UNIT INFORMATION

100099

KHC SERIES
7.5 to 10 ton
26.3 to 35.2 kW

Service Literature

KHC092 through 120

The KHC commercial heat pump is available in 7.5, 8.5, and 10 ton capacities. The

KHC092/102/120 refrigerant systems utilize two compressors, two reversing valves, two accumulators, and other parts common to a heat pump. Optional auxiliary electric heat is factory or field installed in KHC units. Electric heat operates in single or multiple stages depending on the kW input size. 7.5kW through 60kW heat sections are available for the KHC heat pump.

KHC units are designed to accept any of several different energy management thermostat control systems with minimum field wiring.

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

If the unit must be lifted for service, rig unit by attaching four cables to the holes located in the unit base rail (two holes at each corner). Refer to the installation instructions for the proper rigging technique.

⚠ WARNING

To prevent serious injury or death:

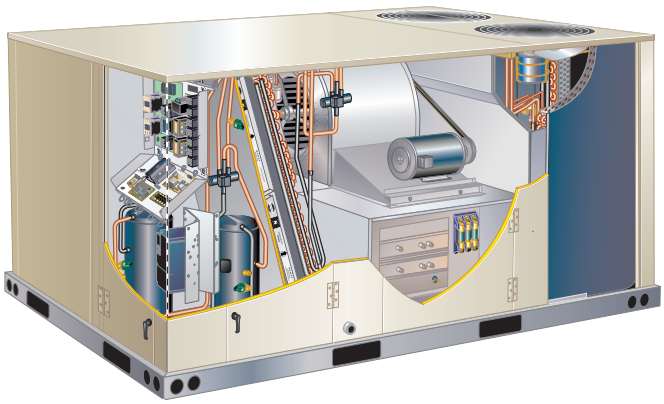
1- Lock-out/tag-out before performing maintenance.

2- If system power is required (e.g., smoke detector maintenance), disable power to blower, remove fan belt where applicable, and ensure all controllers and thermostats are set to the "OFF" position before performing maintenance.

3- Always keep hands, hair, clothing, jewelry, tools, etc., away from moving parts.

⚠ 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 licensed professional HVAC installer or equivalent, service agency, or the gas supplier



⚠ CAUTION

As with any mechanical equipment, contact with sharp sheet metal edges can result in personal injury. Take care while handling this equipment and wear gloves and protective clothing.

⚠ WARNING

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

Table of Contents

OPTIONS / ACCESSORIES

Item Description		Catalog Number	Unit Model No 092	102	120
COOLING SYSTEM					
Condensate Drain Trap	PVC	**22H54**	X	X	X
	Copper	**76W27**	X	X	X
Drain Pan Overflow Switch		**74W42**	X	X	X
Low Ambient Kit		**54W16**	X	X	X
Refrigerant Type		R-410A	O	O	O
BLOWER - SUPPLY AIR					
Blower Motors	Belt Drive - 2 hp	Factory	O	O	O
	Belt Drive - 3 hp	Factory	O	O	O
	Belt Drive - 5 hp	Factory	O	O	O
VFD Manual Bypass Kit		**90W53**	X	X	X
Drive Kits	Kit #1 590-890 rpm	Factory	O	O	O
See Blower Data Tables for selection	Kit #2 800-1105 rpm	Factory	O	O	O
	Kit #3 795-1195 rpm	Factory	O	O	O
	Kit #4 730-970 rpm	Factory	O	O	O
	Kit #5 940-1200 rpm	Factory	O	O	O
	Kit #6 1015-1300 rpm	Factory	O	O	O
	Kit #10 900-1135 rpm	Factory	O	O	O
	Kit #11 1040-1315 rpm	Factory	O	O	O
	Kit #12 1125-1425 rpm	Factory	O	O	O
CABINET					
Combination Coil/Hail Guards		**13T24**	X	X	X
Hinged Access Panels		Factory	O	O	O
Horizontal Discharge Kit		**51W25**	X	X	X
Return Air Adaptor Plate (for LC/LG/LH and TC/TG/TH unit replacement)		**54W96**	OX	OX	OX
CONTROLS					
Smoke Detector - Supply or Return (Power board and one sensor)		**11K76**	X	X	X
Smoke Detector - Supply and Return (Power board and two sensors)		**11K80**	X	X	X

NOTE - Catalog numbers shown are for ordering field installed accessories.

OX - Configure To Order (Factory Installed) or Field Installed

O = Configure To Order (Factory Installed)

X = Field Installed

OPTIONS / ACCESSORIES

Item Description		Catalog Number	Unit Model No 092	102	120
INDOOR AIR QUALITY					
Healthy Climate® High Efficiency Air Filters 20 x 25 x 2 (Order 4 per unit)	MERV 8	**50W61**	X	X	X
	MERV 13	**52W41**	X	X	X
	MERV 16	**21U41**	X	X	X
Replacement Media Filter With Metal Mesh Frame (includes non-pleated filter media)		**Y3063**	X	X	X
Indoor Air Quality (CO_2) Sensors					
Sensor - Wall-mount, off-white plastic cover with LCD display		**77N39**	X	X	X
Sensor - Wall-mount, off-white plastic cover, no display		**23V86**	X	X	X
Sensor - Black plastic case with LCD display, rated for plenum mounting		**87N52**	X	X	X
Sensor - Wall-mount, black plastic case, no display, rated for plenum mounting		**87N54**	X	X	X
CO_2 Sensor Duct Mounting Kit - for downflow applications		**85L43**	X	X	X
Aspiration Box - for duct mounting non-plenum rated CO_2 sensors (**77N39**)		**90N43**	X	X	X
Needlepoint Bipolar Ionization (NPBI)					
Needlepoint Bipolar Ionization Kit		**22U15**	X	X	X
UVC Germicidal Lamps					
[1] Healthy Climate® UVC Light Kit (110/230V-1ph)		**21A93**	X	X	X
Step-Down Transformers	460V primary, 230V secondary	**10H20**	X	X	X
	575V primary, 230V secondary	**10H21**	X	X	X
ELECTRICAL					
Voltage 60 Hz	208/230V - 3 phase	Factory	O	O	O
	460V - 3 phase	Factory	O	O	O
	575V - 3 phase	Factory	O	O	O
Disconnect Switch - See Electrical/Electric Heat tables for selection	80 amp	**54W56**	OX	OX	OX
	150 amp	**54W57**	OX	OX	OX
GFI Service Outlets	15 amp non-powered, field-wired (208/230V, 460V only)	**74M70**	OX	OX	OX
	[2] 20 amp non-powered, field-wired (208/230V, 460V, 575V)	**67E01**	X	X	X
	[2] 20 amp non-powered, field-wired (575V)	Factory	O	O	O
Weatherproof Cover for GFI		**10C89**	X	X	X
ELECTRIC HEAT					
7.5 kW	208/240V-3ph	**56W38**	X	X	
	460V-3ph	**56W39**	X	X	
	575V-3ph	**56W40**	X	X	
15 kW	208/240V-3ph	**56W41**	X	X	X
	460V-3ph	**56W42**	X	X	X
	575V-3ph	**56W43**	X	X	X
22.5 kW	208/240V-3ph	**56W44**	X	X	X
	460V-3ph	**56W45**	X	X	X
	575V-3ph	**56W46**	X	X	X
30 kW	208/240V-3ph	**56W47**	X	X	X
	460V-3ph	**56W48**	X	X	X
	575V-3ph	**56W49**	X	X	X
45 kW	208/240V-3ph	**56W50**	X	X	X
	460V-3ph	**56W51**	X	X	X
	575V-3ph	**56W52**	X	X	X
60 kW	208/240V-3ph	**55W02**			X
	460V-3ph	**55W03**			X
	575V-3ph	**55W04**			X

[1] Lamps operate on 110-230V single-phase power supply. Step-down transformer may be ordered separately for 460V and 575V units. Alternately, 110V power supply may be used to directly power the UVC ballast(s).

[2] Canada requires a minimum 20 amp circuit. Select 20 amp, non-powered, field wired GFI.

NOTE - Catalog numbers shown are for ordering field installed accessories.

OX - Configure To Order (Factory Installed) or Field Installed

O = Configure To Order (Factory Installed)

X = Field Installed

OPTIONS / ACCESSORIES

Item Description		Catalog Number	Unit Model No 092	102	120
ECONOMIZER					
Standard Economizer (Not for Title 24)					
Standard Economizer with Single Temperature Control Downflow or Horizontal Applications - Includes Barometric Relief Dampers and Air Hoods		**13U45**	X	X	X
Standard Economizer Controls (Not for Title 24)					
Single Enthalpy Control		**21Z09**	X	X	X
Differential Enthalpy Control (order 2)		**21Z09**	X	X	X
High Performance Economizer (Approved for California Title 24 Building Standards / AMCA Class 1A Certified)					
High Performance Economizer Downflow or Horizontal Applications - Includes Barometric Relief Dampers and Air Hoods Factory Installed Economizer - Enthalpy control is furnished as standard. Field programmable for Sensible Control without additional hardware Field Installed Economizer - Sensible Sensor is furnished as standard		**23G23**	OX	OX	OX
High Performance Economizer Controls					
Single Enthalpy Control		**23G26**	X	X	X
Differential Enthalpy Control (order 1 for factory; order 2 for field) (Not for Title 24)		**23G26**	X	X	X
Economizer Accessories					
WLAN Stick (For High Performance Economizer only)		**23K58**	X	X	X
Horizontal Low Profile Barometric Relief Dampers With Exhaust Hood					
Horizontal Low Profile Barometric Relief Dampers With Exhaust Hood		**53K04**	X	X	X
OUTDOOR AIR					
Outdoor Air Dampers with Outdoor Air Hood					
Motorized		**14G28**	X	X	X
Manual		**14G29**	X	X	X
POWER EXHAUST					
Standard Static	208/230V-3ph	**53W44**	X	X	X
	460V-3ph	**53W45**	X	X	X
	575V-3ph	**53W46**	X	X	X
ROOF CURBS					
Hybrid Roof Curbs, Downflow					
8 in. height	C1CURB70B-1	**11F54**	X	X	X
14 in. height	C1CURB71B-1	**11F55**	X	X	X
18 in. height	C1CURB72B-1	**11F56**	X	X	X
24 in. height	C1CURB73B-1	**11F57**	X	X	X
Adjustable Pitch Curb, Downflow					
14 in. height	C1CURB55B-1	**54W50**	X	X	X
CEILING DIFFUSERS					
Step-Down - Order one	RTD11-95S	**13K61**	X		
	RTD11-135S	**13K62**		X	X
Flush - Order one	FD11-95S	**13K56**	X		
	FD11-135S	**13K57**		X	X
Transitions (Supply and Return) - Order one	C1DIFF30B-1	**12X65**	X		
	C1DIFF31B-1	**12X66**		X	X

NOTE - Catalog numbers shown are for ordering field installed accessories.

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SPECIFICATIONS

General Data		7.5 Ton	8.5 Ton	10 Ton
	Model Number	**KHC092S4M**	**KHC102S4M**	**KHC120S4M**
	Efficiency Type	**Standard**	**Standard**	**Standard**
	Blower Type	MSAV® (Multi-Stage Air Volume)	MSAV® (Multi-Stage Air Volume)	MSAV® (Multi-Stage Air Volume)
Cooling Performance	Gross Cooling Capacity - Btuh	91,600	103,400	119,500
	[1] Net Cooling Capacity - Btuh	89,000	100,000	116,000
	[1] AHRI Rated Air Flow - cfm	2800	3200	3400
	Total Unit Power - kW	8.1	9.1	10.7
	[1] EER (Btuh/Watt)	11.0	11.0	11.0
	[1] IEER (Btuh/Watt)	14.1	14.1	14.1
	Refrigerant Type	R-410A	R-410A	R-410A
	Refrigerant Charge Furnished Circuit 1	12 lbs. 8 oz.	14 lbs. 8 oz.	15 lbs. 0 oz.
	Refrigerant Charge Furnished Circuit 2	13 lbs. 8 oz.	15 lbs. 0 oz.	15 lbs. 0 oz.
Heating Performance	[1] Total High Heat Capacity - Btuh	88,000	99,000	115,000
	Total Unit Power - kW	7.6	8.5	9.9
	[1] C.O.P.	3.4	3.4	3.4
	[1] Total Low Heat Capacity - Btuh	53,000	59,000	70,000
	Total Unit Power (kW)	6.9	7.8	9.1
	[1] C.O.P.	2.25	2.2	2.25
Electric Heat Available		7.5, 15, 22.5, 30 & 45 kW		15, 22.5, 30, 45 & 60 kW
Compressor Type (number)		(1) Two-Stage Scroll (1) Single-Stage Scroll		
Outdoor Coils	Net face area (total) - sq. ft.	28.8	28.8	28.8
	Tube diameter - in.	3/8	3/8	3/8
	Number of rows	2	3	3
	Fins per inch	20	20	20
Outdoor Coil Fans	Motor - (No.) horsepower	(2) 1/3 PSC	(2) 1/2 PSC	(2) 1/2 PSC
	Motor rpm	1075	1075	1075
	Total Motor watts	665	806	806
	Diameter - (No.) in.	(2) 24	(2) 24	(2) 24
	Number of blades	3	3	3
	Total Air volume - cfm	8200	8800	8800
Indoor Coils	Net face area (total) - sq. ft.	12.8	12.8	12.8
	Tube diameter - in.	3/8	3/8	3/8
	Number of rows	3	4	4
	Fins per inch	14	14	14
	Drain connection - Number and size	(1) 1 in. NPT coupling		
	Expansion device type	Balance port TXV, removable head		
[2] **Indoor Blower and Drive Selection**	Nominal motor output	2 hp, 3 hp, 5 hp		
	Maximum usable motor output (US Only)	2.3 hp, 3.45 hp, 5.75 hp		
	Motor - Drive kit number	2 hp [3] **Kit 1** 590-890 rpm **Kit 2** 800-1105 rpm **Kit 3** 795-1195 rpm 3 hp **Kit 4** 730-970 rpm **Kit 5** 940-1200 rpm **Kit 6** 1015-1300 rpm 5 hp **Kit 10** 900-1135 rpm **Kit 11** 1040-1315 rpm **Kit 12** 1125-1425 rpm		
	Blower wheel nominal diameter x width - in.	(1) 15 X 15		
Filters	Type of filter	MERV 4, Disposable		
	Number and size - in.	(4) 20 x 25 x 2		
Electrical characteristics		208/230V, 460V or 575V - 60 hertz - 3 phase		

NOTE - Net capacity includes evaporator blower motor heat deduction. Gross capacity does not include evaporator blower motor heat deduction.

[1] AHRI Certified to AHRI Standard 340/360:
Cooling Ratings - 95°F outdoor air temperature and 80°F db/67°F wb entering indoor coil air.
High Temperature Heating Ratings - 47°F db/43°F wb outdoor air temperature and 70°F entering indoor coil air.
Low Temperature Heating Ratings - 17°F db/15°F wb outdoor air temperature and 70°F entering indoor coil air.

[2] 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 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.

[3] Standard motor and drive kit furnished with unit.

NOTE – Motor service factor limit - 1.0.

KHC092S4M - BASE UNIT

BLOWER TABLE INCLUDES RESISTANCE FOR BASE UNIT ONLY (NO HEAT SECTION) WITH DRY INDOOR COIL AND AIR FILTERS IN PLACE. FOR ALL UNITS ADD:

1 − Wet indoor coil air resistance of selected unit.

2 − Any factory installed options air resistance (heat section, economizer, etc.)

3 − Any field installed accessories air resistance (duct resistance, diffuser, etc.)

Then determine from blower table blower motor output required.

See page 8 for blower motors and drives.

See page 8 for wet coil and option/accessory air resistance data.

Minimum Air Volume Required For Use With Optional Electric Heat (Maximum Static Pressure - 2.0 in. w.g.):

7.5 kW, 15 kW, 22.5 kW, 30 kW and 45 kW - 2800 cfm

Total Air Volume cfm	Total Static Pressure − in. w.g.													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1750	583	0.09	627	0.06	673	0.09	723	0.06	777	0.45	834	0.82	892	1.13
2000	593	0.11	636	0.07	682	0.10	731	0.22	784	0.60	840	0.96	898	1.26
2250	604	0.15	645	0.11	690	0.15	739	0.39	790	0.74	846	1.08	901	1.34
2500	615	0.19	655	0.15	699	0.20	747	0.55	797	0.89	851	1.20	906	1.44
2750	626	0.23	666	0.19	709	0.37	755	0.71	805	1.03	858	1.32	912	1.55
3000	637	0.27	677	0.24	719	0.55	764	0.87	813	1.18	866	1.45	920	1.67
3250	650	0.31	688	0.43	730	0.73	775	1.04	823	1.34	875	1.60	930	1.81
3500	663	0.35	700	0.63	741	0.92	786	1.22	834	1.50	886	1.76	942	1.96
3750	676	0.57	714	0.84	754	1.12	798	1.41	846	1.68	899	1.93	956	2.14

Total Air Volume cfm	Total Static Pressure − in. w.g.											
	1.6		1.8		2		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1750	943	1.28	990	1.38	1038	1.44	1084	1.60	1131	1.79	1179	2.25
2000	948	1.38	996	1.47	1045	1.57	1092	1.71	1140	1.92	1188	2.32
2250	953	1.48	1002	1.57	1052	1.70	1100	1.86	1149	2.09	1197	2.42
2500	959	1.58	1009	1.68	1059	1.83	1108	2.01	1158	2.26	1206	2.52
2750	966	1.70	1017	1.81	1067	1.97	1117	2.17	1166	2.44	1215	2.71
3000	975	1.82	1026	1.96	1076	2.13	1126	2.35	1176	2.63	1225	2.92
3250	985	1.97	1036	2.12	1086	2.31	1136	2.54	1186	2.83	1235	3.13
3500	997	2.14	1048	2.31	1097	2.51	1147	2.75	1196	3.04	1245	3.35
3750	1010	2.32	1060	2.51	1109	2.72	1158	2.98	1207	3.27	1255	3.58

KHC102S4M, KHC120S4M - BASE UNIT

BLOWER TABLE INCLUDES RESISTANCE FOR BASE UNIT ONLY (NO HEAT SECTION) WITH DRY INDOOR COIL AND AIR FILTERS IN PLACE. FOR ALL UNITS ADD:

1 − Wet indoor coil air resistance of selected unit.

2 − Any factory installed options air resistance (heat section, economizer, etc.)

3 − Any field installed accessories air resistance (duct resistance, diffuser, etc.)

Then determine from blower table blower motor output required.

See page 8 for blower motors and drives.

See page 8 for wet coil and option/accessory air resistance data.

Minimum Air Volume Required For Use With Optional Electric Heat (Maximum Static Pressure - 2.0 in. w.g.):

7.5 kW, 15 kW, 22.5 kW, 30 kW and 45 kW - 2800 cfm; 60 kW - 4000 cfm

Total Air Volume cfm	Total Static Pressure − in. w.g.													
	0.2		0.4		0.6		0.8		1.0		1.2		1.4	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1750	480	0.19	548	0.39	618	0.57	689	0.70	758	0.81	824	0.92	885	1.07
2000	492	0.27	560	0.47	629	0.64	700	0.77	768	0.88	832	1.00	892	1.16
2250	505	0.35	573	0.55	643	0.72	713	0.85	780	0.97	842	1.10	900	1.25
2500	520	0.45	588	0.64	658	0.81	727	0.94	793	1.07	853	1.21	909	1.37
2750	536	0.55	604	0.74	674	0.91	743	1.05	806	1.19	865	1.34	919	1.50
3000	553	0.66	622	0.85	692	1.02	760	1.17	821	1.32	878	1.48	930	1.64
3250	572	0.77	641	0.98	712	1.15	778	1.32	837	1.48	892	1.64	942	1.81
3500	592	0.90	663	1.12	733	1.31	798	1.48	854	1.65	907	1.82	955	1.99
3750	614	1.04	687	1.28	756	1.48	818	1.66	872	1.83	922	2.01	969	2.19
4000	639	1.22	712	1.47	780	1.67	838	1.85	890	2.03	939	2.22	983	2.42
4250	666	1.42	740	1.68	804	1.88	859	2.06	909	2.25	956	2.45	998	2.67
4500	697	1.65	769	1.91	829	2.10	881	2.28	929	2.48	973	2.71	1013	2.95
4750	729	1.91	798	2.15	854	2.34	903	2.53	948	2.75	991	3.00	1030	3.27
5000	763	2.18	826	2.41	878	2.60	925	2.81	968	3.05	1009	3.33	1046	3.61

Total Air Volume cfm	Total Static Pressure − in. w.g.											
	1.6		1.8		2		2.2		2.4		2.6	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1750	941	1.23	992	1.40	1039	1.55	1084	1.70	1128	1.85	1156	2.08
2000	946	1.32	995	1.48	1041	1.65	1085	1.81	1127	1.97	1160	2.13
2250	952	1.42	999	1.59	1044	1.76	1087	1.93	1127	2.10	1164	2.27
2500	959	1.54	1005	1.71	1048	1.89	1089	2.07	1127	2.25	1166	2.42
2750	968	1.67	1012	1.86	1053	2.04	1092	2.23	1129	2.41	1167	2.60
3000	977	1.83	1020	2.02	1059	2.21	1096	2.41	1133	2.60	1170	2.79
3250	988	2.00	1028	2.20	1066	2.41	1102	2.61	1138	2.81	1174	3.01
3500	999	2.19	1038	2.41	1074	2.63	1109	2.84	1144	3.04	1180	3.24
3750	1010	2.41	1048	2.64	1084	2.87	1118	3.09	1152	3.29	1188	3.50
4000	1023	2.65	1060	2.90	1095	3.14	1128	3.36	1162	3.57	1198	3.77
4250	1036	2.92	1072	3.18	1106	3.42	1139	3.65	1172	3.86	1208	4.07
4500	1050	3.22	1085	3.48	1118	3.73	1151	3.96	1184	4.17	1221	4.39
4750	1065	3.55	1099	3.81	1132	4.06	1164	4.29	1198	4.51	1235	4.74
5000	1081	3.90	1114	4.17	1146	4.42	1178	4.65	1212	4.87	1250	5.09

BLOWER DATA

FACTORY INSTALLED BELT DRIVE KIT SPECIFICATIONS

Nominal hp	Maximum hp	Drive Kit Number	RPM Range
2	2.3	1	590 - 890
2	2.3	2	800 - 1105
2	2.3	3	795 - 1195
3	3.45	4	730 - 970
3	3.45	5	940 - 1200
3	3.45	6	1015 - 1300
5	5.75	10	900 - 1135
5	5.75	11	1040 - 1315
5	5.75	12	1125 - 1425

NOTE - 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 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.

NOTE – Motor service factor limit - 1.0.

POWER EXHAUST FAN PERFORMANCE

Return Air System Static Pressure	Air Volume Exhausted
in. w.g.	cfm
0	3175
0.05	2955
0.10	2685
0.15	2410
0.20	2165
0.25	1920
0.30	1420
0.35	1200

FACTORY INSTALLED OPTIONS/FIELD INSTALLED ACCESSORY AIR RESISTANCE - in. w.g.

Air Volume cfm	Wet Indoor Coil		Electric Heat	Economizer	Filters			Return Air Adaptor Plate
	092	102,120			MERV 8	MERV 13	MERV 16	
1750	0.03	0.04	0.03	0.05	0.01	0.03	0.06	0.00
2000	0.04	0.05	0.03	0.06	0.01	0.03	0.08	0.00
2250	0.05	0.06	0.04	0.08	0.01	0.04	0.09	0.00
2500	0.05	0.07	0.04	0.11	0.01	0.05	0.10	0.00
2750	0.06	0.08	0.05	0.12	0.02	0.05	0.11	0.00
3000	0.07	0.10	0.06	0.13	0.02	0.06	0.12	0.02
3250	0.08	0.11	0.06	0.15	0.02	0.06	0.13	0.02
3500	0.09	0.12	0.09	0.15	0.03	0.07	0.15	0.04
3750	0.10	0.14	0.09	0.15	0.03	0.08	0.16	0.07
4000	0.11	0.15	0.09	0.19	0.04	0.08	0.17	0.09
4250	0.13	0.17	0.13	0.19	0.04	0.09	0.19	0.11
4500	0.14	0.19	0.14	0.22	0.04	0.09	0.20	0.12
4750	0.15	0.20	0.17	0.25	0.05	0.10	0.21	0.16
5000	0.16	0.22	0.20	0.29	0.06	0.10	0.23	0.18
5250	0.17	0.24	0.22	0.32	0.06	0.11	0.24	0.19
5500	0.19	0.25	0.25	0.34	0.07	0.12	0.25	0.22
5750	0.20	0.27	0.31	0.45	0.07	0.12	0.27	0.25
6000	0.22	0.29	0.33	0.52	0.08	0.13	0.28	0.27

BLOWER DATA

CEILING DIFFUSERS AIR RESISTANCE - in. w.g.

Unit Size	RTD11 Step-Down Diffuser				FD11 Flush Diffuser
	Air Volume cfm	2 Ends Open	1 Side, 2 Ends Open	All Ends & Sides Open	
092 Models	2400	0.21	0.18	0.15	0.14
	2600	0.24	0.21	0.18	0.17
	2800	0.27	0.24	0.21	0.20
	3000	0.32	0.29	0.25	0.25
	3200	0.41	0.37	0.32	0.31
	3400	0.50	0.45	0.39	0.37
	3600	0.61	0.54	0.48	0.44
	3800	0.73	0.63	0.57	0.51
102 & 120 Models	3600	0.36	0.28	0.23	0.15
	3800	0.40	0.32	0.26	0.18
	4000	0.44	0.36	0.29	0.21
	4200	0.49	0.40	0.33	0.24
	4400	0.54	0.44	0.37	0.27
	4600	0.60	0.49	0.42	0.31
	4800	0.65	0.53	0.46	0.35
	5000	0.69	0.58	0.50	0.39

CEILING DIFFUSER AIR THROW DATA

Model No.	Air Volume	[1] Effective Throw Range	
		RTD11 Step-Down	FD11 Flush
	cfm	ft.	ft.
092 Models	2600	24 - 29	19 - 24
	2800	25 - 30	20 - 28
	3000	27 - 33	21 - 29
	3200	28 - 35	22 - 29
	3400	30 - 37	22 - 30
102 & 120 Models	3600	25 - 33	22 - 29
	3800	27 - 35	22 - 30
	4000	29- 37	24 - 33
	4200	32 - 40	26 - 35
	4400	34 - 42	28 - 37

[1] Throw is the horizontal or vertical distance an air stream travels on leaving the outlet or diffuser before the maximum velocity is reduced to 50 ft. per minute. Four sides open.

ELECTRICAL/ELECTRIC HEAT DATA — 7.5 TON

		Model No.	KHC092S4M								
[1] Voltage - 60Hz			208/230V - 3 Ph			460V - 3 Ph			575V - 3 Ph		
Compressor 1 (Non-Inverter)	Rated Load Amps		12.9			7.1			4.6		
	Locked Rotor Amps		105			62			39		
Compressor 2 (Non-Inverter)	Rated Load Amps		13.7			6.1			4.8		
	Locked Rotor Amps		83.1			43			33		
Outdoor Fan Motors (2)	Full Load Amps (2 Non-ECM)		2.4			1.3			1		
	Total		4.8			2.6			2		
Power Exhaust (1) 0.33 HP	Full Load Amps		2.4			1.3			1		
Service Outlet 115V GFI (amps)			15			15			20		
Indoor Blower Motor	Horsepower		2	3	5	2	3	5	2	3	5
	Full Load Amps		7.5	10.6	16.7	3.4	4.8	7.6	2.7	3.9	6.1
[2] Maximum Overcurrent Protection (MOCP)	Unit Only		50	50	60	25	25	30	20	20	25
	With (1) 0.33 HP Power Exhaust		50	60	70	25	30	30	20	20	25
[3] Minimum Circuit Ampacity (MCA)	Unit Only		43	46	53	21	23	26	16	17	20
	With (1) 0.33 HP Power Exhaust		45	48	55	23	24	27	17	18	21

ELECTRIC HEAT DATA

Electric Heat Voltage			208V	240V	208V	240V	208V	240V	480V	480V	480V	600V	600V	600V
[2] Maximum Overcurrent Protection (MOCP)	Unit+ Electric Heat	**7.5 kW**	70	70	70	70	80	80	35	35	40	25	30	30
		15 kW	90	90	90	100	100	100	45	45	50	35	35	40
		22.5 kW	110	110	110	125	125	125	60	60	60	45	45	50
		30 kW	125	150	125	150	150	150	70	70	80	60	60	60
		45 kW	175	200	175	200	175	200	90	100	100	70	80	80
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat	**7.5 kW**	62	65	65	68	72	75	33	34	37	25	26	29
		15 kW	82	88	85	91	92	98	44	45	48	34	35	38
		22.5 kW	101	110	105	114	111	120	55	57	60	43	44	47
		30 kW	121	133	124	136	131	143	67	68	71	52	53	56
		45 kW	160	178	163	181	170	188	89	91	93	70	71	74
[2] Maximum Overcurrent Protection (MOCP)	Unit+ Electric Heat and (1) 0.33 HP Power Exhaust	**7.5 kW**	70	70	70	80	80	80	35	35	40	30	30	30
		15 kW	90	90	90	100	100	100	45	50	50	35	40	40
		22.5 kW	110	125	110	125	125	125	60	60	70	45	45	50
		30 kW	125	150	150	150	150	150	70	70	80	60	60	60
		45 kW	175	200	175	200	175	200	90	100	100	80	80	80
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat and (1) 0.33 HP Power Exhaust	**7.5 kW**	65	68	68	71	75	78	34	35	38	26	27	30
		15 kW	84	90	87	93	94	100	45	47	50	35	36	39
		22.5 kW	104	113	107	116	114	123	57	58	61	44	45	48
		30 kW	123	135	127	139	133	145	68	69	72	53	54	57
		45 kW	162	181	166	184	172	190	90	92	95	71	72	75

ELECTRICAL ACCESSORIES

Disconnect	**7.5 kW**	**54W56**	**54W56**	**54W56**
	15 kW	**54W57**	**54W56**	**54W56**
	22.5 kW	**54W57**	**54W56**	**54W56**
	30 kW	**54W57**	**54W56**	**54W56**
	45 kW	**Not Available**	**54W57**	**54W56**

Disconnects - 54W56 - 80A
54W57 - 150A

NOTE - All units have a minimum Short Circuit Current Rating (SCCR) of 5000 amps.

[1] Extremes of operating range are plus and minus 10% of line voltage.

[2] HACR type breaker or fuse.

[3] Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

ELECTRICAL/ELECTRIC HEAT DATA — 8.5 TON

		Model No.	KHC102S4M								
[1] Voltage - 60Hz			208/230V - 3 Ph			460V - 3 Ph			575V - 3 Ph		
Compressor 1 (Non-Inverter)	Rated Load Amps		16.7			7.1			5.7		
	Locked Rotor Amps		110			54.7			47.8		
Compressor 2 (Non-Inverter)	Rated Load Amps		13.7			6.1			4.8		
	Locked Rotor Amps		83.1			43			33		
Outdoor Fan Motors (2)	Full Load Amps (2 Non-ECM)		3			1.5			1.2		
	Total		6			3			2.4		
Power Exhaust (1) 0.33 HP	Full Load Amps		2.4			1.3			1		
Service Outlet 115V GFI (amps)			15			15			20		
Indoor Blower Motor	Horsepower		2	3	5	2	3	5	2	3	5
	Full Load Amps		7.5	10.6	16.7	3.4	4.8	7.6	2.7	3.9	6.1
[2] Maximum Overcurrent Protection (MOCP)	Unit Only		60	60	70	30	30	35	20	20	25
	With (1) 0.33 HP Power Exhaust		60	60	70	30	30	35	20	20	25
[3] Minimum Circuit Ampacity (MCA)	Unit Only		47	50	56	24	25	28	17	19	21
	With (1) 0.33 HP Power Exhaust		49	52	59	25	26	29	18	20	22

ELECTRIC HEAT DATA

Electric Heat Voltage			208V	240V	208V	240V	208V	240V	480V	480V	480V	600V	600V	600V
[2] Maximum Overcurrent Protection (MOCP)	Unit+ Electric Heat	7.5 kW	80	80	80	80	80	90	35	35	40	30	30	30
		15 kW	90	100	100	100	100	110	45	50	50	40	40	40
		22.5 kW	110	125	110	125	125	125	60	60	60	45	50	50
		30 kW	150	150	150	150	150	150	70	70	80	60	60	60
		45 kW	175	200	175	200	175	200	90	100	100	80	80	80
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat	7.5 kW	68	71	71	74	77	80	33	35	37	27	28	30
		15 kW	88	94	91	97	97	103	44	46	49	36	37	39
		22.5 kW	107	116	110	119	116	125	56	57	60	45	46	48
		30 kW	127	139	130	142	136	148	67	68	71	54	55	57
		45 kW	166	184	169	187	175	193	90	91	94	72	73	75
[2] Maximum Overcurrent Protection (MOCP)	Unit+ Electric Heat and (1) 0.33 HP Power Exhaust	7.5 kW	80	80	80	80	90	90	35	40	40	30	30	35
		15 kW	90	100	100	100	100	110	50	50	50	40	40	40
		22.5 kW	110	125	125	125	125	150	60	60	70	50	50	50
		30 kW	150	150	150	150	150	150	70	70	80	60	60	60
		45 kW	175	200	175	200	200	200	100	100	100	80	80	80
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat and (1) 0.33 HP Power Exhaust	7.5 kW	71	74	74	77	80	83	34	36	39	28	29	31
		15 kW	90	96	93	99	99	105	46	47	50	37	38	40
		22.5 kW	110	119	113	122	119	128	57	58	61	46	47	49
		30 kW	129	141	132	144	138	150	68	70	73	55	56	58
		45 kW	168	186	171	189	177	195	91	92	95	73	74	76

ELECTRICAL ACCESSORIES

		208/230V - 3 Ph	460V - 3 Ph	575V - 3 Ph
Disconnect	7.5 kW	54W56	54W56	54W56
	15 kW	54W57	54W56	54W56
	22.5 kW	54W57	54W56	54W56
	30 kW	54W57	54W56	54W56
	45 kW	Not Available	54W57	54W56

Disconnects - 54W56 - 80A
54W57 - 150A

NOTE - All units have a minimum Short Circuit Current Rating (SCCR) of 5000 amps.

[1] Extremes of operating range are plus and minus 10% of line voltage.

[2] HACR type breaker or fuse.

[3] Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

ELECTRICAL/ELECTRIC HEAT DATA — 10 TON

		Model No.	KHC120S4M								
[1] Voltage - 60Hz			208/230V - 3 Ph			460V - 3 Ph			575V - 3 Ph		
Compressor 1 (Non-Inverter)	Rated Load Amps		16.7			7.1			5.7		
	Locked Rotor Amps		110			54.7			47.8		
Compressor 2 (Non-Inverter)	Rated Load Amps		19.6			8.2			6.6		
	Locked Rotor Amps		136			66.1			55.3		
Outdoor Fan Motors (2)	Full Load Amps (2 Non-ECM)		3			1.5			1.2		
	Total		6			3			2.4		
Power Exhaust (1) 0.33 HP	Full Load Amps		2.4			1.3			1		
Service Outlet 115V GFI (amps)			15			15			20		
Indoor Blower Motor	Horsepower		2	3	5	2	3	5	2	3	5
	Full Load Amps		7.5	10.6	16.7	3.4	4.8	7.6	2.7	3.9	6.1
[2] Maximum Overcurrent Protection (MOCP)	Unit Only		70	70	80	30	30	35	25	25	25
	With (1) 0.33 HP Power Exhaust		70	70	80	30	30	35	25	25	30
[3] Minimum Circuit Ampacity (MCA)	Unit Only		55	58	64	24	26	28	20	21	23
	With (1) 0.33 HP Power Exhaust		58	61	67	26	27	30	21	22	24

ELECTRIC HEAT DATA

Electric Heat Voltage			208V	240V	208V	240V	208V	240V	480V	480V	480V	600V	600V	600V
[2] Maximum Overcurrent Protection (MOCP)	Unit+ Electric Heat	**15 kW**	100	110	100	110	110	110	50	50	60	40	40	45
		22.5 kW	125	125	125	150	125	150	60	60	70	50	50	50
		30 kW	150	150	150	150	150	175	70	80	80	60	60	60
		45 kW	175	200	200	200	200	200	100	100	100	80	80	80
		60 kW	200	200	200	225	200	225	100	100	110	80	80	90
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat	**15 kW**	94	100	97	103	103	110	47	48	51	38	39	41
		22.5 kW	114	123	117	126	123	132	58	59	62	47	48	50
		30 kW	133	145	136	149	143	155	69	71	74	56	57	59
		45 kW	172	191	176	194	182	200	92	93	96	74	75	77
		60 kW	180	200	183	203	189	209	96	98	101	77	78	81
[2] Maximum Overcurrent Protection (MOCP)	Unit+ Electric Heat and (1) 0.33 HP Power Exhaust	**15 kW**	100	110	110	110	110	125	50	50	60	40	40	45
		22.5 kW	125	125	125	150	125	150	60	70	70	50	50	60
		30 kW	150	150	150	175	150	175	80	80	80	60	60	60
		45 kW	175	200	200	200	200	225	100	100	100	80	80	80
		60 kW	200	225	200	225	200	225	100	100	110	80	80	90
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat and (1) 0.33 HP Power Exhaust	**15 kW**	97	103	100	106	106	112	48	50	52	39	40	42
		22.5 kW	116	125	119	128	125	134	59	61	64	48	49	51
		30 kW	136	148	139	151	145	157	71	72	75	57	58	60
		45 kW	175	193	178	196	184	202	93	95	97	75	76	78
		60 kW	183	202	186	205	192	211	98	99	102	78	79	82

ELECTRICAL ACCESSORIES

Disconnect	**15 kW**	**54W57**	**54W56**	**54W56**
	22.5 kW	**54W57**	**54W56**	**54W56**
	30 kW	**54W57**	**54W56**	**54W56**
	45 kW	**Not Available**	**54W57**	**54W56**
	60 kW	**Not Available**	**54W57**	**54W56**

Disconnects - 54W56 - 80A
54W57 - 150A

NOTE - All units have a minimum Short Circuit Current Rating (SCCR) of 5000 amps.

[1] Extremes of operating range are plus and minus 10% of line voltage.

[2] HACR type breaker or fuse.

[3] Refer to National or Canadian Electrical Code manual to determine wire, fuse and disconnect size requirements.

ELECTRIC HEAT CAPACITIES

Volts Input	7.5 kW			15 kW			22.5 kW			30 kW			45 kW			60 kW		
	kW Input	Btuh Output	No. of Stages	kW Input	Btuh Output	No. of Stages	kW Input	Btuh Output	No. of Stages	kW Input	Btuh Output	No. of Stages	kW Input	Btuh Output	No. of Stages	kW Input	Btuh Output	No. of Stages
208	5.6	19,100	1	11.3	38,600	1	16.9	57,700	2	22.5	76,800	2	33.8	115,300	2	45.0	153,600	2
220	6.3	21,500	1	12.6	43,000	1	18.9	64,500	2	25.2	86,000	2	37.8	129,000	2	50.4	172,000	2
230	6.9	23,600	1	13.8	47,100	1	20.7	70,700	2	27.5	93,900	2	41.3	141,000	2	55.1	188,000	2
240	7.5	25,600	1	15.0	51,200	1	22.5	76,800	2	30.0	102,400	2	45.0	153,600	2	60.0	204,800	2
440	6.9	21,500	1	12.6	43,000	1	18.9	64,500	2	25.2	86,000	2	37.8	129,000	2	50.4	172,000	2
460	6.9	23,600	1	13.8	47,100	1	20.7	70,700	2	27.5	93,900	2	41.3	141,000	2	55.1	188,000	2
480	7.5	25,600	1	15.0	51,200	1	22.5	76,800	2	30.0	102,400	2	45.0	153,600	2	60.0	204,800	2
550	6.3	21,500	1	12.6	43,000	1	18.9	64,500	2	25.2	86,000	2	37.8	129,000	2	50.4	172,000	2
575	6.9	23,600	1	13.8	47,100	1	20.7	70,700	2	27.5	93,900	2	41.3	141,000	2	55.1	188,000	2
600	7.5	25,600	1	15.0	51,200	1	22.5	76,800	2	30.0	102,400	2	45.0	153,600	2	60.0	204,800	2

FIELD WIRING NOTES

- For use with copper wiring only
- Field wiring not furnished
- All wiring must conform to NEC or CEC and local electrical codes
- For specific wiring information, please refer to the installation instructions

KHC Parts Arrangement

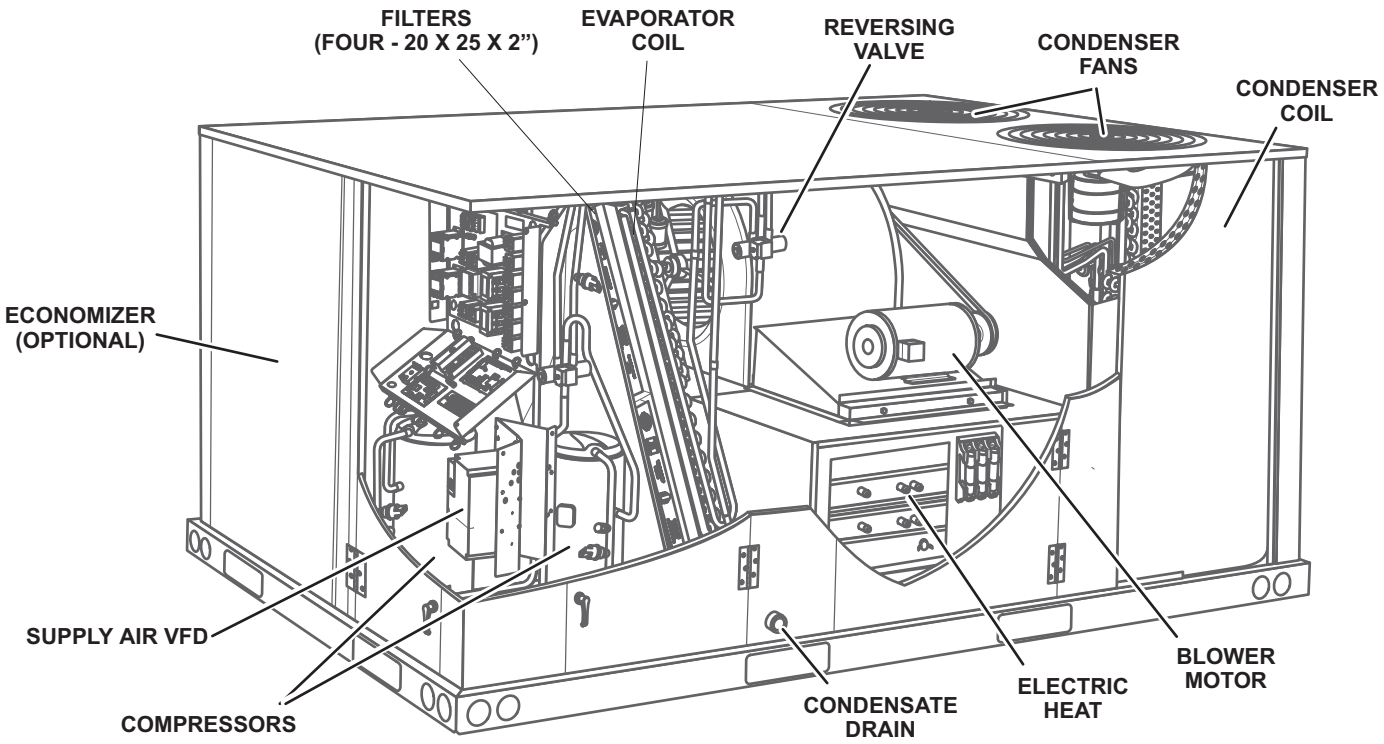


FIGURE 1

KHC Control Box Y, G, J Volt Units

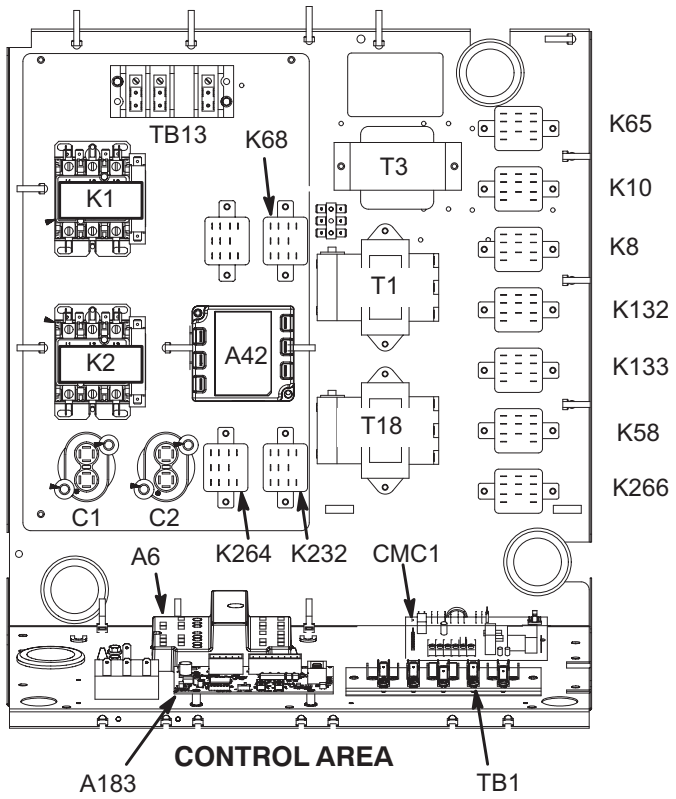


FIGURE 2

I-UNIT COMPONENTS

All 7.5, 8.5 and 10 ton units are configure to order units (CTO). The KHC unit components are shown in FIGURE 1. All units come standard with removable unit panels. All L1, L2 and L3 wiring is color-coded; L1 is red, L2 is yellow and L3 is blue.

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions to neutralize electrostatic charge by touching your hand and tools to metal prior to handling the control.

A-Control Box Components

KHC control box components are shown in FIGURE 2. The control box is located in the upper portion of the compressor compartment.

1-Disconnect Switch S48

All units may be equipped with an optional disconnect switch S48 or circuit breaker CB10. S48 and CB10 are toggle switches, which can be used by the service technician to disconnect power to the unit.

2-Control Transformer T1

All use a single line voltage to 24VAC transformer installed in the control box. The transformer supplies power to control circuits in the unit. The transformer is rated at 70VA and is protected by a 3.5 amp circuit breaker (CB8). The 208/230 (Y) voltage transformers use two primary voltage taps as shown in FIGURE 3, while 460 (G) and 575 (J) voltage transformers use a single primary voltage tap.

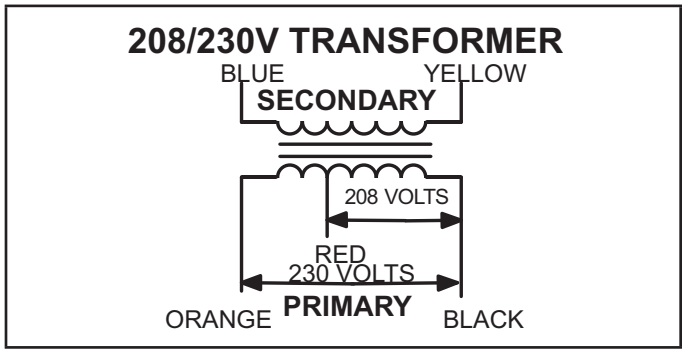


FIGURE 3

3-Terminal Strip TB1

All indoor thermostat connections are made at terminal block TB1 located in the control area. For thermostats without “occupied “ and “unoccupied” modes, a factory-installed jumper across terminals R and OC should be in place.

4-Transformer T18

T18 is a single line voltage to 24VAC transformer used in all KHC units. T18 is identical to T1 and is protected by a 3.5 amp circuit breaker (CB18). T18 provides 24VAC to K1 and K2 coil and reversing valve L1 and L2 (via K58-1 contacts).

5-Condenser Fan Capacitors C1 & C2

Fan capacitors C1 and C2 are used to assist in the start up of condenser fans B4 and B5. Ratings will be on side of capacitor or outdoor fan motor nameplate.

6-Compressor Contactor K1 & K2

All compressor contactors are three-pole-double-break contactors with 24VAC coils. In all KHC units, K1 and K2 energize compressors B1 and B2 in response to thermostat demand. See FIGURE 4.

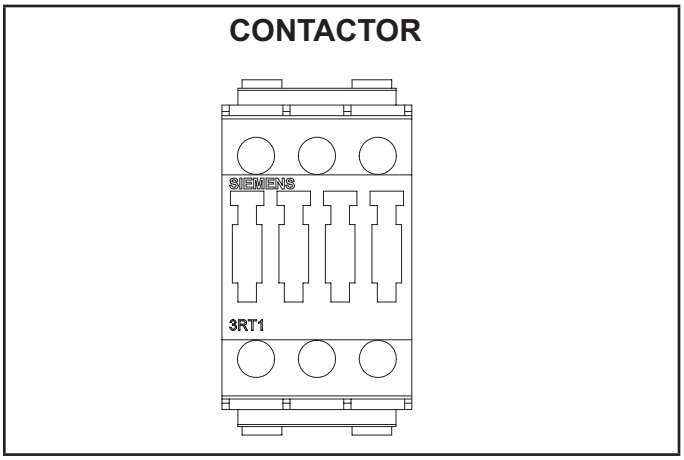


FIGURE 4

7-Condenser Fan Relay K10

Outdoor fan relay K10 is a DPDT relay with a 24VAC coil. K10 energizes condenser fans B4 and B5.

8-Power Exhaust Relay K65 (PED units)

Power exhaust relay K65 is a DPDT relay with a 24VAC coil. K65 is used in all units equipped with the optional power exhaust dampers. K65 is energized by the economizer enthalpy control A6, after the economizer dampers reach 50% open (adjustable) When K65 closes, exhaust fan B10 is energized.

9-Compressor On Relays (K132 & K133)

K132 and K133 are two-pole relays with a 24V coil used to energize compressor contactor coils. K1 is energized by K132 with a Y1 demand. K2 is energized by K133 with a Y2 demand. Both K1 and K2 are energized by K132 and K133 with a W1 demand.

10-Transfer Relay (K8)

K8 is a three-pole relay with a 24V coil used to de-energize the reversing valve during a heating demand. On a firststage demand K8-1 closes de-energizing the reversing valve. K8-2 closes energizing Y1 on the CMC1 board. Without K8 the reversing valve would remain energized at all times.

11-Low Ambient Kit Relay (K58)

Low ambient relay K58 is a DPDT relay with a 24V coil energized by a CMC1 output in the heating cycle. K58-1 closes to allow power to reversing valves L1 and L2. K58-2 closes to bypass S11 and S84. This allows the fan to operate during the heating demand and cycle during the cooling demand.

12-Blower Motor Overload Relay Switch (S42)

The blower motor overload relay is used in all units equipped with high efficiency motors. The relay (S42) is connected in line with the blower motor to monitor the current flow to the motor. When the relay senses and overload condition, a set of normally closed contacts open to de-energize 24VAC power T1 transformer.

13-Terminal Block (TB1)

TB1 provides 24VAC field connections. All indoor thermostat connections are connected to TB1 located in the control box.

14- VFD Phase Protection Monitor (A42)

A42 is an optional 3-phase line monitor that protects against phase loss, phase reverse and phase unbalance. The unit will not start if phase is incorrect. and will shut down if proper phasing is interrupted.

15- Terminal Block TB13

TB13 provides power connection for KHC units with belt drive blowers driven by inverter.

16-Defrost Board

The defrost thermostat, defrost pressure switch and the defrost control work together to ensure that the heat pump outdoor coil does not ice excessively during the heating mode.

Compressor Accumulated Run-Time Interval

The defrost control will not energize a defrost cycle unless the unit has been operating in heating mode for an accumulated 60 minutes (default) on 100269-02 boards; 90 minutes (default) on 100269-07 boards. The run time interval can be changed by moving the jumper on the CMC board timing pins. See FIGURE 5.

The defrost interval can be adjusted to 30, 60, or 90 minutes. The defrost timing jumper is factory-installed to provide a 60-minute defrost interval. If the timing selector jumper is not in place, the control defaults to a 90-minute defrost interval.

Defrost Test Option

A TEST option is provided for troubleshooting. The TEST mode may be started any time the unit is in the heating mode and the defrost thermostat is closed or jumpered.

If the timing jumper is in the TEST position at power-up, the defrost control will ignore the test pins. When the jumper is placed across the TEST pins for two seconds, the control will enter the defrost mode. If the jumper is removed before an additional 5-second period has elapsed (7 seconds total), the unit will remain in defrost mode until the defrost pressure switch opens or 14 minutes have passed.

If the jumper is removed before an additional 5-second period has elapsed (7 seconds total), the unit will remain in defrost mode until the defrost pressure switch opens or 14 minutes have passed. If the jumper is not removed until after the additional 5-second period has elapsed, the defrost will terminate and the test option will not function again until the jumper is removed and re-applied

Diagnostic LEDs

The defrost board uses two LEDs for diagnostics. The LEDs flash a sequence according to the condition.

TABLE 1

Defrost Control Board Diagnostic LED		
Indicates	**LED 1**	**LED 2**
Normal operation / power to board	Synchronized Flash with LED 2	Synchronized Flash with LED 1
Board failure / no power	Off	Off
Board failure	On	On
Pressure switch open	Flash	On

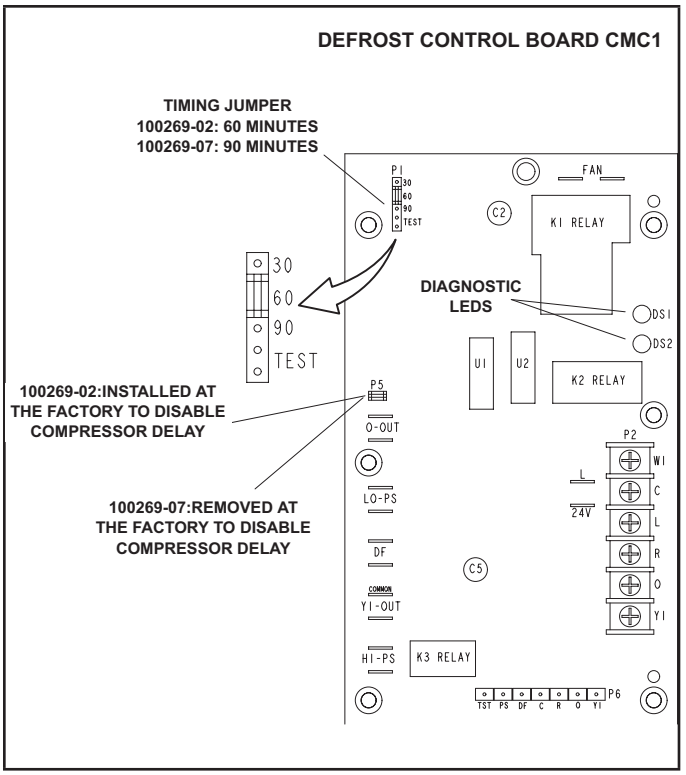


FIGURE 5

Supply Air Inverter Start-Up

A-General

Units provide three blower speeds. The blower will operate at lower speeds when cooling demand is low and higher speeds when cooling demand is high. This results in lower energy consumption. See TABLE 3 for detailed unit operation.

Inverter-driven blowers will operate at high speed during ventilation (blower “G” only signal) but can be adjusted to operate at low speed.

Low speed is approximately 66% of the full speed RPM and medium speed is 75% of the full speed RPM.

B-Set Maximum Blower CFM

1 - Initiate a blower (G) only signal from the room thermostat or control system.

2 - Adjust the blower pulley to deliver the full (high speed) CFM in the typical manner. See Determining Unit CFM in the Blower Operation and Adjustment section.

NOTE - *The following sections detail how to set ventilation speeds and minimum damper positions on units with standard economizers. On units with high performance economizers, ventilation speeds and three separate damper positions must be programmed via the economizer controller display. See economizer installation instructions and high performance economizer application guide provided with the unit for further instructions.*

C-Set Blower Speed During Ventilation (Units With Standard Economizers Only)

To save energy during ventilation, the blower speed can be set to low. This is accomplished by changing the ventilation speed switch on the VFD control board to “LO”. See FIGURE 6.

NOTE - *On units equipped with a standard economizer, set damper minimum position as shown in the next section. After adjusting the low speed minimum position, the ventilation speed switch will be in the “LO” position.*

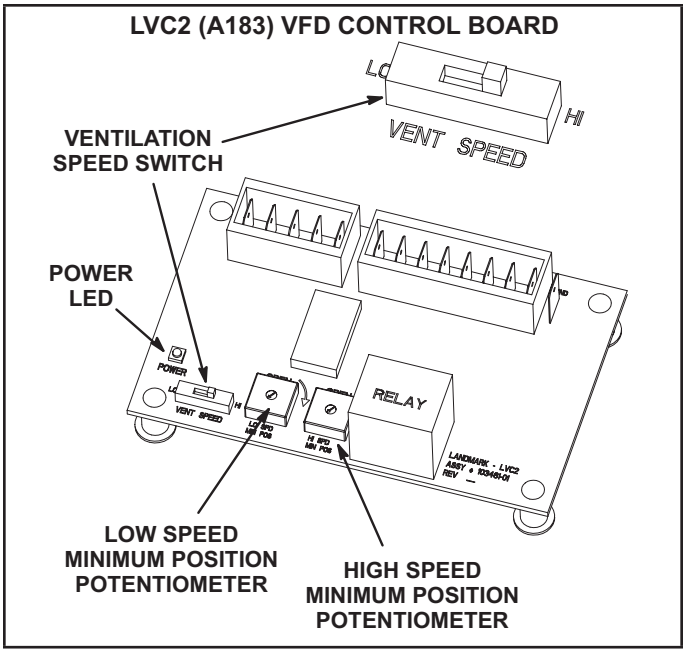


FIGURE 6

D-Set Damper Minimum Position (Units With Standard Economizers Only)

To maintain required minimum ventilation air volumes when the unit is in the occupied mode, two minimum damper positions must be set. A high and a low speed potentiometer are provided on the VFD control board to adjust minimum damper position. See FIGURE 6. The low speed minimum damper position is used for both low and medium blower speeds as standard economizers only offer 2 damper positions.

Set High Speed Minimum Position

1 - Initiate a blower (G) only AND occupied demand from the room thermostat or control system.

2 - Set the ventilation speed switch on the VFD control board to “HI”.

3 - Rotate the high speed potentiometer on the VFD control board to set the high speed minimum damper position.

4 - Measure the intake air CFM. If the CFM is lower than the design specified CFM for ventilation air, use the potentiometer to increase the damper percent open. If the CFM is higher than specified, decrease the damper percent open.

NOTE - *Intake air CFM can also be determined using the outdoor air temperature, return air temperature and mixed air temperature. Refer to the economizer or outdoor air damper installation instructions.*

Set Low Speed Minimum Position

1 - Initiate a blower (G) only AND occupied demand from the room thermostat or control system.

2 - Set the ventilation speed switch on the VFD control board to “LO”.

3 - Rotate the low speed potentiometer on the VFD control board to set the low speed minimum damper position.

4 - Measure the intake air CFM. If the CFM is lower than the design specified CFM for ventilation air, use the potentiometer to increase the damper percent open. If the CFM is higher than specified, decrease the damper percent open.

NOTE - *Intake air CFM can also be determined using the outdoor air temperature, return air temperature and mixed air temperature. Refer to the economizer or outdoor air damper installation instructions.*

Troubleshoot LVC2 Board (A183)

Refer to wiring diagram sections B (unit), C (control) and D (economizer) located on inside of unit panels.

1 - Inspect the LVC2 for damaged components. Replace the LVC2 if damaged components are found.

2 - Check all wire connections to LVC2; secure if loose.

3 - Check for 24VAC signal at the thermostat blower input (G to GND terminal). See FIGURE 7.

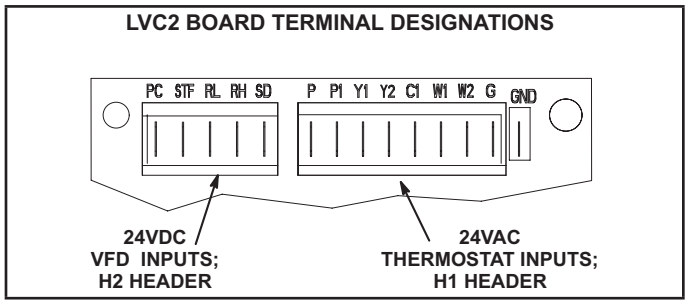


FIGURE 7

4 - If there is no thermostat signal, troubleshoot back toward the thermostat.

5 - Check the power LED on the board. See FIGURE 6.

6 - If the power LED is not on, check voltage between LVC2 terminals PC (H2-1) and SD (H2-5). Voltage should read 24VDC.

7 - If voltage does not read 24VDC, disconnect the H2 header from the LVC2 VFD inputs terminal block (to make sure the LVC2 is not shorting 24VDC supply from the inverter). Measure the voltage between the end terminals on the H2 header. If 24VDC is present, replace the LVC2 board. If no voltage is read, troubleshoot the VFD.

8 - When LVC2 24VAC thermostat blower (G) input and 24VDC power are present, check the LVC2 low and high speed outputs. The LVC2 uses inverse logic to enable the blower; 1VDC will be read at the enabled blower speed terminal. See TABLE 2.

9 - If all inputs are correct and the unit still does not operate as intended, replace LVC2 board.

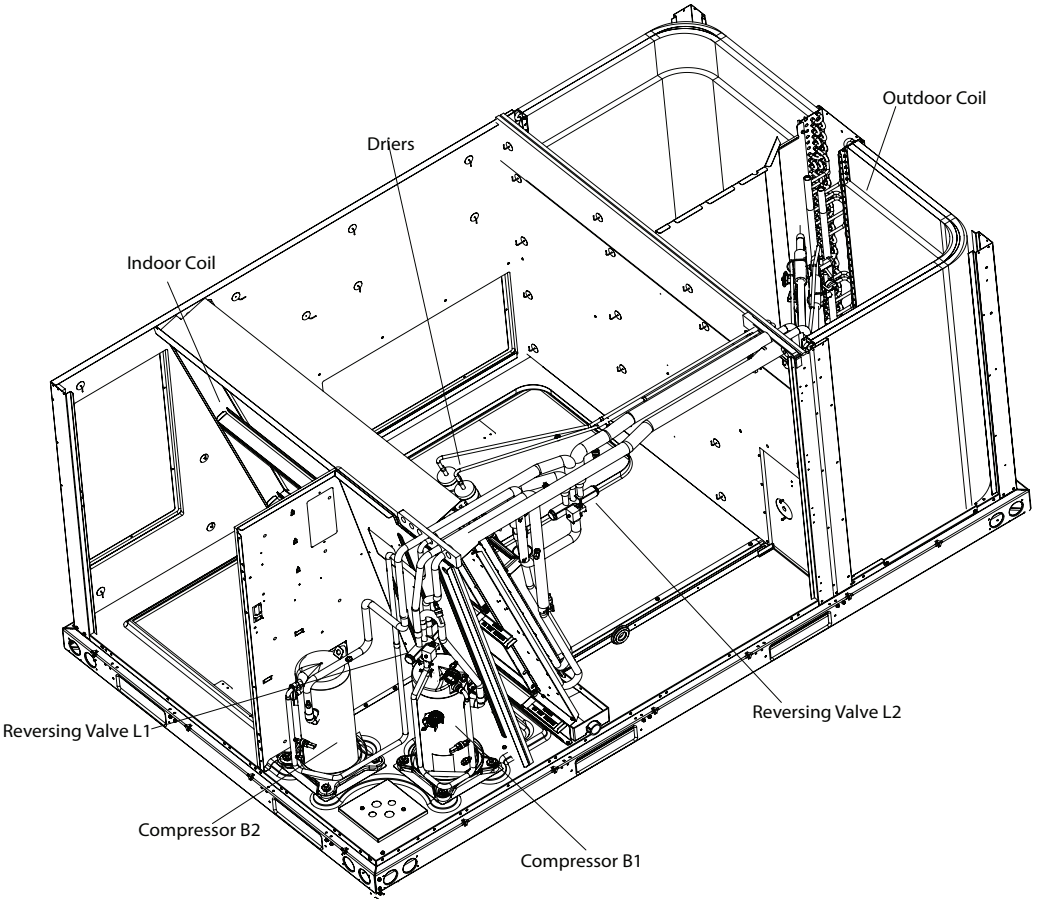
TABLE 2
LVC2 BOARD BLOWER OUTPUTS

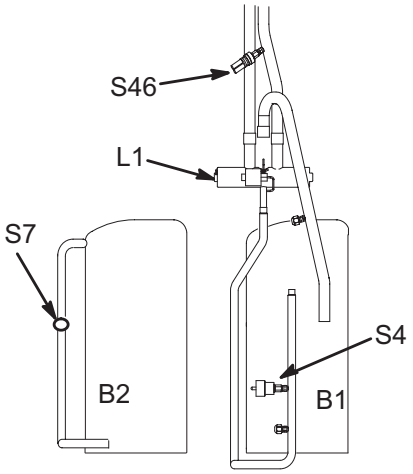
Output Terminals	Voltage	Blower Operation
RL-SD	1VDC	Low Speed
RH-SD	24VDC	
RL-SD	24VDC	High Speed
RH-SD	1VDC	
RL-SD	1VDC	Illegal State (replace board)
RH-SD	1VDC	
RL-SD	24VDC	Blower Off (replace board)
RH-SD	24VDC	

TABLE 3
UNIT OPERATION

T’stat DDC	Defrost	OAS	Compressor			Aux. Heat	Blower Speeds					OD Fans	Economo.		Reheat Valves
			1-Low	1-Hi	2		Vent	Cool C1	Cool C2	Cool C3	Heat (Hi)	1/2	Occupied	Unocc.	
G							X					Off/Off	Min (Vent)	Closed	Off
Y1		No	On	Off	Off			X				On/Off	Min Lo	Closed	On
Y1 + Y2		No	On	Off	On				X			On/On	Min Lo	Closed	On
Y1 + Y2 +Y3		No	On	On	On					X		On/On	Min Hi	Closed	On
Y1		Yes	Off	Off	Off					X		Off/Off	Mod	Mod	Off
Y1 + Y2		Yes	On	Off	Off			X				On/Off	Mod	Mod	On
Y1 + Y2 +Y3		Yes	On	On	Off					X		On/Off	Mod	Mod	On
W1	No		On	On	On	Off					X	On/On	Min Hi	Closed	Off
W1 + W2	No		On	On	On	On					X	On/On	Min Hi	Closed	Off
W1	Yes		On	On	On	On					X	Off/Off	Min Hi	Closed	On
W1 + W2	Yes		On	On	On	On					X	Off/Off	Min Hi	Closed	On

KHC PLUMBING DETAIL





PRESSURE SWITCHES FRONT VIEW

FIGURE 8

B-Cooling Components

All units use independent cooling circuits consisting of separate compressors, condenser coils and evaporator coils. See FIGURE 8. Two draw-through-type condenser fans are used in KHC units. All units are equipped with belt-drive blowers.

Cooling may be supplemented by a factory or field installed economizer. Cross-row circuiting of indoor coil with rifled copper tubing optimizes both sensible and latent cooling capacity. Each evaporator uses a thermostatic expansion valve as the primary refrigerant metering device.

Cooling may be supplemented by a factory or field-installed economizer. In all units each compressor is protected by a freezestat (on each indoor coil) and a high pressure switch (S4, S7). Low ambient switches (S11, S84) are available as an option for additional compressor protection.

1-Compressors B1 and B2

All units use two scroll compressors. Compressor capacity may vary from stage to stage. In all cases, the capacity of each compressor is added to reach the total capacity of the unit. See “SPECIFICATIONS” and “ELECTRICAL DATA” (table of contents) or compressor nameplate for compressor specifications.

⚠ WARNING

Electrical shock hazard. Compressor must be grounded. Do not operate without protective coverover terminals. Disconnect power before removing protective cover. Discharge capacitors before servicing unit. Failure to follow these precautions could cause electrical shock resulting in injury or death.

Each compressor is energized by a corresponding compressor contactor.

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

If Interlink compressor replacement is necessary, call 1-800-453-6669.

⚠ IMPORTANT

Some scroll compressors have an internal vacuum protector that will unload scrolls when suction pressure goes below 20 psig. A hissing sound will be heard when the compressor is running unloaded. Protector will reset when low pressure in system rises above 40 psig. DO NOT REPLACE COMPRESSOR.

2-Freezestats S49 and S50

Each unit is equipped with a low temperature switch (freezestat) located on a return bend of each evaporator coil. S49 (first circuit) and S50 (second circuit) are located on the corresponding evaporator coils.

Freezestats are wired in series with compressor contactors. Each freezestat is a SPST N.C. auto-reset switch which opens at 29°F $\pm$ 3°F (-1.7°C $\pm$ 1.7°C) on a temperature drop and closes at 58°F $\pm$ 4°F (14.4°C $\pm$ 2.2°C) on a temperature rise. To prevent coil icing, freezestats open during compressor operation to temporarily disable the respective compressor until the coil warms sufficiently to melt any accumulated frost. If the freezestats are tripping frequently due to coil icing, check the unit charge, airflow and filters before allowing unit back in operation. Make sure to eliminate conditions which might promote indoor coil ice buildup.

3-High Pressure Switches S4 and S7

The high pressure switch is a manual reset SPST N.C. switch which opens on a pressure rise.

S4 (first circuit) and S7 (second circuit) are located in the compressor discharge line and are wired in series with the respective compressor contactor coils.

When discharge pressure rises to 640 ± 12 psig (4413 ± 138 kPa) (indicating a problem in the system), the switch opens and the respective compressor is de-energized (the economizer can continue to operate).

4-Low Ambient Switches S11, S84

The low ambient switch is an auto-reset SPST N.O. pressure switch which allows for mechanical cooling operation at low outdoor temperatures. In all models a switch is located in each liquid line prior to the indoor coil section.

In the KHC092/120, S11 and S84 wired in parallel are wired in series with outdoor fan relay K10. When liquid pressure rises to 450 ± 10 psig (3102 ± 69 kPa), the switch closes and the condenser fans are energized. When liquid pressure on both refrigerant circuit drops to 240 ± 10 psig (1655 ± 69 kPa), the switch opens and the condenser fans are de-energized. This intermittent fan operation results in higher evaporating temperature allowing the system to operate without icing the indoor coil and losing capacity.

5-Reversing Valve L1 and L2

A refrigerant reversing valve with a 24 volt solenoid coil is used to reverse refrigerant flow during unit operation in all KHC units. The reversing valve is connected in the vapor line of the refrigerant circuit. The reversing valve coil is energized during cooling demand and during defrost.

Reversing valve L1 and L2 are controlled by the defrost control board CMC1 in response to cooling demand or by defrost.

6-Defrost Pressure Switch S46 and S104

The defrost pressure switch S46 and S104 are auto-reset SPST N.C. pressure switches which open on a pressure rise. All KHC units are equipped with these switches.

The switches are located on the discharge line. S46 and S104 are wired in series with the CMC1 control board.

When discharge pressure reaches 450 ± 10 psig (3102 ± 69 kPa) in either circuit (indicating defrost is completed) the appropriate switch opens. The switches automatically reset when pressure in the suction line drops to 300 ± 20 psig (2068 ± 138 kPa).

7-Defrost Temperature Switch S6 and S9

Defrost thermostat switches S6 and S9 have S.P.S.T. N.O. contacts which close on a temperature fall (initiating defrost).

The switches are located on the expansion valve distributor assembly at the inlet to the outdoor coil. The switch monitors the outdoor coil suction temperature to determine when defrost is needed. When the outdoor coil suction temperature falls to 35°F ± 4°F (1.7°C ± 2.2°C) the switch closes (initiating defrost after minimum run time of 30, 60, or 90 minutes). When the temperature rises to 60°F ± 5°F (15.6°C ± 2.8°C) the switch opens.

8- Filter Drier

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.

9- Condenser Fans B4, B5

See SPECIFICATIONS tables at the front of this manual for specifications of condenser fans used in all units. All KHC motors are ball-bearing type single-phase motors. The fan assembly may be removed for servicing and cleaning.

C-Blower Compartment

The blower compartment in all KHC units is located between the indoor coil and the outdoor coil section. The blower assembly is accessed by disconnecting the blower motor and all other plugs and removing the screws in front of the blower housing. The blower pulls out as shown in FIGURE 11.

1-Blower Wheels

All KHC units have one 15 in. x 15 in. (381 mm x 381 mm) blower wheel.

2-Indoor Blower Motor B3

All KHC units use three-phase singlespeed belt-drive blower motors. CFM adjustments are made by adjusting the motor pulley (sheave).for single speed blower motors. Motors are equipped with sealed ball bearings. All motor specifications are listed in the SPECIFICATIONS (table of contents) in the front of this manual. Units may be equipped with motors manufactured by various manufacturers, therefore electrical FLA and LRA specifications will vary. See unit name plate for information specific to your unit.

OPERATION / ADJUSTMENT

Belt-Driven Supply Air Inverter Units - Units are equipped with a phase monitor located in the control compartment. The phase monitor will detect the phasing of incoming power. If the incoming power is out of phase or if any of the three phases are lost, the indicating LED on the phase monitor will turn red and the unit will not start. In normal operation with correct incoming power phasing, the LED will be green.

Blower Operation

Initiate blower demand at thermostat according to instructions provided with thermostat. Unit will cycle on thermostat demand. The following steps apply to applications using a typical electro-mechanical thermostat.

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.

Blower Access

The blower assembly is secured to a sliding base which allows the entire assembly to be pulled out of the unit. See figure 11. Follow the steps below.

1 - Loosen the reusable wire tie which secures the blower wiring to the blower motor mounting plate.

2 - Remove and retain screws on either side of sliding frame. Pull frame toward outside of unit.

3 - Slide frame back into original position when finished servicing. Reattach the blower wiring in the previous location on the blower motor base using the wire tie.

4 - Replace retained screws on either side of the sliding frame.

Determining Unit CFM

IMPORTANT - *Belt-driven supply air inverter units are factory- set to run the blower at full speed when there is a blower (G) demand without a heating or cooling demand. Use the following procedure to adjust motor pulley to deliver the full load cooling or heating CFM. See Belt-Drive Inverter Start- Up in this section to set blower CFM for all modes once the motor pulley is set.*

1 - The following measurements must be made with a dry indoor coil. Run blower without a cooling demand. Measure the indoor blower shaft RPM. 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). See FIGURE 12.

3 - Refer to blower tables in BLOWER DATA (table of contents) in the front of this manual. Use static pressure and RPM readings to determine unit air volume.

4 - The blower RPM 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 11. Do not exceed minimum and maximum number of pulley turns as shown in TABLE 4.

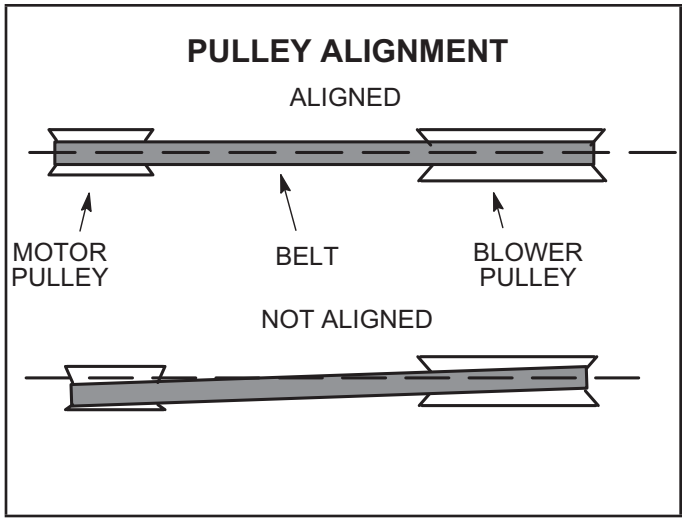


FIGURE 9

TABLE 4

MINIMUM AND MAXIMUM PULLEY ADJUSTMENT

Belt	Minimum Turns Open	Maximum Turns Open
A Section	0	5
B Section	1*	6

*No minimum number of turns open when B belt is used on pulleys 6" O.D. or larger.

Blower Belt Adjustment

Maximum life and wear can be obtained from belts only if proper pulley alignment and belt tension are maintained. Tension new belts after a 24-48 hour period of operation. This will allow belt to stretch and seat in the pulley grooves. Make sure blower and motor pulleys are aligned as shown in FIGURE 9.

1 - Loosen four bolts securing motor base to mounting frame. See FIGURE 11.

2 - *To increase belt tension -*

Turn both adjusting bolts to the right, or clockwise, to move the motor outward and tighten the belt. This increases the distance between the blower motor and the blower housing.

To loosen belt tension -

Turn the adjusting bolts to the left, or counterclockwise to loosen belt tension.

IMPORTANT - *Align top edges of blower motor base and mounting frame base parallel before tightening two bolts on the other side of base. Motor shaft and blower shaft must be parallel.*

3 - Tighten two bolts on each side of the motor mounting base. This secures the mounting base to the frame

Check Belt Tension

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

1 - Measure span length X. See FIGURE 10.

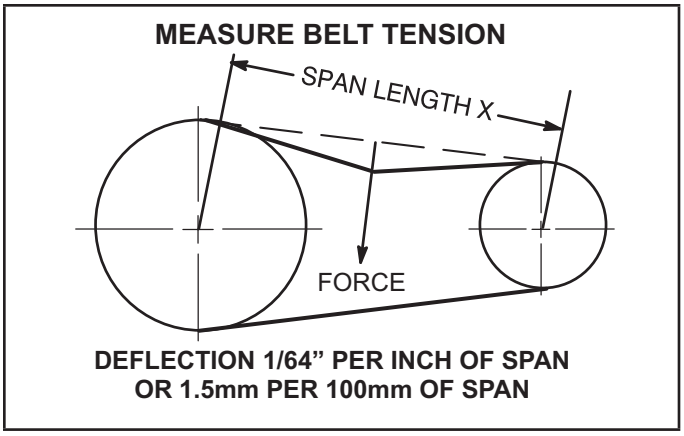


FIGURE 10

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 new 2 and 3hp belt, the deflection force should be 5.0-7.0 lbs. (35-48kPa). For a new 5hp belt, the deflection force should be 7-10lbs. (48-69kPa).

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

Belt Drive Inverter Start-Up

A-General

1 - Units are available with an optional inverter which provides two blower speeds. The blower will operate at lower speeds when cooling demand is low and higher speeds when cooling demand is high. This results in lower energy consumption.

2 - Units will operate at high speed during ventilation (blower "G" only signal) but can be adjusted to operate at low speed.

3 - Low speed is approximately 2/3 of the full speed RPM.

B-Set Maximum Blower CFM

1 - Initiate a blower (G) only signal from the room thermostat or control system.

2 - Adjust the blower pulley to deliver the full (high speed) CFM in the typical manner. See Determining Unit CFM in the Blower Operation and Adjustment section.

Field-Furnished Blower Drives

See BLOWER DATA for field-furnished blower drives to determine BHP and RPM required. Reference TABLE 5 for drive component manufacturer's numbers.

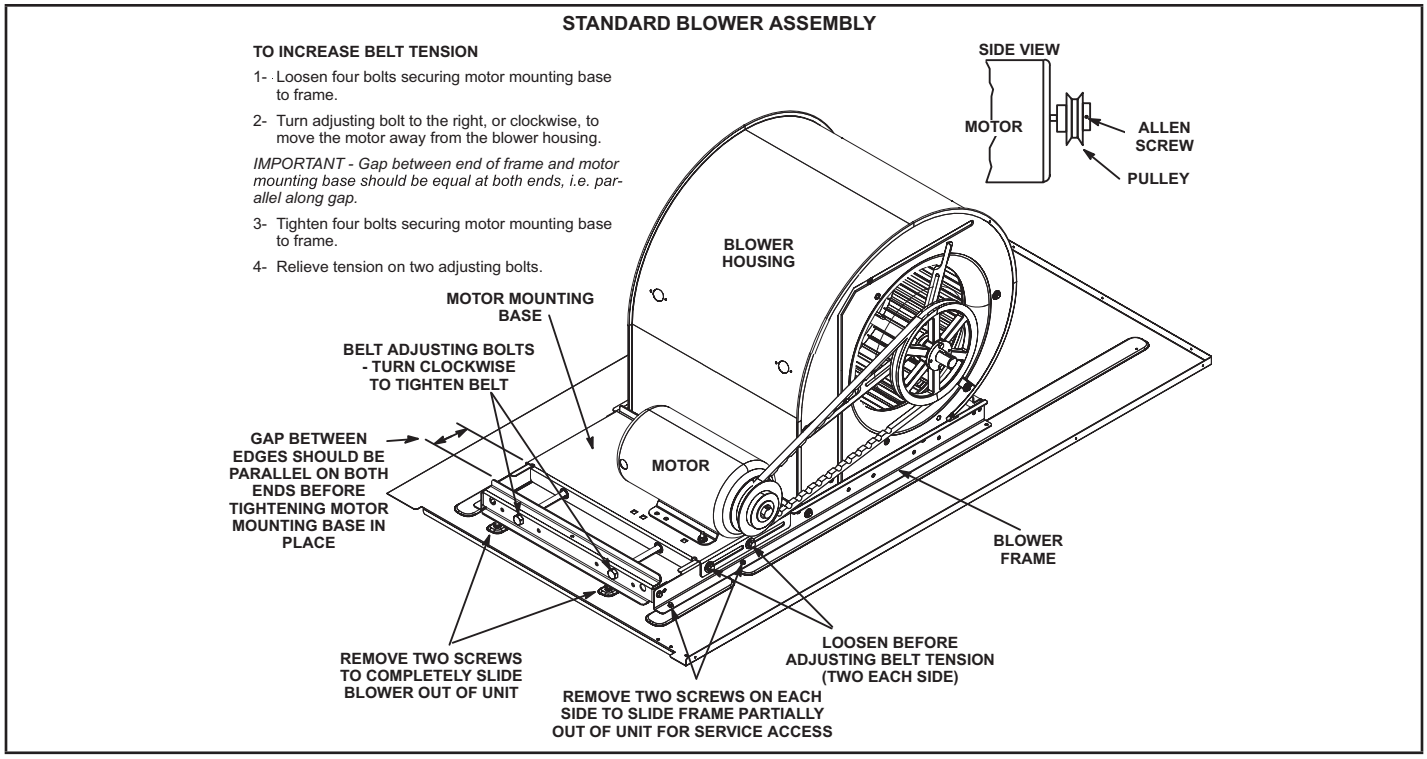


FIGURE 11

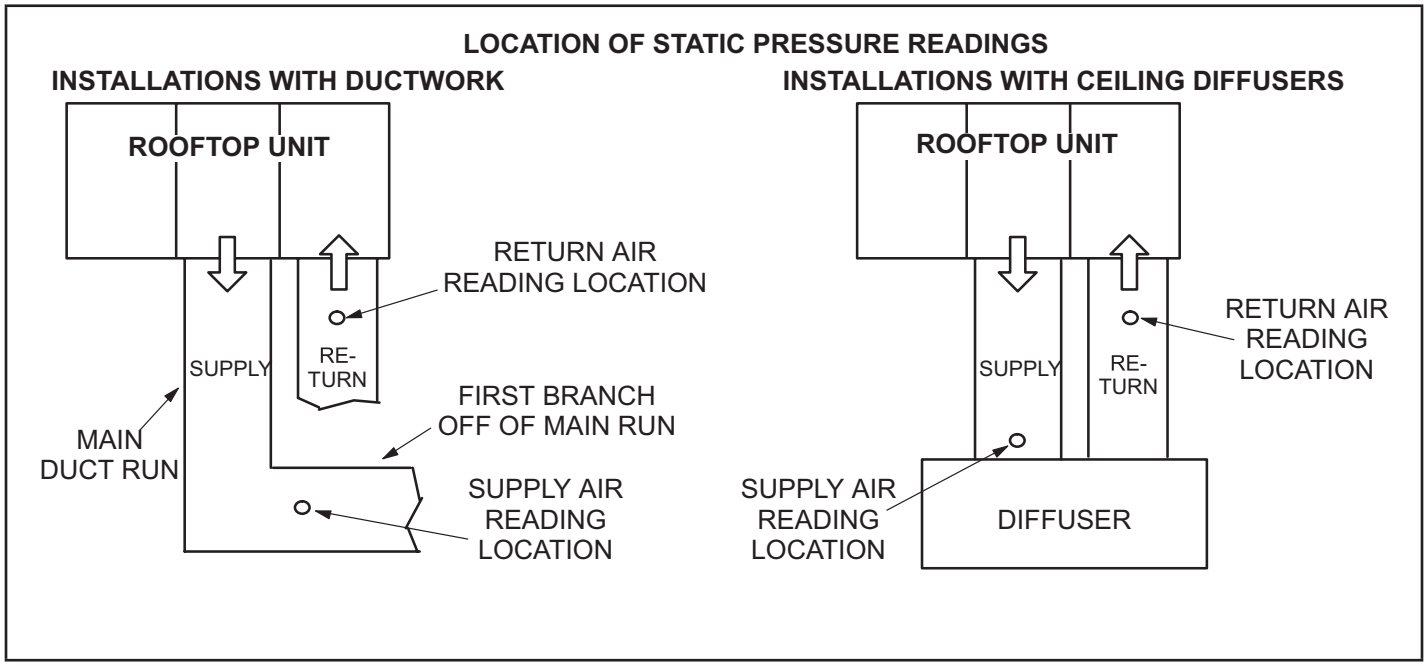


FIGURE 12

TABLE 5
MANUFACTURER'S NUMBERS

DRIVE NO.	DRIVE COMPONENTS					
	ADJUSTABLE SHEAVE		FIXED SHEAVE		BELT	
	BROWNING NO.	OEM PART NO.	BROWNING NO.	OEM PART NO.	BROWNING NO.	OEM PART NO.
1	1VP34x7/8	31K6901	AK61x1	100244-20	AX54	100245-25
2	1VP40x7/8	79J0301	AK59x1	31K6801	AX55	100245-26
3	1VP34x7/8	31K6901	AK46x1	100244-17	AX52	100245-33
4	1VP44x7/8	53J9601	AK74x1	100244-21	AX58	100245-34
5	1VP50x7/8	98J0001	AK69x1	37L4701	AX58	100245-34
6	1VP50x7/8	98J0001	AK64x1	12L2501	AX57	100245-28
10	1VP50x1-1/8	P-8-1977	BK77x1	49K4001	BX59	59A5001
11	1VP50x1-1/8	P-8-1977	BK67x1	100244-24	BX57	78L5301
12	1VP50x1-1/8	P-8-1977	BK62x1	100244-23	BX56	100245-11

D-Optional Electric Heat Components

TABLE 6 on page 26 shows electric heat fuse ratings. See Options/Accessories section (see table of contents) for KHC to EHA match-ups. See Electrical/Electric Heat Data section (see table of contents) of this manual for electrical ratings and capacities.

All electric heat sections consist of electric heating elements exposed directly to the air stream. See figure 12. EHA parts arrangement is shown in figures 12 and 13. Multiple-stage elements are sequenced on and off in response to thermostat demand.

1-Contactors K15, K16

Contactors K15 and K16 are three-pole double-break contactors located on the electric heat vestibule. All contactors are equipped with a 24VAC coil. The coils in the K15 and K16 contactors are energized by a W2 thermostat demand, K9, and DL2. Contactor K15 energizes the first stage heating elements, while K16 energizes the second stage heating elements.

2-High Temperature Limits S15 (Primary)

S15 is a SPST normally closed auto-reset thermostat located on the back panel of the electric heat section below the heating elements. S15 is the high temperature limit for the electric heat section. When S15 opens, indicating a problem in the system, contactor K15 is deenergized. When K15 is de-energized, first stage and all subsequent stages of heat are de-energized. For EHA102/150 units, the electric heat section thermostat is factory set to open at 170F $\pm$ 5F (76C $\pm$ 2.8C) on a temperature rise and automatically reset at 130F $\pm$ 6F (54.4C $\pm$ 3.3C) on a temperature fall. For EHA100 units, the electric heat section thermostat is factory set to open at 160F $\pm$ 5F (71.0C $\pm$ 2.8C) on a temperature rise and automatically reset at 120F $\pm$ 6F (49.0C $\pm$ 3.3C) on a temperature fall. The thermostat is not adjustable.

3-High Temperature Limit S20, S157, S158, S159, S160 & S161 (Secondary)

Limits are SPST normally closed manual-reset thermostat like the primary temperature limit, S20 is wired in series with the first stage contactor coil (K15) and second stage contactor coil (K16). When S20 opens, contactors (K15, K16) are de-energized. When the contactors are de-energized, first stage and all subsequent stages of heat are de-energized. The thermostat is factory set to open at 220F $\pm$ 6F (104C $\pm$ 3.3C) on a temperature rise and can be manually reset when temperature falls below 160F (71.0C).

4-Terminal Strip TB2

Terminal strip TB2 is used for single point power installations only. TB2 distributes L1, L2 and L3 power to TB3. Units with multi-point power connections will not use TB2.

5-Terminal Strip TB3

Electric heat line voltage connections are made to terminal strip TB3 located in the upper left corner of the electric heat vestibule. TB3 distributes power to the electric heat components.

6-Heating Elements HE1 through HE6

Heating elements are composed of helix wound bare nichrome wire exposed directly to the air stream. Three elements are connected in a three-phase arrangement. The elements in 208/230V units are connected in a “Delta” arrangement. Elements in 460 and 575V units are connected in “Wye” arrangement. Each stage is energized independently by the corresponding contactors located on the electric heat vestibule panel. Once energized, heat transfer is instantaneous. High temperature protection is provided by primary and redundant high temperature limits and overcurrent protection is provided by fuses.

7-Fuse F3

Fuse F3 are housed in a fuse block which holds three fuses. Each F3 fuse is connected in series with each leg of electric heat. FIGURE 15 and TABLE 6 show the fuses used with each electric heat section. For simplicity, the service manual labels the fuses F3 - 1, 2 and F4 - 1, 2.

8-Unit Fuse Block F4

Three line voltage fuses F4 provide short circuit and ground fault protection to all cooling components in the KHC units with electric heat. The fuses are rated in accordance with the amperage of the cooling components.

ELECTRIC HEAT CONTROL ASSEMBLY (Field Installed)

1-Electric Heat Relay K9

All KHC series units with electric heat use an electric heat relay K9. K9 is a N.O. DPDT pilot relay intended to electrically isolate the unit’s 24V circuit from the electric heat 24V circuit. K9 is energized by CMC1. K9-1 closes, energizing timer DL2. K9 is located in the electric heat control assembly. See FIGURE 13.

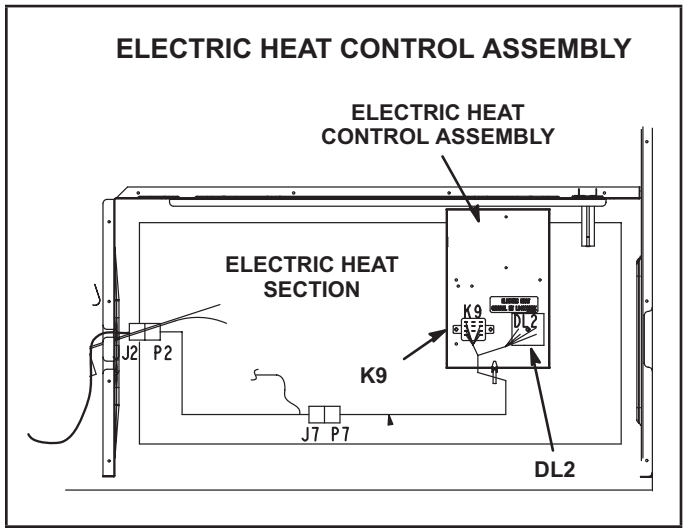


FIGURE 13

TABLE 6

KCC ELECTRIC HEAT SECTION FUSE RATING					
EHA QUANTITY & SIZE	**VOLTAGES**	**FUSE (3 each)**			
		F3 - 1	**F3 - 2**	**F3 - 3**	**F3 - 4**
EHA100-7.5	208/230V	25 Amp 250V	-----	-----	-----
	460V	15 Amp 600V	-----	-----	-----
	575V	10 Amp 600V	-----	-----	-----
EHA100-15	208/230V	50 Amp 250V	-----	-----	-----
	460V	25 Amp 600V	-----	-----	-----
	575V	20 Amp 600V	-----	-----	-----
EHA100-22.5	208/230V	50 Amp250V	-----	-----	25 Amp 250V
	460V	25 Amp 600V	-----	-----	15 Amp 600V
	575V	20 Amp 600V	-----	-----	10 Amp 600V
EHA100-30	208/230V	50 Amp 250V	-----	-----	50 Amp 250V
	460V	25 Amp 600V	-----	-----	25 Amp 600V
	575V	20 Amp 600V	-----	-----	20 Amp 600V
EHA100-45	208/230V	50 Amp 250V	-----	60 Amp 250V	60 Amp 250V
	460V	25 Amp 600V	-----	-----	50 Amp 600V
	575V	20 Amp 600V	-----	-----	40 Amp 600V
EHA102-7.5	208/230V	25 Amp 250V	-----	-----	-----
	460V	15 Amp 600V	-----	-----	-----
	575V	10 Amp 600V	-----	-----	-----
EHA150-15	208/230V	50 Amp 250V	-----	-----	-----
	460V	25 Amp 600V	-----	-----	-----
	575V	20 Amp 600V	-----	-----	-----
EHA360-22.5	208/230V	50 Amp 250V	-----	-----	25 Amp 250V
	460V	25 Amp 600V	-----	-----	15 Amp 600V
	575V	20 Amp 600V	-----	-----	10 Amp 600V
EHA150-30	208/230V	50 Amp 250V	-----	-----	50 Amp 250V
	460V	25 Amp 600V	-----	-----	25 Amp 600V
	575V	20 Amp 600V	-----	-----	20 Amp 600V
EHA150-45	208/230V	50 Amp 250V	-----	60 Amp 250V	60 Amp 250V
	460V	25 Amp 600V	-----	-----	50 Amp 600V
	575V	20 Amp 600V	-----	-----	40 Amp 600V
EHA150-60	208/230V	60 Amp 250V	60 Amp 250V	60 Amp 250V	60 Amp 250V
	460V	50 Amp 600V	-----	-----	50 Amp 600V
	575V	40 Amp 600V	-----	-----	40 Amp 600V

EHA 7.5, 15, 22.5, 30, 45, 60KW
ELECTRIC HEAT SECTION PARTS ARRANGEMENT

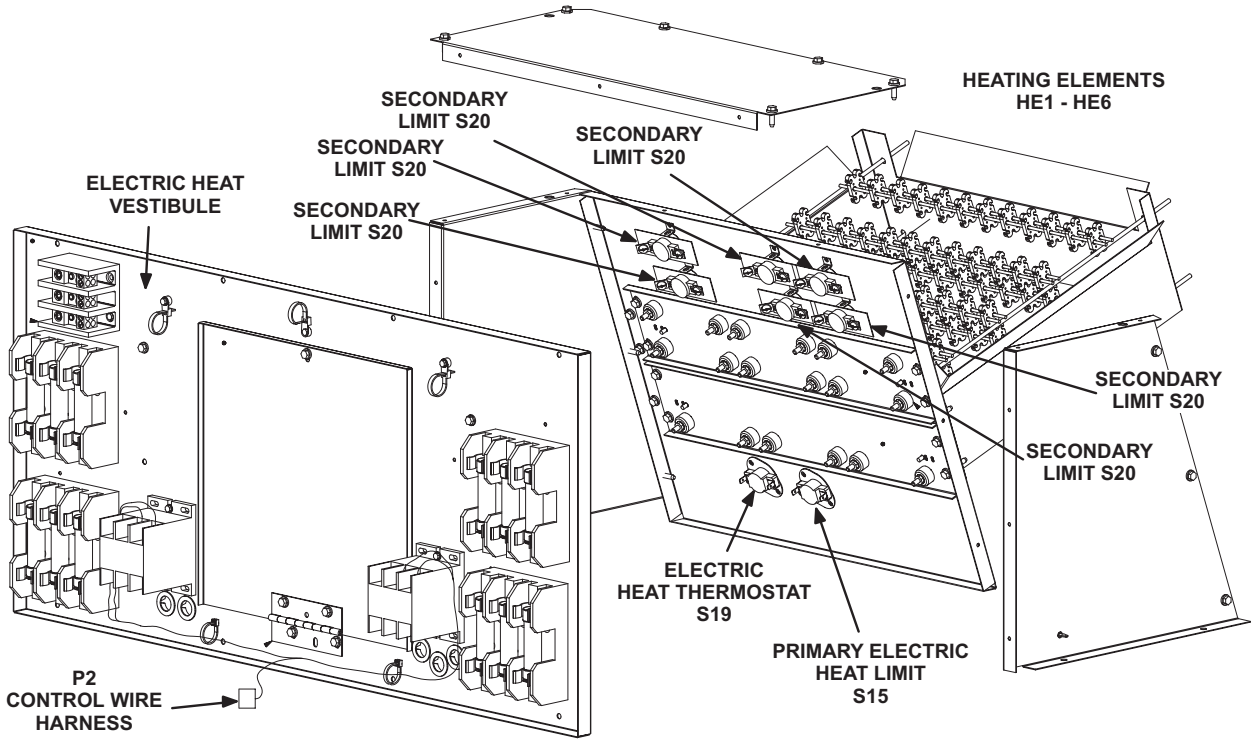


FIGURE 14

ELECTRIC HEAT VESTIBULE PARTS ARRANGEMENT

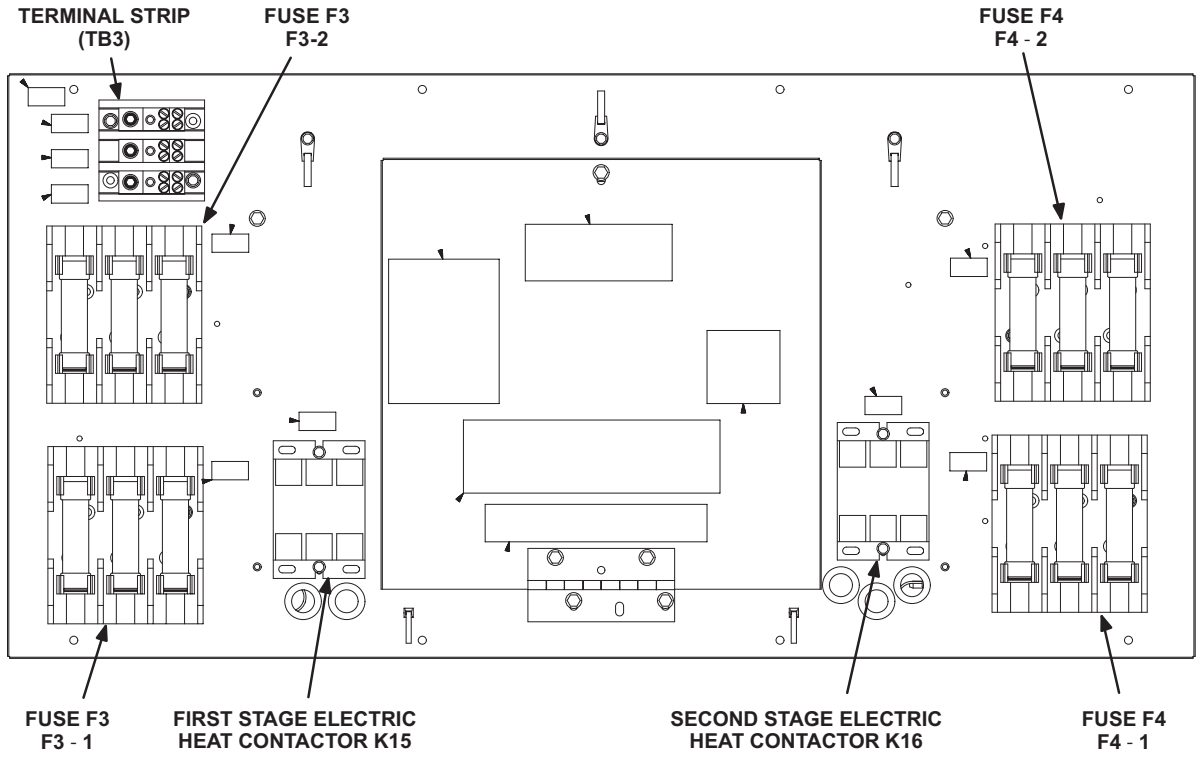


FIGURE 15

II-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.

III-STARTUP - OPERATION

Refer to startup directions and to the unit wiring diagram when servicing. See unit nameplate for minimum circuit ampacity and maximum fuse size.

A-Preliminary and Seasonal Checks

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

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

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

4 - Check voltage at the disconnect switch (if applicable) or TB2. Voltage must be within the range listed on the nameplate. If not, consult the power company and have the voltage corrected before starting the unit.

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

6 - Inspect and adjust blower belt (see section on Blower Compartment - Blower Belt Adjustment).

B - Cooling Start Up

⚠ IMPORTANT

If unit is equipped with a crankcase heater. Make sure heater is energized 24 hours before unit start- up to prevent compressor damage as a result of slugging.

Supply Air Inverter Units - Refer to the Inverter Start-Up section for further instruction on blower control.

Compressor 1 is a two-stage compressor. Compressor 2 is a single-stage compressor.

1 - Initiate first, second, and third stage cooling demands according to instructions provided with thermostat.

2 - No Economizer Installed in Unit -

See TABLE 7 for cooling operation.

Units Equipped With Economizer -

When outdoor air is suitable, any combination of thermostat demands will energize the economizer. See TABLE 8 for cooling operation.

3 - Units contain two refrigerant circuits or stages. See FIGURE 16.

TABLE 7
COOLING OPERATION - NO ECONOMIZER

T'Stat	Compressors	OD Fans
Y1	Compr. 1 Low	Fan 1 On
Y1 + Y2	Compr. 1 Low; Compr. 2 On	Both On
Y1 + Y2 + Y3	Compr. 1 High; Compr. 2 On	Both On

TABLE 8
COOLING OPERATION - WITH ECONOMIZER

T'Stat	Compressors	OD Fans
Y1	Off	Off
Y1 + Y2	Compr. 1 Low	Fan 1 On
Y1 + Y2 + Y3	Compr. 1 High	Fan 1 On

Each refrigerant circuit is separately charged with R-410A refrigerant. See unit rating plate for correct amount of charge.

Refer to Cooling Operation and Adjustment section for proper method to check refrigerant charge

B - Heating Start Up

1 - Set thermostat or temperature control device to initiate a first-stage heating demand.

A first-stage heating demand (W1) will energize compressors 1 and 2. Both outdoor fans are energized with a W1 demand.

NOTE - *L1 and L2 reversing valves are de-energized in the heating mode.*

Units With Optional Electric Heat -

An increased heating demand (W2) will energize electric heat. Electric heat is also energized during the defrost cycle (W1) to maintain discharge air temperature

Three Phase Scroll Compressor Voltage Phasing

Three phase scroll compressors must be phased sequentially to ensure correct compressor and blower rotation and operation. Compressor and blower are wired in phase at the factory. Power wires are color-coded as follows: line 1-red, line 2-yellow, line 3-blue.

1 - Observe suction and discharge pressures and blower rotation on unit start-up

If pressure differential is not observed or blower rotation is not correct:

2 - Suction pressure must drop, discharge pressure must rise, and blower rotation must match rotation marking.

3 - Disconnect all remote electrical power supplies.

4 - Reverse any two field-installed wires connected to the line side of TB2 or F4. Do not reverse wires at VFD or compressors.

5 - Make sure the connections are tight.

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

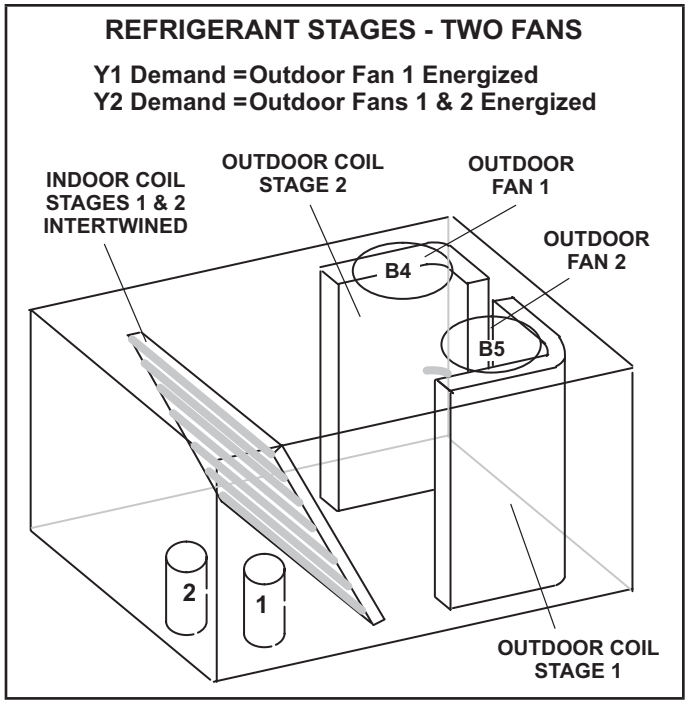


FIGURE 16

C-Safety or Emergency Shutdown

Turn off power to unit

IV-CHARGING

WARNING - Do not exceed nameplate charge under any condition. This unit is factory charged and should require no further adjustment. If the system requires additional refrigerant, 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 with economizer disabled until system stabilizes (approximately five minutes).

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 TABLE 9 to TABLE 11 to determine normal operating pressures. Pressures are listed for sea level applications at 80°F dry bulb and 67°F wet bulb return air.

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.**

TABLE 9

KHC092S NORMAL OPERATING PRESSURES

Outdoor Coil Entering Air Temp	CIRCUIT 1		CIRCUIT 2	
	Dis. ± 10 psig	Suc. ± 5 psig	Dis. ± 10 psig	Suc. ± 5 psig
65°F	256	132	265	137
75°F	293	133	304	138
85°F	334	135	351	140
95°F	380	137	401	142
105°F	432	140	456	144
115°F	491	143	519	147

TABLE 10

KHC102S NORMAL OPERATING PRESSURES

Outdoor Coil Entering Air Temp	CIRCUIT 1		CIRCUIT 2	
	Dis. ± 10 psig	Suc. ± 5 psig	Dis. ± 10 psig	Suc. ± 5 psig
65°F	255	128	250	139
75°F	295	128	291	141
85°F	334	129	329	143
95°F	376	131	375	145
105°F	426	133	425	147
115°F	478	136	479	150

TABLE 11

KHC150S NORMAL OPERATING PRESSURES

Outdoor Coil Entering Air Temp	CIRCUIT 1		CIRCUIT 2	
	Dis. ± 10 psig	Suc. ± 5 psig	Dis. ± 10 psig	Suc. ± 5 psig
65°F	250	127	267	128
75°F	286	128	306	129
85°F	326	128	348	131
95°F	368	129	395	133
105°F	415	131	445	136
115°F	469	133	502	141

6 - If discharge pressure is high, 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.

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

Charge Verification - Approach Method - AHRI Testing

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

Approach Temperature = Liquid temperature (at condenser outlet) minus ambient temperature.

2 - Approach temperature should match values in TABLE 12. An approach temperature greater than value shown indicates an undercharge. An approach temperature less than value shown indicates an overcharge.

TABLE 12
Approach Temperature

Unit	Liquid Temp. Minus Ambient Temp.	
	1st Stage	2nd Stage
092S	5°F ± 1 (2.8°C ± 0.5)	4°F ± 1 (2.2°C ± 0.5)
102S	5°F ± 1 (2.8°C ± 0.5)	5°F ± 1 (2.8°C ± 0.5)
120S	4°F ± 1 (2.2°C ± 0.5)	7°F ± 1 (3.9°C ± 0.5)

3 - The approach method is not valid for grossly over or undercharged systems. Use TABLE 9 through Table 11 as a guide for typical operating pressures.

V- SYSTEMS SERVICE CHECKS

A-Cooling System Service Checks

KHC units are factory charged and require no further adjustment; however, charge should be checked periodically using the approach method. The approach method compares actual liquid temperature with the outdoor ambient temperature. See section IV- CHARGING.

NOTE - *When unit is properly charged, discharge line pressures should approximate those in TABLE 9, TABLE 10 and TABLE 11.*

VI-MAINTENANCE

The unit should be inspected once a year by a qualified service technician.

⚠ WARNING

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

⚠ CAUTION

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

A-Filters

Units are equipped with six 20 X 25 X 2" 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. See FIGURE 17.

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

B-Lubrication

All motors are lubricated at the factory. No further lubrication is required.

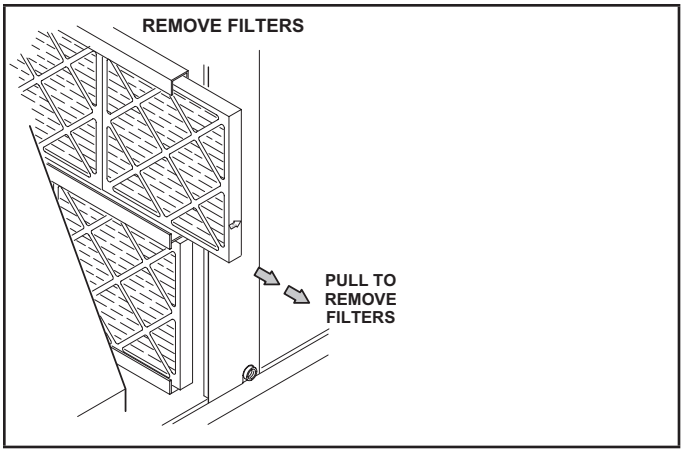


FIGURE 17

C-Evaporator Coil

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

D-Condenser Coil

Clean condenser coil annually with water and inspect monthly during the cooling season.

Clean the coil by spraying the coil steadily and uniformly from top to bottom. Do not exceed 900 psi or a 45° angle; nozzle must be at least 12 inches from the coil face. Take care not to fracture the braze between the fins and refrigerant tubes. Reduce pressure and work cautiously to prevent damage.

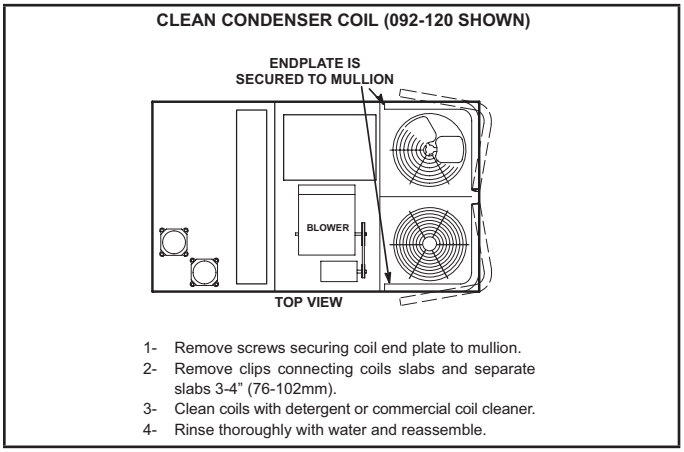


FIGURE 18

E-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.

F-Electrical

1 - Check all wiring for loose connections.

2 - Check for correct voltage at unit (unit operating).

3 - Check amp-draw on both condenser fan motor and blower motor.

Fan Motor Rating Plate ____ Actual _____
Indoor Blower Motor Rating Plate____ Actual____

VII-OPTIONAL ACCESSORIES

The accessories section describes the application of most of the optional accessories which can be installed to the KHC units.

A-Drain Pan Overflow Switch S149 (optional)

The overflow switch is used to interrupt cooling operation when excessive condensate collects in the drain pan. The N.O. overflow switch is controlled by K220 and DL46 relays, located in the unit control panel. When the overflow switch closes, 24VAC power is interrupted and after a fivesecond delay unit compressors are de-energized. Once the condensate level drops below the set level, the switch will open. After a five-minute delay the compressor will be energized.

B-C1CURB Mounting Frames

When installing units on a combustible surface for downflow discharge applications, the C1CURB roof mounting frame is used. The roof mounting frames are recommended in all other applications but not required. If the KHC units are not installed on a flat (roof) surface, they MUST be supported under all edges and under the middle of the unit to prevent sagging. The units MUST be installed level within 1/16" per linear foot or 5mm per meter in any direction.

The assembled C1CURB mounting frame is shown in FIGURE 19. Refer to the roof mounting frame installation instructions for details of proper assembly and installation. The roof mounting frame MUST be squared to the roof and level before installation. Plenum system MUST be installed before the unit is set on the mounting frame. Typical roof curbing and flashing is shown in FIGURE 20. Refer to the roof mounting frame installation instructions for proper plenum construction and attachment.

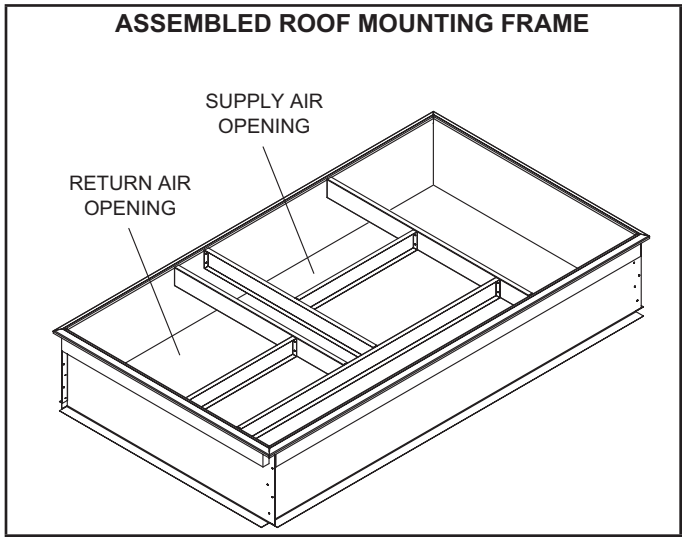


FIGURE 19

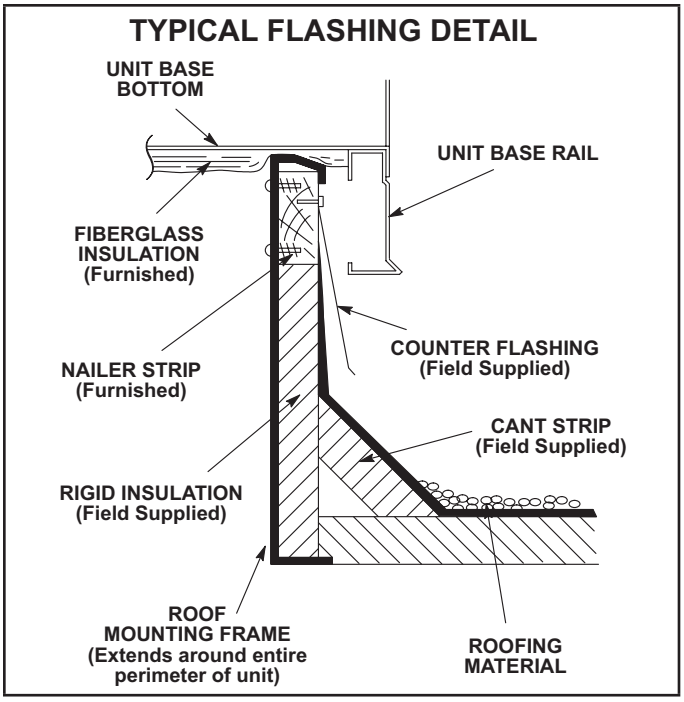


FIGURE 20

C-Transitions

Optional supply/return transition C1DIFF30B-1, C1DIFF31B-1 and C1DIFF32B-1 are available for use with the KHC 7.5 through 12.5 ton units, utilizing optional C1CURB roof mounting frames. Transition must be installed in the C1CURB mounting frame before setting the unit on the frame. Refer to the manufacturer's instructions included with the transition for detailed installation procedures

D-Supply and Return Diffusers

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

E-Outdoor Air Dampers C1DAMP20B-1 and C1DAMP10B-2

Optional manual and motorized outdoor air dampers (FIGURE 23) provide up to 25 percent fresh air for return. Motorized damper opens to minimum position simultaneously with the blower during the occupied period and remains closed during the unoccupied period. Manual damper assembly is manually operated; damper position is manually set at installation and remains in that positio

F-K1ECON20B / K1ECON22B-1 Economizer,

(Field- or Factory-Installed)

See specific economizer installation instructions for more detail for both K1ECON20B and high performance economizer K1ECON22B1 (Title 24 California). Economizers use outdoor air for free cooling when temperature and/or humidity is suitable. See FIGURE 22. Below is a brief description of the K1ECON20B economizer.

The mixed air temperature sensor (R1) measures the supply air sensible temperature. See FIGURE 21. The outdoor air sensible control is the default economizer control. An outdoor air single sensible sensor, S175, is also provided. See TABLE 13 for outdoor and return air (OA and RA) sensor options. Refer to instructions provided with sensors for installation.An IAQ sensor is used when demand control ventilation (DCV) is specified. Damper minimum position can be set lower than traditional minimum air requirements resulting in cost savings. The IAQ sensor allows the A6 to open dampers to traditional ventilation requirements as room occupancy (CO2) increases.

TABLE 13

Sensors	Dampers will modulate to 55°F discharge air (RT6) when:
Single OA Sensible	OA temperature (S175) is lower than free cooling setpoint.
Single OA Sensible	OA temperature and humidity (A7) is lower than free cooling setpoint.
Differential Enthalpy - 1 in OA and 1 in RA	OA temperature and humidity (A7) is lower than RA temperature and humidity (A62).
IAQ Sensor	CO2 sensed (A63) is higher than CO2 setpoint.

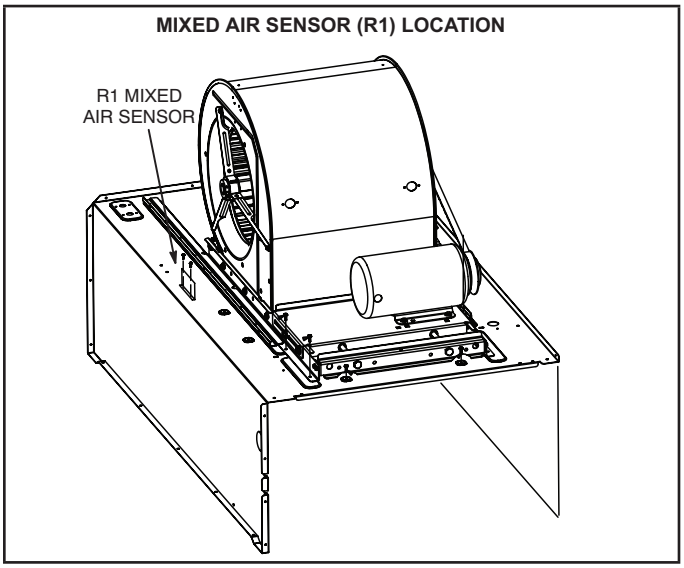


FIGURE 21

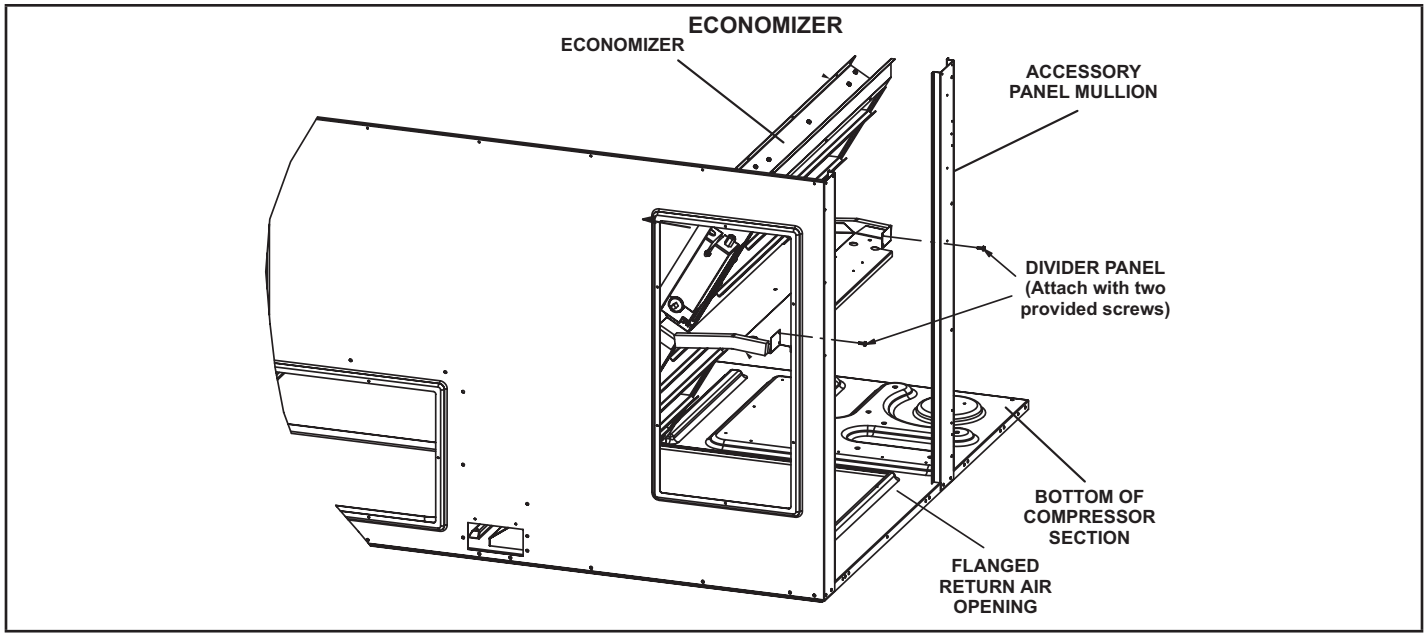
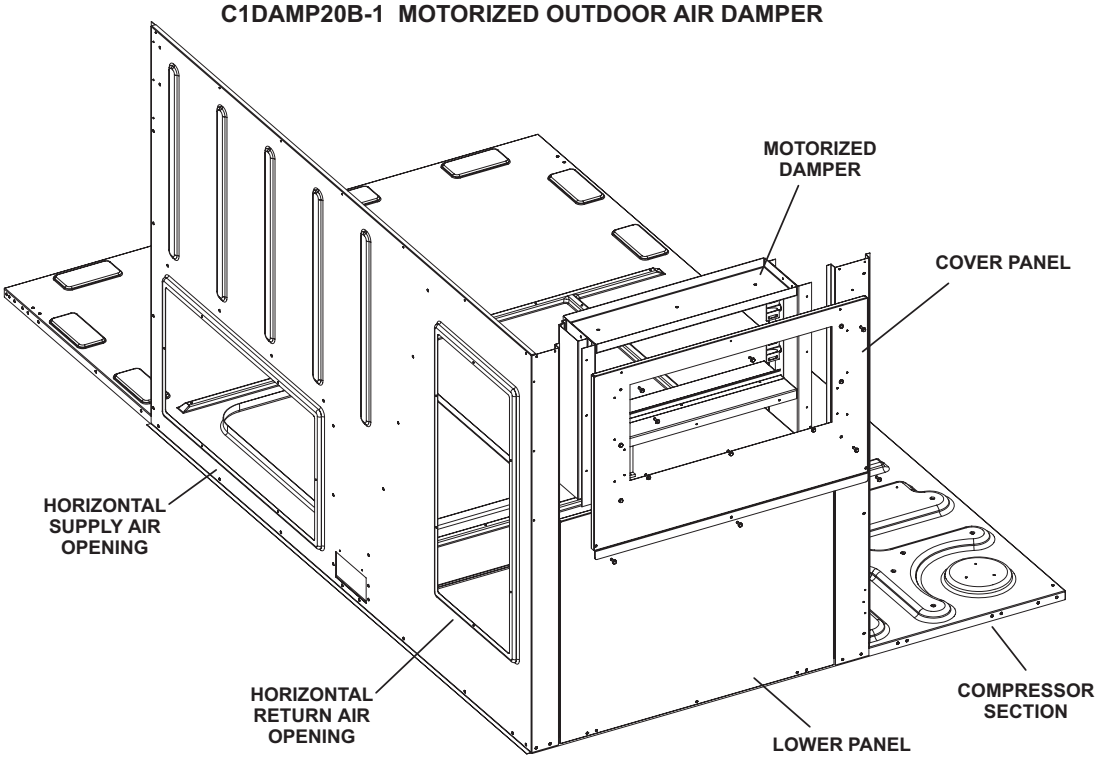


FIGURE 22

C1DAMP20B-1 MOTORIZED OUTDOOR AIR DAMPER



C1DAMP10B-2 MANUAL OUTDOOR AIR DAMPER

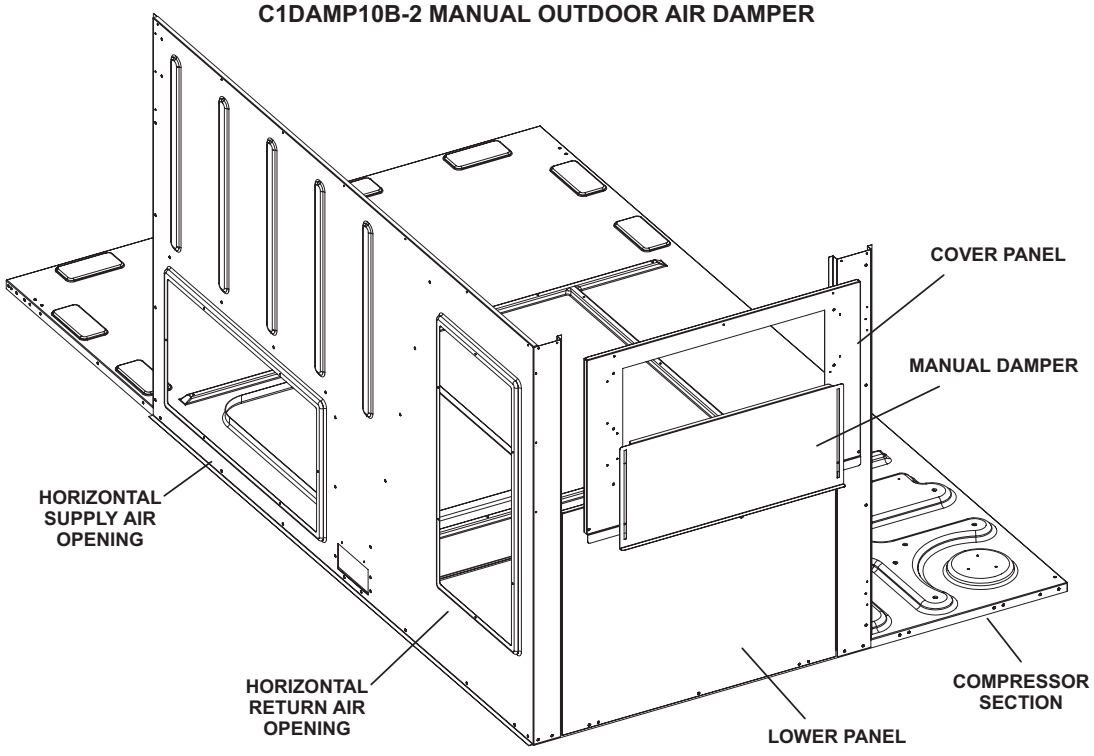


FIGURE 23

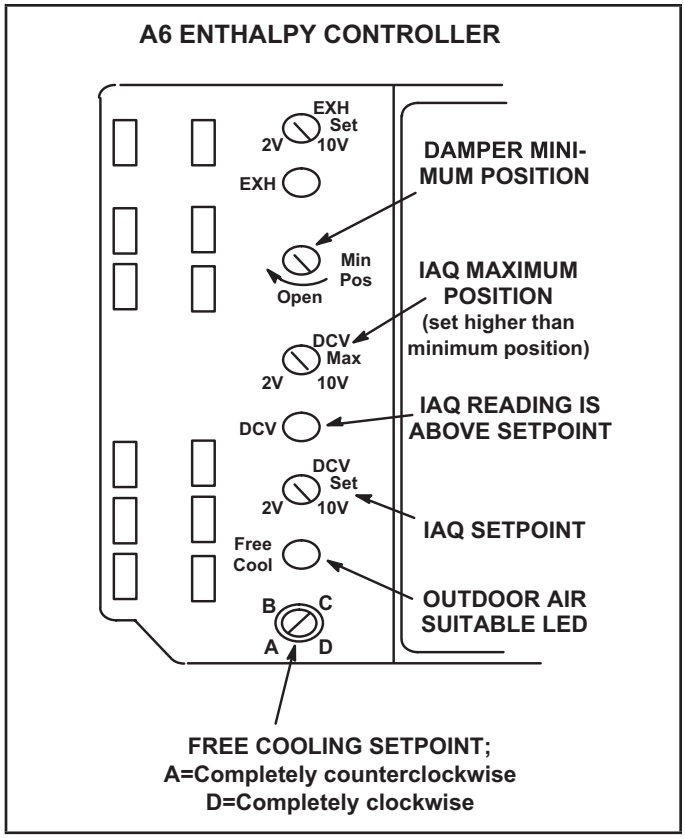


FIGURE 24

A6 Enthalpy Control LEDs

A steady green Free Cool LED indicates that outdoor air is suitable for free cooling.

When an optional IAQ sensor is installed, a steady green DCV LED indicates that the IAQ reading is higher than setpoint requiring more fresh air. See FIGURE 24.

Outdoor air is considered suitable when temperature and humidity are less than the free cooling setpoints shown in TABLE 14. Setting A is recommended. See FIGURE 24. At setting A, free cooling will be energized when outdoor air is approximately 73°F (23°C) and 50% relative humidity. If indoor air is too warm or humid, lower the setpoint to B. At setting B, free cooling will be energized at 70°F (21°C) and 50% relative humidity.

When an optional A62 differential sensor is installed, turn A6 enthalpy control free cooling setpoint potentiometer completely clockwise to position “D”.

TABLE 14

ENTHALPY FREE COOLING SETPOINTS

Control Setting	Enthalpy Setpoint At 50% RH
A	73° F (23° C)
B	70° F (21° C)
C	67° F (19° C)
D	63° F (17° C)

*Setting A is recommended

Damper Minimum Position

NOTE - *A jumper is factory-installed between TB1 R and OC terminals to maintain occupied status (allowing minimum fresh air). When using an electronic thermostat or energy management system with an occupied/unoccupied feature, remove jumper.*

1 - Set thermostat to occupied mode if the feature is available. Make sure jumper is in place between TB1 terminals R and OC if using a thermostat which does not have the feature.

2 - Rotate MIN POS SET potentiometer to approximate desired fresh air percentage.

NOTE - *Damper minimum position can be set lower than traditional minimum air requirements when an IAQ sensor is specified. Dampers will open to DCV MAX setting (if CO2 is above setpoint) to meet traditional ventilation requirements.*

3 - Measure outdoor air temperature. Mark the point on the bottom line of chart 1 and label the point “A” (40F, 4C shown).

4 - Measure return air temperature. Mark that point on the top line of chart 1 (FIGURE 25) and label the point “B” (74F, 23C shown).

5 - Measure mixed air (outdoor and return air) temperature. Mark that point on the top line of chart 1 and label point “C” (70F, 21C shown).

6 - Draw a straight line between points A and B.

7 - Draw a vertical line through point C.

8 - Draw a horizontal line where the two lines meet. Read the percent of fresh air intake on the side.

9 - If fresh air percentage is less than desired, adjust MIN POS SET potentiometer higher. If fresh air percentage is more than desired, adjust MIN POS SET potentiometer lower. Repeat steps 3 through 8 until calculation reads desired fresh air percentage.

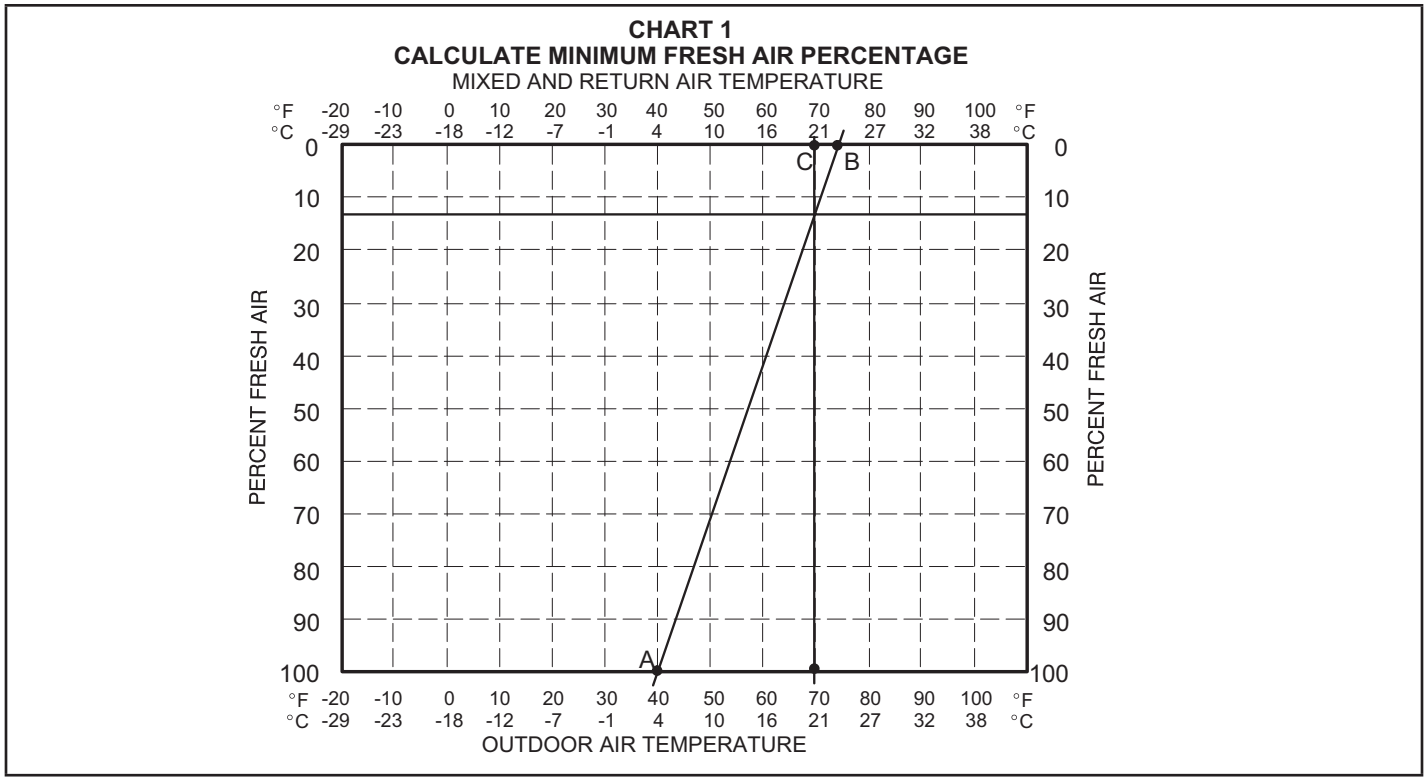


FIGURE 25

DCV Set and Max Settings

Adjust settings when an optional IAQ sensor is installed. The DCV SET potentiometer is factory-set at approximately 50% of the potentiometer range. Using a standard 1-2000ppm CO2 sensor, dampers will start to open when the IAQ sensor reads approximately 1000ppm. Adjust the DCV SET potentiometer to the approximate setting specified by the controls contractor. Refer to FIGURE 24. The DCV MAX potentiometer is factory-set at approximately 50% of the potentiometer range or 6VDC.

Dampers will open approximately halfway when CO2 rises above setpoint. Adjust the DCV MAX potentiometer to the approximate setting specified by the controls contractor. Refer to FIGURE 24.

NOTE - *DCV Max must be set higher than economizer minimum position setting for proper demand control ventilation.*

Economizer Operation

The occupied time period is determined by the thermostat or energy management system.

Outdoor Air Not Suitable:

During the unoccupied time period dampers are closed. During the occupied time period a cooling demand will open dampers to minimum position and mechanical cooling functions normally. See TABLE 16.

During the occupied time period dampers will open to DCV MAX when IAQ reading is above setpoint (regardless of thermostat demand or outdoor air suitability).

Outdoor Air Suitable:

See TABLE 15 for economizer operation with a standard twostage thermostat.

During the occupied period, dampers will open to DCV MAX when IAQ reading is above setpoint (regardless of thermostat demand or outdoor air suitability). DCV MAX will NOT override damper fully open position. When an R1 mixed air sensor for modulating dampers is installed, DCV MAX may override damper free cooling position when occupancy is high and outdoor air temperatures are low. If R1 senses discharge air temperature below 45F (7C), dampers will move to minimum position until discharge air temperature rises to 48F (9C).

⚠ IMPORTANT

Remove jumper R and OC when unit is controlled with a thermostat that has a night setback mode. If reheat operation is desired during tjhis time, wire A20 to R.

TABLE 15

ECONOMIZER OPERATION-OUTDOOR AIR IS **SUITABLE** FOR FREE COOLING -- FREE COOL LED "ON"

Thermostat Demand	Damper Position		Mechanical Cooling
	Unoccupied	**Occupied**	
Off	Closed	Closed	No
G	Closed	Minimum	No
Y1	Modulating	Modulating	No
Y2	Modulating	Modulating	Stage 1
Y3	Modulating	Modulating	Stage 2

TABLE 16

ECONOMIZER OPERATION-OUTDOOR AIR IS **NOT SUITABLE** FOR FREE COOLING -- FREE COOL LED "OFF"

Thermostat Demand	Damper Position		Mechanical Cooling
	Unoccupied	**Occupied**	
Off	Closed	Closed	No
G	Closed	Minimum*	No
Y1	Closed	Minimum*	Stage 1
Y2	Closed	Minimum*	Stage 2

*IAQ sensor can open damper to DCV max.

G-Outdoor Air Dampers

Optional manual and motorized outdoor air dampers provide fresh outdoor air. The motorized damper assembly opens to minimum position during the occupied time period and remains closed during the unoccupied period.

Manual damper assembly is set at installation and remains in that position. Set damper minimum position in the same manner a seconomizer minimum position. Adjust motorized damper position using the thumbwheel on the damper motor. See FIGURE 26. Manual damper fresh air intake percentage can be determined in the same manner.

H-Gravity Exhaust Dampers

Dampers are used in downflow (FIGURE 27) and horizontal (FIGURE 28) air discharge applications. Horizontal gravity exhaust dampers are installed in the return air duct. The dampers must be used any time an economizer and a power exhaust fan is applied to KHC series units. Gravity exhaust dampers allow exhaust air to be discharged from the system when an economizer and/or power exhaust is operating. Gravity exhaust dampers also prevent outdoor air infiltration during unit off cycle. See installation instructions for more detail.

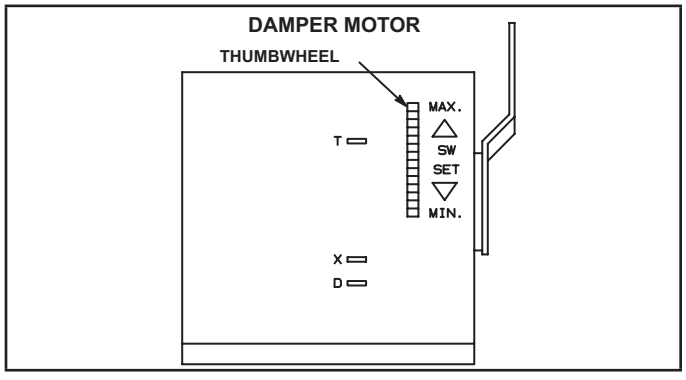


FIGURE 26

NOTE - *GED is optional except when used with power exhaust dampers, where it is required.*

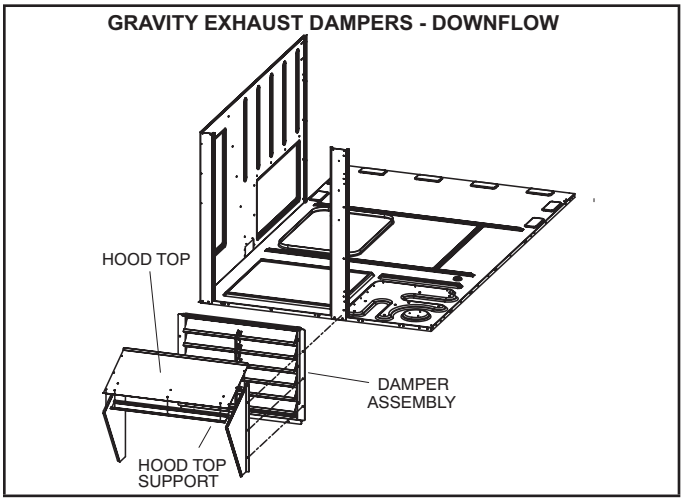


FIGURE 27

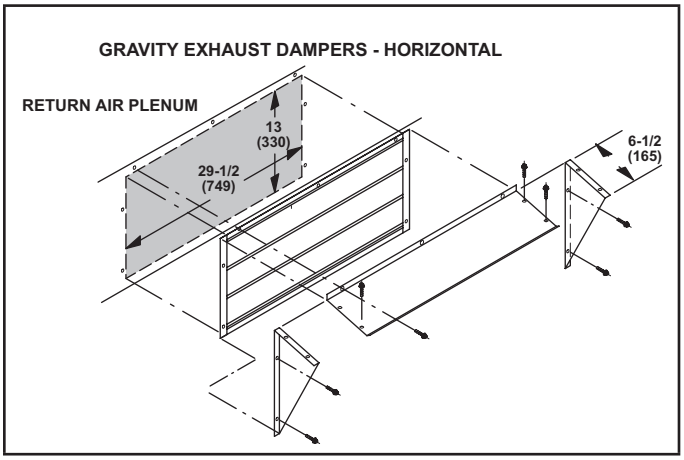


FIGURE 28

I-Power Exhaust Fan

The power exhaust fan (PEF) requires the use of a gravity exhaust damper and economizer and is used in downflow applications only. See FIGURE 29. The PEF provides exhaust air pressure relief and also runs when return air dampers are closed and the supply air blower is operating. See installation instructions for more detail.

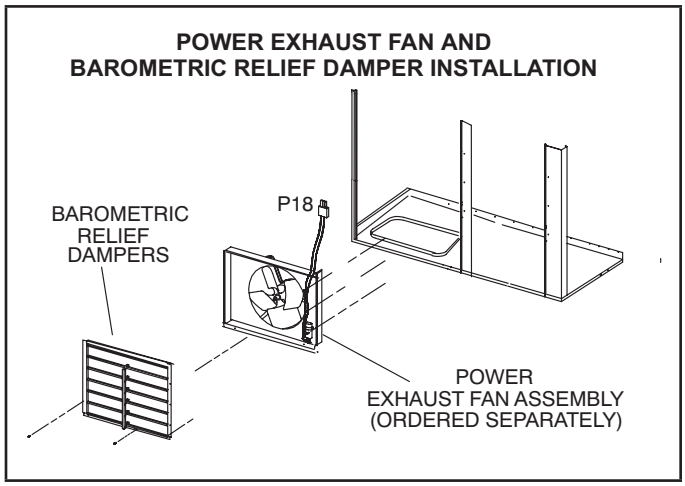


FIGURE 29

Power Exhaust Setpoint Adjustment

Locate the A6 enthalpy control in the control area. The EXH SET potentiometer is factory-set at approximately 50% of the dial range. See FIGURE 30. Power exhaust fans will be energized 30 seconds after dampers are 50% open. Adjust the EXH SET potentiometer higher (clockwise toward 10V) to energize fans when dampers are further open. Adjust the EXH SET potentiometer lower (counterclockwise toward 2V) to energize fans when dampers are further closed. (Thirty- second delay allows dampers to partially open before exhaust fan starts.)

J-Optional Cold Weather Kit (Canada only)

Electric heater is available to automatically control the minimum temperature in the gas burner compartment. Heater is ETL/CSA certified to allow cold weather operation of unit down to -60° F (-50° C).

The kit includes the following parts:

1 - Transformer (T20) is a 600V to 120/240V step-down transformer mounted in the blower compartment.

2 - T20 has two in line fuses (F20), one on each leg of the transformer. Both are rated at 15 amps.

3 - The strip heater (HR6) is located as close as possible to the gas valve. It is wired in series with T20. The strip heater is rated at 500 Watts

4 - A thermostat mounting box is installed on the vestibule of the heating compartment. Included in the box are the following thermostat switches:

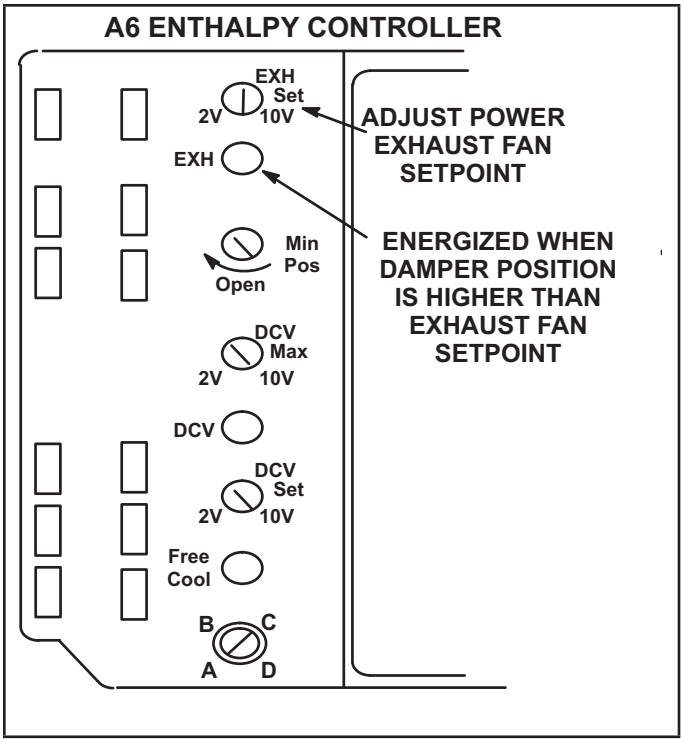


FIGURE 30

a - Thermostat switch (S59) is an auto-reset SPST N.C. switch which opens on a temperature drop. The switch is wired in series with 24V power and the combustion air blower switch. When the temperature drops below -30° F (-35° C) the switch opens and the gas heat section is de-energized. The switch automatically resets when the heating compartment temperature reaches -10° F (-12° C).

b - Thermostat switch (S60) is an auto-reset SPST N.C. switch which opens on a temperature rise. The switch is wired in series with HR6 and T20. When the temperature rises above 20° F (-7° C) the switch opens and the electric heater is de-energized. The switch automatically resets when the heating compartment temperature reaches -10° F (23.3° C).

c -Thermostat switch (S61) is an auto-reset SPST N.O. switch which closes on a temperature drop. The switch is wired in series with HR6 and T20. When temperature drops below 20° F (-7° C) the switch closes and electric heater is energized. The switch automatically opens when heating compartment temperature reaches 76° F (24° C).

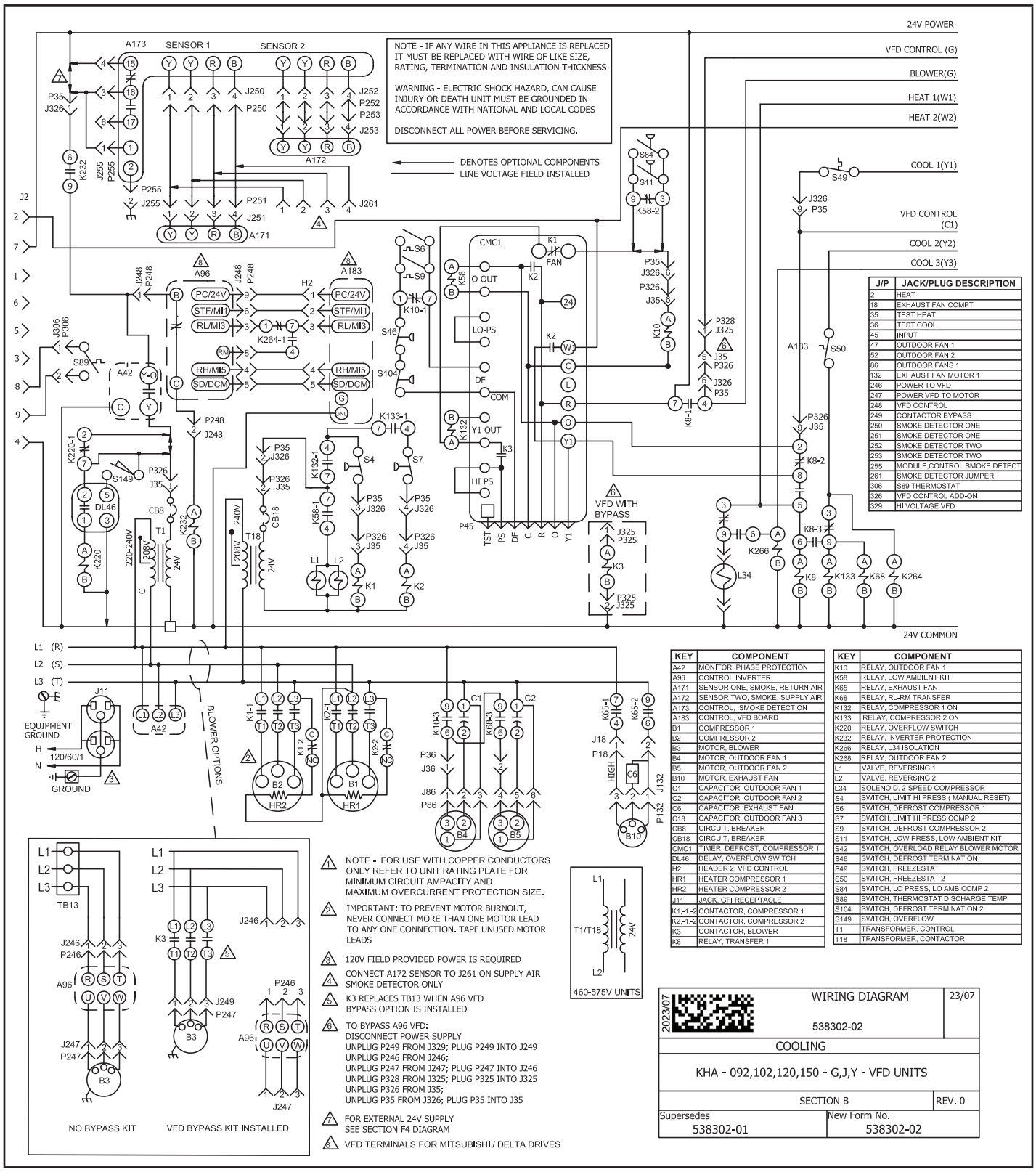
K-Control Systems

All thermostat wiring is connected to TB1 located in the control area. Each thermostat has additional control options available. See thermostat installation instructions for more detail.

L-Smoke Detectors A171 and A172

Photoelectric smoke detectors are a field-installed option. The smoke detectors can be installed in the supply air section (A172), return air section (A171), or in both the supply and return air sections.

VIII-Wiring Diagrams and Sequence of Operation



J/P	JACK/PLUG DESCRIPTION
2	HEAT
18	EXHAUST FAN COMPT
35	TEST HEAT
36	TEST COOL
45	INPUT
47	OUTDOOR FAN 1
52	OUTDOOR FAN 2
86	OUTDOOR FANS 1
132	EXHAUST FAN MOTOR 1
246	POWER TO VFD
247	POWER VFD TO MOTOR
248	VFD CONTROL
249	CONTACTOR BYPASS
250	SMOKE DETECTOR ONE
251	SMOKE DETECTOR ONE
252	SMOKE DETECTOR TWO
253	SMOKE DETECTOR TWO
255	MODULE,CONTROL SMOKE DETECT
261	SMOKE DETECTOR JUMPER
306	S89 THERMOSTAT
326	VFD CONTROL ADD-ON
329	HI VOLTAGE VFD

KEY	COMPONENT
A42	MONITOR, PHASE PROTECTION
A96	CONTROL INVERTER
A171	SENSOR ONE, SMOKE, RETURN AIR
A172	SENSOR TWO, SMOKE, SUPPLY AIR
A173	CONTROL, SMOKE DETECTION
A183	CONTROL, VFD BOARD
B1	COMPRESSOR 1
B2	COMPRESSOR 2
B3	MOTOR, BLOWER
B4	MOTOR, OUTDOOR FAN 1
B5	MOTOR, OUTDOOR FAN 2
B10	MOTOR, EXHAUST FAN
C1	CAPACITOR, OUTDOOR FAN 1
C2	CAPACITOR, OUTDOOR FAN 2
C6	CAPACITOR, EXHAUST FAN
C18	CAPACITOR, OUTDOOR FAN 3
CB8	CIRCUIT, BREAKER
CB18	CIRCUIT, BREAKER
CMC1	TIMER, DEFROST, COMPRESSOR 1
DL46	DELAY, OVERFLOW SWITCH
H2	HEADER 2, VFD CONTROL
HR1	HEATER COMPRESSOR 1
HR2	HEATER COMPRESSOR 2
J11	JACK, GFI RECEPTACLE
K1,-1,-2	CONTACTOR, COMPRESSOR 1
K2,-1,-2	CONTACTOR, COMPRESSOR 2
K3	CONTACTOR, BLOWER
K8	RELAY, TRANSFER 1

KEY	COMPONENT
K10	RELAY, OUTDOOR FAN 1
K58	RELAY, LOW AMBIENT KIT
K65	RELAY, EXHAUST FAN
K68	RELAY, RL-RM TRANSFER
K132	RELAY, COMPRESSOR 1 ON
K133	RELAY, COMPRESSOR 2 ON
K220	RELAY, OVERFLOW SWITCH
K232	RELAY, INVERTER PROTECTION
K266	RELAY, L34 ISOLATION
K268	RELAY, OUTDOOR FAN 2
L1	VALVE, REVERSING 1
L2	VALVE, REVERSING 2
L34	SOLENOID, 2-SPEED COMPRESSOR
S4	SWITCH, LIMIT HI PRESS (MANUAL RESET)
S6	SWITCH, DEFROST COMPRESSOR 1
S7	SWITCH, LIMIT HI PRESS COMP 2
S9	SWITCH, DEFROST COMPRESSOR 2
S11	SWITCH, LOW PRESS, LOW AMBIENT KIT
S42	SWITCH, OVERLOAD RELAY BLOWER MOTOR
S46	SWITCH, DEFROST TERMINATION
S49	SWITCH, FREEZESTAT
S50	SWITCH, FREEZESTAT 2
S84	SWITCH, LO PRESS, LO AMB COMP 2
S89	SWITCH, THERMOSTAT DISCHARGE TEMP
S104	SWITCH, DEFROST TERMINATION 2
S149	SWITCH, OVERFLOW
T1	TRANSFORMER, CONTROL
T18	TRANSFORMER, CONTACTOR

2023/07	WIRING DIAGRAM 538302-02	23/07
COOLING		
KHA - 092,102,120,150 - G,J,Y - VFD UNITS		
SECTION B		REV. 0
Supersedes 538302-01	New Form No. 538302-02	

Sequence of Operation
KHC092/102/120

Power:

1 - Line voltage from unit disconnect energizes transformer T1 and T18. T1 provides 24VAC power to terminal strip TB1. TB1 provides 24VAC to the unit cooling, heating and fan control board and thermostat. T18 provides 24VAC to K1 and K2 relay coils and L1 and L2 reversing valves.

Blower Operation:

2 - VFD Units without a by-pass - Indoor blower operation is controlled by A96 inverter.

VFD Units with a by-pass and CAV Units - Indoor thermostat terminal G energizes blower contactor K3 with 24VAC. N.O. K3 closes, energizing B3.

Economizer Operation:

3 - The EXH (power exhaust set point) found on the face of A6, is factory set at approximate 50% of the dial range. Economizer control module A6 receives a demand and opens outside dampers 50%. Power exhaust fan relay K65 is energized 30 seconds after dampers are 50% open. K65-1 and K65-2 close, energizing power exhaust fan B10.

First Stage Cooling Demand (compressor B1)

4 - First stage cooling demand energizes Y1 and G in the thermostat. G energizes blower (see step 2-)

5 - Transformer T18 energizes reversing valves L1 and L2 via K58-1.

6 - Y1 demand energizes K132 relay coil which closes K132-1 N.O. contacts and routes 24VAC to S49 N.C. freezestat and S4 N.C. high pressure switch. Compressor contactor K1 is energized.

7 - K1-1 N.O. contacts close energizing compressor B1 and K1-2 N.C. contacts open de-energizing crankcase heater HR1.

8 - Y1 signal from CMC1 module energizes K10 relay coil.

9 - K10-1 N.O. contactor close energizing condenser fan B4

Second Stage Cooling Demand

(compressor B1 in full load and compressor B2 energized)

10 - Second stage cooling demand energizes Y1 and Y2.

11 - Y2 demand energizes relay K133 relay coil which closes K1331 N.O. contacts. 24VAC is routed to S50 N.C. freezestat and S7 N.C. high pressure switch. Compressor contactor K2 is energized.

12 - K2-1 N.O. contacts close energizing compressor B2 and K2-2 N.C. contacts open de-energizing crankcase heater HR2.

13 - K10-1 N.O. contactor close energizing condenser fan B4 and K68-1 N.O. contactor close energizing condenser fan B5.

Third Stage Cooling

(compressor B1 in full load and compressor 2 is energized)

14 - Third stage cooling demand energizes Y1, Y2 and Y3.

15 - Y3 demand send 24V to B1 compressor solenoid(L34), B1 compressor runs at full load.

16 - K10-1 N.O. contactor close energizing condenser fan B4 and K68-1 N.O. contactor close energizing condenser fan B5.

First Stage Heat (compressors B1 and B2)

17 - Heating demand energizes W1 in the thermostat.

18 - W1 demand energizes K8 relay coil which closes K8-2 and K8-3 N.O. contacts and K132 and K133 coils.

19 - 24VAC is routed to K1 and K2 contactors 16- K1 and K2 close energizing compressor B1 and B2 and de-energizing crankase heaters HR1 and HR2.

20 - 24VAC from CMC1 module energizes K10 relay coil. Fan control A191 energizes outdoor fans B4 and B5..

Second Stage Heat (electric heat):

21 - Second stage heat demand energizes W2 in the thermostat.

22 - See sequence of operation for electric heat.

Defrost Mode:

23 - During heating operation, when outdoor coil drops to 35 ± 4° the defrost thermostat S6 or S9 closes initiating defrost (after minimum run time of 30, 60 or 90 minutes).

24 - When defrost begins, the reversing valve L1 or L2 is energized. Supplemental electric heat (W2) is energized.

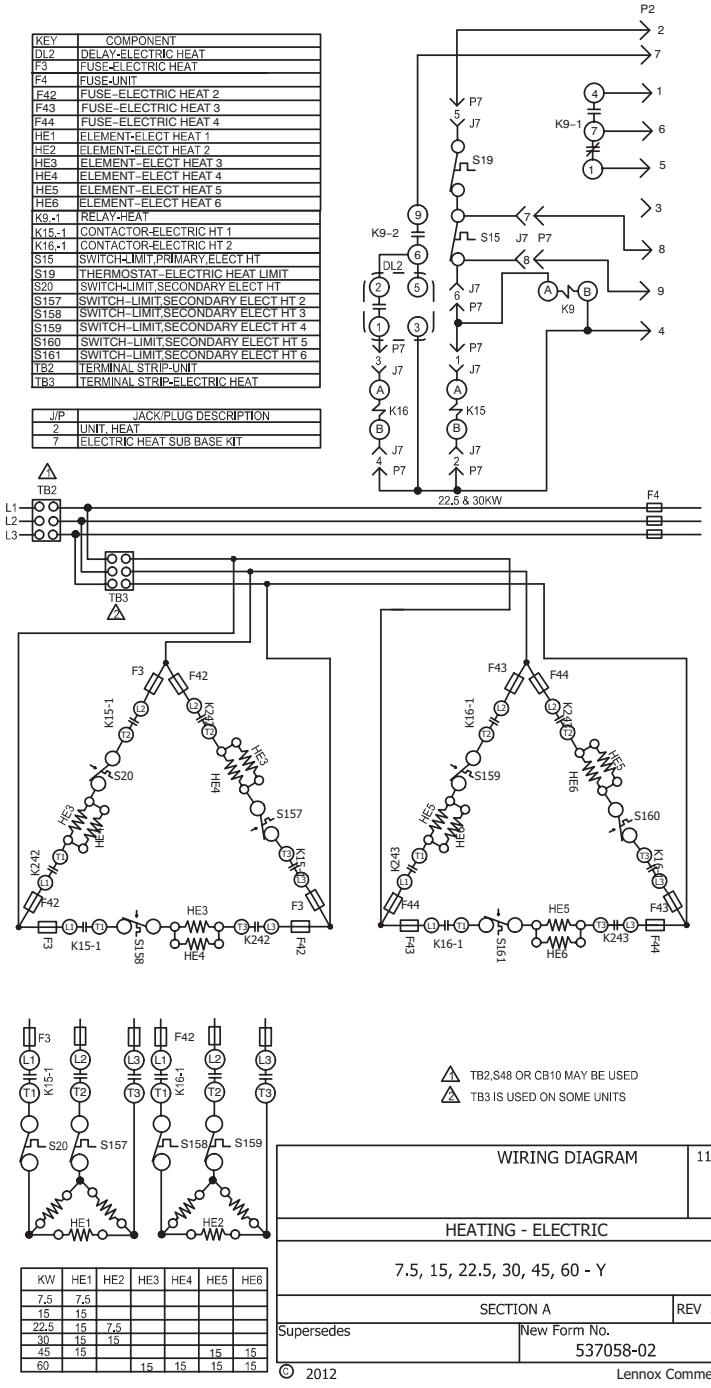
25 - When L1 energizes, outdoor fan relay K10 and outdoor fans B4, B5, are de-energized.

26 - Defrost terminates when the pressure switch for the circuit S46 or S104 opens, or when 15 minutes has elapsed. The defrost cycle is not terminated when thermostat demand ends.

EHA-7.5, 15, 22.5, 30, 45 & 60kW Y VOLTAGE

KEY	COMPONENT
DL2	DELAY-ELECTRIC HEAT
F3	FUSE-ELECTRIC HEAT
F4	FUSE-UNIT
F42	FUSE--ELECTRIC HEAT 2
F43	FUSE--ELECTRIC HEAT 3
F44	FUSE--ELECTRIC HEAT 4
HE1	ELEMENT-ELECT HEAT 1
HE2	ELEMENT-ELECT HEAT 2
HE3	ELEMENT-ELECT HEAT 3
HE4	ELEMENT-ELECT HEAT 4
HE5	ELEMENT-ELECT HEAT 5
HE6	ELEMENT-ELECT HEAT 6
K9-1	RELAY-HEAT
K15-1	CONTACTOR-ELECTRIC HT 1
K16-1	CONTACTOR-ELECTRIC HT 2
S15	SWITCH-LIMIT,PRIMARY,ELECT HT
S19	THERMOSTAT- ELECTRIC HEAT LIMIT
S20	SWITCH-LIMIT,SECONDARY ELECT HT
S157	SWITCH--LIMIT,SECONDARY ELECT HT 2
S158	SWITCH--LIMIT,SECONDARY ELECT HT 3
S159	SWITCH--LIMIT,SECONDARY ELECT HT 4
S160	SWITCH--LIMIT,SECONDARY ELECT HT 5
S161	SWITCH--LIMIT,SECONDARY ELECT HT 6
TB2	TERMINAL STRIP-UNIT
TB3	TERMINAL STRIP-ELECTRIC HEAT

J/P	JACK/PLUG DESCRIPTION
2	UNIT, HEAT
7	ELECTRIC HEAT SUB BASE KIT



1 TB2,S48 OR CB10 MAY BE USED
2 TB3 IS USED ON SOME UNITS

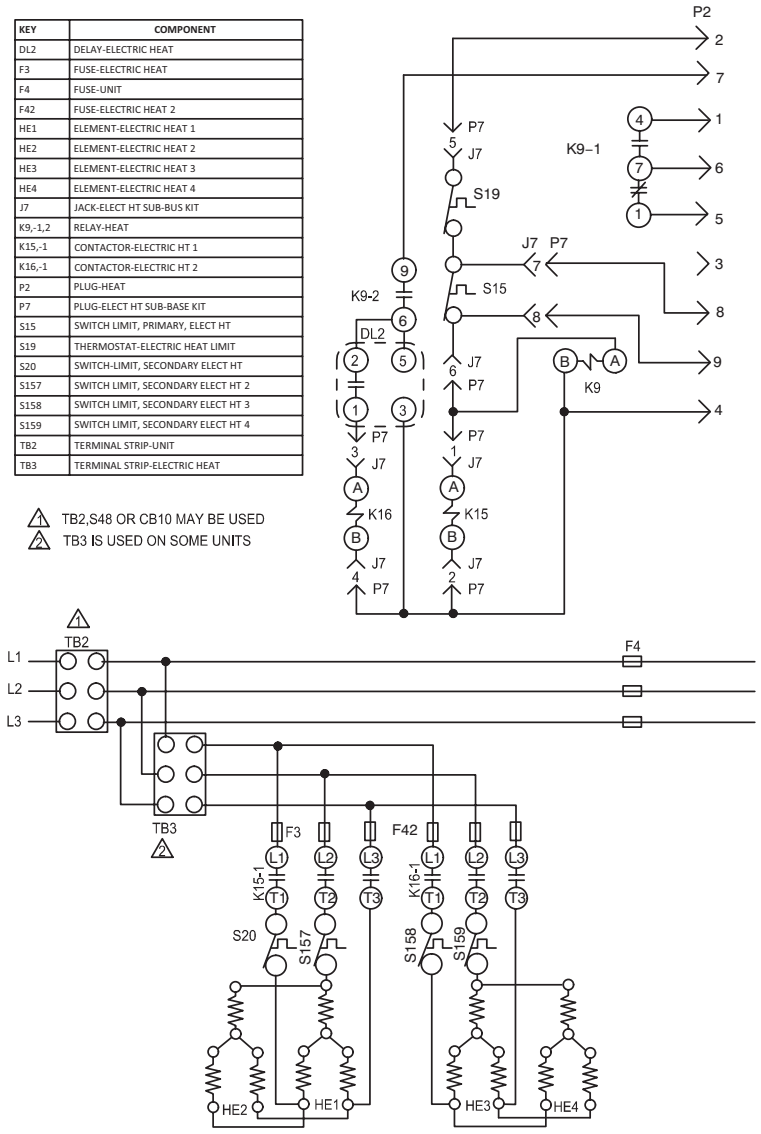
KW	HE1	HE2	HE3	HE4	HE5	HE6
7.5	7.5					
15	15					
22.5	15	7.5				
30	15	15				
45	15				15	15
60			15	15	15	15

WIRING DIAGRAM	11/17
HEATING - ELECTRIC	
7.5, 15, 22.5, 30, 45, 60 - Y	
SECTION A	REV 3
Supersedes	New Form No. 537058-02

EHA-7.5, 15, 22.5, 30, 45 & 60kW G, J VOLTAGE

KEY	COMPONENT
DL2	DELAY-ELECTRIC HEAT
F3	FUSE-ELECTRIC HEAT
F4	FUSE-UNIT
F42	FUSE-ELECTRIC HEAT 2
HE1	ELEMENT-ELECTRIC HEAT 1
HE2	ELEMENT-ELECTRIC HEAT 2
HE3	ELEMENT-ELECTRIC HEAT 3
HE4	ELEMENT-ELECTRIC HEAT 4
J7	JACK-ELECT HT SUB-BUS KIT
K9,-1,2	RELAY-HEAT
K15,-1	CONTACTOR-ELECTRIC HT 1
K16,-1	CONTACTOR-ELECTRIC HT 2
P2	PLUG-HEAT
P7	PLUG-ELECT HT SUB-BASE KIT
S15	SWITCH LIMIT, PRIMARY, ELECT HT
S19	THERMOSTAT-ELECTRIC HEAT LIMIT
S20	SWITCH-LIMIT, SECONDARY ELECT HT
S157	SWITCH LIMIT, SECONDARY ELECT HT 2
S158	SWITCH LIMIT, SECONDARY ELECT HT 3
S159	SWITCH LIMIT, SECONDARY ELECT HT 4
TB2	TERMINAL STRIP-UNIT
TB3	TERMINAL STRIP-ELECTRIC HEAT

1 TB2,S48 OR CB10 MAY BE USED
2 TB3 IS USED ON SOME UNITS



	KW	HE1	HE2	HE3	HE4
G,J	7.5	7.5			
	15	15			
	22.5	15		7.5	
	30	15		15	
	45	15		15	15
	60	15	15	15	15
M	5.7	5.7			
	11.5	11.5			
	17.2	11.5		5.7	
	23	11.5		11.5	
	34.5	11.5		11.5	11.5
	45.9	11.5	11.5	11.5	11.5

WIRING DIAGRAM	11/17
HEATING-ELETRIC	
7.5, 15, 22.5, 30, 45, 60 - G, J 5.7, 11.5, 17.2, 23, 34.5, 45.9 - M	
HEATING SECTION-A4	REV. 2
Supersedes: 537057-02, 537357-02	New Form No.: 537057-03

HEATING ELEMENTS:

1 - Terminal Strip TB3 is energized when the unit disconnect closes. TB3 supplies line voltage to electric heat elements HE1 through HE6. Each element is protected by fuse F3.

SECOND STAGE HEAT:

2 - Heating demand initiates at W2 in thermostat.

3 - 24VAC W2 signal is routed through from the thermostat to TB1. After S15 normally closed primary limit and S20 secondary limit is proved, the electric heat contactor K15 is energized.

4 - N.O. contacts K15-1 close allowing the first bank of elements to be energized.

5 - Relay K9 is energized. N.O. contacts K9-1 close energizing timer DL2.

6 - After a 30-second delay, DL2 closes energizing contactor K16.

7 - N.O. contacts K16-1 close allowing the second bank of elements to be energized.

END OF SECOND STAGE HEAT:

8 - Heating demand is satisfied. Terminal W1 in the thermostat is de-energized.

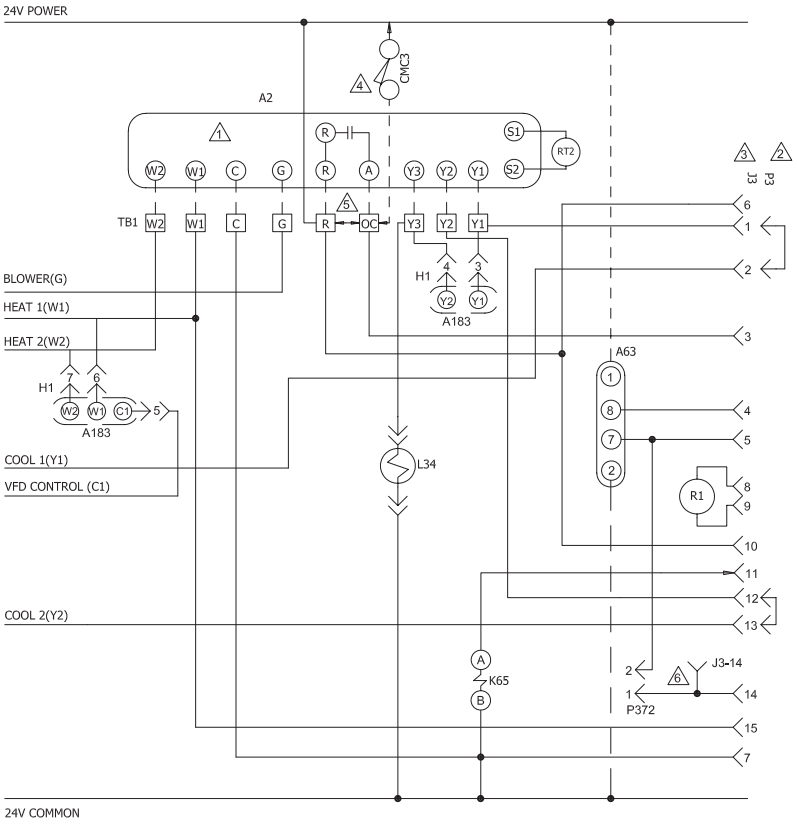
9 - Electric heat contactor K16 is de-energized.

10 - The second set of electric heat elements are de-energized.

11 - Electric heat contactor K15 is de-energized.

12 - The first set of electric heat elements are de-energized.

ELECTRONIC OR ELECTROMECHANICAL THERMOSTAT



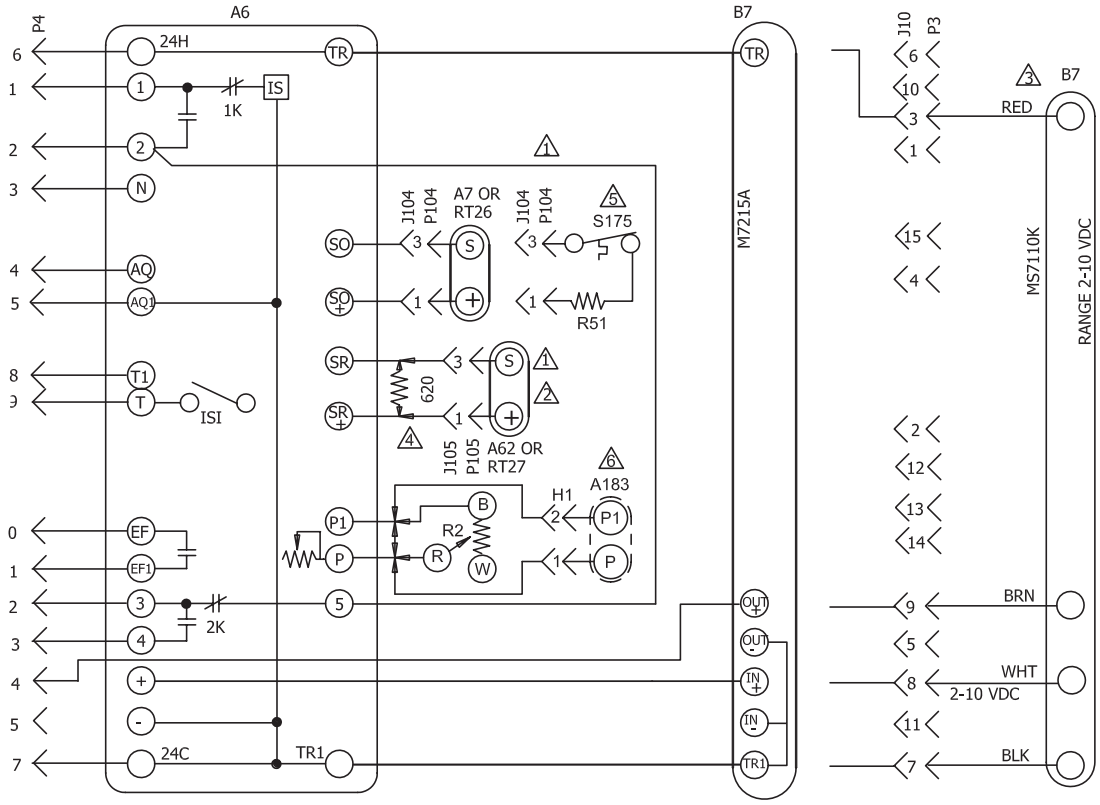
KEY	COMPONENT
A2	SENSOR, ELECTRONIC THERMOSTAT
A63	SENSOR, CO2
A183	CONTROL, VFD BOARD
CMC3	CLOCK, TIME
H1	HEADER 1 ON VFD BOARD
J3	JACK, UNIT ECONOMIZER
K65	RELAY, EXHAUST FAN
P3	PLUG, LESS ECONOMIZER
P372	PLUG, BACNET/JADE ALARM
R1	SENSOR, MIXED AIR OR SUPPLY AIR
RT2	SENSOR, REMOTE THERMOSTAT
TB1	TERMINAL STRIP, CLASS II VOLTAGE
L34	SOLENOID, 2-SPEED COMPRESSOR

1. THERMOSTAT SUPPLIED BY USER
2. REMOVE P3 WHEN ECONOMIZER IS USED
3. J3 MAXIMUM LOAD 20VA 24VAC CLASS II
4. TIME CLOCK CONTACTS (OPTIONAL) CLOSED OCCUPIED
5. REMOVE JUMPER BETWEEN TB1-R AND TB1-OC WHEN USING A NITE SETBACK THERMOSTAT
6. P372 USED FOR ALARM FEEDBACK SIGNAL FOR UNITS EQUIPPED WITH JADE ECONOMIZER CONTROL AND BACNET, TITLE 24 APPLICATION

DENOTES OPTIONAL COMPONENTS
CLASS II FIELD WIRING

2022/05	WIRING DIAGRAM 538300-01	05/22
CONTROL		
ELECTRONIC/ELECTROMECHANICAL THERMOSTAT		
SECTION C		REV 0
Supersedes	New Form No. 538300-01	

ECONOMIZER



KEY	COMPONENT
A6	CONTROL-SOLID STATE ENTHALPY
A7	SENSOR-SOLID STATE ENTHALPY
A62	SENSOR-ENTHALPY, INDOOR
A183	CONTROL, VFD BOARD
B7	MOTOR-DAMPER, ECONOMIZER
H1	HEADER 1 ON LANDMARK VFD BOARD
J10	JACK-ECONOMIZER
J104	JACK-SENSOR,OUTDOOR ENTHALPY
J105	JACK-SENSOR,RETURN AIR ENTHALPY
P3	PLUG-LESS ECONOMIZER
P4	PLUG-ECONOMIZER
P104	PLUG-SENSOR,OUTDOOR ENTHALPY
P105	PLUG-SENSOR,RETURN AIR ENTHALPY
R2	POT-MINIMUM POSITION
R51	RESISTOR-SENSIBLE 820 OHM
RT26	SENSOR-OUTDOOR AIR TEMP
RT27	SENSOR-INDOOR AIR TEMP
S175	THERMOSTAT-SENSIBLE TEMP 55-70F

1. RT26 AND RT27, TEMPERATURE SENSORS MAY BE USED INSTEAD OF A7 AND A62 ENTHALPY SENSORS
2. A62 ENTHALPY SENSOR OR RT27 USED FOR DIFFERENTIAL SENSING
3. USED ON C BOX UNITS
4. REPLACE A7 OR RT26 WITH 620 OHM RESISTOR FOR CONTROLS WITH GLOBAL ECON
5. OPTIONAL OUTDOOR THERMOSTAT TO REPLACE RT26 SENSIBLE SENSOR
6. A183 USED ON UNITS WITH VFD ONLY

DESIGNATES OPTIONAL WIRING

CLASS II FIELD WIRING

2018/09	LANDMARK WIRING DIAGRAM 537080-02	18/09
ACCESSORIES		
ECONOMIZER		
SECTION D		REV 1
Supersedes	New Form No. 537080-02	