open	1 Side 2 Ends Open	All Ends & Sides Open	
GCS/ CHA16-180	4800	2265	.14 (35)	.15 (37)	.03 (7)	.46 (114)	.40 (99)	.36 (90)	.24 (60)
	5000	2360	.14 (35)	.17 (42)	.03 (7)	.51 (127)	.44 (109)	.39 (97)	.27 (67)
	5200	2455	.15 (37)	.20 (50)	.03 (7)	.56 (139)	.48 (119)	.42 (104)	.30 (75)
	5400	2550	.16 (40)	.22 (55)	.04 (10)	.61 (152)	.52 (129)	.45 (112)	.33 (82)
	5600	2645	.17 (42)	.22 (55)	.04 (10)	.66 (164)	.56 (139)	.48 (119)	.36 (90)
	5800	2735	.18 (45)	.25 (62)	.05 (12)	.71 (177)	.59 (147)	.51 (127)	.39 (97)
	6000	2830	.19 (47)	.26 (64)	.05 (12)	.76 (189)	.63 (157)	.55 (137)	.42 (104)
	6200	2925	.20 (50)	.29 (72)	.05 (12)	.80 (199)	.68 (169)	.59 (147)	.46 (114)
	6400	3020	.21 (52)	.31 (77)	.06 (15)	.86 (214)	.72 (179)	.63 (157)	.50 (124)
	6600	3115	.22 (55)	.32 (80)	.06 (15)	.92 (229)	.77 (191)	.67 (167)	.54 (134)
	6800	3210	.23 (57)	.33 (82)	.07 (17)	.99 (246)	.83 (206)	.72 (174)	.58 (144)
	7000	3305	.24 (60)	.33 (82)	.07 (17)	1.03 (256)	.87 (216)	.76 (189)	.62 (154)
	7200	3400	.25 (62)	.34 (85)	.08 (20)	1.09 (271)	.92 (229)	.80 (199)	.66 (164)
GCS/ CHA16-240	6000	2830	.24 (60)	.26 (64)	.05 (12)	.36 (90)	.31 (77)	.27 (67)	.29 (72)
	6500	3065	.28 (70)	.32 (80)	.06 (15)	.42 (104)	.36 (90)	.31 (77)	.34 (85)
	7000	3305	.31 (77)	.33 (82)	.07 (17)	.49 (122)	.41 (102)	.36 (90)	.40 (99)
	7500	3540	.34 (85)	.40 (99)	.09 (22)	.51 (127)	.46 (114)	.41 (102)	.45 (112)
	8000	3775	.38 (94)	.42 (104)	.10 (25)	.59 (147)	.49 (122)	.43 (107)	.50 (124)
	8500	4010	.42 (104)	.50 (124)	.11 (27)	.69 (172)	.58 (144)	.50 (124)	.57 (142)
	9000	4245	.46 (114)	.58 (144)	.13 (32)	.79 (196)	.67 (167)	.58 (144)	.66 (164)

CEILING DIFFUSER AIR THROW DATA

Model No.	Air Volume		[1] Effective Throw Range			
			RTD11 Step-Down		FD11 Flush	
	cfm	L/s	ft.	m	ft.	m
GCS/CHA 16-180	5600	2645	39 - 49	12 - 15	28 - 37	9 - 11
	5800	2740	42 - 51	13 - 16	29 - 38	9 - 12
	6000	2830	44 - 54	13 - 17	40 - 50	12 - 15
	6200	2925	45 - 55	14 - 17	42 - 51	13 - 16
	6400	3020	46 - 55	14 - 17	43 - 52	13 - 16
	6600	3115	47 - 56	14 - 17	45 - 56	14 - 17
GCS/CHA 16-240	7200	3400	33 - 38	10 - 12	26 - 35	8 - 11
	7400	3490	35 - 40	11 - 12	28 - 37	9 - 11
	7600	3585	36- 41	11 - 13	29 - 38	9 - 12
	7800	3680	38 - 43	11 - 13	40 - 50	12 - 15
	8000	3775	39 - 44	12 - 13	42 - 51	13 - 16
	8200	3870	41 - 46	12 - 14	43 - 52	13 - 16
	8400	3965	43 - 49	13 - 15	44 - 54	13 - 17
	8600	4060	44 - 50	13 - 15	46 - 57	14 - 17
	8800	4155	47 - 55	14 - 17	48 - 59	15 - 18

[1] 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. (15 m) per minute. Four sides open.

PED16-18/24 POWER EXHAUST FANS PERFORMANCE

Model No.	Air Volume		Return Air System Static Pressure	
	cfm	L/s	In. w.g.	Pa
PED16-18/24	6000	2830	0	0
	5700	2690	.05	12
	5300	2500	.10	25
	5000	2360	.15	37
	4700	2210	.20	50
	4200	1980	.25	62
	3600	1700	.30	75

OPTIONAL ACCESSORIES

Item			GCS/CHA16-180	GCS/CHA16-240
Coil Guard - PVC coated steel wire guards to protect outdoor coil. Not used with Hail Guards.			**78L49**	
Control Systems			See Engineering Handbook	
Differential Enthalpy Control - For use with economizer dampers, solid-state return air sensor allows selection between outdoor air and return air (whichever has lowest enthalpy).			**54G44**	
Diffusers (Step-Down) - Aluminum grilles, double deflection louvers, large center grille, insulated diffuser box with flanges, hanging rings furnished, interior transition (even air flow), internally sealed (prevents recirculation), adapts to T-bar ceiling grids or plaster ceilings.			RTD11-185 392 lbs. (178 kg)	RTD11-275 403 lbs. (183 kg)
Diffusers (Flush) - Aluminum grilles, fixed blade louvers, large center grille, insulated diffuser box with flanges, hanging rings furnished, interior transition (even air flow), internally sealed (prevents recirculation), adapts to T-bar ceiling grids or plaster ceilings.			FD11-185 289 lbs. (131 kg)	FD11-275 363 lbs. (165 kg)
Transitions (Supply and Return) - Used with diffusers, installs in roof mounting frame, galvanized steel construction, flanges furnished for duct connection, fully insulated.			SRT16-18 75 lbs. (34 kg)	SRT16-24 120 lbs. (54 kg)
Economizer Dampers (Down-Flow or Horizontal) - Mechanically linked recirculated air and outdoor air dampers, plug-in connections to unit, nylon bearings, stainless steel seals (outdoor dampers), 24 volt fully modulating spring return damper motor, adjustable minimum damper position switch, mixed air sensor, solid-state adjustable outdoor air enthalpy control, 0 to 100% outdoor air adjustable, powdered enamel paint finish. NOTE - Economizer Damper Hood is required and must be ordered separately (see below). NOTE - Gravity Exhaust Dampers are required for down-flow applications and must be ordered separately (see below).		Model No. - Net Wt.	REMD16M-18/24 95 lbs. (43 kg) (order Economizer Damper Hood for complete assembly)	
		Net face area	5.3 sq. ft. (0.49 m^2)	
Economizer Damper Hood - Required with REMD16M economizer dampers (see above). Installs over outdoor air dampers. Includes cleanable aluminum mesh frame filters.		Order No.	**81L45** 36 lbs. (16 kg)	
		No. & Size of Filters - in. (mm)	(2) 25 x 25 x 1 (635 x 635 x 25)	
Economizer Gravity Exhaust Dampers - Required with REMD16 economizer dampers in down-flow applications. Optional for horizontal applications. Neoprene coated fiberglass dampers. Includes rain hood. Field installs on economizer for down-flow applications. Field installs on return air duct for horizontal applications. See dimension drawings.			GED16-18/24 23 lbs. (10 kg)	
Economizer Power Exhaust Fans - For use with REMD16M economizer dampers (see above). Provides pressure relief. Installed between economizer and gravity exhaust dampers (required). Interlocked to run when return air dampers are closed and supply air blowers are operating. Overload protected. Must be ordered separately.		Model No. - Net Wt.	PED16-18/24 80 lbs. (36 kg)	
		Dia. - in. (mm) No. blades	20 (508) - 5	
		Total air volume - cfm (L/s)	6000 (2830)	
		Motor horsepower (W)	(2) - 1/3 (250)	
		Total Watts input	850	
Hail Guards - Heavy duty field installed coil guard protects coils from damage. Not used with Coil Guards.			**78L48**	
Horizontal Supply and Return Air Kit - Provides duct connection to unit, flanges furnished, hardware furnished, two filler panels furnished for unused air openings in unit base.			HDK16-18/24 55 lbs. (25 kg)	
Low Ambient Controls - Allows unit operation down to 0°F (-17.7°C).			LB-57113BY **(85L42)**	
LPG/Propane Kits GCS MODELS ONLY			**81L86**	
Outdoor Air Damper Section (Down-Flow Applications Only) - Linked mechanical dampers, 0 to 25% (fixed) outdoor air adjustable, installs on unit for down-flow applications, outdoor air hood and panel kit must be ordered separately (see below) Minimum mixed air temperature: Heat mode (aluminized heat exchanger) - 45°F (7°C) Maximum mixed air temperature: Cool mode - 90°F (32°C),		Model No.	OAD16-18/24 (Order Air Damper Hood and Damper Panel Kit for complete assembly)	
Outdoor Air Damper/Hood - Cleanable aluminum mesh frame type filter furnished, installs over outdoor air damper section.		Catalog No. - Net Wt.	**81L38** 52 lbs. (24 kg)	
		No. & Size of Filters	(1) 26 x 28 x 1 in. (660 x 711 x 25 mm)	
Electric Heat - Factory or field installed, helix wound nichrome elements, time delay for element staging. individual element limit controls, may be two-stage controlled, requires optional Fuse Block **CHA16 MODELS ONLY**			ECH16-185-15 15 kW (all voltages) ECH16-185/300 30-45-60 kW (all voltages) 75 kW (460/575v)	ECH16-185/300 30-45-60 kW (all voltages) 75 kW (460/575v)
Unit Fuse Block - Required for electric heat installation, wiring harness and mounting screws furnished **CHA16 MODELS ONLY**	208/230v -3 phase	3 hp (2.2 kW)	**84L19** (90 amp)	- - - -
		5 hp (3.7 kW)	**84L19** (90 amp)	**84L24** (110 amp)
		7.5 hp (5.7 kW)	- - - -	**89L37** (125 amp)
	460v - 3 phase	3 hp (2.2 kW)	**84L20** (45 amp)	- - - -
		5 hp (3.7 kW)	**84L22** (50 amp)	**84L22** (50 amp)
		7.5 hp (5.7 kW)	- - - -	**84L22** (50 amp)
	575v - 3 phase	3 hp (2.2 kW)	**84L21** (30 amp)	- - - -
		5 hp (3.7 kW)	**84L23** (35 amp)	**84L25** (40 amp)
		7.5 hp (5.7 kW)	- - - -	**84L24** (45 amp)

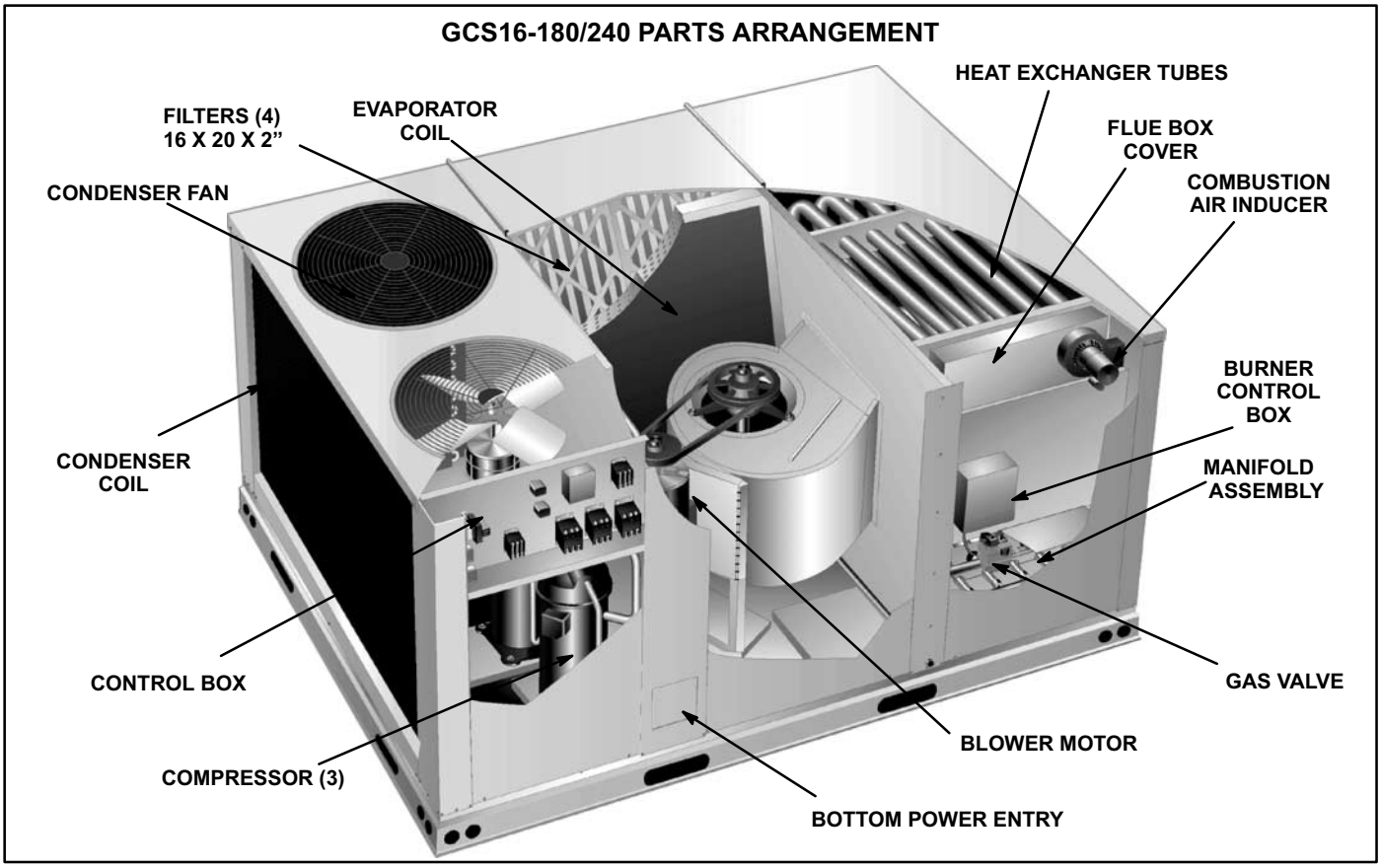


FIGURE 1

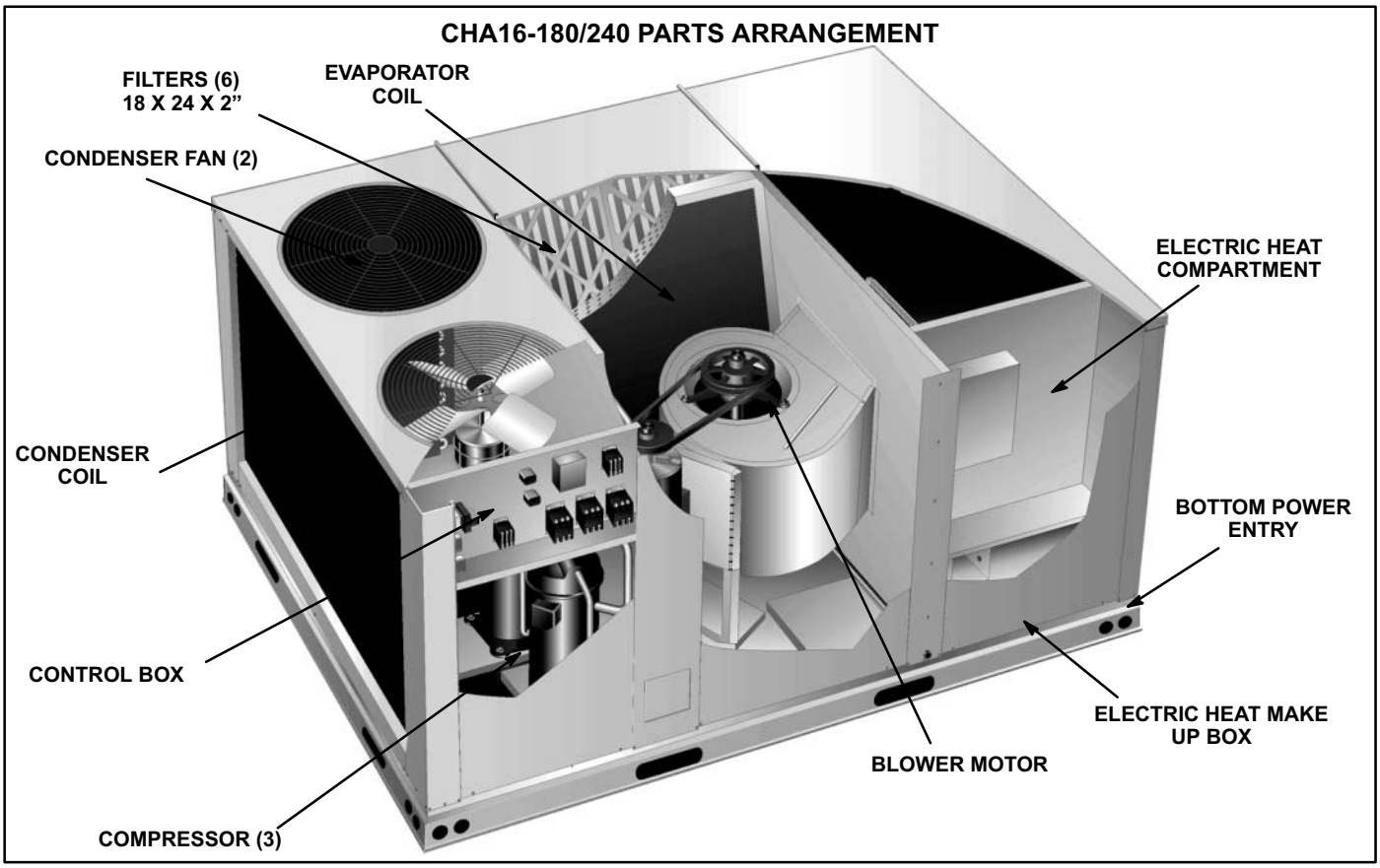


FIGURE 2

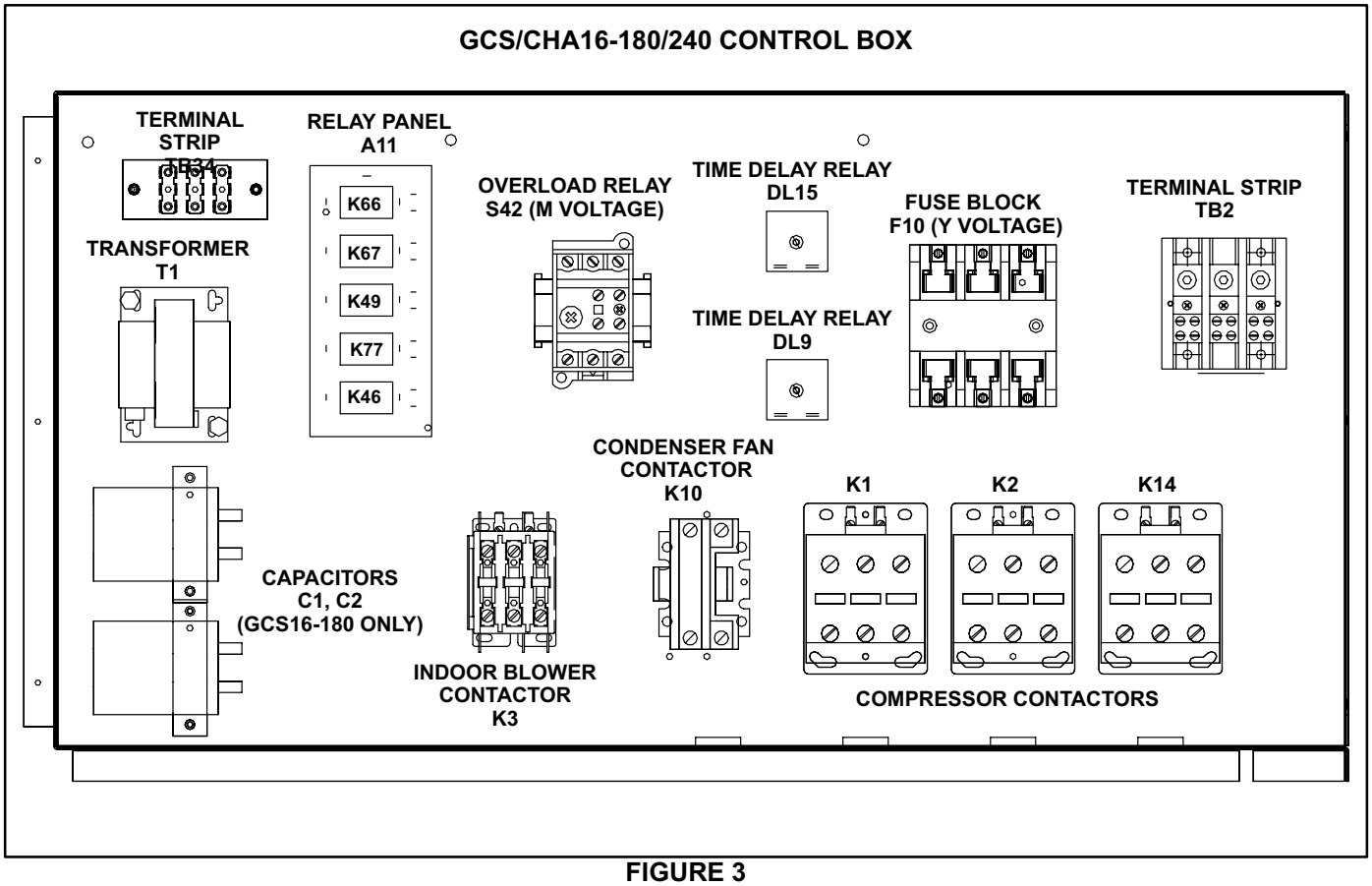


FIGURE 3

I-APPLICATION

GCS/CHA16 15 and 20 ton units are available in one cabinet size. All models are applicable for commercial three phase installations. GCS/CHA16 models are factory equipped with the hardware required for installing Lennox' optional thermostat control systems like the T7300 or T8621D (refer to the Engineering Handbook for more specific application data).

⚠ DANGER

Remove all power to disconnect before servicing.

Electrical shock resulting in death or injury may result if power is not disconnected.

II-UNIT COMPONENTS

See figures 1 and 2 for GCS16 or CHA16-180/240 parts arrangement.

A-Control Box Components

⚠CAUTION

Label all wires prior to disconnection when servicing control box. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

The GCS/CHA16 control box is shown in figure 3. The control box is located in the upper portion of the compressor compartment behind the compressor compartment access panel. Note that the burner ignition control and other components are located in the burner control box, above the manifold assembly.

The condenser fans can be accessed by removing the fan grills located on top of the unit.

The indoor blower access panel (all units) is located to the left side of the heating compartment access.

1 - Transformer T1

All GCS16/CHA-180/240 units use a line voltage to 24VAC transformer mounted in the control box. The transformer supplies power to control circuits in the unit. Transformers are rated at 70VA and is protected by a 3.5 amp circuit breaker (CB8). CB8 is internal to the transformer. Transformers use two primary voltage taps as shown in figure 4.

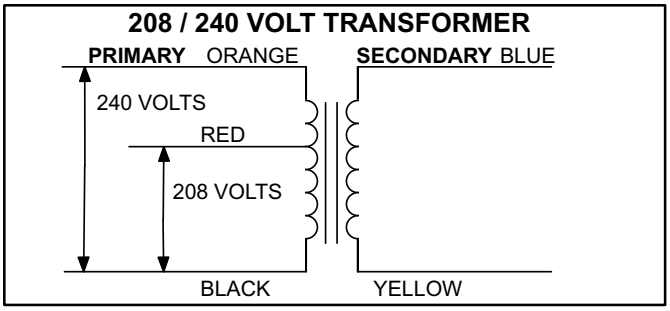


FIGURE 4

2 - Cooling Contactor K1, K2 & K14

K1, K2 and K14, are 24V coil contactors used to energize the compressors in response to thermostat demand. K1 and K2 energize compressors B1 and B2 in response to Y1 first stage cooling demand. K14 energizes compressor B13 in response to Y2 second stage cooling demand. All units use three-pole-double-break contactors.

3 - Compressor Run Time Delay DL15 & DL9

All GCS16 units are equipped with compressor run time delay DL15 (1st stage cool) and DL9 (2nd stage cool). The delay time (approximately 2 seconds) prevents compressors B1, B2 and B13 from energizing simultaneously during a demand for 1st or 2nd stage cool.

4 - Indoor Blower Contactor K3

All GCS16/CHA-180/240 units use a three-pole double break contactor to energize the indoor blower and optional economizer. The coil is energized by blower demand from indoor thermostat terminal "G" (cooling demand or fan switch in "ON" position).

5 - Condenser Fan Contactor K10

K10 is a single pole contactor in -180 units and three pole contactor in -240 units, used to energize condenser fans B4 and B5 in response to thermostat demand.

6 - Condenser Fan Motor Capacitors C1 &C2

Fan capacitors C1 and C2 (GCS16-180 only) are used to assist in start up of condenser fans B4 and B5 respectively. See condenser fan motor nameplate for capacitor ratings.

7 - Condenser Fan Motor Fuse F10

Three line voltage fuses F10 provide overcurrent protection to condenser fans B4 and B5 (and optional power exhaust fans) in all Y voltage GCS16 units. The fuses are rated at 30A.

8 - Terminal Strips TB2, TB13 and TB34

Terminal strips TB13 and TB2 distribute line voltage power to line voltage components in the unit. TB34 distributes 24V power from transformer T1 to the control box components. TB13 is located in the bottom power entry section for GCS units and in the electric heat make up box for CHA units.

9 - Power Exhaust Relay K65

K65 is a N.O. DPDT relay with a 24Vcoil. K65 is used with all units with the optional power exhaust fans. K65 is energized by a mercury switch S39, which is mounted on the economizer intake blades. S39 closes when the damper reaches 50% open. When K65 closes exhaust fans B10 and B11 are energized. K65 is located behind the filter access panel.

10 - Blower Motor Overload Relay S42

The motor relay is used on all M voltage GCS16 units. The relay is connected in line with the blower motor to monitor the current flow to the motor. When the relay senses an overload condition, a set of normally closed contacts open to de-energize the blower motor and terminate 24V supply to TB34.

Relay Panel A11

A11 is a pilot duty relay board that reduces load on the thermostat circuit. Installations with extended thermostat wiring without A11 will have excessive voltage drop affecting start up operation. The following relays: K46, K77, K49,K66 and K67 are a part of this board. If any of these relays fail replace the entire board.

11 - Blower Relay K46

Blower relay K46 is located on relay panel (A11) in the main control box. K46 is energized in response to "G" demand from the indoor thermostat. K46 contacts close energizing indoor blower relay K3.

12 - Heat Relay K77 (1st Stage)

Heat relay K77 is located on the relay panel (A11) in the main control box. K77 is energized in response to 1st stage heat demand W1. K77 contacts close energizing combustion air inducer relay K13 to begin heat operation.

13 - Heat Relay K49 (2nd Stage)

Heat relay K49 is located on the relay panel (A11) in the main control box. K49 is energized in response to 2nd stage heat W2. K49 contacts close energizing DL3 heat delay timer. After 180 seconds DL3 energizes the gas valve on 2nd stage heat.

14 - Cool Relay K66 (1st Stage)

Cool relay K66 is located on the relay panel (A11) in the main control box. K66 is energized in response to 1st stage cool demand Y1. K66 contacts close energizing compressor contactor K1 which in turn energizes compressor B1. Simultaneously, compressor delay DL15 is energized, starting a two second delay. After the delay, compressor contactor K2 is energized which in turn energizes compressor B2.

15 - Cool Relay K67 (2nd Stage)

Cool relay K67 is located on the relay panel (A11) in the main control box. K67 is energized in response to 2nd stage cool demand Y2. K67 contacts close energizing compressor delay DL9. After a two second delay, compressor contactor K14 is energized which in turn energizes compressor B13.

B-Burner Control Box Figure 5
GCS models only

Figure 1 shows the location of the burner control box just above the manifold assembly.

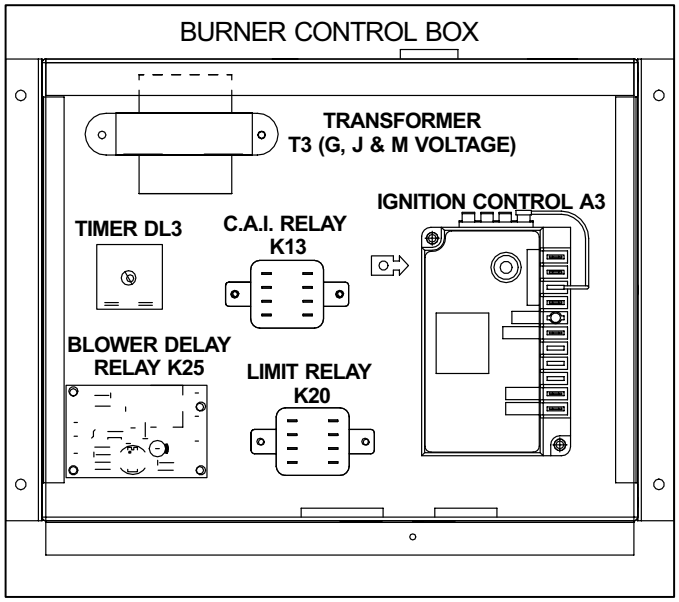


FIGURE 5

1 - Indoor Blower Delay Relay K25

Relay K25 is a printed circuit board located in the burner control box wired in series with the gas valve. K25 is designed to provide an indoor blower delay of 45 seconds on time and 150 seconds off time during a heat demand. When there is a demand for heat, the gas valve will open and the on time delay will begin. When heat demand is satisfied the gas valve will close and the off time will begin.

2 - Combustion Air Inducer Relay K13

Relay K13 is a DPDT relay located inside the control box. K13 is energized by heating demand from the thermostat and is energized throughout the heating demand. When energized, K13 normally open contacts close to energize the combustion air inducer and begin a heating sequence.

3 - Indoor Blower Limit Relay K20

Relay K20 is a DPDT relay located in the burner control box. Relay K20 is wired in series with limit S10 and S21. If either limit opens, K20-1 contacts close energizing blower contactor K3. Simultaneously, K20-2 contacts open de-energizing the gas valve on second stage heat.

4 - Gas Delay DL3

DL3 is a SPST time delay located in the burner control box. Upon receiving increased heat demand, DL3 initiates a 180 second time delay before closing its N.O. contacts. After the delay, DL3 energizes W2 on the gas valve bringing on 2nd. stage heat. DL3 is wired in series with the gas valve and indoor blower limit relay K20.

5 - Transformer T3 (G, J & M Voltage Only)

All GCS16/CHA-180/240 G and J units use one 230VAC transformer mounted in the control box. The transformer has an output rating of 0.5A. T3 transformer supplies 230VAC power to combustion air inducer motor B6.

6 - Ignition Control A3

⚠DANGER

Shock Hazard.

Spark related components contain high voltage. Disconnect power before servicing unit. The ignition control is not field repairable.

Can cause unsafe operation, injury or death.

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions during unit installation and service to protect the electronic controls. Precautions will help to avoid control exposure to electrostatic discharge by putting the unit, the control and the technician at the same electrostatic potential. Neutralize electrostatic charge by touching hand and all tools on an unpainted unit surface, such as the gas valve or blower deck, before performing any service procedure.

ALL GCS16 units are equipped with a Johnson control. See figure 6. The ignition control provides three main functions: gas valve control, ignition, and flame sensing. The unit will usually ignite on the first attempt; however, the ignition attempt sequence provides three trials for ignition before locking out. After one hour, the ignition control automatically resets and provides three more attempts at ignition. Manual reset after lockout requires breaking and remaking power to the ignition control. See figure 7 for ignition sequence with retrials timings.

Flame rectification sensing is used on all GCS16 units. Loss of flame during a heating cycle is indicated by an absence of flame signal. If this happens, the control will immediately restart the ignition sequence and then lock out if ignition is not gained after the third trial. Normal flame signal is 0.5 - 1.0 micro amps with a drop out signal of .09.

The ignition control shuts off gas flow immediately in the event of a 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.

On a heating demand, the combustion air blower is energized. As the combustion air blower nears full speed, the combustion air prove switch S18 closes energizing ignition control A3. The ignition control then has a 30 to 40 second delay to allow the combustion air blower to purge exhaust gases from the

combustion chamber and introduce fresh air. After the delay, the ignition control then activates gas valve, the spark electrode and the flame sensing electrode.

Sparking stops immediately 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.

Spade connections are used to connect the control to the unit. Each of the spade terminals are identified by function. The spark electrode wire connects to the spark-plug-type connector on top of the control.

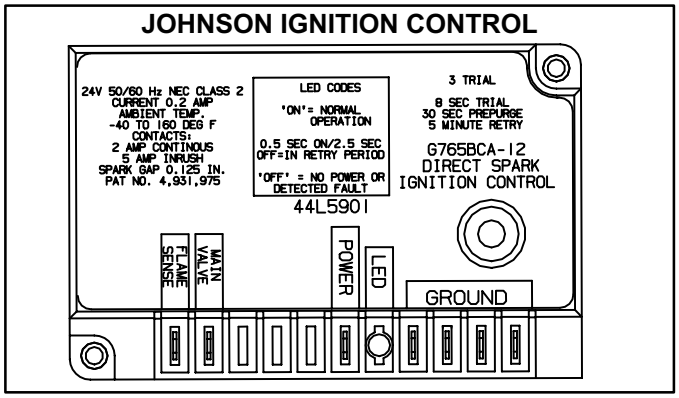


FIGURE 6

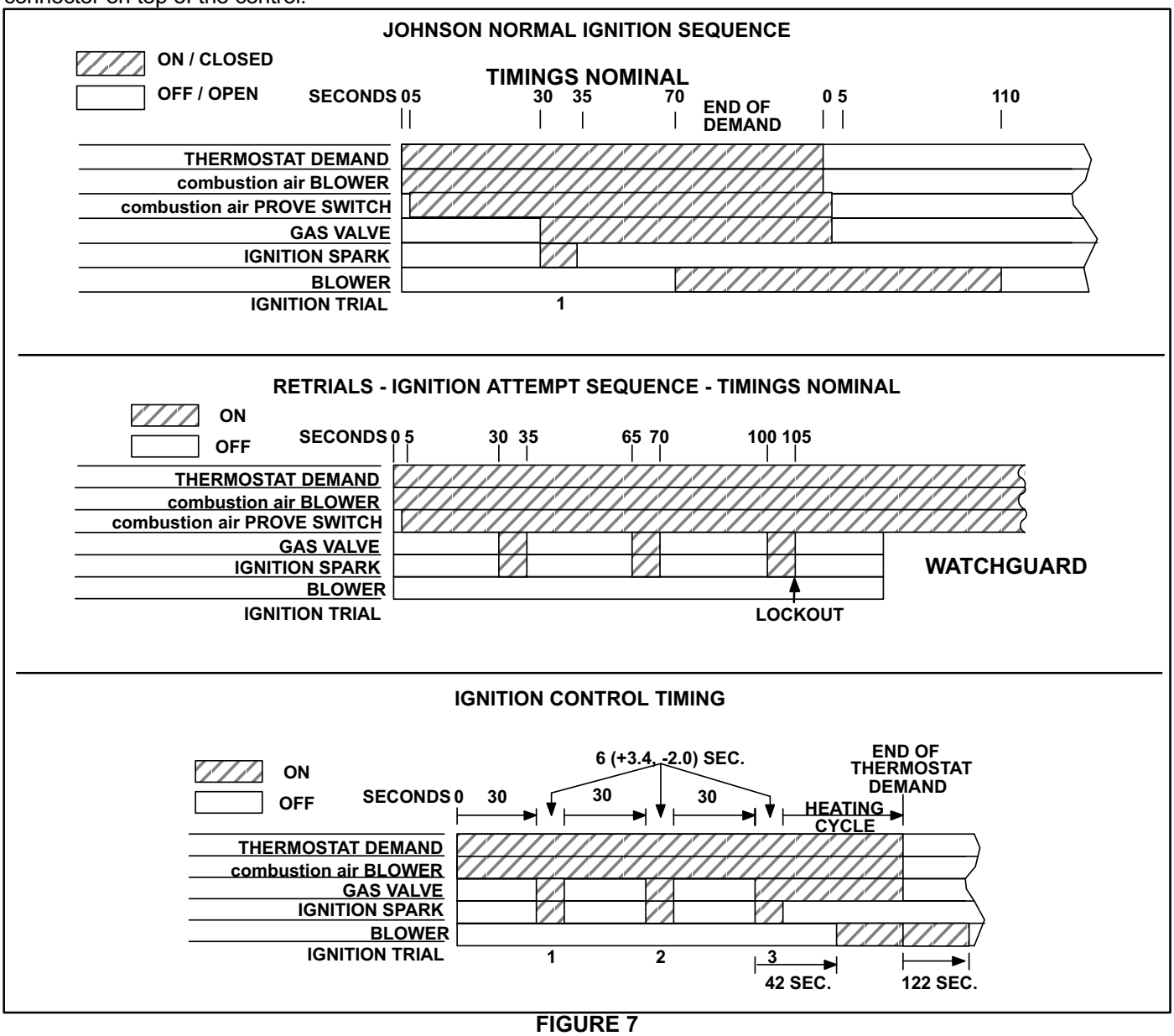


FIGURE 7

GCS16-180/240 HEAT EXCHANGER ASSEMBLY
HIGH INPUT ASSEMBLY SHOWN

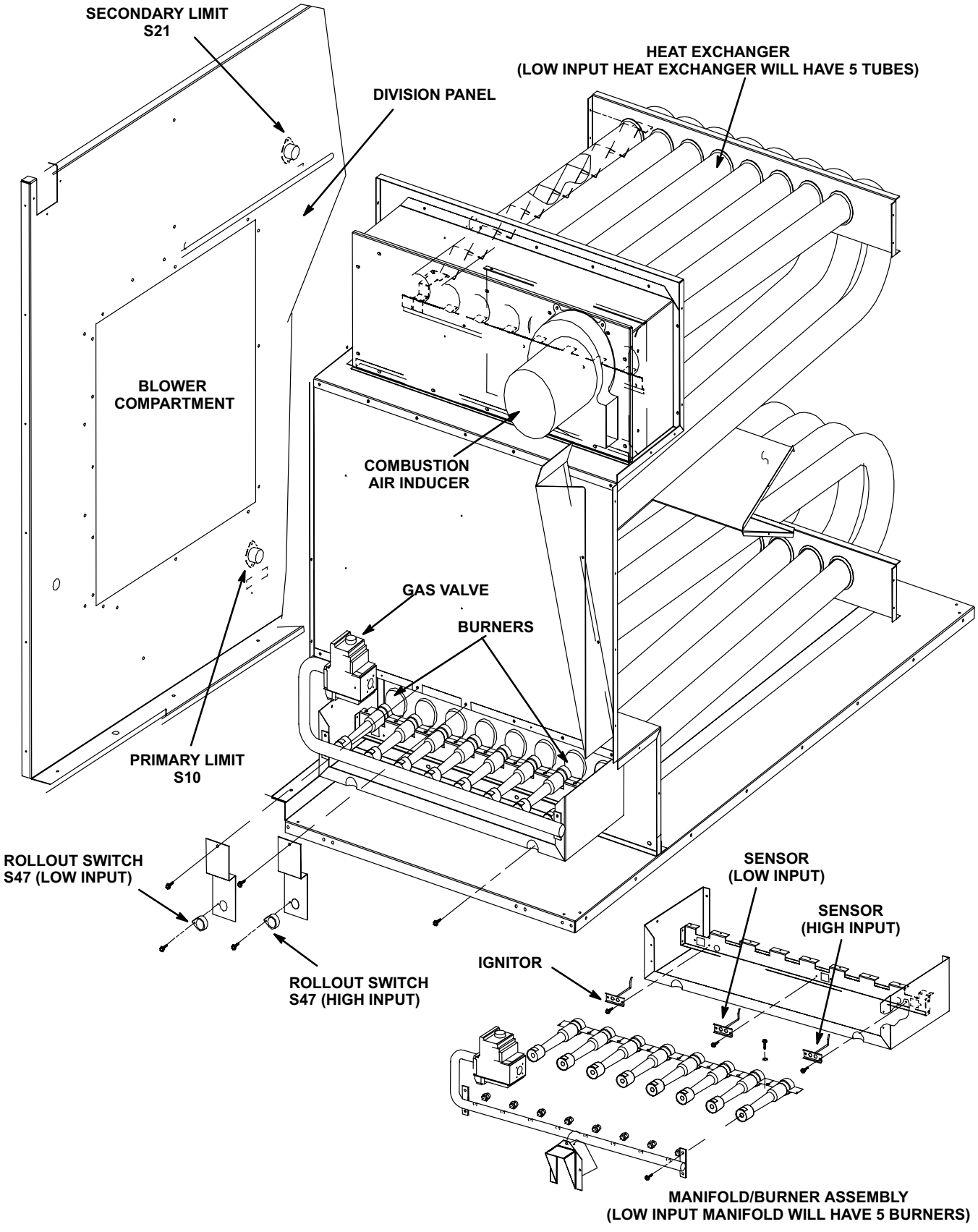


FIGURE 8

C-Gas Heat Components

1 - Heat Exchanger (Figure 8)

All units use an aluminized steel tubular heat exchanger. Each tube has a matching inshot burner. GCS16 low input units will a five tube heat exchanger with matching inshot burners. High input units will have an eight tube heat exchanger with matching burners. Combustion takes place at each tube entrance and is drawn upwards through each tube by the combustion air blower. Heat is transferred from all surfaces of the heat exchanger tubes. The supply air blower, controlled by the ignition control, forces air across all surfaces of the tubes to extract the heat of the combustion. The shape of the tubes ensure maximum heat exchange.

2 - Burner Assembly (Figure 8)

The burners are controlled by the spark electrode, flame sensing electrode, gas valve GV1 and combustion air blower B6. The spark electrode, flame sensing electrode and gas valve GV1 are directly controlled by ignition control A3.

a - Burners

All units use inshot burners. Burners are factory set and do not require adjustment. Units are furnished with a peep hole cover in the access panel for flame viewing. Always operate unit with access panel in place. Burners can be individually removed for service. Burner maintenance and service is detailed in the MAINTENANCE section of this manual.

b - Orifice

Each burner uses an orifice which is matched to the burner input. The orifice is threaded into the 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 for correct sizing.

3 - Flame Rollout Switch S47 (figure 9)

Flame rollout switch S47 is a high temperature limit located just above the burner on all units. See figure 8. The limit is a N.C. SPST manual re-set thermostat connected in series with ignition control A3. When S47 senses flame rollout, ignition control immediately closes the gas valve. The switch is factory set to open at 180° and cannot be adjusted.

S47 ROLLOUT SWITCH

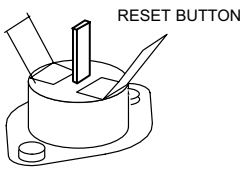


FIGURE 9

4 - Primary High Temperature Limit S10

S10 is an auto re-set primary limit for gas heat. See figure 10. S10 is located in the bottom area of the division panel between the blower compartment and the heat section. See figure 8. Primary limit S10 is wired in series with the burner control A3. S10 N.C. contacts open to de-energize the ignition control when excessive heat is reached in the heat exchanger. At the same time, the N.O. contacts close energizing K20 blower limit relay, which in turn energizes the blower relay K3 energizing indoor blower B3. See table 1 for factory set point.

S10 and S21 HIGH TEMPERATURE LIMIT

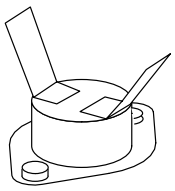


FIGURE 10

TABLE 1

Heat Input	S10 Set Point°	S21 Set Point°
235,000 Btuh	200	140
375,000 Btuh	180	140

5 - Secondary Limit S21

All GCS16 model units are equipped with a secondary limit (figure 8) located in the upper area of the division panel between the blower compartment and heat section. The limit is a SPDT auto-re-set thermostat which opens on temperature rise. S21 is wired in series with the ignition control. The limit is used to de-energize the ignition control and shut down the unit when temperature in the blower compartment becomes too high. The limit is factory set and is not adjustable. See table 1. This is a safety shutoff function of this unit and must never be by-passed.

6 - Combustion Air Prove Switch S18

Combustion air prove switch S18 is a SPST N.O. centrifugal switch inside the combustion air motor. It is used to monitor combustion air inducer operation. The switch is wired in series with ignition control A3. On start up, the switch closes when the combustion air motor reaches a set speed (RPM) to allow power to the ignition control (proves, by closing, that the combustion air inducer is operating before allowing the ignition control to be energized).

7 - Combustion Air Inducer B6

Combustion air inducer B6 provides fresh air to the burner while clearing the combustion chamber of exhaust gases. The blower uses a PSC, 208/230VAC, single phase, 1/25 hp motor. The blower begins operating immediately upon receiving a thermostat demand and is de-energized immediately when thermostat demand is satisfied. However, at colder ambients down to -40°F, the blower may take up to 15 seconds before rotation begins. All combustion air inducer motors are sealed and cannot be oiled.

8 - Capacitor C3

Combustion air inducers on all GCS16 units require run capacitors. Capacitor C3 is connected to and aids in the start up of combustion air inducer B6. See combustion air inducer motor nameplate for capacitor ratings.

9 - Flue Vent (Figure 11)

⚠ IMPORTANT

Vent cap assembly must be installed without modification. Any modification to the vent cap assembly or failure to install assembly can result in improper operation and will void the C.S.A. certification of the unit.

⚠ CAUTION

Do not start or operate unit unless vent cap is in place.

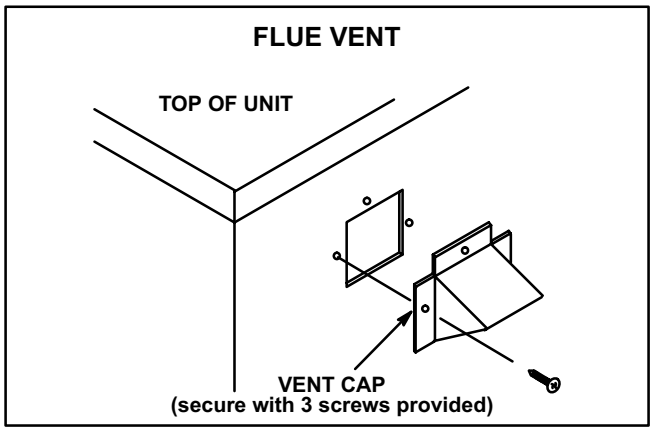


FIGURE 11

10 - Gas Valve GV1

Gas valve GV1 is a two-stage redundant gas valve used in all GCS16 units. Units are equipped with valves manufactured by White-Rodgers. First stage (low fire) is quick opening (on and off in less than 3 seconds). Second stage is slow opening (on in 40 seconds off in 30 seconds). On a call for first stage heat (low fire), the valve is energized by the ignition control simultaneously with spark electrode. On a call for second stage heat (W2) timer DL3 energizes W2 on the valve after a 3 minute delay. A manual shut off knob is provided on the valve for shut off. The knob immediately closes both stages without delay. See table 2 for manifold range.

TABLE 2
Manifold Pressure Range

Valve Stage	Nat“ W.C.	L.P.” W.C.
*Low Fire	1.6 ± 0.2	5.5 ± 0.3
High Fire	3.7 ± 0.3	10.5 ± 0.5

**Low fire manifold pressure is NOT adjustable.*

11 - Ignitor / Flame Sensor Figure 12

Ignitor tips are located in the path of the left most burner. The sensor tip is located in the right most burner path. Both ignitor and sensor are fastened to the lower burner bracket. See figure 12. **The sensor and ignitor are identical components. However, each line up differently to the center line of the burner.** See figure 13. During ignition, spark travels through the ignitor electrode and arcs across to the ground electrode. During operation, flame is sensed by a current passed along the ground electrode, through the flame and into the sensor.

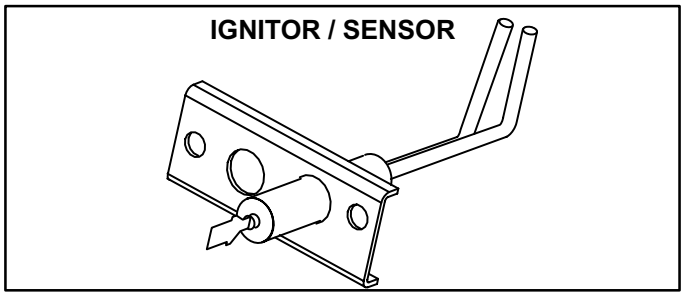


FIGURE 12

⚠ IMPORTANT

In order to maximize spark energy to the electrode, the high voltage wire should not rest on the bottom of unit vestibule panel and should touch unit cabinet as little as possible.

a - 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. See figure 13 for gap dimensions. The electrode is located on the left side of the burner/ manifold assembly for both, high and low input units. See figure 8.

b - Flame Sensor

Flame is sensed by rectification through the flame sensing rod. The sensor is located on the right side of the burner/manifold assembly for both low and high input units. See figure 8.

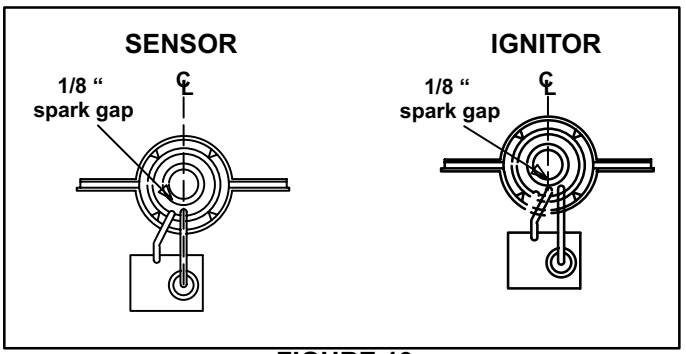
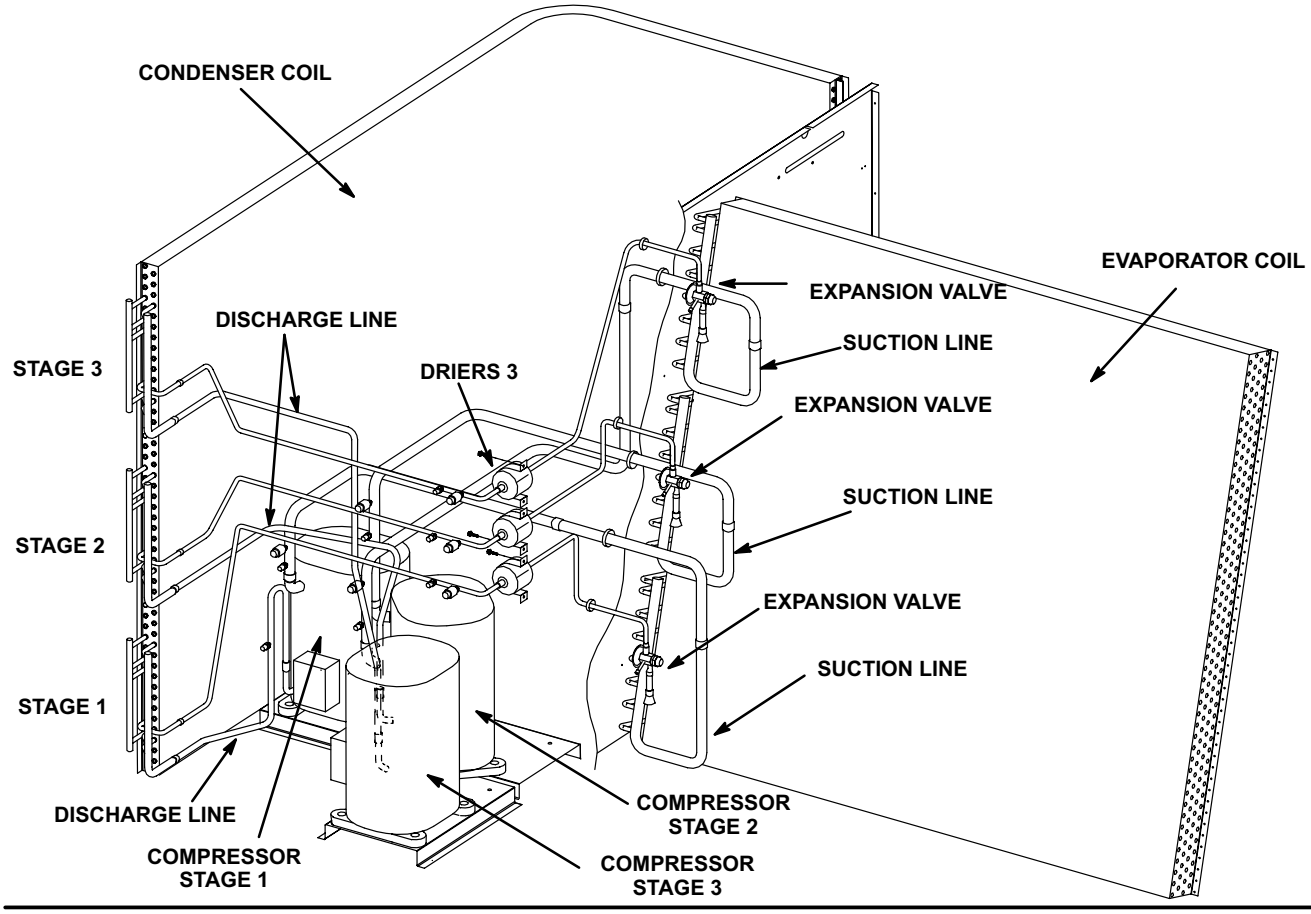


FIGURE 13

PLUMBING COMPONENTS GCS/CHA16-180



PLUMBING COMPONENTS GCS/CHA16-240

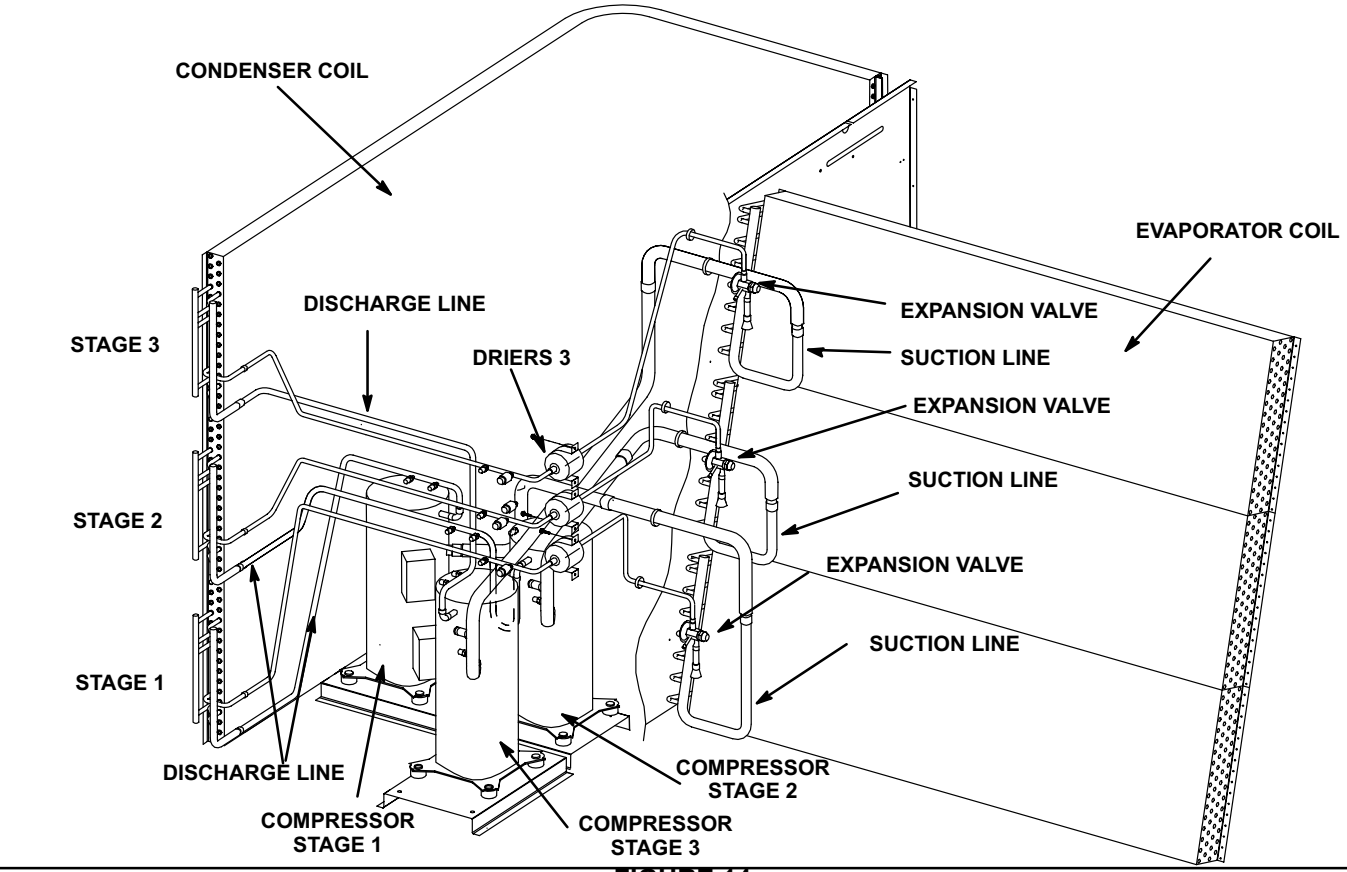


FIGURE 14

D-Cooling Components

⚠ DANGER

Shock hazard.

Compressor must be grounded. Do not operate without protective cover over terminals. Capacitors contain high voltage. Disconnect power before removing cover. Discharge capacitors before servicing unit. Disconnect power before servicing unit.

Can cause unsafe operation, injury or death.

Summary of Features

All units use DX cooling. Cooling in GCS16 units may also be supplemented by field-installed economizer. All units use a single slab-type enhanced fin evaporator with rifled tubing and a thermal expansion valve ("TXV") as the expansion device (figures 14). All models use draw-through type condenser fans.

1 - Scroll Compressor

All GCS/CHA16-240 units utilize three scroll compressors. The scroll compressor design is simple, efficient and requires few moving parts. A cutaway diagram of the scroll compressor is shown in figure 15. The scrolls are located in the top of the compressor can and the motor is located in the bottom of the compressor can. The oil level is immediately below the motor and oil is pressure fed to the moving parts of the compressor. The lower portion of the compressor shell is exposed to low side pressure while only the very top of the shell is exposed to high side pressure.

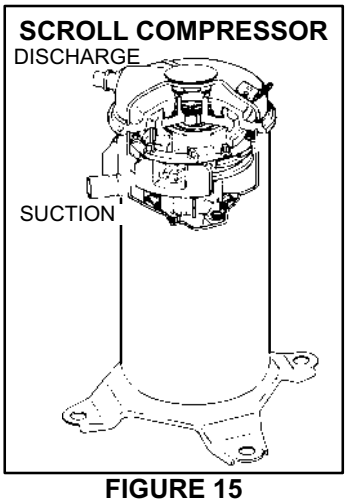


FIGURE 15

The scroll is a simple compression concept centered around the unique spiral shape of the scroll and its inherent properties. Figure 16 shows the basic scroll form. Two identical scrolls are mated together forming concentric spiral shapes (figure 17). One scroll remains stationary, while the other is allowed to orbit (figure 18-1). Note that the orbiting scroll does not rotate or turn but merely orbits the stationary scroll.

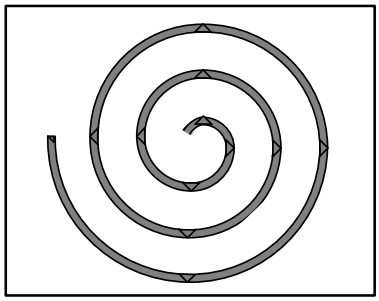


FIGURE 16

The counterclockwise orbiting scroll draws gas into the outer crescent shaped gas pocket created by the two scrolls (figure 18-2). The centrifugal action of the orbiting scroll seals off the flanks of the scrolls (figure 18-3). As the orbiting motion continues, the gas is forced toward the center of the scroll and the gas pocket becomes compressed (figure 18-4).

When compressed gas reaches the center, it is discharged vertically into a chamber and discharge port in the top of the compressor (figure15). The discharge pressure forcing down on the top scroll helps seal the upper and lower edges (tips) of the scrolls (figure 17). During a single orbit, several pockets of gas are compressed simultaneously providing smooth continuous compression.

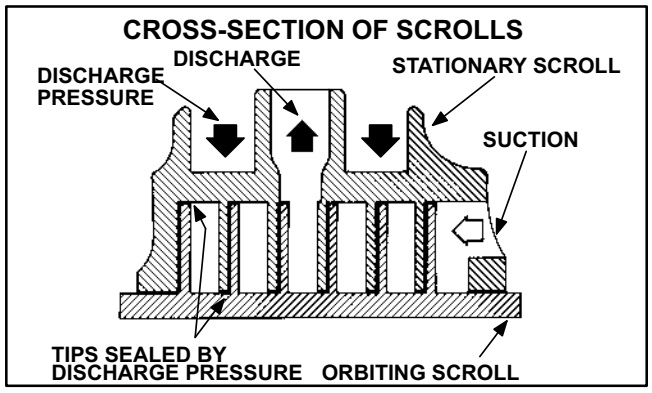


FIGURE 17

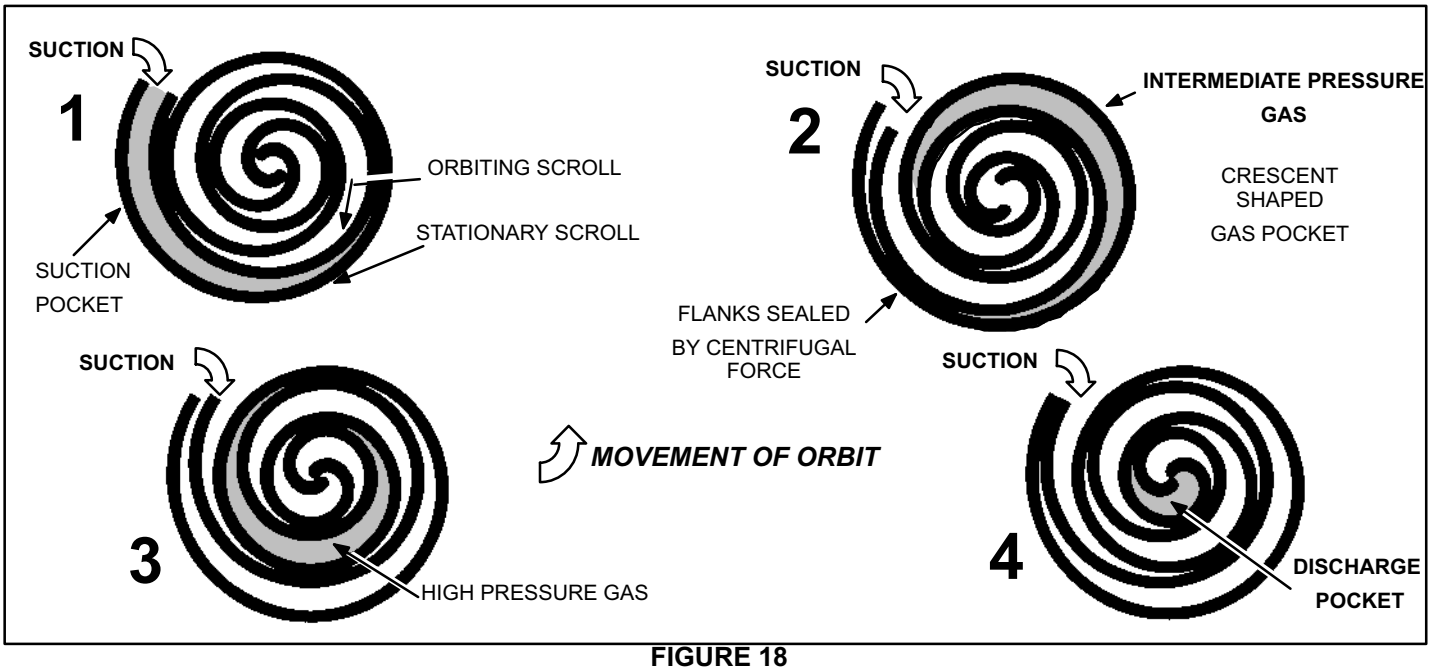


FIGURE 18

The scroll compressor is tolerant to the effects of liquid return. If liquid enters the scrolls, the orbiting scroll is allowed to separate from the stationary scroll. The liquid is worked toward the center of the scroll and is discharged. If the compressor is replaced, conventional Lennox cleanup practices must be used.

Due to its efficiency, the scroll compressor is capable of drawing a much deeper vacuum than reciprocating compressors. Deep vacuum operation can cause internal fusite arcing resulting in damaged internal parts and compressor failure. It is permissible to "pump-down" the system using the compressor but never use a scroll compressor for drawing a vacuum on the system. This type of damage can be detected and will result in denial of warranty claims.

⚠ CAUTION

The head of a scroll compressor may be hot since it is in constant contact with discharge gas.

Contact could result in serious burns.

For compressor specifications see compressor nameplate or ELECTRICAL DATA section in this manual. All compressors are protected by internal overload protection circuitry.

2 - Reciprocating Compressor

GCS/CHA16-180 units are equipped with three reciprocating compressors B1, B2 and B13. Compressor B1 and B2 are energized in response to Y1 (1st stage cool) demand and B13 is energized in response to Y2 (2nd stage cool) demand. See compressor nameplate or ELECTRICAL DATA section for compressor specifications.

3 - Condenser Fan and Motor B4 & B5

The specifications section in this manual shows the specifications of condenser fans used in GCS/CHA16 units. Condenser fans B4 and B5 are controlled by condenser fan relay K10 and are both energized in response to demand.

4 - Indoor Blower Motor B3

All GCS16/CHA16-180/240 series units use three-phase, belt drive blower motors. See motor nameplate or ELECTRICAL DATA section for motor specifications.

5 - Evaporator Coil

GCS/CHA16-180 units have three row single slab evaporator coils. GCS16-240 units have four row three slab evaporator coils. The rows are of rifled copper tubes fitted with ripple-edged aluminum fins. A Thermal Expansion Valve (TXV) feeds multiple parallel circuits through the coil. See figure 19.

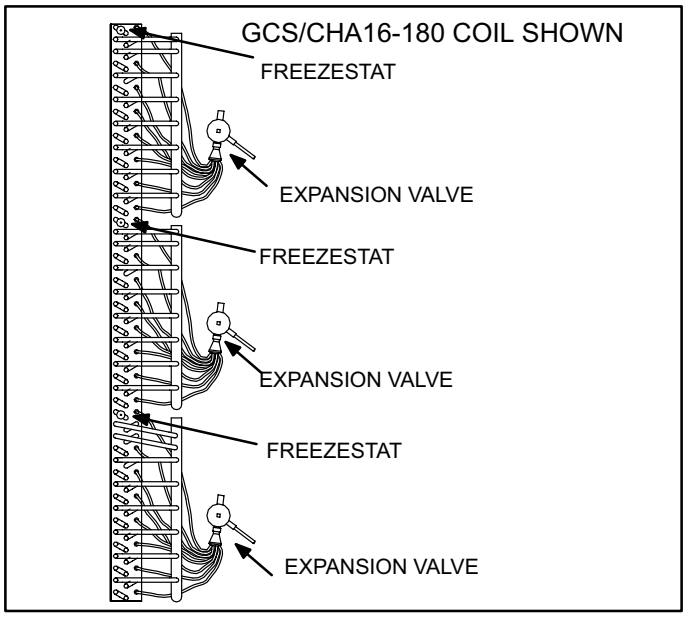


FIGURE 19

6 - Condenser Coil

All GCS/CHA16 model units have a single condenser coil. Each coil has two rows of copper tubes fitted with ripple-edged aluminum enhanced fins.

7 - High Pressure Switch S4, S7 & S28 (Optional)

High pressure switches S4 (compressor 1), S7 (compressor 2) and S28 (compressor 3) are manually reset SPST N.C. switches, which open on pressure rise. S4 is field installed on the discharge line (compressor 1) and wired in series with compressor contactor K1. S7 is field installed on the discharge line (compressor 2) and wired in series with compressor contactor K2. S28 is field installed on the discharge line (compressor 3) and wired in series with compressor contractor K14. When discharge pressure rises above 410±10 psig (2826 kPa± 69 kPa) the switch opens and the 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.

8 - Freezestat Switch S49, S50 & S53

All GCS/CHA16-180/240 units are equipped with a low temperature freezestat switch. S49 is wired in series with high pressure switch S4 and compressor contactor K1. S50 is wired in series with high pressure switch S7 and compressor contactor K2. S53 is wired in series with high pressure switch S28 and compressor contactor K14. S49, S50 and S53 are SPST N.C. auto-reset switches which open at 29 °F±3 °F (-1.7 °C ± 1.7 °C) on temperature drop and close at 58 °F ± 4 °F (14.4 °C ± 2.2 °C) on a temperature rise. To prevent coil icing, freezestats open during compressor operation to temporarily disable the compressor(s) until the coil warms sufficiently to melt any accumulated frost.

If freezestats trip frequently due to coil icing, check the unit charge, air flow and filters before allowing unit back in operation. Make sure to eliminate conditions which might promote ice build up.

9 - Drier

All GCS/CHA16-180/240 units have a filter drier located in the liquid line of each refrigerant circuit at the exit of each condenser coil. The drier removes contaminants and moisture from the system.

E-Optional Electric Heat

Tables 3 and 4 show all possible CHA16 to ECH16 matchups and electrical ratings.

The electric heat section is connected to the unit using jack plug J2 and plug P2. ECH16 parts arrangement is shown in figure 20. All ECH16 units consist of electric heat elements exposed to the air stream. Multiple-stage elements are sequenced on and off by time delays in response to thermostat demand.

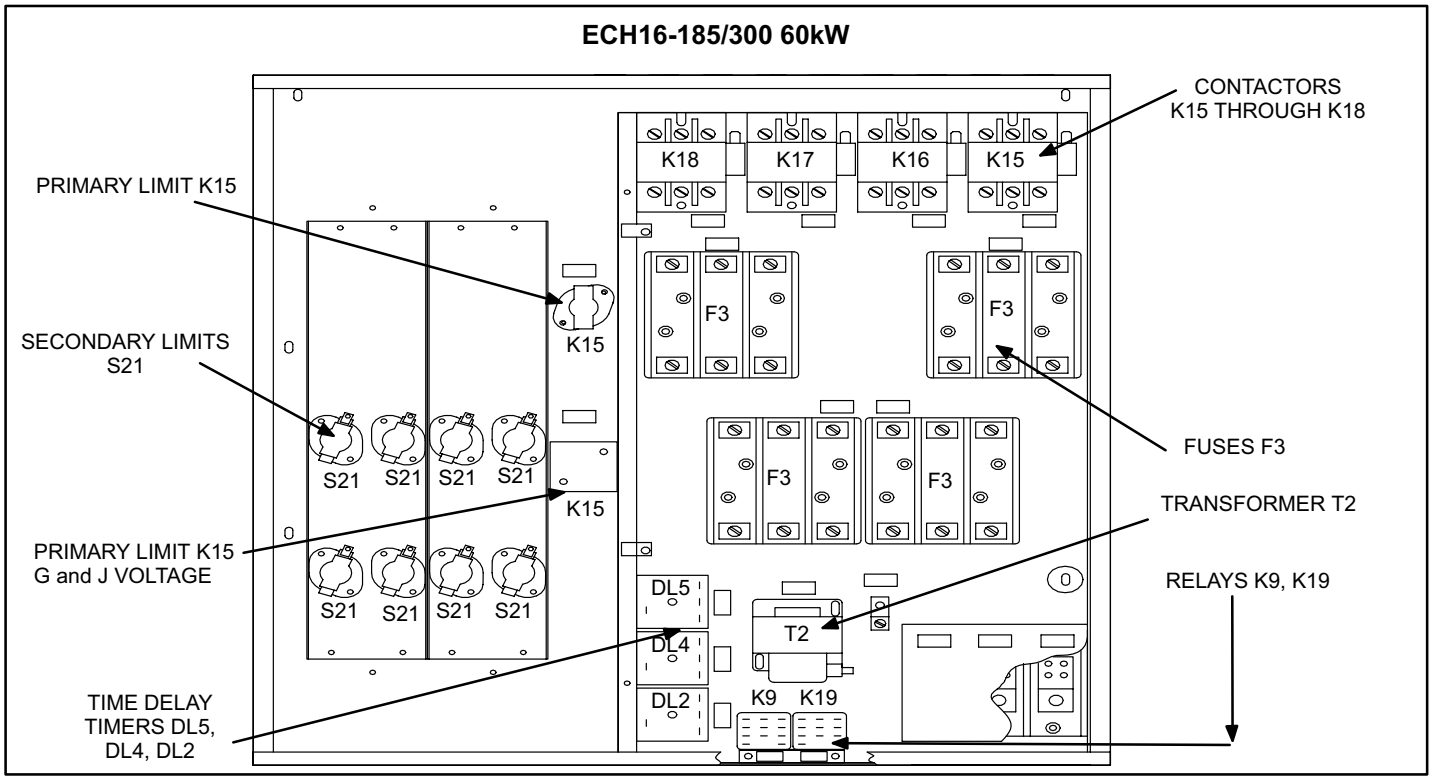


FIGURE 20

TABLE 3

CHA16-180

Electric Heat Model No. & Net Weight	No. of Steps	Volts Input	kw Input	Btuh Output	†Total Unit with Power Exhaust Fans & Electric Heat Minimum Circuit Ampacity	
					3 hp (2.2 kW)	5 hp (3.7 kW)
ECH16-185-15 208/230v **(24H27)** 460v **(24H32)** 575v **(24H38)** 47 lbs. (21 kg)	1	208	11.3	38,600	78	84
	1	220	12.6	43,000		
	1	230	13.8	47,100		
	1	240	15.0	51,200		
	1	440	12.6	43,000	40	42
	1	460	13.8	47,100		
	1	480	15.0	51,200		
	1	550	12.6	43,000	29	31
	1	575	13.8	47,100		
	1	600	15.0	51,200		
ECH16-185/300-30 208/230v **(24H28)** 460v **(24H33)** 575v **(24H39)** 51 lbs. (23 kg)	[1]2	208	22.5	76,800	110	118
	[1]2	220	25.2	86,000		
	[1]2	230	27.6	93,900		
	[1]2	240	30.0	102,400		
	1	440	25.2	86,000	55	58
	1	460	27.6	93,900		
	1	480	30.0	102,400		
	1	550	25.2	86,000	44	47
	1	575	27.6	93,900		
	1	600	30.0	102,400		
ECH16-185/300-45 208/230v **(24H29)** 460v **(24H34)** 575v **(24H40)** 62 lbs. (28 kg)	[1]2	208	33.8	115,300	155	163
	[1]2	220	37.8	129,000		
	[1]2	230	41.3	141,000		
	[1]2	240	45.0	153,600		
	[1]2	440	37.8	129,000	77	81
	[1]2	460	41.3	141,000		
	[1]2	480	45.0	153,600		
	[1]2	550	37.8	129,000	62	65
	[1]2	575	41.3	141,000		
	[1]2	600	45.0	153,600		
ECH16-185/300-60 208/230v **(24H30)** 460v **(24H35)** 575v **(24H41)** 67 lbs. (30 kg)	[1]2	208	45.1	153,900	164	172
	[1]2	220	50.4	172,000		
	[1]2	230	55.1	188,000		
	[1]2	240	60.0	204,800		
	[1]2	440	50.4	172,000	82	85
	[1]2	460	55.1	188,000		
	[1]2	480	60.0	204,800		
	[1]2	550	50.4	172,000	66	68
	[1]2	575	55.1	188,000		
	[1]2	600	60.0	204,700		
ECH16-185/300-75 460v **(24H36)** 575v **(24H42)** 88 lbs. (40 kg)	[1]2	440	63.0	215,000	100	103
	[1]2	460	68.9	235,100		
	[1]2	480	75.0	256,000		
	[1]2	550	63.0	215,000	80	83
	[1]2	575	68.9	235,100		
	[1]2	600	75.0	256,000		

†Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements. Use wires suitable for at least 167°F (75°C).
[1]May be used with two stage control.

TABLE 4

CHA16-240

Electric Heat Model No. & Net Weight	No. of Steps	Volts Input	kw Input	Btuh Output	†Total Unit with Power Exhaust Fans & Electric Heat Minimum Circuit Ampacity	
					5 hp (3.7 kW)	7.5 hp (5.7 kW)
ECH16-185/300-30 208/230v **(24H28)** 460v **(24H33)** 575v **(24H39)** 51 lbs. (23 kg)	[1]2	208	22.5	76,800	118	127
	[1]2	220	25.2	86,000		
	[1]2	230	27.6	93,900		
	[1]2	240	30.0	102,400		
	1	440	25.2	86,000	58	63
	1	460	27.6	93,900		
	1	480	30.0	102,400		
	1	550	25.2	86,000	47	50
	1	575	27.6	93,900		
	1	600	30.0	102,400		
ECH16-185/300-45 208/230v **(24H29)** 460v **(24H34)** 575v **(24H40)** 62 lbs. (28 kg)	[1]3	208	33.8	115,300	163	172
	[1]3	220	37.8	129,000		
	[1]3	230	41.3	141,000		
	[1]3	240	45.0	153,600		
	[1]2	440	37.8	129,000	81	85
	[1]2	460	41.3	141,000		
	[1]2	480	45.0	153,600		
	[1]2	550	37.8	129,000	65	68
	[1]2	575	41.3	141,000		
	[1]2	600	45.0	153,600		
ECH16-185/300-60 208/230v **(24H30)** 460v **(24H35)** 575v **(24H41)** 67 lbs. (30 kg)	[1]4	208	45.1	153,900	172	181
	[1]4	220	50.4	172,000		
	[1]4	230	55.1	188,000		
	[1]4	240	60.0	204,800		
	[1]2	440	50.4	172,000	85	90
	[1]2	460	55.1	188,000		
	[1]2	480	60.0	204,800		
	[1]2	550	50.4	172,000	68	72
	[1]2	575	55.1	188,000		
	[1]2	600	60.0	204,800		
ECH16-185/300-75 460v **(24H36)** 575v **(24H42)** 88 lbs. (40 kg)	[1]3	440	63.0	215,000	103	108
	[1]3	460	68.9	235,100		
	[1]3	480	75.0	256,000		
	[1]3	550	63.0	215,000	83	86
	[1]3	575	68.9	235,100		
	[1]3	600	75.0	256,000		

†Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements. Use wires suitable for at least 167°F (75°C).
[1]May be used with two stage control.

1 - Contactor K15

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

2 - Contactor K16

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

3 - Contactor K17

Contactor K17 is also a three-pole double-break contactor located in the control box. K17 is equipped with a 24VAC coil which is energized after time delay DL2 and DL4 close in sequence. When K17 is energized, the third stage heating elements are energized.

4 - Contactor K18

Contactor K18 is also a three-pole double-break contactor located in the control box. K18 is equipped with a 24VAC coil which is energized after time delay DL2, DL4 and DL5 close in sequence. When K18 is energized, the fourth stage heating elements are energized.

5 - Relay K9

Relay K9 is a three-pole double-throw pilot relay intended to electrically isolate the CHA16 and ECH16 24V circuits. The coil of relay K9 is connected to first stage heating demand from the CHA16. When K9 is energized, one to three sets of contacts switch, depending on the kW size and voltage of the unit. When K9-1 switches, the indoor blower is energized. When K9-2 closes, second stage electric heat is enabled (but not energized until second stage demand is received from the thermostat). When K9-3 closes, contactor K15 is energized.

6 - Relay K19

Relay K19 is a single-pole double-throw pilot relay also intended to electrically isolate the CHA24 24VAC circuits from the ECH16 24V circuits on the 45kW and 60kW units. The coil of relay K19 is connected to second-stage heating demand from the CHA16. When K19 is energized, a single set of contacts switch. When K19-1 closes, second-stage electric heat is energized.

7 - Time Delay DL2

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

8 - Time Delay DL4

Time delay DL4 is identical to DL2. It is factory installed in 45kW and 60kW units and all other units which have three or more stages. DL4 allows staging by providing a timed interval between the second and third heating elements. DL4 is identical to DL2 and is energized only after time delay DL2 closes.

9 - Time Delay DL5

Time delay DL5 is identical to DL2 and DL4. It is factory installed in 45kW and 60kW units and all other units which have three or more stages. DL5 allows staging by providing a timed interval between the third and fourth heating elements. DL5 is energized only after time delay DL4 closes.

10 - Primary Limit S15

S15 is the primary high temperature limit. It is located in the electric heat unit immediately downstream from the heating elements. S15 is a single-pole single-throw normally closed thermostat wired in series with first stage contactor coil. Thermostat opens at a temperature of 145°F $\pm$ 5°F (62.8°C $\pm$ 2.8°C) and closes at 105°F $\pm$ 6°F (40.6°C $\pm$ 3.3°C). Temperature differential is factory set and is not adjustable.

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

11 - Secondary Limit S20

Each heating element assembly is electrically connected to two high temperature limits S20 (refer to wiring diagrams in back of this manual). Each limit is connected in series with one leg of the three-phase element assembly. The third leg of each assembly is not equipped with a limit. Three-phase operating characteristics allow one of the other two limits to protect the third leg.

Each S20 limit is physically located adjacent to element it is protecting. S20 is a single-pole single-throw normally closed thermostat. Thermostat actuates at 185°F $\pm$ 8°F (85°C $\pm$ 4.4°C) on a temperature rise and cannot be reset. Once tripped, it must be replaced.

12 - Fuse F3

F3 is a current limiting fuse connected in series with each leg of electric heat (each stage of electric heat uses three fuses). Fuses used in CHA16 series heating sections are shown in table 5.

TABLE 5

CHA16 ELECTRIC HEAT SECTION FUSE RATING					
ECH kW SIZE	VAC	FUSE (3 each)			
		F3 - 1	F3 - 2	F3 - 3	F3 - 4
ECH-185-15	208/230V	60 AMP 250V			
	460V	30 AMP 600V			
	575V	30 AMP 600V			
ECH-185/300 -30	208/230V	60 AMP 230V	60 AMP 230V		
	460V	60 AMP 600V			
	575V	60 AMP 600V			
ECH-185/300 -45	208/230V	60 AMP 250V	60 AMP 250V	60 AMP 250V	
	460V	60 AMP 600V	30 AMP 600V		
	575V	60 AMP 600V	30 AMP 600V		
ECH-185/300 -60	208/230V	60 AMP 250V	60 AMP 250V	60 AMP 250V	60 AMP 250V
	460V	60 AMP 600V	60 AMP 600V		
	575V	60 AMP 600V	60 AMP 600V		
ECH16-185/300 -75	460V	60 AMP 600V	60 AMP 600V	30 AMP 600V	
	575V	60 AMP 600V	60 AMP 600V	30 AMP 600V	

13 - Transformer T2

T2 is a line voltage to 24V transformer located in the electric heat control box of the 40kW 208/230v unit. The transformer provides 24VAC power to all ECH16 controls (contactor coils and time delays). Pilot relays (K9 and K19) plug in to the CHA24 to provide 24V circuit isolation. Transformer T2 is rated at 50VA and has a 2.5 amp internal fuse (F2).

14 - Heating Elements HE1, HE2, HE3 & HE4

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

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

III-PLACEMENT AND INSTALLATION

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

IV-ELECTRICAL CONNECTIONS

A-Field Wiring

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

B-Power Supply

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

⚠ DANGER

Remove all power to disconnect before servicing.

Electrical shock resulting in death or injury may result if power is not disconnected.

V-INDOOR BLOWER OPERATION / ADJUSTMENT

A-Blower Operation

1- Blower operation is manually set at the thermostat subbase fan switch. With fan switch in **ON** position, blowers will operate continuously.

2- With fan switch in **AUTO** position, the blowers will cycle with demand. Blowers and entire unit will be off when system switch is in **OFF** position.

B-Determining Unit CFM

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

2- With all access panels in place, measure static pressure external to unit (from supply to return).

3- Measure the indoor blower motor RPM.

4- Referring to tables in “BLOWER DATA” section, use static pressure and RPM readings to determine unit CFM.

5- The CFM can be adjusted at the motor pulley. Loosen Allen screw and turn adjustable pulley clockwise to increase CFM. Turn counterclockwise to decrease CFM. See figure 23.

C-Blower Belt Adjustment

NOTE - Remove shipping screw from top of motor mounting plate.

Maximum life and wear can be obtained from belts only if proper pulley alignment and belt tension are maintained. Tension new belt after a 24-48 hour period of operation. This will allow belt to stretch and seat grooves. To increase belt tension, loosen locking bolt and pull mounting plate. Tighten bolt so that the motor mounting plate is in a vertical position. See figure 23.

D-Check Belt Tension

Overtensioning belts shortens belt and bearing life. Check belt tension as follows:

1- Measure span length X. See figure 21.

2- Apply perpendicular force to center of span (X) with enough pressure to deflect belt 1/64" for every inch of span length or 1.5mm per 100mm of span length.

Example: Deflection distance of a 40" span would be 40/64" or 5/8".

Example: Deflection distance of a 400mm span would be 6mm.

3- Measure belt deflection force. For a used belt, the deflection force should be 5 lbs. (35kPa). A new belt deflection force should be 7 lbs. (48kPa).

A force below these values indicates and undertensioned belt. A force above these values indicates an overtensioned belt.

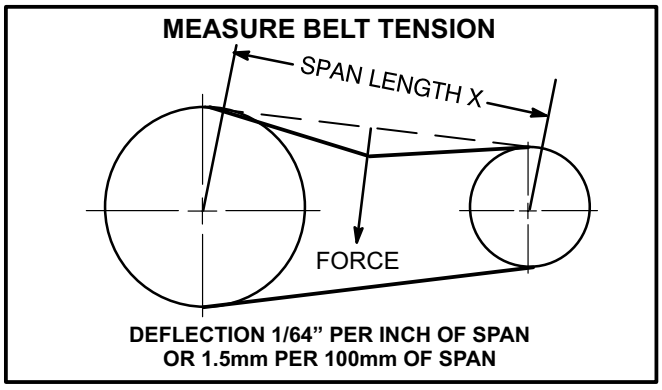


FIGURE 21

E- To Measure Discharge Static Pressure

1 - Measure tap locations as shown in figure 22.

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

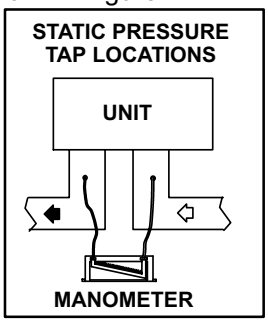


FIGURE 22

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

4 - Seal the hole when check is complete.

5 - See figure 23 for speed change instructions.

BLOWER SPEED ADJUSTMENT

TO INCREASE BELT TENSION:

1 - Loosen locking bolt.

2 - Turn adjusting bolt clockwise to pivot motor away from blower.

3 - Tighten locking bolt.

TO INCREASE CFM:
LOOSEN ALLEN SCREW &
TURN PULLEY CLOCKWISE

TO DECREASE CFM:
TURN PULLEY
COUNTERCLOCKWISE

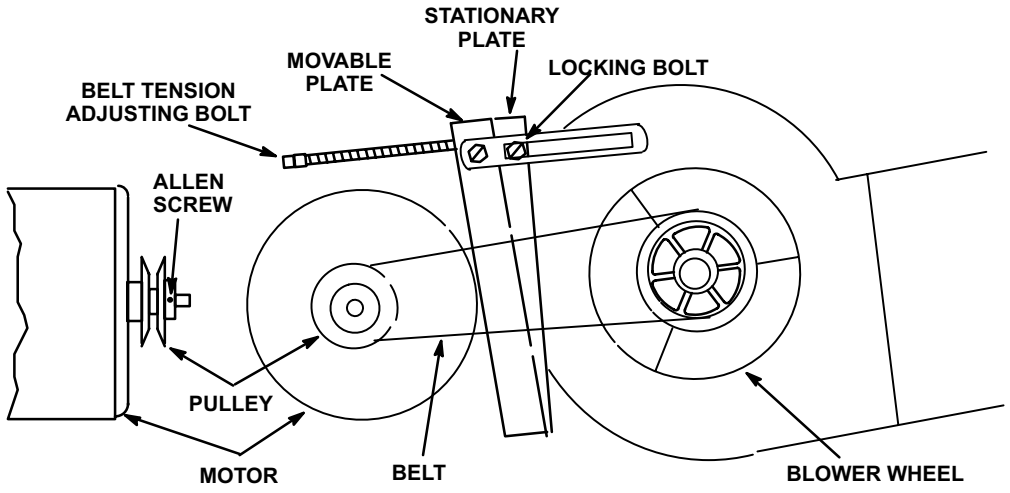


FIGURE 23

VI-START-UP OPERATION

A-Preliminary Checks

1 - Make sure unit is installed in accordance with the installation instructions and applicable codes.
2 - Inspect electrical wiring, both field and factory installed for loose connections. Tighten as required.
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 range listed on the nameplate. If not, consult the power company and have the voltage condition corrected before starting the unit.
5 - Recheck voltage with unit running. If power is not within range listed on unit nameplate, stop unit and consult power company. Check amperage of unit. Refer to nameplate for correct running amps.

B-Cooling Start Up

1- Set fan switch to **AUTO** or **ON** and move system selection switch to cool. Adjust thermostat to a setting below room temperature to bring on all compressors. Compressors will start and cycle on demand from thermostat.
2- Each refrigerant circuit is separately charged with R-22 refrigerant. See unit rating plate for correct amount of charge.
3- Refer to REFRIGERATION SYSTEM SERVICE CHECK section for proper method to check refrigerant charge.

C-Three Phase Scroll Compressor

Three phase scroll compressors must be phased sequentially to ensure correct compressor rotation and operation.

At compressor start-up, a rise in discharge and drop in suction pressures indicates proper compressor phasing and operation. Excessive compressor noise may also indicate incorrect phasing. If discharge and suction pressures do not function normally, follow these steps:

1- Disconnect field power supply to unit.
2- Reverse any two field power leads to the unit.
3- Reapply field power supply to unit.

Discharge and suction pressures should operate at their normal start-up ranges.

D-Heating Start Up

⚠ WARNING

Shock and burn hazard.

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

BEFORE LIGHTING smell all around the appliance area for gas. Be sure to smell next to the base of unit because some gas is heavier than air and will settle on the floor or base.

Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, do not try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

Gas Valve Operation (Figure 24)

1 - Placing Furnace In Operation

This unit is equipped with an automatic spark ignition system. There is no pilot. In case of a safety shutdown, move thermostat switch to "OFF," then return the thermostat switch to "HEAT" position.

1- Set thermostat to lowest setting.
2- Turn off all electrical power to appliance.
3- This appliance is equipped with an ignition device which automatically lights the burner. Do **not** try to light by hand.
4- Remove heat access panel
5- Turn knob on gas valve clockwise ↷ to off. Do not force.
6- Wait 5 minutes to clear out any gas. If you then smell gas, STOP! Immediately call the gas supplier from a neighboring building. Follow the gas suppliers instructions. If you do not smell gas go to the next step.

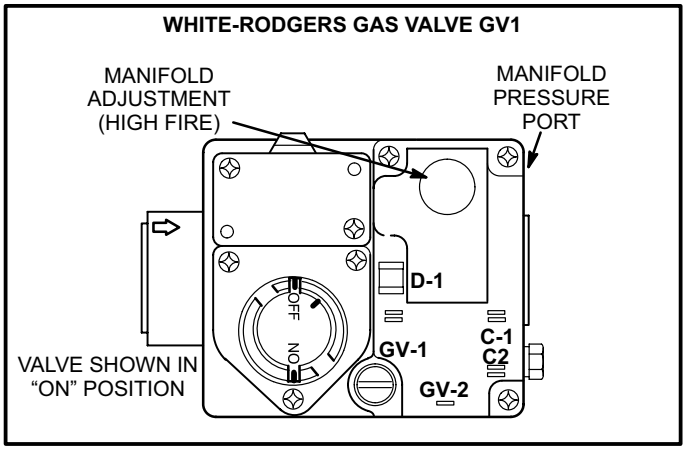


FIGURE 24

7- Turn knob on gas valve counterclockwise ↶ to **ON**.
8- Replace heat access panel.
9- Turn on all electrical power to unit.
10- Set thermostat to desired setting.
11- If the appliance will not operate, follow the instructions "To Turn Off Gas To Unit".

2 - To Turn Off Gas To Unit

1 - Set thermostats to lowest setting.
2 - Turn off electrical power to unit if service is to be made.
3 - Remove heat section access panel.
4 - Turn knob on gas valve clockwise ↷ to **OFF**.
5 - Replace heat section access panel.

E-Safety or Emergency Shutdown:

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

F-Extended Period Shutdown:

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

VII-REFRIGERATION SYSTEM SERVICE CHECKS

WARNING-Do not exceed nameplate charge under any conditions.

This unit is factory charged and should require no further adjustment. If the system requires charge, *reclaim the charge, evacuate the system,* and *add required nameplate charge.*

NOTE - System charging is not recommended below 60°F (15°C). In temperatures below 60°F (15°C), the charge ***must*** *be weighed into the system.*

If weighing facilities are not available, or to check the charge, use the following procedure:

1- Attach gauge manifolds and operate unit in cooling mode until system stabilizes (approximately five minutes). Make sure all outdoor air dampers are closed.

2- Check each system separately with all stages operating.

3- Use a thermometer to accurately measure the outdoor ambient temperature.

4- Apply the outdoor temperature to tables 6 or 7 to determine normal operating pressures.

TABLE 6
GCS/CHA16-180 NORMAL OPERATING PRESSURES

Outdoor Coil Entering Air Temp	CIRCUIT 1		CIRCUIT 2		CIRCUIT 3	
	Dis. ±10 psig	Suct. ±5 psig	Dis. ±10 psig	Suc. ±5 psig	Dis. ±10 psig	Suc. ±5 psig
65°F	198	73	198	75	197	76
75°F	225	75	225	77	223	77
85°F	254	77	253	78	252	79
95°F	285	79	286	80	284	80
105°F	318	80	320	82	318	82
115°F	354	82	357	84	356	84

TABLE 7
GCS/CHA16-240 NORMAL OPERATING PRESSURES

Outdoor Coil Entering Air Temp	CIRCUIT 1		CIRCUIT 2		CIRCUIT 3	
	Dis. ±10 psig	Suct. ±5 psig	Dis. ±10 psig	Suc. ±5 psig	Dis. ±10 psig	Suc. ±5 psig
65°F	205	72	203	73	205	73
75°F	231	74	229	75	231	75
85°F	262	76	260	77	262	77
95°F	294	78	292	79	294	79
105°F	326	79	324	80	326	80
115°F	363	81	361	82	363	82

5- Compare the normal operating pressures to the pressures obtained from the gauges. Minor variations in these pressures may be expected due to differences in installations. Significant differences could mean that the system is not properly charged or that a problem exists with some component in the system. **Correct any system problems before proceeding.**

6- Use the following approach method along with the normal operating pressures to confirm readings.

Charge Verification - Approach Method

7- Using the same thermometer, compare liquid temperature to outdoor ambient temperature.

Approach Temperature = Liquid temperature minus ambient temperature.

8- Approach temperature should be as shown in table 8. An approach temperature greater than value shown indicates an undercharge. An approach temperature less than value shown indicates an overcharge.

9- If approach temperature is higher than value in table 8 , remove refrigerant from the system. If discharge pressure is low, add refrigerant to the system.

- Add or remove charge in increments.
- Allow the system to stabilize each time refrigerant is added or removed.

10- Do not use the approach method if system pressures do not match pressures in tables 6 or 7. The approach method is not valid for grossly over or undercharged systems.

TABLE 8

GCS/CHA16	LIQUID TEMP. MINUS AMBIENT TEMP.		
	Circuit 1	Circuit 2	Circuit 3
-180	10°F ± 1 (5.6°C ± 0.5)	9°F ± 1 (5.0°C ± 0.5)	9°F ± 1 (5.0°C ± 0.5)
-240	9°F ± 1 (5.0°C ± 0.5)	9°F ± 1 (5.0°C ± 0.5)	9°F ± 1 (5.0°C ± 0.5)

VIII-HEATING SYSTEM SERVICE CHECKS

A-C.S.A

Applications and Requirements

All GCS/CHA16s are C.S.A. design certified without modification.

Refer to the GCS/CHA16 Operation and Installation Instruction Manual for more information.

B-High Altitude

CSA certified units must be derated when installed at an elevation of more than 4500 feet (1372 m) above sea level. See table 9 for installations greater than 4500 feet (1372 m).

This is the only permissible derate for these units.

TABLE 9

Unit	Altitude Ft	Man. Press. Nat. (in. w.c.)	Man. Press. LP (in. w.c.)
GCS16-180 /240	0 - 4500	3.7	10.5
	4501 - 5500	3.4	9.7
	5501 - 6500	3.1	8.9
	6501 - 7500	2.9	8.1

C-Gas Piping

Gas supply piping must not allow more than 0.5"W.C. drop in pressure between gas meter and unit. Supply gas pipe must not be smaller than unit gas connection.

Compounds used on threaded joints of gas piping **must** be resistant to the action of L.P. gas.

D-Testing Gas Piping Pressure

⚠ IMPORTANT

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

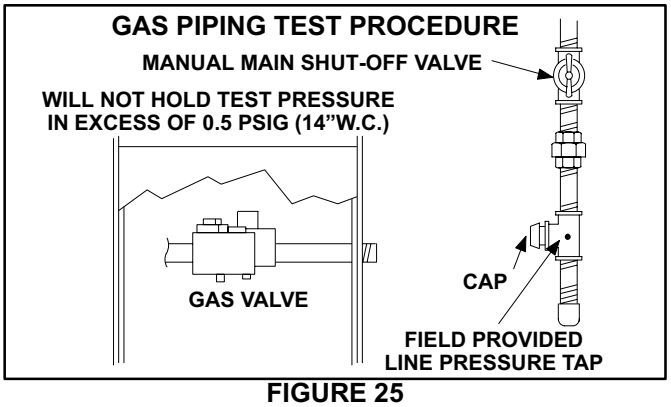


FIGURE 25

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 0.5 psig (14"W.C.). See Figure 25. If test pressure is equal to or less than 0.5 psig (14"W.C.), use the main manual shut-off valve before testing to isolate unit from gas supply system.

When checking piping connection for gas leaks, use a soap solution or other preferred means. Common kitchen detergents can cause harmful corrosion on various metals used in gas piping. The use of specialty Gas Leak Detector is strongly recommended. It is available through Lennox under part number 31B2001. **Do not use matches, candles, flame, or other source of ignition to check for gas leaks.**

E-Testing Gas Supply Pressure

When testing gas supply pressure, connect test gauge to the inlet pressure tap **(field provided).** Test supply gas pressure with unit firing at maximum rate. 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 4.5"W.C. and 10.5"W.C. For L.P. gas units, operating pressure at the unit gas connection must be between 11.0"W.C. and 13.5"W.C.

On multiple unit installations, each unit should be checked separately, with and without the other units operating. Supply pressure must fall within the range listed in the previous paragraph.

F-Check and Adjust Manifold Pressure

After line pressure has been checked and adjusted, check manifold pressure. Refer back to figure 24 for location of manifold pressure adjustment screw and pressure tap outlet.

The gas valve is factory set and should not require adjustment. All gas valves are factory regulated. Manifold pressure for natural gas is 1.6" low fire and 3.7" high fire. For L.P. units manifold pressure is 5.5" low fire and 10.5" high fire. These manifold pressures are the same for all GCS16 models regardless of input and size. 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.

NOTE-Do NOT attempt to adjust low fire manifold pressure. Low fire manifold pressure is not adjustable.

⚠ IMPORTANT

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

1 - Connect a test gauge to the outlet pressure tap on the gas valve. Start the unit and allow five minutes for the unit to reach steady state.
2 - While waiting for the unit to stabilize, notice the flame. The flame should be stable without flashback and should not lift from the burner head. Natural gas should burn blue. L.P. gas should burn mostly blue with some orange streaks.
3 - After allowing the unit to stabilize for five minutes, record the manifold pressure. Make adjustments if necessary.
4 - Disconnect heating demand as soon as an accurate reading has been obtained.

G-Proper Gas Flow (Approximate)

To check for proper gas flow to burners, determine BTUH input from unit rating plate or the gas heating capacity table in “SPECIFICATIONS” section in this manual. 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 hourly flow of gas to the burners.

NOTE-For a more accurate reading, all other gas appliances should be turned off.

H-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 electrodes should be located so the tips are at least 1/2” inside the flame envelope. Do not bend electrodes. To measure flame current, follow the procedure below:

1 - Disconnect power to unit.
2 - Remove lead between sensing electrode and ignition control. Install a microamp meter in series between the sensing electrode and the control. See figure 26.
3 - Reconnect power and adjust thermostat for heating demand.
4 - See table 10 after flame is established for meter reading. Do not bend electrodes.
5 - If the meter scale reads 0, the leads are reversed. Disconnect power and reconnect leads for proper polarity.
6 - When finished, disconnect power to unit before disconnecting meter. Make sure sensor wire is securely reconnected before reconnecting power to unit.

TABLE 10

Manufacturer	Nominal Signal Microamps	Drop Out
JOHNSON	0.5-1.0	.09

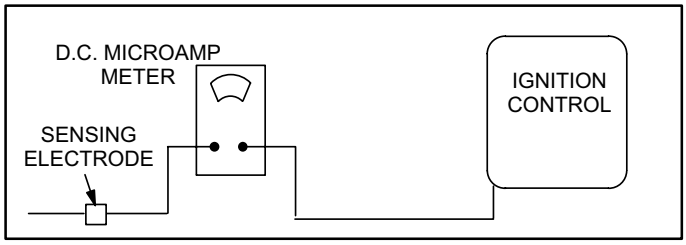


FIGURE 26

IX-MAINTENANCE

Units should be inspected yearly by a qualified service technician.

⚠ WARNING

Electric shock hazard and danger of explosion. Can cause injury, death or product or property damage. Turn off gas and electrical power to unit before performing any maintenance or servicing operations on the unit. Follow lighting instructions attached to unit when putting unit back into operation and after service or maintenance.

⚠ CAUTION

Danger of sharp metallic edges. Can cause injury. Take care when servicing unit to avoid accidental contact with sharp edges.

A-Lubrication

All motor bearings are prelubricated. No further lubrication is required.

B-Filters

Unit is equipped with six 18” x 24” x 2” pleated throw-away type filters. Filters should be checked and replaced when necessary with filters of like kind and size. Take note of air flow direction marking on filter frame when reinstalling filters.

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

C-Burners

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

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

3- Clean burners as follows:

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

b- Remove access panel to burner compartment.

c- Remove burner retaining clip and lift burners from orifice.

d- Clean as necessary and replace burners. Refit retaining clips. Make sure that burner heads line up correctly. Spark gaps on ignition and flame sensing electrode must be properly set. See HEATING COMPONENTS section for correct gap. Replace access panel.

⚠ WARNING

Danger of explosion. Can cause injury or death. Do not overtighten main burner mounting screws. Snug tighten only.

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

D-Combustion Air Inducer

A combustion air centrifugal switch, S18, checks combustion air inducer operation before allowing power to the gas controller.

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

Cleaning Combustion Air Inducer and Vent Cap

1- Shut off power supply and gas to unit.

2- Remove four screws retaining vent cap and combustion air inducer to side panel. Clean vent cap as necessary.

3- Disconnect wiring to combustion air inducer.

4- Remove screws holding combustion air inducer to flue box and vent connector. Take care not to lose or damage vent screen.

5- Clean inducer wheel blades with a small brush and wipe off any dust from housing. Clean accumulated dust from front of flue box cover.

6- Replace combustion air inducer by reversing this procedure. It is recommended that the combustion air inducer gasket be replaced during reassembly.

7- Clean louvers in combustion air supply (right side of (vestibule panel) using a small brush.

E-Flue Passageway and Flue Box

1- Remove combustion air blower assembly as described in section D.

2- Remove flue box cover and flue tube collector plate. Clean with a wire brush as required.

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

4- Reinsert tube baffles and reassemble the unit. The flue box cover gasket and combustion air blower gasket should also be replaced during reassembly.

F-Evaporator Coil

Inspect and clean coil at beginning of each cooling and heating season. Clean using mild detergent or commercial coil cleanser. Flush coil and condensate drain with water taking care not to get insulation, filters and return air ducts wet.

G-Condenser Coil

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

⚠ IMPORTANT

If owner complains of insufficient cooling, unit should be gauged and refrigerant charge checked. Refer to gauge manifold attachment, checking charge and charging sections in this instructions.

H-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.

I-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

1-RMF16 Mounting Frame

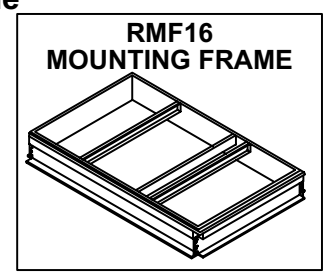


FIGURE 27

When installing a GCS16 unit on a combustible surface for downflow discharge applications, RMF16 roof mounting (figure 27) frame is required. Otherwise, the RMF16 is recommended but not required. The GCS16, if not mounted on a flat (roof) surface, MUST be supported under all edges and under the middle of the unit to prevent sagging. The GCS16 MUST be mounted level within 1/16" per linear foot in any direction.

The assembled RMF16 mounting frame is shown in figure 27. Refer to the RMF16 installation instructions for details of proper assembly and mounting. Roof mounting frame MUST be squared to roof before mounting. Plenum system MUST be installed before unit is set on mounting frame. Refer to RMF16 installation instructions for proper plenum construction.

Many types of roof framing or supports can be used to mount the GCS16 unit, depending upon different roof structures.

2-REMD16M Economizer

The REMD16M economizers (figure 28) open a set of dampers to allow 0 to 100 percent outdoor air to be used for cooling when outdoor humidity and temperature are acceptable. Additional (2nd stage) cooling demand is directed to the compressor while the dampers remain open. If outdoor air becomes unacceptable, the outdoor air dampers close to a predetermined minimum position while the compressor cooling circuit cycles as needed.

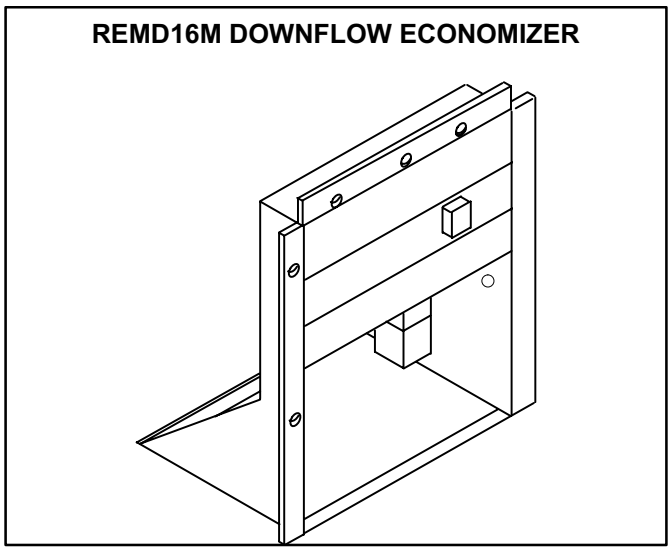


FIGURE 28

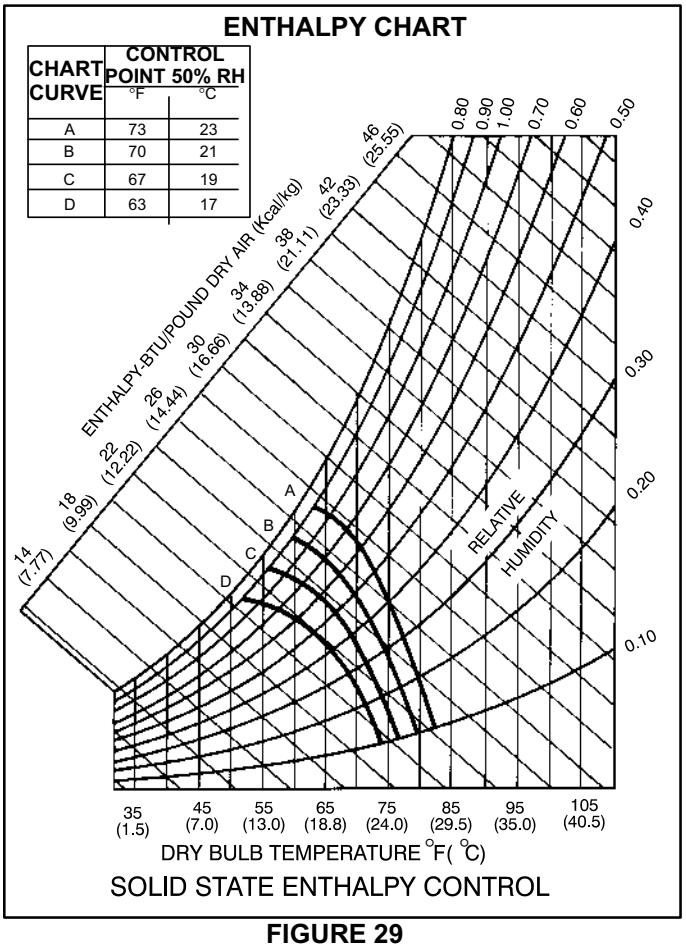


FIGURE 29

Economizer Operation

a-Enthalpy Control: Setpoint Control

The key to economizer operation is the enthalpy control. The enthalpy control senses the total heat content of the outside air (temperature plus humidity) and uses that information to control the amount of outside air brought into the system. When the enthalpy of outside air is below the control setpoint, the control actuates a motor which in turn adjusts the outdoor dampers to meet the cooling demands of the building.

When the heat content rises above the control setpoint, the control de-activates and the dampers close to the preset minimum position (not closed) position.

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 29.

Example:

If the enthalpy control is set at setpoint "A" as shown in figure 29, the following situation could occur. A cooling demand when the outside air is at 75° and 20 percent humidity would drive the economizer outdoor air dampers open to utilize outdoor air for cooling. The compressor cooling circuit would be disabled. However, if the outdoor air should change to 70°F (a drop in temperature) and 70 percent humidity (a dramatic rise in humidity), the "total heat content" of the outdoor air would rise above the enthalpy control setpoint and de-activate the damper motor to the preset minimum position. If cooling demand is still present when the total heat of the outside air rises above the control setpoint, cooling demand is routed from the economizer to the compressor cooling circuit.

b-Minimum Position

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 position switch (potentiometer) which allows the outdoor dampers to be adjusted to a preset minimum position. This allows a preset amount of air exchange at all times during unit operation. When unit operation stops, the dampers drive fully closed. The potentiometer is located on the enthalpy control face.

c-Enthalpy Sensor

The enthalpy sensor is located on the outside portion of the outdoor damper blades (as shown in figure 30). The sensor monitors the total heat content of the outdoor air (temperature plus humidity) and sends the information to the enthalpy control. The enthalpy control uses the information to determine if outdoor air can be used for cooling.

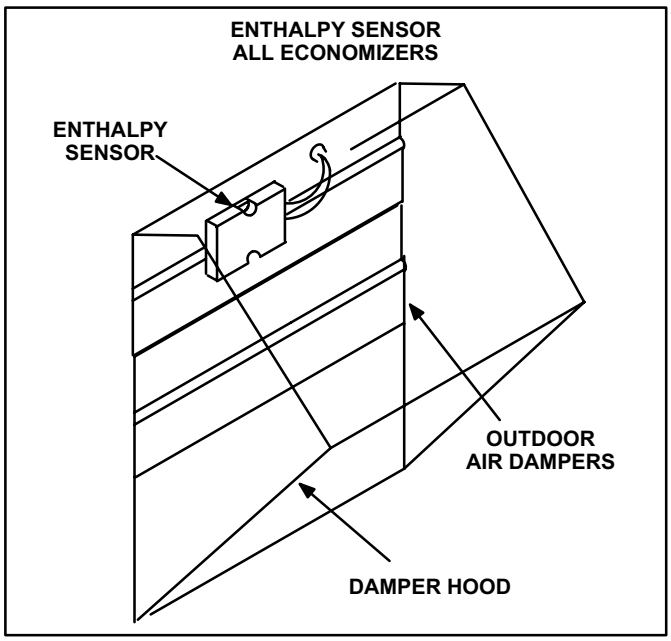


FIGURE 30

d-Mixed Air Sensor

The sensor measures the resultant temperature of the mixed air downstream of the evaporator coil. The mixed air temperature is used by the enthalpy control when outdoor dampers are open to modulate the damper position to maintain a 55°F supply air temperature. Modulating economizers are equipped with a single mixed air sensor.

The mixed air sensor is located in the supply air stream. The sensor fits through a factory supplied hole in the panel dividing the unit return and supply air.

e-Modulating Damper Motor Check

Honeywell W7459A

1 -Disconnect main power to the GCS16.

2 -Turn thermostat control to OFF position (occupied mode).

3 -Install jumper across terminals 6-9 on blower relay in unit control box.

4 -Install jumper across enthalpy control terminals T and T1. See figure 31 for location.

5 -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.

6 -Disconnect power to the unit. Outdoor damper should spring return to closed position.

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

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

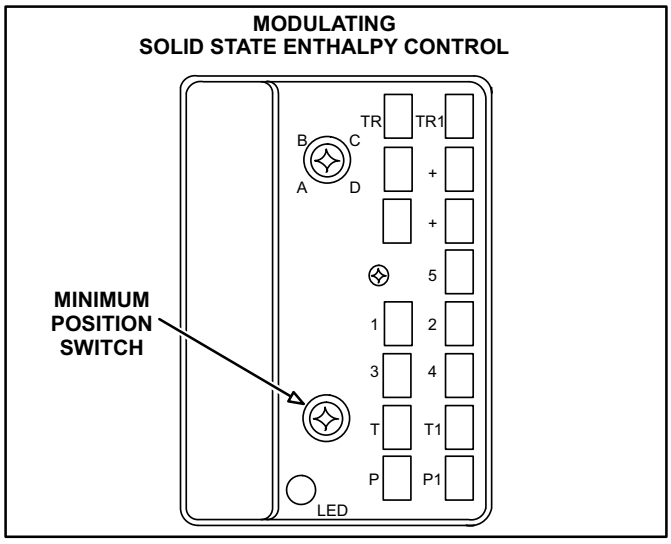


FIGURE 31

f-Warm Up Kit

An optional warm up kit may be added to REMD16 economizer (except GCS16s 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 mounts to the GCS16 in the control mounting area of the blower compartment. The kit plugs into the unit wiring harness inline between the unit and the economizer.

g-Night Relay

Optional night relay must be added to economizer when night setback functions are desired with W973 or electromechanical control systems. Kit includes a DPDT relay which is hard-wired to the economizer harness.

If a W973 system is used, the relay holds the outdoor dampers closed during setback. If an electromechanical thermostat system is used, the relay holds the outdoor dampers closed during setback, de-energizes the indoor thermostat and energizes the setback thermostat. Night relay is not required for any other control system.

3-Firestats S74 & S75

Some local codes require the installation of discharge air and return air firestats to auotomatically 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.

4-OAD16 Outdoor Air Damper

OAD16 damper section (figure 32) may be installed any place outside of the building in the return air duct. Refer to OAD16 installation instruction manual for specific details regarding installation. The OAD16 damper motor kit (35G21) provides motorized operation of air damper blades. The washable filter supplied with the OAD16 can be cleaned with water and 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 (30165).

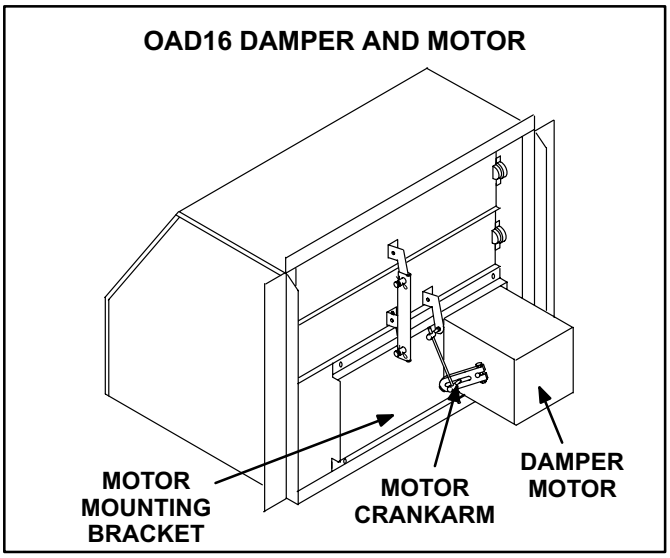


FIGURE 32

5-LPG Kit

All C.S.A. rated GCS16s are factory set for use with natural gas. An optional L.P.G. conversion kit allows changeover from natural to L.P.G. supply. GCS16 units have 1/8 NPT pipe thread gas orifices.

Refer to the L.P.G. conversion kit installation instruction for specific installation procedures.

6-Condenser Coil Guard Kit

Optional condenser coil guard kit is available for all units. The kit includes PVC coated steel wire coil guard which is field installed.

7-Low Ambient Kit

The optional low ambient kit (figure 33) allows for mechanical cooling operation down to 0°F (-17.7°C)

⚠ CAUTION

Compressor monitor cannot be used with optional low ambient kit. Optional field installed compressor monitor MUST be disconnected before allowing low ambient kit to be used.

The low ambient pressure switch is wired in series with the condenser fan relay K10. Refer to the low ambient kit installation instruction manual for detailed installation instructions.

The low ambient pressure switch cycles the condenser fan while allowing normal compressor operation. This intermittent fan operation results in a high evaporating temperature which allows the system to operate without evaporator coil icing and losing capacity.

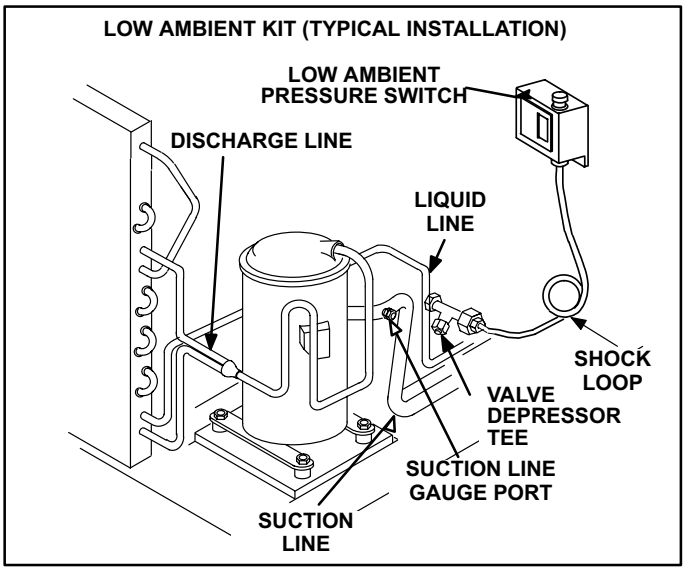


FIGURE 33

Adjustment:

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

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

1 - Loosen knob securing screw to allow knob stop to pass over fixed stop on control (see figure 34).

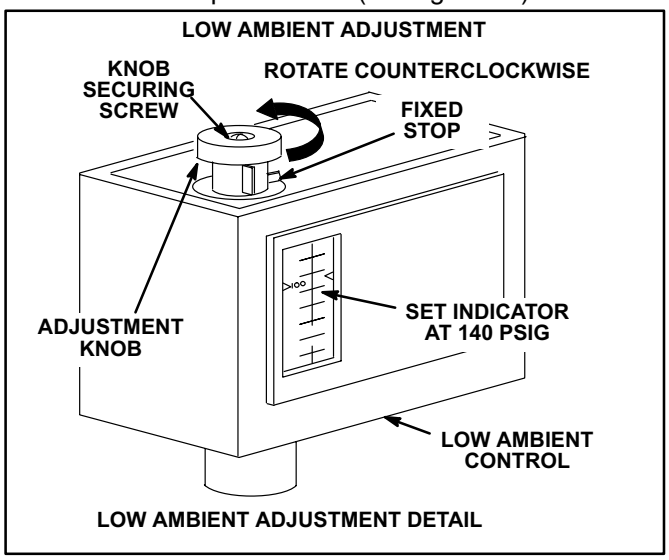


FIGURE 34

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

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

CUT-OUT = CUT-IN minus the DIFFERENCE.

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

3 - Tighten the securing screw after adjusting.

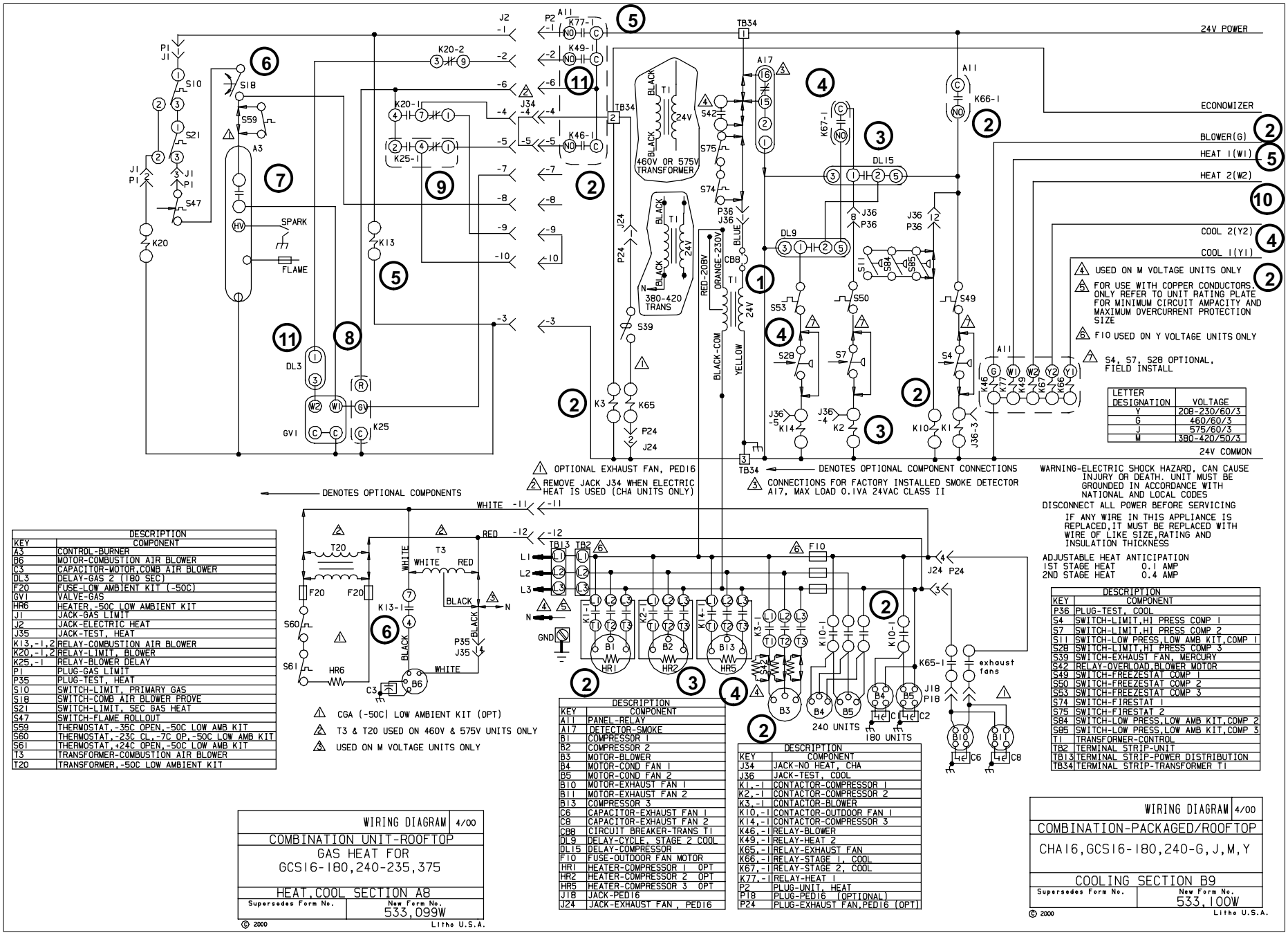
8-Transitions

Optional supply/return transitions SRT16 are available for use with downflow GCS16s utilizing the optional RMF16 roof mounting frame. The transition must be installed in the RMF16 mounting frame before mounting the GCS16 to the frame. See OPTIONAL ACCESSORIES section for size and kit number. Refer to the manufacturer's instructions included with the transition for detailed installation procedures.

9-Supply and Return Diffusers

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

XI-WIRING DIAGRAM AND SEQUENCE OF OPERATION GCS/CHA16-180/240



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

KEY	DESCRIPTION COMPONENT
A3	CONTROL-BURNER
B6	MOTOR-COMBUSTION AIR BLOWER
C3	CAPACITOR-MOTOR,COMB AIR BLOWER
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
J2	JACK-ELECTRIC HEAT
J35	JACK-TEST, HEAT
K13,-1,2	RELAY-COMBUSTION AIR BLOWER
K20,-1,2	RELAY-LIMIT, BLOWER
K25,-1	RELAY-BLOWER DELAY
P1	PLUG-GAS LIMIT
P35	PLUG-TEST, HEAT
S10	SWITCH-LIMIT, PRIMARY GAS
S18	SWITCH-COMB AIR BLOWER PROVE
S21	SWITCH-LIMIT, SEC GAS HEAT
S47	SWITCH-FLAME ROLLOUT
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
T3	TRANSFORMER-COMBUSTION AIR BLOWER
T20	TRANSFORMER,-50C LOW AMBIENT KIT

KEY	DESCRIPTION COMPONENT
A11	PANEL-RELAY
A17	DETECTOR-SMOKE
B1	COMPRESSOR 1
B2	COMPRESSOR 2
B3	MOTOR-BLOWER
B4	MOTOR-COND FAN 1
B5	MOTOR-COND FAN 2
B10	MOTOR-EXHAUST FAN 1
B11	MOTOR-EXHAUST FAN 2
B13	COMPRESSOR 3
C6	CAPACITOR-EXHAUST FAN 1
C8	CAPACITOR-EXHAUST FAN 2
CB8	CIRCUIT BREAKER-TRANS T1
DL9	DELAY-CYCLE, STAGE 2 COOL
DL15	DELAY-COMPRESSOR
F10	FUSE-OUTDOOR FAN MOTOR
HR1	HEATER-COMPRESSOR 1 OPT
HR2	HEATER-COMPRESSOR 2 OPT
HR5	HEATER-COMPRESSOR 3 OPT
J18	JACK-PED16
J24	JACK-EXHAUST FAN , PED16

KEY	DESCRIPTION COMPONENT
J34	JACK-NO HEAT, CHA
J36	JACK-TEST, COOL
K1,-1	CONTACTOR-COMPRESSOR 1
K2,-1	CONTACTOR-COMPRESSOR 2
K3,-1	CONTACTOR-BLOWER
K10,-1	CONTACTOR-OUTDOOR FAN 1
K14,-1	CONTACTOR-COMPRESSOR 3
K46,-1	RELAY-BLOWER
K49,-1	RELAY-HEAT 2
K65,-1	RELAY-EXHAUST FAN
K66,-1	RELAY-STAGE 1, COOL
K67,-1	RELAY-STAGE 2, COOL
K77,-1	RELAY-HEAT 1
P2	PLUG-UNIT, HEAT
P18	PLUG-PED16 (OPTIONAL)
P24	PLUG-EXHAUST FAN,PED16 (OPT)

KEY	DESCRIPTION COMPONENT
P36	PLUG-TEST, COOL
S4	SWITCH-LIMIT,HI PRESS COMP 1
S7	SWITCH-LIMIT,HI PRESS COMP 2
S11	SWITCH-LOW PRESS,LOW AMB KIT,COMP 1
S28	SWITCH-LIMIT,HI PRESS COMP 3
S39	SWITCH-EXHAUST FAN, MERCURY
S42	RELAY-OVERLOAD,BLOWER MOTOR
S49	SWITCH-FREEZESTAT COMP 1
S50	SWITCH-FREEZESTAT COMP 2
S53	SWITCH-FREEZESTAT COMP 3
S74	SWITCH-FIRESTAT 1
S75	SWITCH-FIRESTAT 2
S84	SWITCH-LOW PRESS,LOW AMB KIT,COMP 2
S85	SWITCH-LOW PRESS,LOW AMB KIT,COMP 3
T1	TRANSFORMER-CONTROL
TB2	TERMINAL STRIP-UNIT
TB13	TERMINAL STRIP-POWER DISTRIBUTION
TB34	TERMINAL STRIP-TRANSFORMER T1

WIRING DIAGRAM	4/00
COMBINATION UNIT-ROOFTOP	
GAS HEAT FOR GCS16-180,240-235,375	
HEAT,COOL SECTION A8	
Supersedes Form No.	New Form No. 533,099W

WIRING DIAGRAM	4/00
COMBINATION-PACKAGED/ROOFTOP	
CHA16,GCS16-180,240-G,J,M,Y	
COOLING SECTION B9	
Supersedes Form No.	New Form No. 533,100W

GCS/CHA16-180/240 SEQUENCE OF OPERATION

Operation Sequence
Cooling: 1st. Stage

1- Line voltage energizes transformer T1. Transformer T1 provides 24VAC power to all unit controls and thermostat.

2- Cooling demand energizes Y1 and G in the thermostat. K46-1 contacts close energizing K3 blower relay. K3-1 closes energizing blower B3. 1st stage cool relay K66-1 contacts close. Voltage passes through freeze stat S49 and optional high pressure switch S4 energizing compressor contactor K1. K1-1 closes energizing compressor B1. Simultaneously, voltage passes through optional low ambient pressure switch S11 (compressor 1) and S84 (compressor 2) to energize K10 condenser fan relay. K10-1 closes energizing condenser fan B4 and B5. Economizer is also energized to minimum position.

3-K66-1 contacts close energizing compressor delay DL15. After a short delay of approximately 3 seconds, DL15 contacts close sending voltage through freeze stat S50 and high pressure switch S7, energizing compressor contactor K2. K2-1 closes energizing compressor B2.

Cooling: 2nd. Stage

4- Cooling demand energizes Y2 in the thermostat. 2nd. stage cool relay K67-1 contacts close, energizing compressor delay DL9. After a short delay of approximately 3 seconds, DL-9 contacts close sending voltage through freeze stat S53 and optional high pressure switch S28, energizing compressor contactor K14. K14-1 closes energizing compressor B13.

Heating: 1st. Stage

5- Heating demand initiates at W1 in the thermostat. 1st stage heat relay K77 contacts close energizing combustion air inducer relay K13.

6- K13-1 contacts close energizing combustion air inducer B6. Economizer is also energized to minimum position. When the combustion air inducer nears full speed, prove switch S18 closes. Heating demand continues through S18, S10 primary limit, S21 secondary limit and flame rollout switch S47 to energize ignition control A3.

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

8-After the ignition control delay, A3 activates gas valve GV1 and the spark electrode. When flame is sensed by the flame sensor (minimum 5 microamps) the spark electrode stops. If flame is not sensed after the first trial for ignition, controller A3 repeats two more times before locking out. If the control locks out, it can be reset by breaking and remaking thermostat demand.

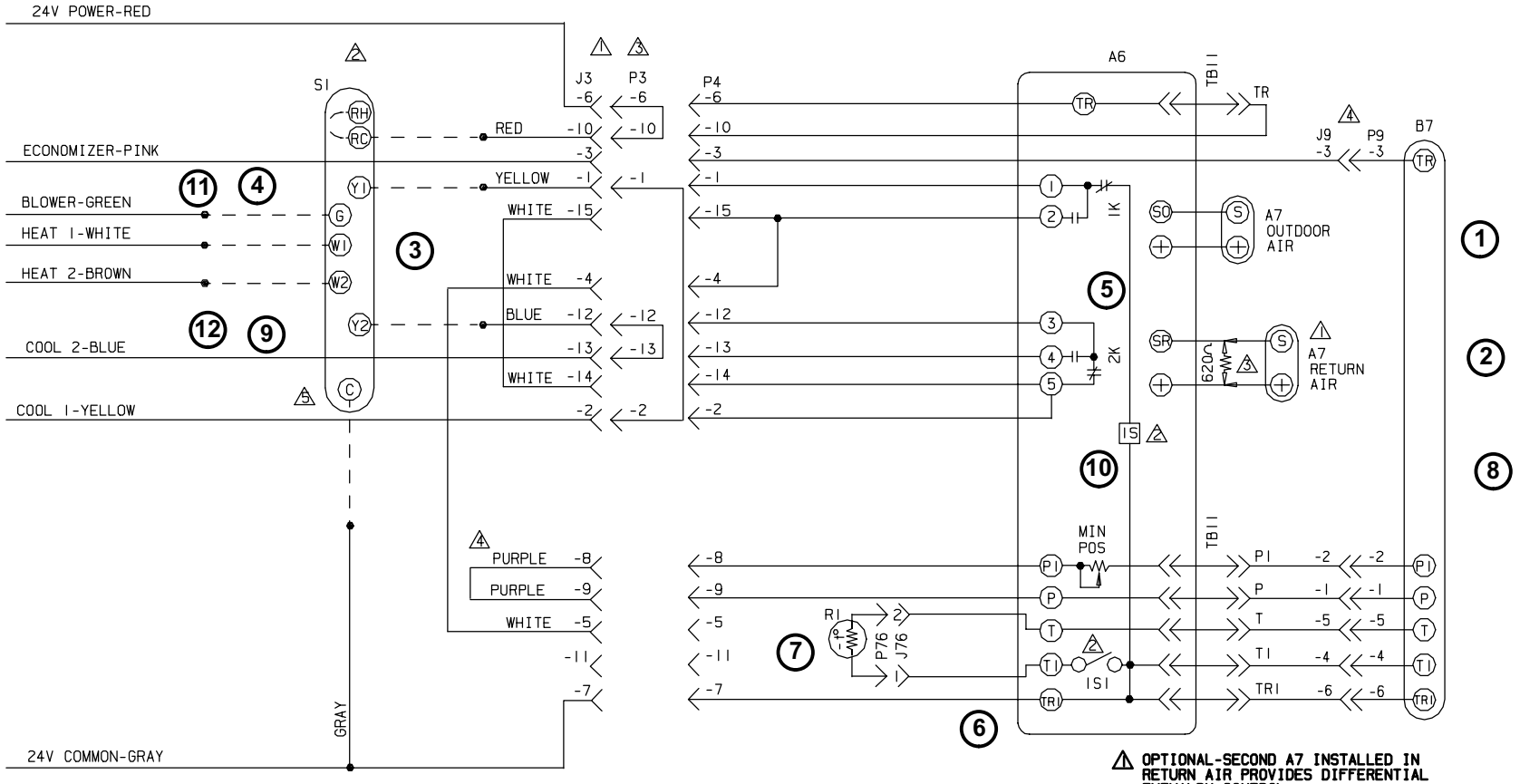
9- Blower delay relay K25 energizes blower relay K3 which in turn energizes blower B3 after 45 second delay.

Heating: 2nd. Stage

10-With first stage operating, an additional heating demand initiates W2 in the thermostat.

11- 2nd stage heat relay K49 contacts close sending voltage through limit relay K20, energizing timer DL3. DL3 energizes gas valve GV1 after 180 second delay. Unit operates at full heating capacity.

ELECTROMECHANICAL THERMOSTAT WITH ECONOMIZER



DESCRIPTION	
KEY	COMPONENT
J3	JACK-UNIT.ECONOMIZER
P3	PLUG-LESS ECONOMIZER
S1	THERMOSTAT-ROOM

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

⚠2 WHEN IS RECEIVES POWER, IS1 CLOSES.

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

⚠4 J9 AND P9 MAY OR MAY NOT BE USED

⚠5 DO NOT CONNECT GRAY COMMON WIRE UNLESS THE THERMOSTAT HAS TERMINAL "C" COMMON. MOST ELECTROMECHANICAL THERMOSTATS DO NOT HAVE THE "C" TERMINAL

⚠4 PURPLE JUMPER WIRE IS MADE LONG TO EXTEND INTO JUNCTION BOX

⚠3 REMOVE P3 WHEN ECONOMIZER IS USED

⚠2 THERMOSTAT SUPPLIED BY USER

⚠1 J3 MAXIMUM LOAD 20VA 24VAC CLASS II

WIRING DIAGRAM	11/99
ACCESSORIES	
ELECTROMECHANICAL THERMOSTAT FOR 16 & 20 SERIES VALUE LINE (2 HEAT, 2 COOL)	
THERMOSTAT-SECTION C1	
Supersedes Form No. 532,928W	New Form No. 533,392W

DESCRIPTION	
KEY	COMPONENT
A6	CONTROL-ENTHALPY W7459A
A7	SENSOR-ENTHALPY
B7	MOTOR-DAMPER
J9	JACK-ECONOMIZER.MOTOR
J76	JACK-SENSOR ECONOMIZER
P4	PLUG-ECONOMIZER
P9	PLUG-ECONOMIZER.MOTOR
P76	PLUG-SENSOR ECONOMIZER
R1	SENSOR-SUPPLY AIR
TB11	TERMINAL STRIP

WIRING DIAGRAM	11/99
ACCESSORIES	
REMD-16-M EMDH-16-M MODULATING ECONOMIZER FOR VALUE LINE UNITS	
ECONOMIZER-SECTION D5	
Supersedes Form No.	New Form No. 533,305W

ELECTROMECHANICAL THERMOSTAT WITH ECONOMIZER

Operation Sequence:

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

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

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

Enthalpy Low, 1st Stage Cool:

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

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

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

7- When a voltage is applied across terminals T and T1 of damper motor, the damper motor energizes and outdoor air dampers open. Supply air sensor R1 varies the voltage across T and T1 and the outdoor air dampers open and 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:

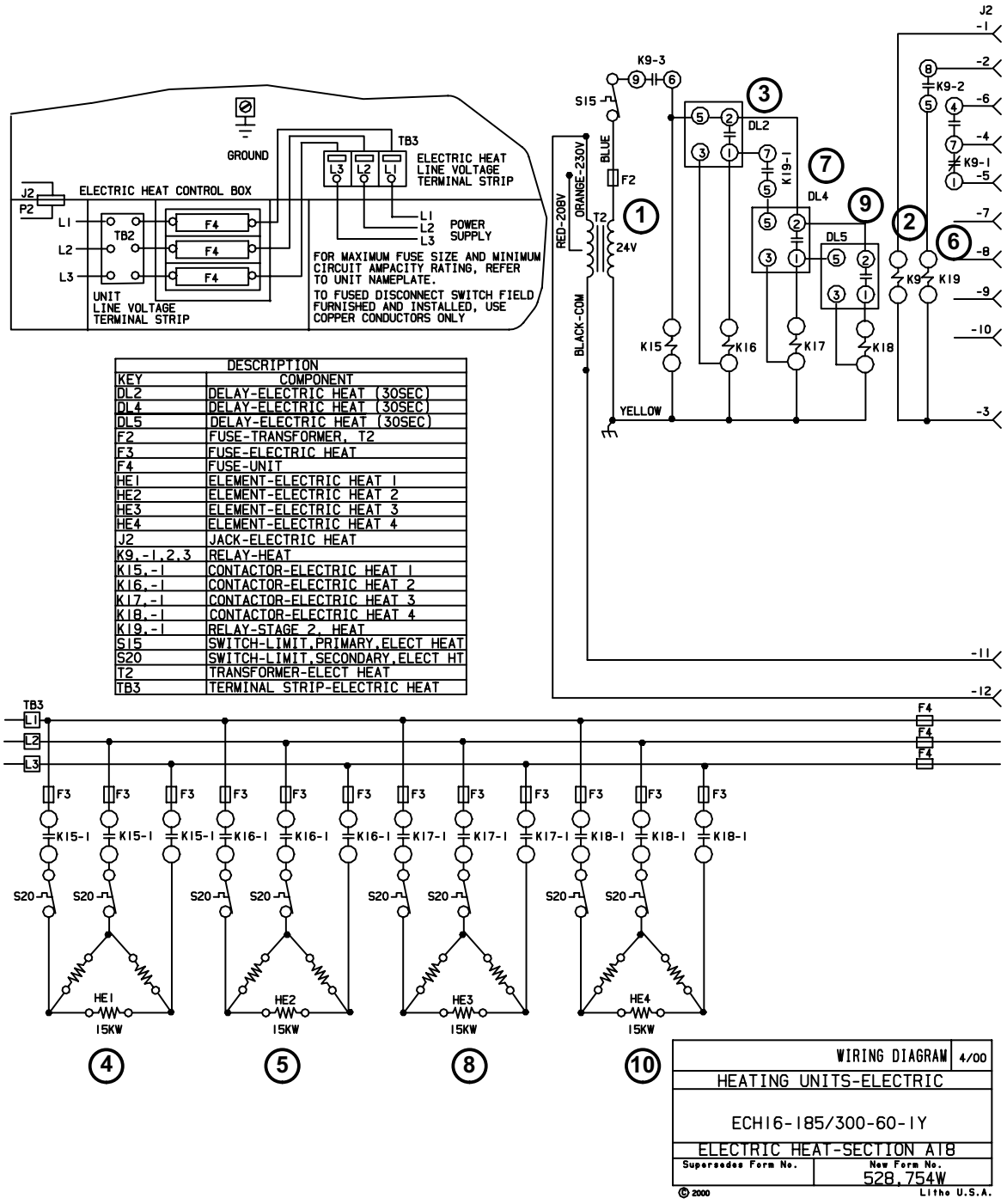
10-Enthalpy control internal relays 1K and 2K switch. Internal relay 1S is de-energized and 1S1 opens. Outdoor air dampers close to minimum position.

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.

ECH16-185/300-60 kW Y VOLTAGE



DESCRIPTION	
KEY	COMPONENT
DL2	DELAY-ELECTRIC HEAT (30SEC)
DL4	DELAY-ELECTRIC HEAT (30SEC)
DL5	DELAY-ELECTRIC HEAT (30SEC)
F2	FUSE-TRANSFORMER, T2
F3	FUSE-ELECTRIC HEAT
F4	FUSE-UNIT
HE1	ELEMENT-ELECTRIC HEAT 1
HE2	ELEMENT-ELECTRIC HEAT 2
HE3	ELEMENT-ELECTRIC HEAT 3
HE4	ELEMENT-ELECTRIC HEAT 4
J2	JACK-ELECTRIC HEAT
K9,-1,2,3	RELAY-HEAT
K15,-1	CONTACTOR-ELECTRIC HEAT 1
K16,-1	CONTACTOR-ELECTRIC HEAT 2
K17,-1	CONTACTOR-ELECTRIC HEAT 3
K18,-1	CONTACTOR-ELECTRIC HEAT 4
K19,-1	RELAY-STAGE 2, HEAT
S15	SWITCH-LIMIT,PRIMARY,ELECT HEAT
S20	SWITCH-LIMIT,SECONDARY,ELECT HT
T2	TRANSFORMER-ELECT HEAT
TB3	TERMINAL STRIP-ELECTRIC HEAT

WIRING DIAGRAM	4/00
HEATING UNITS-ELECTRIC	
ECH16-185/300-60-1Y	
ELECTRIC HEAT-SECTION A18	
Supersedes Form No.	New Form No. 528.754W

NOTE-For ECH16-15kW follow steps 1 through 4 (minus DL2). For ECH16-30, follow steps 1 through 5. For ECH16-45 follow steps 1 through 8 (minus DL5).

Operation Sequence:

1- Control voltage in this heater is supplied by a separate transformer T2 which is powered at all times.

2- 1st stage heating demand closes W1. W1 energizes relay K9.

3- When K9-1 switches, the indoor blower is energized (and optional economizer opens to minimum position). When K9-2 closes, second stage heat is enabled. When K9-3 closes, time delay DL2 is energized. Control voltage passes through primary limits S15 to energize contactor K15.

4- When K15-1 closes, heating elements HE1 are energized.

5- DL2 closes after 30 seconds energizing contactor K16. When K16-1 closes, heating elements HE2 are energized.

6- Additional heating demand W2 passes through K9-2 to energize relay K19.

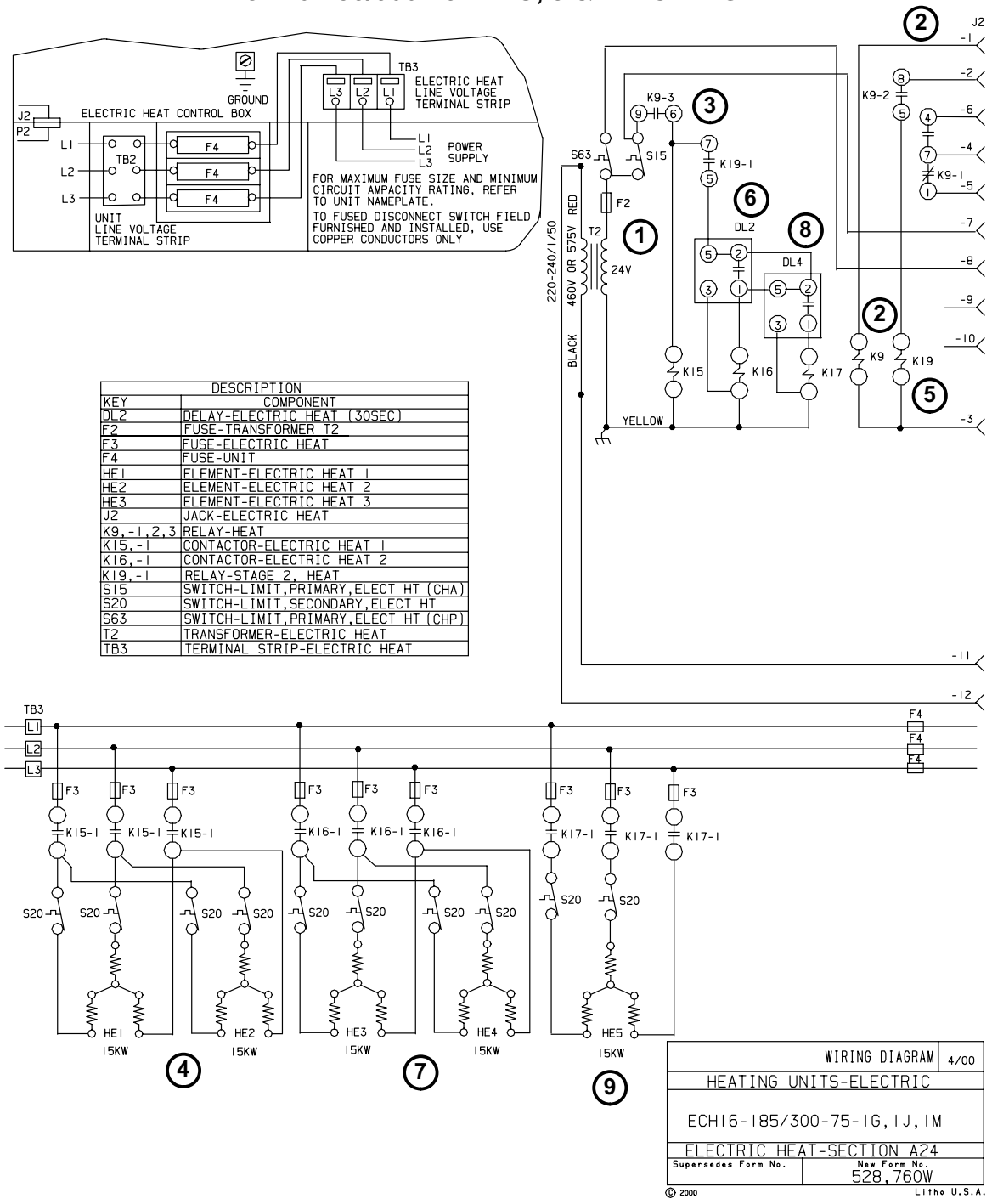
7- When K19-1 switches, time delay DL4 is energized. DL4 closes 30 seconds later to energize contactor K17 and time delay DL5.

8- When K17-1 closes heating elements HE3 are energized,

9- DL5 closes after 30 seconds to energize contactor K18.

10- When K18-1 closes, heating elements HE4 are energized.

ECH16-185/300-75 kW G, J & M VOLTAGE



DESCRIPTION	
KEY	COMPONENT
DL2	DELAY-ELECTRIC HEAT (30SEC)
F2	FUSE-TRANSFORMER T2
F3	FUSE-ELECTRIC HEAT
F4	FUSE-UNIT
HE1	ELEMENT-ELECTRIC HEAT 1
HE2	ELEMENT-ELECTRIC HEAT 2
HE3	ELEMENT-ELECTRIC HEAT 3
J2	JACK-ELECTRIC HEAT
K9,-1,2,3	RELAY-HEAT
K15,-1	CONTACTOR-ELECTRIC HEAT 1
K16,-1	CONTACTOR-ELECTRIC HEAT 2
K19,-1	RELAY-STAGE 2, HEAT
S15	SWITCH-LIMIT,PRIMARY,ELECT HT (CHA)
S20	SWITCH-LIMIT,SECONDARY,ELECT HT
S63	SWITCH-LIMIT,PRIMARY,ELECT HT (CHP)
T2	TRANSFORMER-ELECTRIC HEAT
TB3	TERMINAL STRIP-ELECTRIC HEAT

NOTE-For ECH16-15kW follow steps 1 through 4. For ECH16-45 follow steps 1 through 7 (minus DL4).

Operation Sequence:

1- Control voltage in this heater is supplied by a separate transformer T2 which is powered at all times.

2- 1st stage heating demand closes W1. W1 energizes relay K9.

3- When K9-1 switches, the indoor blower energized (and optional economizer opens to minimum position). When K9-2 closes, second stage heat is enabled. When K9-3 is energized. Control voltage passes through primary limits S15 to energize contactor K15.

4- When K15-1 closes, heating elements HE1 and HE2 are energized.

5- Additional heating demand W2 passes through K9-2 to energize relay K19.

6- When K19-1 switches, time delay DL2 is energized. DL2 closes 30 seconds later to energize contactor K16 and time delay DL4.

7- When K16-1 closes heating elements HE3 and HE4 are energized,

8- DL4 closes after 30 seconds to energize contactor K17.

9- When K17-1 closes, heating elements HE5 are energized.