UNIT INFORMATION

KHC SERIES
15 / 20 ton

100072

Service Literature

KHC180 and 240

KHC180 and 240 packaged heat pump units are available in 178,000 to 220,000 Btuh heating outputs and 15 or 20-ton cooling capacities. Units utilize two compressors, two reversing valves and other parts common to a heat pump.

Optional electric heat is field-installed. Electric heat operates in single or multiple stages depending on the kW input size. 15kW to 60kW heat sections are available for 180 units and 15kW to 90kW heat sections are available for 240 units.

Units equipped with supply air inverter (VFD) are available. The blower will operate at lower speeds when cooling demand is low and increase to higher speeds when cooling demand is high. Refer to Supply Air Inverter Start-Up section.

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

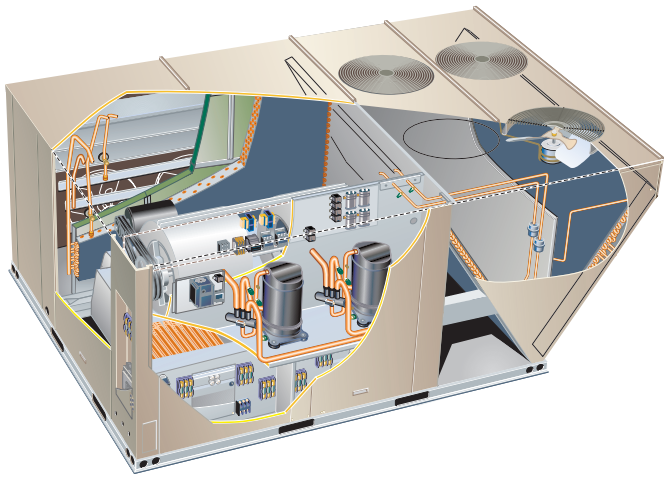
Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

⚠ CAUTION

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.

⚠ CAUTION

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFC's and HCFC's) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration may be levied for non-compliance.



⚠ 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.

Table of Contents

OPTIONS / ACCESSORIES

Item Description		Catalog Number	180	240
COOLING SYSTEM				
Condensate Drain Trap	PVC	**22H54**	X	X
	Copper	**76W27**	X	X
Drain Pan Overflow Switch		**10C24**	X	X
Low Ambient Kit		**55W73**	X	X
Refrigerant Type		R-410A	O	O
BLOWER - SUPPLY AIR				
Blower Options	MSAV Multi-Stage Air Volume	Factory	O	O
Motors - MSAV® Multi-Stage Air Volume	Belt Drive - 3 hp	Factory	O	
	Belt Drive - 5 hp	Factory	O	O
	Belt Drive - 7.5 hp	Factory	O	O
	Belt Drive - 10 hp	Factory		O
VFD Manual Bypass Kit (for MSAV® equipped units)	3 hp, 5 hp (208/230V) 3 hp, 5 hp, 7.5 hp, 10 hp (460V and 575V)	**90W52**	X	X
	7.5 hp, 10 hp (208/230V)	**90W51**	X	X
Drive Kits See Blower Data Tables for usage and selection	Kit #1 535-725 rpm	Factory	O	
	Kit #2 710-965 rpm	Factory	O	
	Kit #3 685-856 rpm	Factory	O	O
	Kit #4 850-1045 rpm	Factory	O	O
	Kit #5 945-1185 rpm	Factory	O	O
	Kit #6 850-1045 rpm	Factory	O	O
	Kit #7 945-1185 rpm	Factory	O	O
	Kit #8 1045-1285 rpm	Factory	O	O
	Kit #10 1045-1285 rpm	Factory		O
	Kit #11 1135-1365 rpm	Factory		O
CABINET				
Combination Coil/Hail Guards		**23U71**	OX	OX
Hinged Access Panels		Factory	O	O
CONTROLS				
NOTE - Also see Conventional Thermostat Control Systems for Additional Options.				
Smoke Detector - Supply or Return (Power board and one sensor)		**22H56**	X	X
Smoke Detector - Supply and Return (Power board and two sensors)		**22H57**	X	X

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

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

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OPTIONS / ACCESSORIES

Item Description		Catalog Number	180	240
INDOOR AIR QUALITY				
Air Filters				
Healthy Climate® High Efficiency Air Filters 24 x 24 x 2 (Order 6 per unit)	MERV 8	**54W67**	X	X
	MERV 13	**52W40**	X	X
	MERV 16	**21U42**	X	X
Replacement Media Filter With Metal Mesh Frame (includes non-pleated filter media)		**44N61**	X	X
Indoor Air Quality (CO_2) Sensors				
Sensor - Wall-mount, off-white plastic cover with LCD display		**77N39**	X	X
Sensor - Wall-mount, off-white plastic cover, no display		**23V86**	X	X
Sensor - Black plastic case with LCD display, rated for plenum mounting		**87N52**	X	X
Sensor - Wall-mount, black plastic case, no display, rated for plenum mounting		**87N54**	X	X
CO_2 Sensor Duct Mounting Kit - for downflow applications		**85L43**	X	X
Aspiration Box - for duct mounting non-plenum rated CO_2 sensors (**77N39**)		**90N43**	X	X
Needlepoint Bipolar Ionization (NPBI)				
Needlepoint Bipolar Ionization Kits		**21U37**	X	
		21U38		X
UVC Germicidal Light Kit				
[1] Healthy Climate® UVC Light Kit (110/230v-1ph)		**21A94**	X	X
Step-Down Transformers	460V primary, 230V secondary	**10H20**	X	X
	575V primary, 230V secondary	**10H21**	X	X
ELECTRICAL				
Voltage 60 Hz	208/230V - 3 phase	Factory	O	O
	460V - 3 phase	Factory	O	O
	575V - 3 phase	Factory	O	O
Disconnect Switch (see Electric Heat Tables for usage)	80 amp	**54W85**	OX	OX
	150 amp	**54W86**	OX	OX
	250 amp	**54W87**	OX	OX
GFI Service Outlets	15 amp non-powered, field-wired (208/230V, 460V only)	**74M70**	OX	OX
	[2] 20 amp non-powered, field-wired (208/230V, 460V, 575V)	**67E01**	X	X
	[2] 20 amp non-powered, field-wired (575V)	Factory	O	O
Weatherproof Cover for GFI		**10C89**	X	X
ELECTRIC HEAT				
15 kW	208/230V-3ph	**22H66**	X	X
	460V-3ph	**22H67**	X	X
	575V-3ph	**22V35**	X	X
30 kW	208/230V-3ph	**22H70**	X	X
	460V-3ph	**22H71**	X	X
	575V-3ph	**22V37**	X	X
45 kW	208/230V-3ph	**22H74**	X	X
	460V-3ph	**22H75**	X	X
	575V-3ph	**22V39**	X	X
60 kW	208/230V-3ph	**22H78**	X	X
	460V-3ph	**22H79**	X	X
	575V-3ph	**22V41**	X	X
90 kW	208/230V-3ph	**22H80**		X
	460V-3ph	**22H81**		X
	575V-3ph	**22V42**		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.

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OPTIONS / ACCESSORIES

Item Description		Catalog Number	180	240
ECONOMIZER				
Standard Economizer With Outdoor Air Hood (Not for Title 24)				
Standard Economizer Downflow or Horizontal Applications - Includes Outdoor Air Hood, order Downflow or Horizontal Barometric Relief Dampers separately		**13U48**	X	X
Standard Economizer Controls (Not for Title 24)				
Single Enthalpy Control		**21Z09**	X	X
Differential Enthalpy Control (order 2)		**21Z09**	X	X
High Performance Economizer With Outdoor Air Hood (Approved for California Title 24 Building Standards / AMCA Class 1A Certified)				
High Performance Economizer Downflow or Horizontal Applications - Includes Outdoor Air Hood, order Downflow or Horizontal Barometric Relief Dampers separately		**23G24**	OX	OX
High Performance Economizer Controls				
Single Enthalpy Control		**23G26**	X	X
Differential Enthalpy Control (order 1 for factory. order 2 for field) (Not for Title 24)		**23G26**	X	X
Economizer Accessories				
WLAN Stick (For High Performance Economizer only)		**23K58**	X	X
Barometric Relief Dampers With Exhaust Hood				
Downflow Barometric Relief Dampers		**54W78**	OX	OX
Horizontal Barometric Relief Dampers		**16K99**	X	X
OUTDOOR AIR				
Outdoor Air Dampers With Outdoor Air Hood				
Motorized		**22J27**	X	X
Manual		**13U05**	X	X
[1] POWER EXHAUST (DOWNFLOW APPLICATIONS ONLY)				
Standard Static, SCCR Rated	208/230V	**22H90**	X	X
	460V	**22H91**	X	X
	575V	**22V34**	X	X
ROOF CURBS				
Hybrid Roof Curbs, Downflow				
8 in. height		**11F58**	X	X
14 in. height		**11F59**	X	X
18 in. height		**11F60**	X	X
24 in. height		**11F61**	X	X
Adjustable Pitch Curb				
14 in. height		**43W26**	X	X
Standard Roof Curbs, Horizontal - Requires Horizontal Return Air Panel Kit				
26 in. height - slab applications		**11T89**	X	X
37 in. height - rooftop applications		**11T96**	X	X
Insulation Kit For Standard Horizontal Curbs				
For 26 in. Curb		**73K32**	X	X
For 37 in. Curb		**73K34**	X	X
Horizontal Return Air Panel Kit				
Required for Horizontal Applications with Roof Curb		**87M00**	X	X
CEILING DIFFUSERS				
Step-Down - Order one	RTD11-185S	**13K63**	X	
	RTD11-275S	**13K64**		X
Flush - Order one	FD11-185S	**13K58**	X	
	FD11-275S	**13K59**		X
Transitions (Supply and Return) - Order one	C1DIFF33C-1	**12X68**	X	
	C1DIFF34C-1	**12X70**		X

[1] Field installed Power Exhaust requires Economizer with Outdoor Air Hood and Downflow Barometric Relief Dampers with Exhaust Hood. Must be ordered separately.

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

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SPECIFICATIONS

General Data		Nominal Tonnage	15 Ton	20 Ton
		Model Number	**KHC180S4M**	**KHC240S4M**
		Efficiency Type	**Standard**	**Standard**
		Blower Type	MSAV® Multi-Stage Air Volume	MSAV® Multi-Stage Air Volume
Cooling Performance		Gross Cooling Capacity - Btuh	181,000	230,000
		[1] Net Cooling Capacity - Btuh	176,000	222,000
		[1] AHRI Rated Air Flow - cfm	5500	7000
		Total Unit Power - kW	16.6	20.9
		[1] EER (Btuh/Watt)	10.6	10.6
		[1] IEER (Btuh/Watt)	13.5	13.5
		Refrigerant Type	R-410A	R-410A
	Refrigerant Charge Furnished	Circuit 1	22 lbs. 12 oz.	22 lbs. 8 oz.
		Circuit 2	21 lbs. 12 oz.	21 lbs. 8 oz.
Heating Performance		[1] Total High Heat Capacity - Btuh	166,000	218,000
		Total Unit Power - kW	14.7	19.3
		[1] C.O.P.	3.30	3.30
		[1] Total Low Heat Capacity - Btuh	92,000	116,000
		Total Unit Power (kW)	13.1	16.5
		[1] C.O.P.	2.05	2.05
Electric Heat Available			15-30-45-60 KW	15-30-45-60-90 KW
Compressor Type (number)			(2) Single-Stage Scroll	(2) Single-Stage Scroll
Outdoor Coils		Net face area (total) - sq. ft.	55.1	55.1
		Tube diameter - in.	3/8	3/8
		No. of rows	2	2
		Fins per inch	20	20
Outdoor Coil Fans		No. and type	(4) PSC	(4) PSC
		Motor - (No.) horsepower	(4) 1/3	(4) 1/3
		Motor rpm	1075	1075
		Total Motor watts	1750	1750
		Diameter - (No.) in.	(4) 24	(4) 24
		Number of blades	3	3
		Total Air volume - cfm	12,500	12,500
Indoor Coils		Net face area (total) - sq. ft.	21.4	21.4
		Tube diameter - in.	3/8	3/8
		Number of rows	4	4
		Fins per inch	14	14
		Drain connection - No. and size	(1) 1 in. FPT	(1) 1in. FPT
		Expansion device type	Balance port TXV, removable head	
[2] **Indoor Blower and Drive Selection**		Nominal motor output	3 hp, 5 hp, 7.5 hp	5 hp, 7.5 hp, 10 hp
		Maximum usable motor output (US Only)	3.45 hp, 5.75 hp, 8.63 hp	5.75 hp, 8.63 hp, 11.5 hp
		Motor - Drive kit number	**3 hp** **Kit 1** 535-725 rpm **Kit 2** 710-965 rpm **5 hp** **Kit 3** 685-856 rpm **Kit 4** 850-1045 rpm **Kit 5** 945-1185 rpm **7.5 hp** **Kit 6** 850-1045 rpm **Kit 7** 945-1185 rpm **Kit 8** 1045-1285 rpm	**5 hp** **Kit 3** 685-856 rpm **Kit 4** 850-1045 rpm **Kit 5** 945-1185 rpm **7.5 hp** **Kit 6** 850-1045 rpm **Kit 7** 945-1185 rpm **Kit 8** 1045-1285 rpm **10 hp** **Kit 7** 945-1185 rpm **Kit 10** 1045-1285 rpm **Kit 11** 1135-1365 rpm
		Blower wheel nominal diameter x width - in.	(2) 15 x 15	(2) 15 x 15
Filters		Type of filter	MERV 4, Disposable	
		Number and size - in.	(6) 24 x 24 x 2	
Electrical characteristics			208/230V, 460V or 575V - 60 hertz - 3 phase	

NOTE - Gross cooling capacity includes evaporator blower motor heat deduction. Net cooling 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.

NOTE – Motor service factor limit - 1.0.

BLOWER DATA

BLOWER TABLE INCLUDES RESISTANCE FOR BASE UNIT ONLY WITH DRY INDOOR COIL & AIR FILTERS IN PLACE

FOR ALL UNITS ADD:

1 - Wet indoor coil air resistance of selected unit.
2 - Any factory installed options air resistance (electric heat, economizer, etc.)
3 - Any field installed accessories air resistance (electric heat, duct resistance, diffuser, etc.)

Then determine from blower table blower motor output and drive required.
See page 7 for wet coil and option/accessory air resistance data.
See page 7 for factory installed drive kit specifications.
See page 8 for minimum air volume required for use with optional electric heat.

Air Volume cfm	TOTAL STATIC PRESSURE - Inches Water Gauge (Pa)																									
	0.20		0.40		0.60		0.80		1.00		1.20		1.40		1.60		1.80		2.00		2.20		2.40		2.60	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3250	405	0.40	520	0.60	615	0.85	695	1.10	765	1.30	830	1.60	890	1.85	950	2.10	---	---	---	---	---	---	---	---	---	---
3500	415	0.45	530	0.70	620	0.95	700	1.20	775	1.45	840	1.70	900	2.00	955	2.25	1005	2.55	---	---	---	---	---	---	---	---
3750	425	0.50	540	0.75	630	1.05	710	1.30	780	1.60	845	1.85	905	2.15	960	2.45	1010	2.70	1060	3.00	1110	3.30	---	---	---	---
4000	435	0.55	545	0.85	635	1.10	715	1.40	785	1.70	850	2.00	910	2.30	965	2.60	1020	2.90	1070	3.25	1115	3.55	1160	3.85	1205	4.15
4250	445	0.60	555	0.90	645	1.25	725	1.55	795	1.85	855	2.15	915	2.45	970	2.80	1025	3.10	1075	3.45	1120	3.75	1165	4.10	1210	4.45
4500	455	0.70	565	1.00	655	1.35	730	1.65	800	2.00	865	2.35	925	2.65	980	3.00	1030	3.30	1080	3.65	1130	4.05	1175	4.35	1215	4.70
4750	470	0.75	575	1.10	660	1.45	740	1.80	810	2.15	870	2.50	930	2.85	985	3.20	1040	3.55	1085	3.90	1135	4.25	1180	4.65	1225	5.00
5000	480	0.85	585	1.25	670	1.60	750	1.95	815	2.30	880	2.70	940	3.05	995	3.40	1045	3.80	1095	4.15	1140	4.50	1185	4.90	1230	5.30
5250	495	0.95	595	1.35	680	1.70	755	2.10	825	2.50	890	2.90	945	3.25	1000	3.65	1050	4.00	1100	4.40	1150	4.80	1195	5.20	1235	5.60
5500	505	1.05	605	1.45	690	1.85	765	2.25	835	2.65	895	3.05	955	3.45	1010	3.85	1060	4.25	1110	4.70	1155	5.10	1200	5.50	1240	5.90
5750	520	1.15	615	1.60	700	2.00	775	2.45	840	2.85	905	3.25	960	3.65	1015	4.10	1065	4.50	1115	4.95	1160	5.35	1205	5.80	1250	6.25
6000	530	1.30	630	1.75	710	2.15	785	2.60	850	3.05	910	3.45	970	3.90	1025	4.35	1075	4.80	1120	5.20	1170	5.65	1215	6.10	1255	6.55
6250	545	1.40	640	1.90	720	2.35	795	2.80	860	3.25	920	3.70	975	4.15	1030	4.60	1080	5.05	1130	5.50	1175	5.95	1220	6.45	1265	6.90
6500	560	1.55	650	2.05	730	2.50	805	3.00	870	3.45	930	3.95	985	4.40	1040	4.85	1090	5.35	1140	5.85	1185	6.30	1225	6.75	1270	7.25
6750	570	1.70	665	2.20	745	2.70	815	3.20	880	3.70	940	4.20	995	4.65	1045	5.10	1095	5.60	1145	6.10	1190	6.60	1235	7.10	1275	7.60
7000	585	1.85	675	2.35	755	2.90	825	3.40	890	3.95	950	4.45	1005	4.95	1055	5.40	1105	5.95	1155	6.45	1200	6.95	1240	7.45	1285	8.00
7250	600	2.00	690	2.60	765	3.10	835	3.65	900	4.15	955	4.65	1015	5.25	1065	5.75	1115	6.25	1160	6.75	1205	7.30	1250	7.85	1290	8.35
7500	615	2.20	700	2.75	775	3.30	845	3.85	910	4.45	965	4.95	1020	5.50	1075	6.05	1125	6.60	1170	7.15	1215	7.65	1260	8.25	1300	8.75
7750	630	2.40	715	3.00	790	3.55	855	4.10	920	4.70	975	5.25	1030	5.80	1080	6.35	1130	6.90	1180	7.50	1225	8.05	1265	8.60	1305	9.15
8000	640	2.55	725	3.20	800	3.80	865	4.35	930	4.95	985	5.50	1040	6.10	1090	6.70	1140	7.25	1185	7.85	1230	8.40	1275	9.00	1315	9.60
8250	655	2.80	740	3.40	810	4.00	880	4.65	940	5.25	995	5.85	1050	6.45	1100	7.05	1150	7.65	1195	8.25	1240	8.85	1280	9.40	1325	10.05
8500	670	3.00	750	3.65	825	4.30	890	4.90	950	5.55	1005	6.15	1060	6.80	1110	7.40	1160	8.05	1205	8.65	1250	9.25	1290	9.85	1330	10.45
8750	685	3.25	765	3.90	835	4.55	900	5.20	960	5.85	1015	6.45	1070	7.15	1120	7.75	1165	8.35	1215	9.05	1255	9.65	1300	10.30	1340	10.90
9000	700	3.50	780	4.20	850	4.85	910	5.50	970	6.15	1025	6.80	1080	7.50	1130	8.15	1175	8.75	1220	9.40	1265	10.10	1310	10.80	1350	11.40
9250	715	3.75	790	4.45	860	5.15	925	5.85	985	6.55	1040	7.20	1090	7.85	1140	8.55	1185	9.20	1230	9.85	1275	10.55	1315	11.20	---	---
9500	730	4.00	805	4.75	875	5.45	935	6.15	995	6.90	1050	7.60	1100	8.25	1150	8.95	1195	9.60	1240	10.30	1285	11.05	---	---	---	---
9750	745	4.30	820	5.05	885	5.75	950	6.55	1005	7.20	1060	7.95	1110	8.65	1160	9.40	1205	10.05	1250	10.80	1295	11.50	---	---	---	---
10,000	760	4.60	835	5.40	900	6.15	960	6.85	1015	7.60	1070	8.35	1120	9.05	1170	9.80	1215	10.50	1260	11.25	---	---	---	---	---	---
10,250	775	4.90	845	5.65	910	6.45	970	7.20	1030	8.00	1080	8.75	1135	9.55	1180	10.25	1225	11.00	---	---	---	---	---	---	---	---
10,500	790	5.20	860	6.00	925	6.85	985	7.65	1040	8.40	1095	9.20	1145	10.00	1190	10.70	1235	11.45	---	---	---	---	---	---	---	---
10,750	805	5.55	875	6.40	940	7.25	1000	8.05	1055	8.85	1105	9.65	1155	10.45	1200	11.20	---	---	---	---	---	---	---	---	---	---
11,000	820	5.90	890	6.80	950	7.60	1010	8.45	1065	9.30	1115	10.05	1165	10.90	---	---	---	---	---	---	---	---	---	---	---	---

BLOWER DATA

FACTORY INSTALLED BELT DRIVE KIT SPECIFICATIONS

Nominal hp	Maximum hp	Drive Kit Number	RPM Range
3	3.45	1	535 - 725
3	3.45	2	710 - 965
5	5.75	3	685 - 856
5	5.75	4	850 - 1045
5	5.75	5	945 - 1185
7.5	8.63	6	850 - 1045
7.5	8.63	7	945 - 1185
7.5	8.63	8	1045 - 1285
10	11.50	7	945 - 1185
10	11.50	10	1045 - 1285
10	11.50	11	1135 - 1365

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.

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

Air Volume cfm	Wet Indoor Coil	Electric Heat	Economizer	Filters			Horizontal Roof Curb
				MERV 8	MERV 13	MERV 16	
3250	0.03	- - -	- - -	0.01	0.04	0.07	0.04
3500	0.03	- - -	- - -	0.01	0.04	0.08	0.05
3750	0.03	- - -	- - -	0.01	0.04	0.08	0.05
4000	0.04	- - -	- - -	0.01	0.04	0.09	0.06
4250	0.04	- - -	- - -	0.01	0.05	0.10	0.07
4500	0.05	- - -	- - -	0.01	0.05	0.10	0.07
4750	0.05	- - -	- - -	0.02	0.05	0.11	0.08
5000	0.05	- - -	- - -	0.02	0.06	0.12	0.08
5250	0.06	- - -	- - -	0.02	0.06	0.12	0.09
5500	0.07	- - -	- - -	0.02	0.06	0.13	0.10
5750	0.07	- - -	- - -	0.02	0.07	0.14	0.11
6000	0.08	0.01	- - -	0.03	0.07	0.14	0.11
6250	0.08	0.01	0.01	0.03	0.07	0.15	0.12
6500	0.09	0.01	0.02	0.03	0.08	0.16	0.13
6750	0.10	0.01	0.03	0.03	0.08	0.17	0.14
7000	0.10	0.01	0.04	0.04	0.08	0.17	0.15
7250	0.11	0.01	0.05	0.04	0.09	0.18	0.16
7500	0.12	0.01	0.06	0.04	0.09	0.19	0.17
8000	0.13	0.02	0.09	0.05	0.10	0.21	0.19
8500	0.15	0.02	0.11	0.05	0.10	0.22	0.21
9000	0.16	0.04	0.14	0.06	0.11	0.24	0.24
9500	0.18	0.05	0.16	0.07	0.12	0.25	0.26
10,000	0.20	0.06	0.19	0.07	0.12	0.27	0.29
10,500	0.22	0.09	0.22	0.08	0.13	0.29	0.31
11,000	0.24	0.11	0.25	0.09	0.14	0.30	0.34

BLOWER DATA

MINIMUM AIR VOLUME REQUIRED FOR USE WITH OPTIONAL ELECTRIC HEAT

Electric Heat kW	Minimum cfm
15	6000
30	6000
45	6000
60	6000
90	6000

POWER EXHAUST FAN PERFORMANCE

Return Air System Static Pressure	Air Volume Exhausted
in. w.g.	cfm
0.00	8630
0.05	8210
0.10	7725
0.15	7110
0.20	6470
0.25	5790
0.30	5060
0.35	4300
0.40	3510
0.45	2690
0.50	1840

CEILING DIFFUSER AIR RESISTANCE - in. w.g.

Air Volume cfm	Step-Down Diffuser						Flush Diffuser	
	RTD11-185S			RTD11-275			FD11-185S	FD11-275
	2 Ends Open	1 Side/2 Ends Open	All Ends & Sides Open	2 Ends Open	1 Side/2 Ends Open	All Ends & Sides Open		
5000	.51	.44	.39	- - -	- - -	- - -	.27	- - -
5200	.56	.48	.42	- - -	- - -	- - -	.30	- - -
5400	.61	.52	.45	- - -	- - -	- - -	.33	- - -
5600	.66	.56	.48	- - -	- - -	- - -	.36	- - -
5800	.71	.59	.51	- - -	- - -	- - -	.39	- - -
6000	.76	.63	.55	.36	.31	.27	.42	.29
6200	.80	.68	.59	- - -	- - -	- - -	.46	- - -
6400	.86	.72	.63	- - -	- - -	- - -	.50	- - -
6500	- - -	- - -	- - -	.42	.36	.31	- - -	.34
6600	.92	.77	.67	- - -	- - -	- - -	.54	- - -
6800	.99	.83	.72	- - -	- - -	- - -	.58	- - -
7000	1.03	.87	.76	.49	.41	.36	.62	.40
7200	1.09	.92	.80	- - -	- - -	- - -	.66	- - -
7400	1.15	.97	.84	- - -	- - -	- - -	.70	- - -
7500	- - -	- - -	- - -	.51	.46	.41	- - -	.45
7600	1.20	1.02	.88	- - -	- - -	- - -	.74	- - -
8000	- - -	- - -	- - -	.59	.49	.43	- - -	.50
8500	- - -	- - -	- - -	.69	.58	.50	- - -	.57
9000	- - -	- - -	- - -	.79	.67	.58	- - -	.66
9500	- - -	- - -	- - -	.89	.75	.65	- - -	.74
10,000	- - -	- - -	- - -	1.00	.84	.73	- - -	.81
10,500	- - -	- - -	- - -	1.10	.92	.80	- - -	.89
11,000	- - -	- - -	- - -	1.21	1.01	.88	- - -	.96

CEILING DIFFUSER AIR THROW DATA

Model No.	Air Volume cfm	[1] Effective Throw Range - ft.	
		RTD11-185S Step-Down	FD11-185S Flush
180	5600	39 - 49	28 - 37
	5800	42 - 51	29 - 38
	6000	44 - 54	40 - 50
	6200	45 - 55	42 - 51
	6400	46 - 55	43 - 52
	6600	47 - 56	45 - 56

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

Model No.	Air Volume cfm	[1] Effective Throw Range - ft.	
		RTD11-275 Step-Down	FD11-275 Flush
240	7200	33 - 38	26 - 35
	7400	35 - 40	28 - 37
	7600	36 - 41	29 - 38
	7800	38 - 43	40 - 50
	8000	39 - 44	42 - 51
	8200	41 - 46	43 - 52
	8400	43 - 49	44 - 54
	8600	44 - 50	46 - 57
	8800	47 - 55	48 - 59

ELECTRICAL/ELECTRIC HEAT DATA — 15 TON

		Model No.	KHC180S4M								
[1] Voltage - 60Hz			208/230V - 3 Ph			460V - 3 Ph			575V - 3 Ph		
Compressor 1 (Non-Inverter)		Rated Load Amps	25			12.8			9.6		
		Locked Rotor Amps	164			100			78		
Compressor 2 (Non-Inverter)		Rated Load Amps	25			12.2			9		
		Locked Rotor Amps	164			100			78		
Outdoor Fan Motors (4)	Full Load Amps (4 Non-ECM)		2.4			1.3			1		
		Total	9.6			5.2			4		
Power Exhaust (2) 0.33 HP		Full Load Amps	2.4			1.3			1		
		Total	4.8			2.6			2		
Service Outlet 115V GFI (amps)			15			15			20		
Indoor Blower Motor		Horsepower	3	5	7.5	3	5	7.5	3	5	7.5
		Full Load Amps	10.6	16.7	24.2	4.8	7.6	11	3.9	6.1	9
[2] Maximum Overcurrent Protection (MOCP)		Unit Only	100	100	110	50	50	50	35	40	40
		With (2) 0.33 HP Power Exhaust	100	110	110	50	50	50	40	40	45
[3] Minimum Circuit Ampacity (MCA)		Unit Only	77	83	91	39	41	45	29	32	34
		With (2) 0.33 HP Power Exhaust	82	88	95	41	44	48	31	34	36

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**	125	125	125	150	150	150	70	70	70	50	50	60
		30 kW	175	175	175	175	175	200	90	90	90	70	70	80
		45 kW	200	225	200	225	225	250	110	110	125	90	90	90
		60 kW	225	225	225	250	225	250	125	125	125	90	90	100
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat	**15 kW**	116	122	122	128	130	136	61	64	67	47	50	53
		30 kW	155	167	161	173	169	181	84	87	90	65	68	71
		45 kW	194	212	200	218	208	226	106	109	113	84	86	89
		60 kW	202	221	208	227	216	235	111	114	117	87	89	92
[2] Maximum Overcurrent Protection (MOCP)	Unit+ Electric Heat and (2) 0.33 HP Power Exhaust	**15 kW**	125	150	150	150	150	150	70	70	70	50	60	60
		30 kW	175	175	175	200	175	200	90	90	100	70	70	80
		45 kW	200	225	225	225	225	250	110	125	125	90	90	100
		60 kW	225	250	225	250	225	250	125	125	125	90	100	100
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat and (2) 0.33 HP Power Exhaust	**15 kW**	121	127	127	133	134	140	64	67	70	49	52	55
		30 kW	160	172	166	178	174	186	86	89	93	67	70	73
		45 kW	199	217	205	223	213	231	109	112	115	86	88	91
		60 kW	207	226	213	232	220	240	113	116	120	89	91	94

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.

[4] Disconnect must be field furnished.

ELECTRICAL/ELECTRIC HEAT DATA — 20 TON

		Model No.	KHC240S4M										
[1] Voltage - 60Hz			208/230V - 3 Ph			460V - 3 Ph			575V - 3 Ph		
Compressor 1 (Non-Inverter)		Rated Load Amps	31.1			13			11		
		Locked Rotor Amps	255			123			93.7		
Compressor 2 (Non-Inverter)		Rated Load Amps	31.1			13			11		
		Locked Rotor Amps	255			123			93.7		
Outdoor Fan Motors (4)	Full Load Amps (4 Non-ECM)		2.4			1.3			1		
	Total		9.6			5.2			4		
Power Exhaust (2) 0.33 HP		Full Load Amps	2.4			1.3			1		
		Total	4.8			2.6			2		
Service Outlet 115V GFI (amps)			15			15			20		
Indoor Blower Motor		Horsepower	5	7.5	10	5	7.5	10	5	7.5	10
		Full Load Amps	16.7	24.2	30.8	7.6	11	14	6.1	9	11
[2] Maximum Overcurrent Protection (MOCP)		Unit Only	125	125	125	50	50	60	45	45	50
		With (2) 0.33 HP Power Exhaust	125	125	125	50	60	60	45	50	50
[3] Minimum Circuit Ampacity (MCA)		Unit Only	97	104	111	43	46	49	35	38	40
		With (2) 0.33 HP Power Exhaust	102	109	116	45	49	52	37	40	42

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**	150	150	150	150	150	175	70	70	80	60	60	60
		30 kW	175	200	200	200	200	225	90	100	100	80	80	80
		45 kW	225	250	225	250	250	250	110	125	125	90	100	100
		60 kW	250	250	250	250	250	300	125	125	125	100	100	100
		90 kW	300	350	300	350	300	350	175	175	175	125	125	150
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat	**15 kW**	136	142	143	149	150	156	65	69	72	53	56	58
		30 kW	175	187	182	194	189	201	88	91	94	71	74	76
		45 kW	214	232	222	240	228	246	110	114	117	89	92	94
		60 kW	222	241	229	249	236	255	115	118	121	93	96	98
		90 kW	284	313	292	321	299	327	151	154	157	122	125	127
[2] Maximum Overcurrent Protection (MOCP)	Unit+ Electric Heat and (2) 0.33 HP Power Exhaust	**15 kW**	150	150	150	175	175	175	70	80	80	60	60	60
		30 kW	200	200	200	200	200	225	90	100	100	80	80	80
		45 kW	225	250	250	250	250	300	125	125	125	100	100	100
		60 kW	250	250	250	300	250	300	125	125	125	100	100	110
		90 kW	300	350	300	350	350	350	175	175	175	125	150	150
[3] Minimum Circuit Ampacity (MCA)	Unit+ Electric Heat and (2) 0.33 HP Power Exhaust	**15 kW**	141	147	148	154	155	161	68	71	74	55	58	60
		30 kW	180	192	187	199	194	206	90	94	97	73	76	78
		45 kW	219	237	226	244	233	251	113	116	119	91	94	96
		60 kW	227	246	234	253	241	260	117	121	124	95	98	100
		90 kW	289	318	297	326	303	332	153	157	160	124	127	129

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.

[4] Disconnect must be field furnished.

ELECTRIC HEAT CAPACITIES

Volts Input	15 kW			30 kW			45 kW			60 kW			90 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
208	11.3	38,600	1	22.5	76,800	1	33.8	115,300	2	45.0	153,600	2	67.6	230,700	2
220	12.6	43,000	1	25.2	86,000	1	37.8	129,000	2	50.4	172,000	2	75.6	258,000	2
230	13.8	47,100	1	27.5	93,900	1	41.3	141,000	2	55.1	188,000	2	82.7	282,200	2
240	15.0	51,200	1	30.0	102,400	1	45.0	153,600	2	60.0	204,800	2	90.0	307,100	2
440	12.6	43,000	1	25.2	86,000	1	37.8	129,000	2	50.4	172,000	2	75.6	258,000	2
460	13.8	47,100	1	27.5	93,900	1	41.3	141,000	2	55.1	188,000	2	82.7	282,200	2
480	15.0	51,200	1	30.0	102,400	1	45.0	153,600	2	60.0	204,800	2	90.0	307,100	2
550	12.6	43,000	1	25.2	86,000	1	37.8	129,000	2	50.4	172,000	2	75.6	258,000	2
575	13.8	47,100	1	27.5	93,900	1	41.3	141,000	2	55.1	188,000	2	82.7	282,200	2
600	15.0	51,200	1	30.0	102,400	1	45.0	153,600	2	60.0	204,800	2	90.0	307,100	2

PARTS ARRANGEMENT

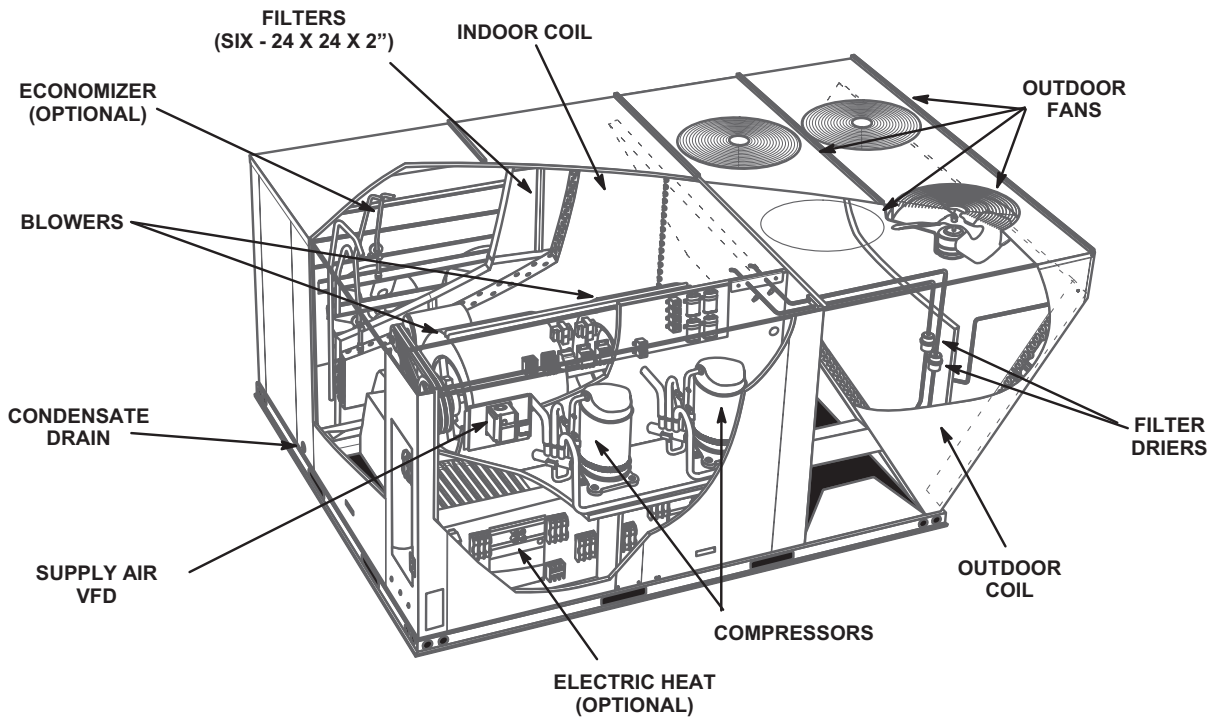


FIGURE 1

CONTROL BOX

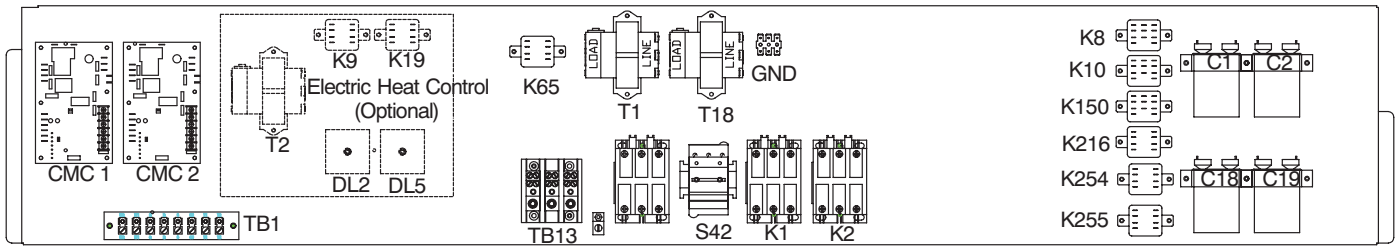


FIGURE 2

I-UNIT COMPONENTS

Unit components are shown in figure 1. All units come standard with removeable 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

KCC control box components are shown in FIGURE 2. The control box is located in the compressor compartment.

1-Disconnect Switch S48 (field or factory installed)

All units may be equipped with an optional disconnect switch S48. S48 can be a toggle switch or a twist style switch. Both types can be used by the service technician to disconnect power to the unit. Units without S48 will be equipped with terminal strip TB2.

2-Terminal Strip TB2

Units without S48 will have supply power connected to TB2.

3-Fuse F4

Fuse F4 is used only with single point power supply. F4 gives over amperage protection to the compressor and other cooling components. F4, S48 and TB2 are located inside a sheet metal enclosure in the unit left front corner mullion.

4-Terminal Strip TB13

All units are equipped with TB13. TB13 is located on the control panel in the compressor compartment.

5-Control Transformer T1

All use a single line voltage to 24VAC transformer mounted in the control box. 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) which is located on the transformer itself. The 208/230 (Y) voltage transformers have two primary voltage taps, but only one may be used depending on supply voltage. See FIGURE 3.

460 (G) and 575 (J) voltage transformers use a single primary voltage tap.

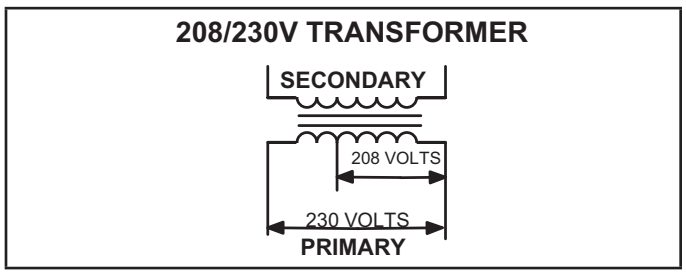


FIGURE 3

6-Control Transformer T18

T18 is a single line voltage to 24VAC transformer. Transformer T18 is protected by a 3.5 amp circuit breaker (CB18) located on the transformer itself. T18 is identical to transformer T1. The transformer supplies 24VAC power to the CMC1, CMC2 and reversing valves L1 and L2.

7- Terminal Strip TB1

All indoor thermostat connections will be to TB1 located on the control panel. For thermostats with “occupied “ and “unoccupied” modes, a factory-installed jumper across terminals R and OC should be removed. Unit wiring is designed for a two-stage thermostat. See TABLE 1.

TABLE 1

TB1 TERMINAL DESIGNATIONS

Y1	Cool Stage 1
Y2	Cool Stage 2
W1	Heat Stage 1
W2	Heat Stage 2
OC	Occupied
G	Indoor Blower
R	24V To Thermostat
C	Ground

8-Outdoor Fan Capacitors C1, C2, C18 & C19

Fan capacitors C1, C2, C18, C19 are 10 MFD / 370V capacitors used to assist in the start up of condenser fans B4, B5, B21, B22 respectively.

9-Outdoor Fan Relay K10, K150, K254, K255

Outdoor fan relays are DPDT relays with a 24VAC coil. K10, K150, K254 and K255 energizes B4, B5, B21 and B22 respectively.

10-Compressor Contactor K1 & K2 (all units)

All compressor contactors are three-pole-double-break contactors with 24VAC coils. K1 and K2 energize compressors B1 and B2 respectively, in response to thermostat demand.

11-Blower Contactor K3

Blower contactor K3 is used in all units with the VFD by-pass option. The contactor is three-pole-double-break with a 24VAC coil used to energize the indoor blower motor B3, in response to blower demand. K3 is energized from terminal G on TB1.

12-Blower Motor Overload Relay S42

S42 is a manual reset overload relay, used in all units with a 10 HP blower motor and VFD by-pass. The relay is connected in line with the blower motor to monitor the current flow to the motor. When the relay senses an overload condition, a set of normally closed contacts opens de-energizing the 24 volt output of T1. See FIGURE 4.

13-Power Exhaust Relay K65 (PED units)

Power exhaust relay K65 is a DPDT relay with a 24VAC coil. K65 is used in units equipped with field-installed, 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 fans B10 and B11 are energized.

14-Variable Frequency Drive A96

MSAV® units are equipped with a VFD which alters the supply power frequency and voltage to the blower motor. Blower speed is staged depending on the compressor stages, heating demand, or ventilation demand. The amount of airflow for each stage is preset from the factory. Full speed airflow can be adjusted by changing the variable sheave on the blower motor. Part load cooling speed is ⅔ of full speed. The VFD is located below the upper control panel.

15-Inverter Default Relay K232

The relay is used in MSAV units and is a two-pole, doublethrow relay with a 24VAC coil. K232 is energized through the A96 VFD B-C normally closed contact.

If the VFD fails, the B-C contact will open and de-energize the K232 coil and cut the 24VAC power to the thermostat and the whole unit. K232 is located beside A96

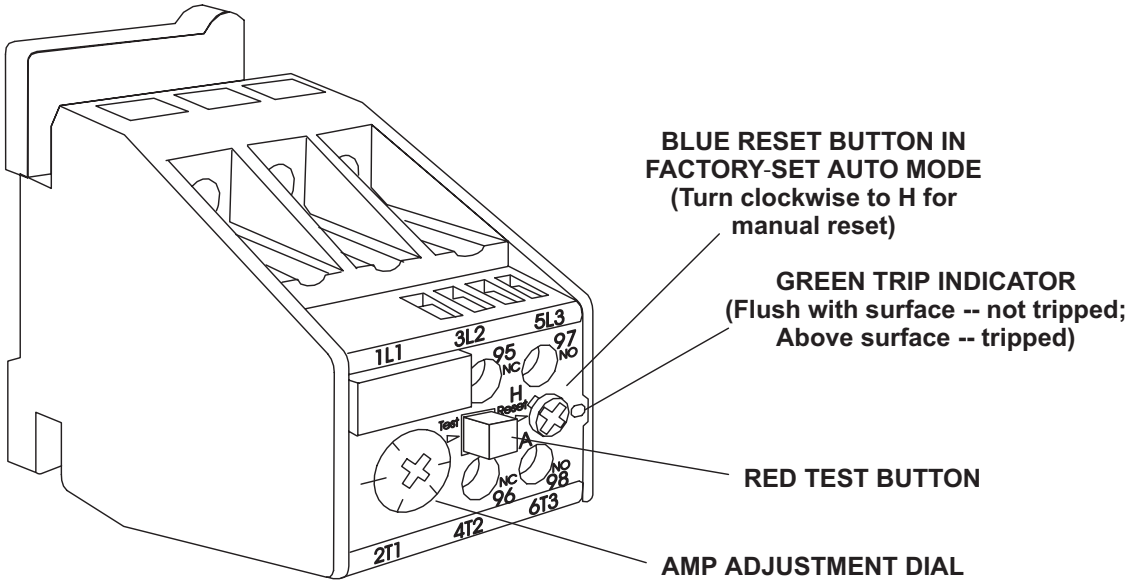
16-Phase Monitor A42

Phase monitor detects the phasing of incoming power. If the incoming power is out of phase or if any of the three phases are lost, an indicator 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. A42 is located beside A96.

17-VFD Control Board A183

VFD control board A183 is a solid-state control board powered with 24VDC from the variable frequency drive A96. A183 gets signals from the thermostat, ignition control and economizer modules to determine blower speeds and damper minimum positions. For more information on the A183, refer to the MSAV Start Up section. A183 is located on the left side of the control area.

SIEMENS OVERLOAD RELAY



Adjust relay amp setting according to value given on the blower motor nameplate. Proper relay amp setting equals motor nameplate FLA X service factor of 1.15 X .95.

Use small slotted screwdriver to adjust control mode from automatic reset (A) to manual reset (H).

Control must be in the manual reset mode (H) to perform a test. Press the red test button. Green trip indicator should pop out. Press the blue reset screw to reset the relay.

FIGURE 4

18-Defrost Control Boards CMC1 & CMC2

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). 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.

NOTE - *When adjusting timing pins, set both CMC1 and CMC2 defrost controls to the same 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 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 2

Defrost Control Board Diagnostic LED		
Indicates	**LED1**	**LED2**
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

DEFROST CONTROL BOARD CMC1 AND CMC2

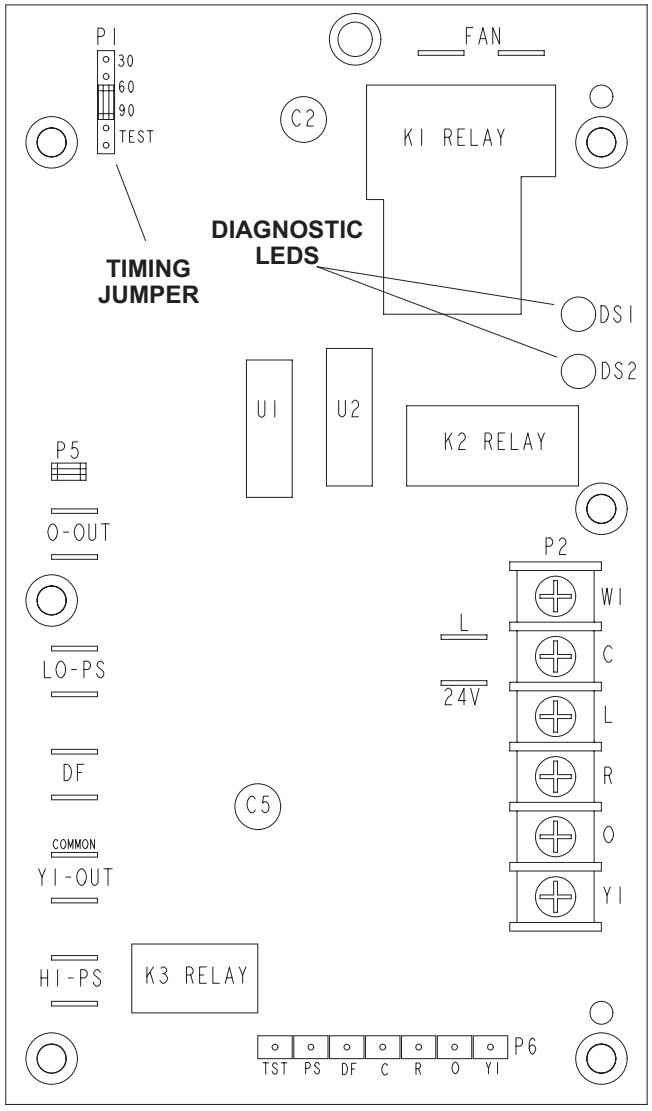
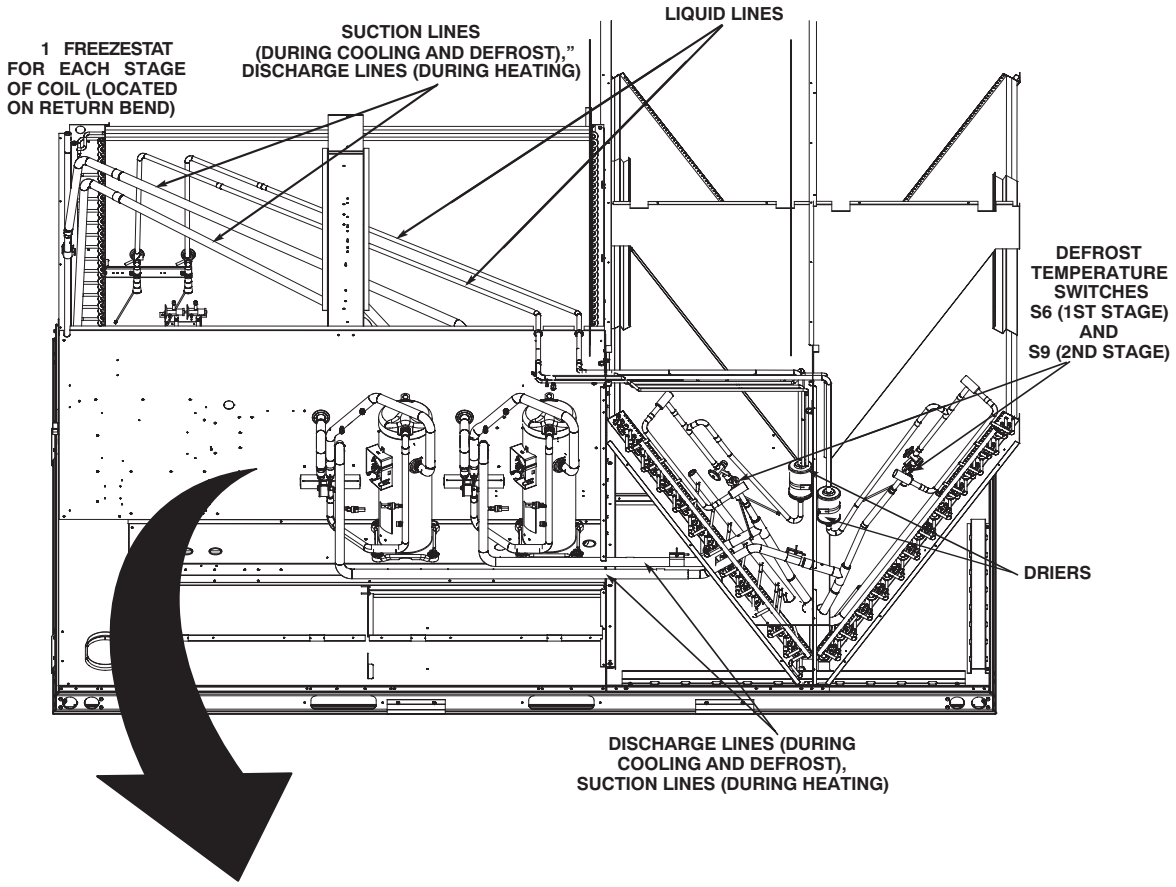
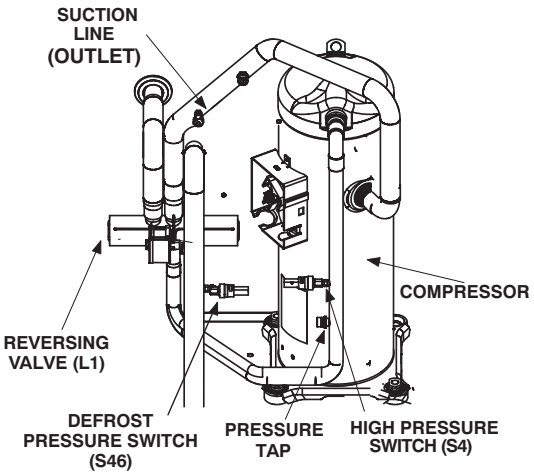


FIGURE 5

PLUMBING, COMPRESSOR AND REFRIGERANT CIRCUITS DETAIL



COMPRESSOR DETAIL



REFRIGERANT CIRCUITS

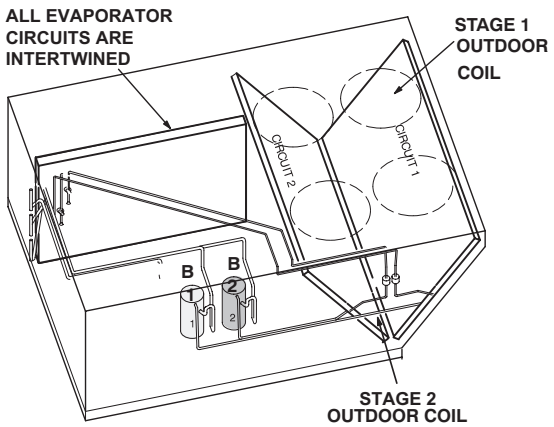


FIGURE 6

B-Cooling Components

⚠ IMPORTANT

The Clean Air Act of 1990 bans the intentional venting of refrigerant (CFC's and HCFC's) as of July 1, 1992. Approved methods of recovery, recycling or reclaiming must be followed. Fines and/or incarceration may be levied for non-compliance.

All units use independent cooling circuits consisting of separate compressors, condenser coils and evaporator coils. See FIGURE 6. Draw-through type condenser fans are used in all units. All units are equipped with belt-drive blowers which draw air across the evaporator during unit operation.

Cooling may be supplemented by an optional factory- or field-installed economizer. The evaporators are slab type and are stacked. Each evaporator uses a thermostatic expansion valve as the primary expansion device. Each evaporator is also equipped with enhanced fins and rifled tubing. In all units each compressor is protected by a freezestat (on each evaporator) and a high pressure switch (on each discharge line). Optional field installed low ambient switches are available for additional compressor protection.

1-Compressors B1, B2 (all units)

Both units are equipped with two scroll compressors. All units are equipped with independent cooling circuits. 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.

Each compressor is energized by a corresponding compressor contactor.

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

⚠ 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.

2-Reversing Valves L1 and L2

A refrigerant reversing valve with a 24 volt solenoid coil is used to reverse refrigerant flow during unit operation. 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.

3-High Pressure Switches S4 and S7

The high pressure switch is an auto-reset SPST N.C switch which opens on a pressure rise. The switch is located in the compressor discharge line and is wired in series with the compressor contactor coil. Units are equipped with two switches.

S4 (first circuit) and S7 (second circuit) are wired in series with the respective compressor contactor coils. When discharge pressure rises to 640 ± 10 psig (4413 ± 69 kPa) (indicating a problem in the system) the switch opens and the respective compressor is de-energized (the economizer can continue to operate). S4 and S7 will close once the pressure falls to 475 ± 20 psig (3275 ± 138kPa)

4-Crankcase Heaters HR1 and HR2

Units use belly-band type crankcase heaters. HR1 is installed around compressor B1, heater HR2 compressor B2. Crankcase heater wattage varies by compressor size.

5-Low Ambient Kit

The Low ambient kit is optional and field installed. This kit has 2 temperature switches (S201, S202) and 2 head pressure controllers (A190, A191). This kit allows mechanical cooling operation by maintaining liquid pressures at low outdoor temperatures, by stopping or slowing the outdoor fans.

When ambient temperature drops below 55°F, S201 and S202 open de-energizing K10 and K150, de-energizing condenser fans 1 (B4) & 3 (B21). When the liquid pressure falls below 355psig, the liquid line pressure transducers A188, A189 convert the pressure to analog signal which is sent to the head pressure control units (A190, A191). The head pressure control provides a variable output which slows condenser fans 2 (B4) and fan 4 (B22) operation to maintain optimum liquid pressure . All the fans cycles to full speed above 355 psig and in heating mode.

6-Filter Drier (all units)

Units have a bi-flow filter drier located in the liquid line of each refrigerant circuit in the compressor compartment. The drier removes contaminants and moisture from the system.

7-Freezestats S49, S50

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

Each freezestat is wired in series with the corresponding compressor contactor. Each freezestat is an auto-reset switch which opens at $29^0F \pm 3^0F$ ($-1.7^0C \pm 1.7^0C$) on a temperature drop and closes at $58^0F \pm 4^0F$ ($14.4^0C \pm 2.2^0C$) on a temperature rise. To prevent coil icing, Freezestats open during compressor operation to temporarily disable the respective compressor until the coil temperature rises.

8-Condenser Fans B4, B5, B21 and B22 (all units)

See SPECIFICATIONS tables at the front of this manual for specifications of condenser fans. All condenser fans used have single-phase motors. The fan assembly may be removed for servicing and cleaning.

9-Defrost Components and Operation

a-Defrost Pressure Switch S46 and S104

The defrost pressure switches (S46 and S104) are auto-reset SPST N.C. pressure switches which open on a pressure rise. All units are equipped with these switches. The switches are located on the vapor line during heating cycle (discharge line during cooling and defrost cycle). S46 (refrigeration circuit one) is wired to the main control board CMC1. S104 (refrigeration circuit two) is wired to the heat pump control board CMC2.

When discharge pressure reaches 450 + 10 psig (3103 ± 69 kPa) (indicating defrost is completed) the switch opens.

The switch automatically resets when pressure in the vapor line drops to 300 ± 10 psig (2068 ± 69 kPa).

b-Defrost Thermostat Switches S6 and S9 (all units)

Defrost thermostat switches S6 (refrigeration circuit one) and S9 (refrigeration circuit two) are S.P.S.T. N.O. contacts which close on a temperature fall (initiating defrost). The switches are located on each of the expansion valve distributor assemblies at the inlet to the outdoor coil. The switches monitor the outdoor coil suction temperature to determine when defrost is needed. When the outdoor coil suction temperature falls to 35^0F ± 4^0F (1.7^0C ± 2.2^0C) the switch closes (initiating defrost after minimum run time of 30, 60, or 90 minutes). When the temperature rises to 60^0F ± 5^0F (15.6^0C ± 2.8^0C) the switch opens.

DEFROST OPERATION

Defrost operation of each of the two refrigeration circuits are controlled independently with separate timers, thermostats (S6 and S9) and pressure switches (S46 and S104). During heating operation when outdoor coil temperature drops to 35 ± 4 °, the defrost thermostat S6 or S9 closes initiating defrost.

When defrost begins, the reversing valve (L1 or L2) for the circuit in defrost mode is energized. Supplemental electric heat is then energized. All the fans B4, B5, B21, B22 de-energized by defrost control boards CMC1 and CMC2.

C-Blower Compartment

The blower compartment in is located between the evaporator coil and the compressor / control section on the opposite side of the condenser coil. The blower assembly is accessed by removing the screws on either side of the sliding base. The base pulls out as shown in FIGURE 7.

1-Blower Wheels

Units have two 15 in. x 15 in. (381 mm x 381 mm) blower wheels. Both wheels are driven by one motor mounted on a single shaft. Shaft bearings are equipped with grease ports for service.

2-Indoor Blower Motor B3

All units use three-phase single-speed blower motors. CFM adjustments are made by adjusting the motor pulley (sheave). 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 rating plate for information specific to your unit.

OPERATION / ADJUSTMENT

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 - Set thermostat or temperature control device fan switch to AUTO or ON. With fan switch in ON position, blower will operate continuously. With fan switch in AUTO position, the blower will cycle with demand.

2 - Blower and entire unit will be off when thermostat or temperature control device system switch is in OFF position.

C-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 7.

1 - Remove the clamp which secures the blower wiring to the blower motor base.

2 - Remove and retain screws on either side of sliding base. Pull base toward outside of unit. When pulling the base out further than 12” (305mm), disconnect wiring to K3 blower contactor T1, T2, and T3. Pull wiring toward blower to allow enough slack to slide the base out further.

3 - Slide base back into original position when finished servicing. Replace the clamp and blower wiring in the previous location on the blower motor base. Reconnect wiring to K3 if it was disconnected.

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

5 - Tighten two bolts on motor pulley side.

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.*

6 - Tighten two bolts on other side of base.

D-Determining Unit CFM

IMPORTANT - *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 Supply Air Inverter Start-Up 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 and with air filters in place. Run blower without a cooling demand. Measure the indoor blower shaft RPM.

2 - With all access panels in place, measure static pressure external to unit (from supply to return). Blower performance data is based on static pressure readings taken in locations shown in FIGURE 8.

NOTE - *Static pressure readings can vary if not taken where shown*

3 - Measure the indoor blower wheel RPM.

4 - 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.

5 - 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 7. Tighten Allen screw after adjustment. Do not exceed minimum and maximum number of pulley turns as shown in TABLE 3.

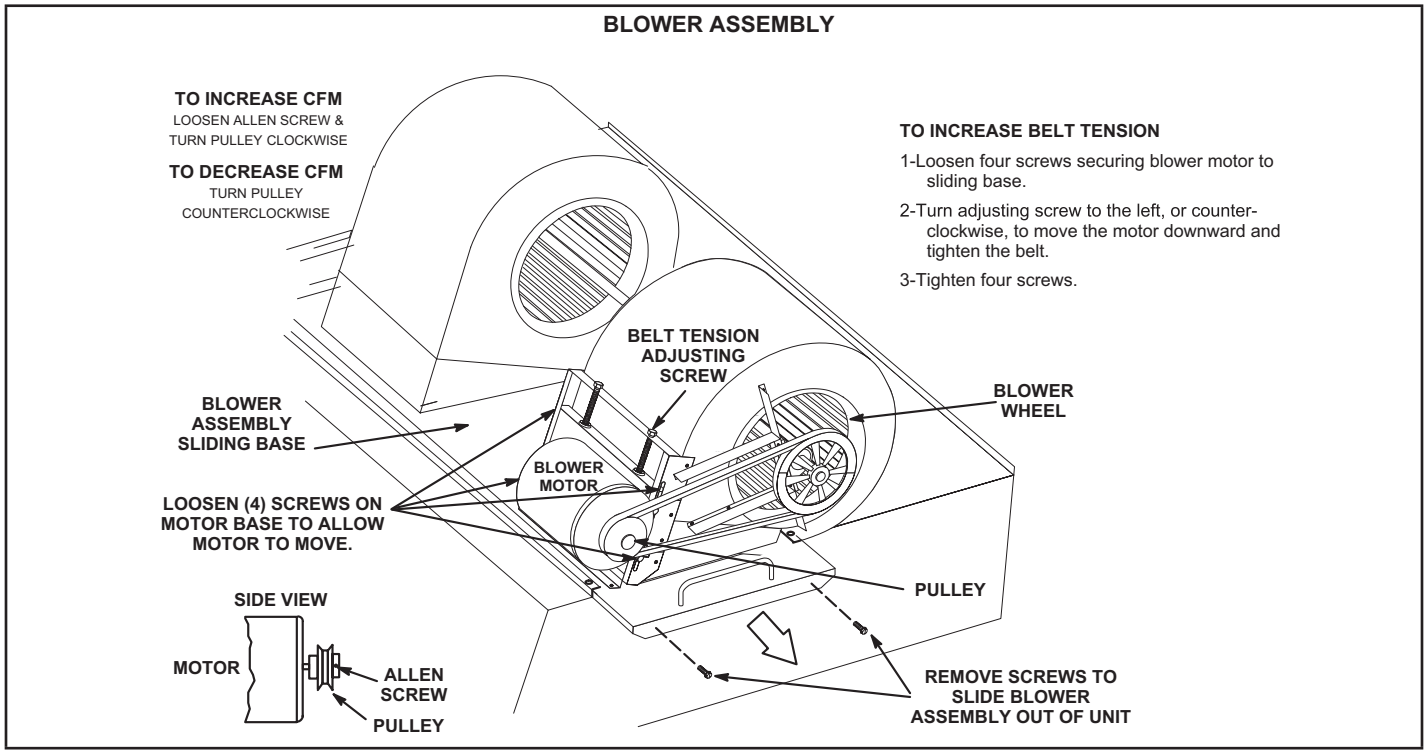


FIGURE 7

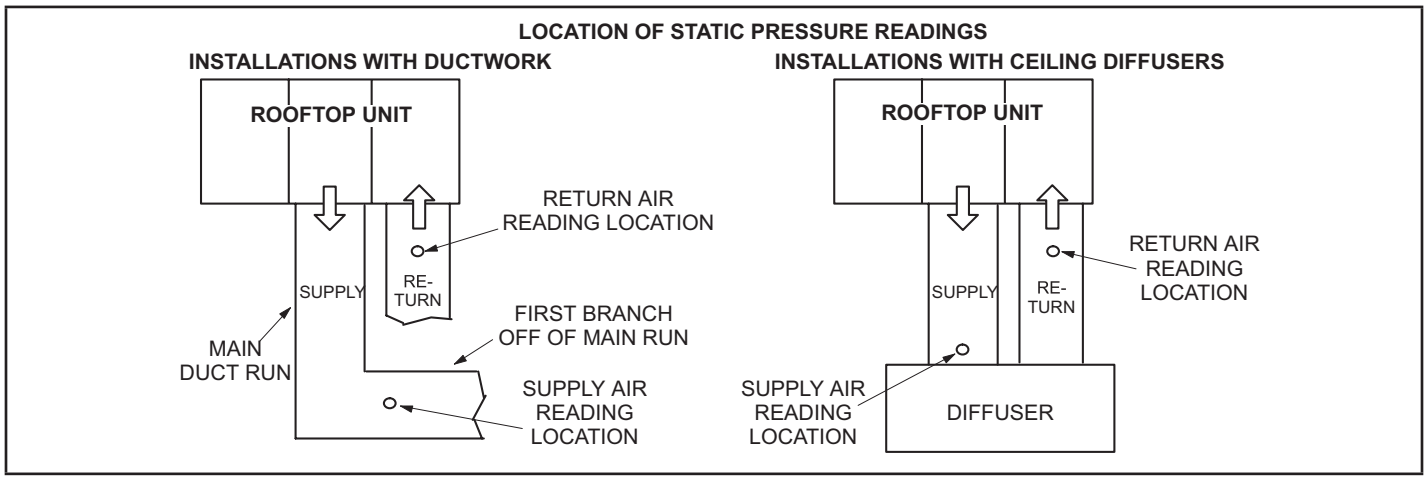


FIGURE 8

TABLE 3

MINIMUM AND MAXIMUM PULLEY ADJUSTMENT

Belt	Minimum Turns Open	Minimum Turns Open
A Section	No Minimum	5
B Section	1*	6

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

E-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 grooves. Make sure blower and motor pulley are aligned as shown in FIGURE 9.

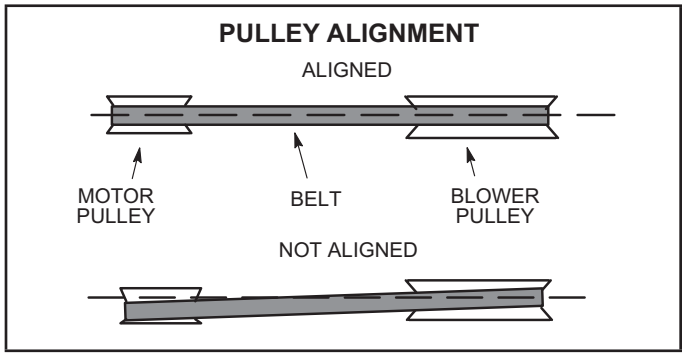


FIGURE 9

1 - Loosen four screws securing blower motor to sliding base. See FIGURE 7.

2 - *To increase belt tension -*

Turn belt tension adjusting screw to the left, or counterclockwise, to tighten the belt. This increases the distance between the blower motor and the blower housing.

To loosen belt tension -

Turn the adjusting screw to the right, or clockwise to loosen belt tension.

F-Check Belt Tension

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

1 - Measure span length X. See 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 used belt, the deflection force should be 5 lbs. (35kPa) . A new belt deflection force should be 7 lbs. (48kPa).

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

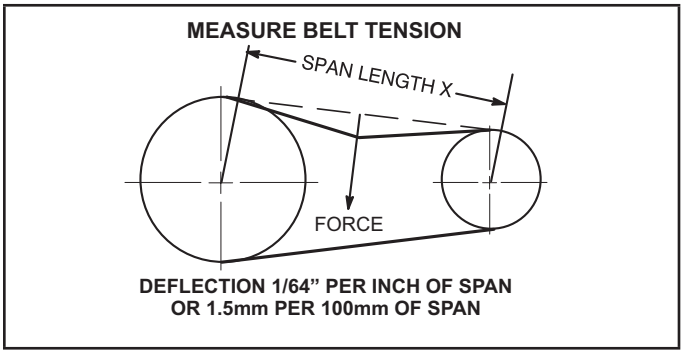


FIGURE 10

G-Field-Furnished Blower Drives

Use the BLOWER DATA TABLES at the front of this manual to determine BHP and RPM for field-furnished blower drives. TABLE 4 lists blower drives.

TABLE 4

		DRIVE COMPONENTS									
		RPM		ADJUSTABLE SHEAVE		FIXED SHEAVE		BELTS		SPLIT BUSHING	
Drive No.	H.P.	Min	Max	Supplier No.	OEM Part No.	Supplier No.	OEM Part No.	Supplier No.	OEM Part No.	Supplier No.	OEM Part No.
1	2, 3	535	725	1VP40x7/8	79J0301	BK95X1-7/16	80K1601	BX59	59A5001	N/A	N/A
2	2, 3	710	965	1VP40x7/8	79J0301	BK72x1-7/16	100244-13	BX55	63K0501	N/A	N/A
3	5	685	865	1VP50x1-1/8	P-8-1977	BK100x1-7/16	39L1301	BX61	93J9801	N/A	N/A
4	5	850	1045	1VP65x1-1/8	100239-03	BK110H	100788-06	BX65	100245-08	H-1-7/16	49M6201
5	5	945	1185	1VP60x1-1/8	41C1301	BK90H	100788-04	BX61	93J9801	H-1-7/16	49M6201
6	7.5	850	1045	1VP65x1-3/8	78M7101	BK110H	100788-06	BX66	97J5901	H-1-7/16	49M6201
7	7.5, 10	945	1185	1VP60x1-3/8	78L5501	BK90H	100788-04	BX63	97J5501	H-1-7/16	49M6201
8	7.5	1045	1285	1VP65x1-3/8	78M7101	BK90H	100788-04	BX64	97J5801	H-1-7/16	49M6201
10	10	1045	1285	1VP65x1-3/8	78M7101	1B5V86	78M8301	5VX670	100245-21	B-1-7/16	100246-01
11	10	1135	1365	1VP65x1-3/8	78M7101	1B5V80	100240-05	5VX660	100245-20	B-1-7/16	100246-01

D-Optional Electric Heat Components

See ELECTRICAL / ELECTRIC HEAT (table of contents) for possible KCC to EHA match-ups and electrical ratings. All electric heat sections consist of electric heating elements exposed directly to the air stream. Two electric heat sections (first section and second section) are used in all 15kW through 90kW heaters used in KCC180/300 units. Multiple-stage elements are sequenced on and off in response to thermostat demand. EHA parts arrangement is shown in FIGURE 12 and FIGURE 13.

Control Box Components

The main control box (FIGURE 2) houses some electric heat components and the electric heat control “hat” section.

Electric Heat Hat Section (FIGURE 11)

1-Electric Heat Relay K9

All KCC 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 assembly 24V circuit. K9 is energized by W1 TB1. K9-1 closes, enabling T2 to energize the electric heat.

2-Electric Heat Relay K19

All KCC series units with electric heat use an electric heat relay K19. K19 is a N.O. SPDT pilot relay intended to electrically isolate the unit’s 24V circuit from the electric heat assembly 24V circuit. K19 is energized by TB1 (once K9 is energized). K19-1 closes, enabling T2 to energize the remaining electric heat.

3-Time Delay DL2

DL2 is a solid state timer used in all electric heat units. DL2 staggers the energizing of the first (W1) and second (W2) stage heating elements by providing a timed interval. When the timer is de-energizing, the contacts are delayed 1 second before opening.

4-Time Delay DL5

Time delay DL5 is identical to DL2. DL5 further staggers the (W2) second stage heating elements by providing a timed interval between the energizing of the elements activated by DL2 and elements activated by DL5

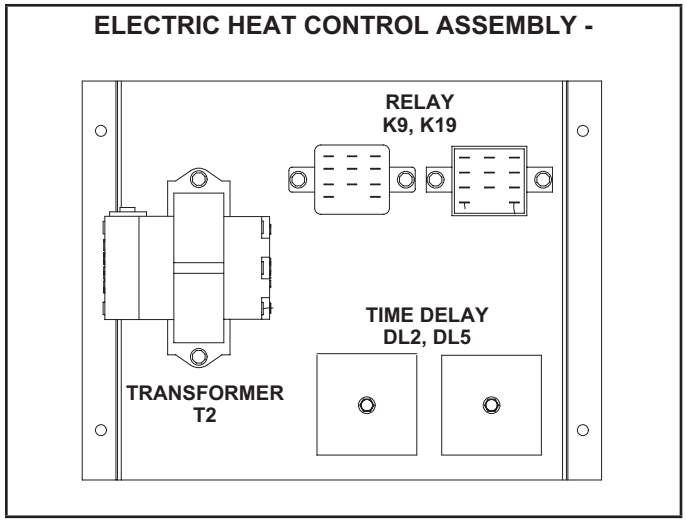


FIGURE 11

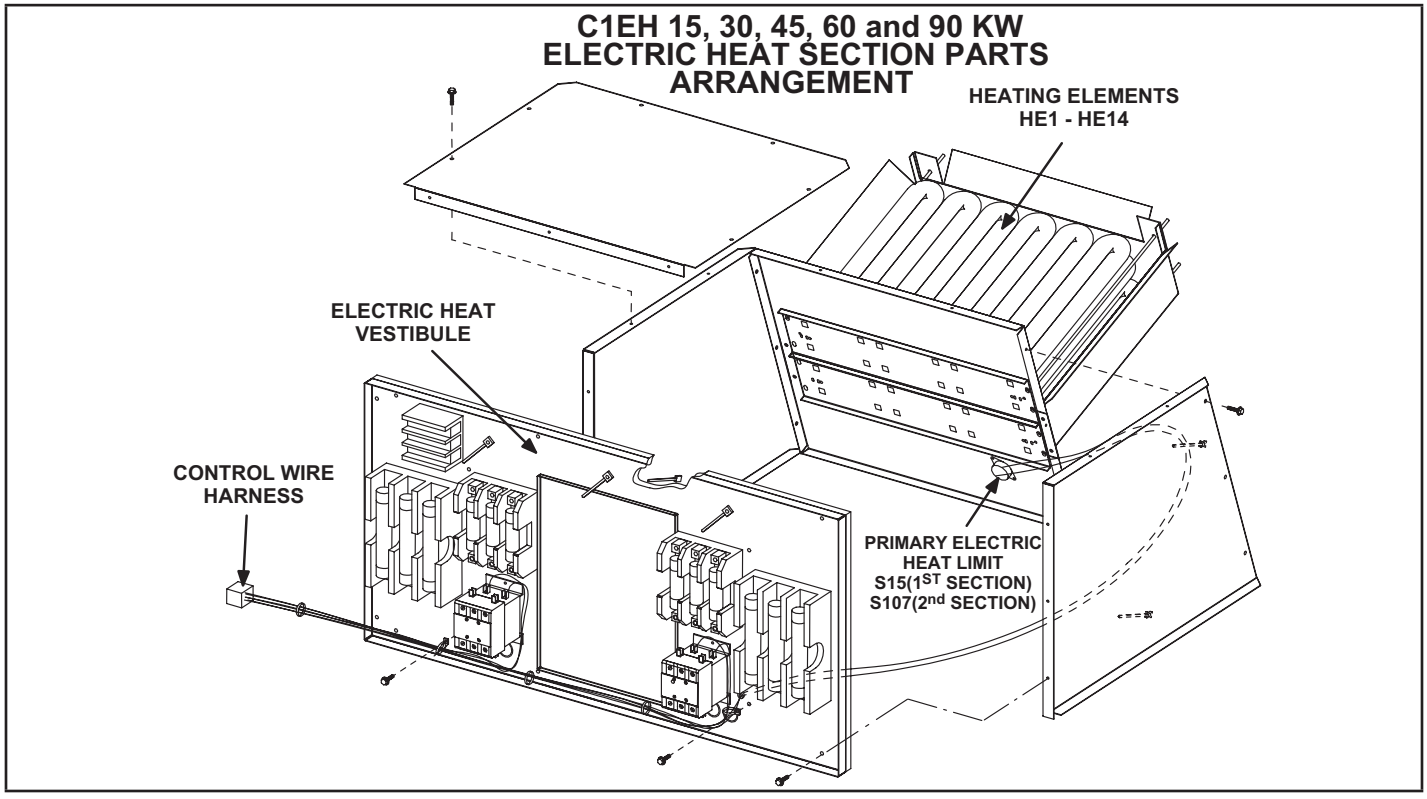
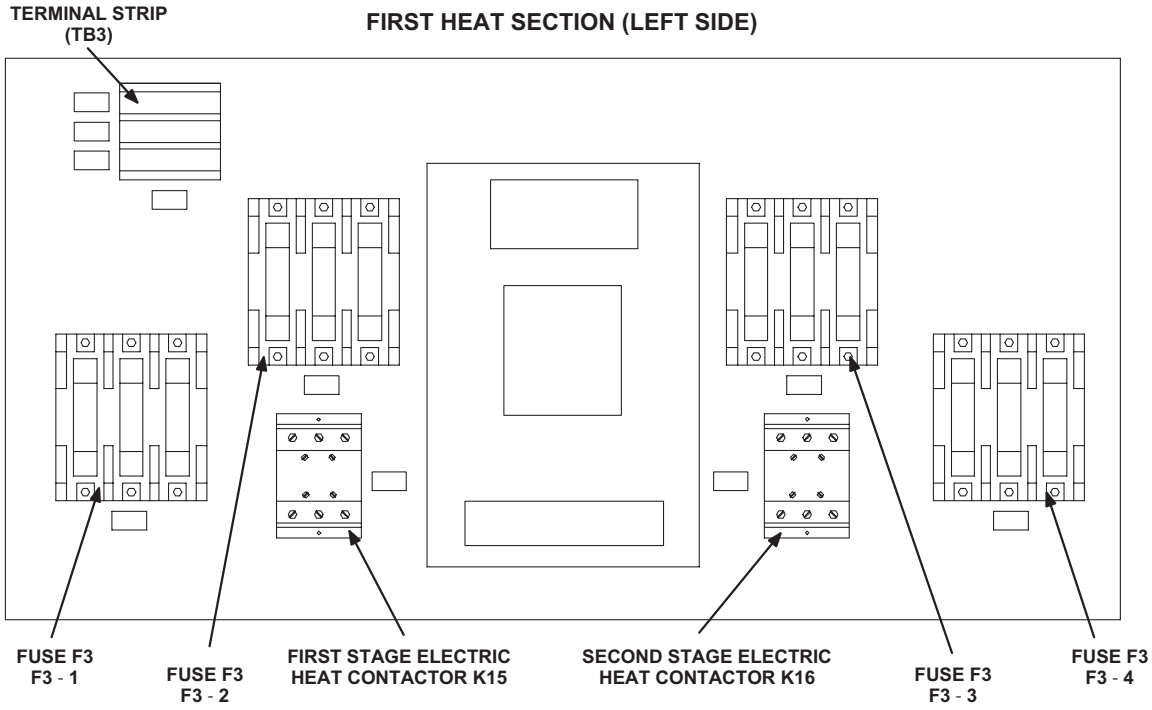


FIGURE 12

ELECTRIC HEAT VESTIBULE PARTS ARRANGEMENT



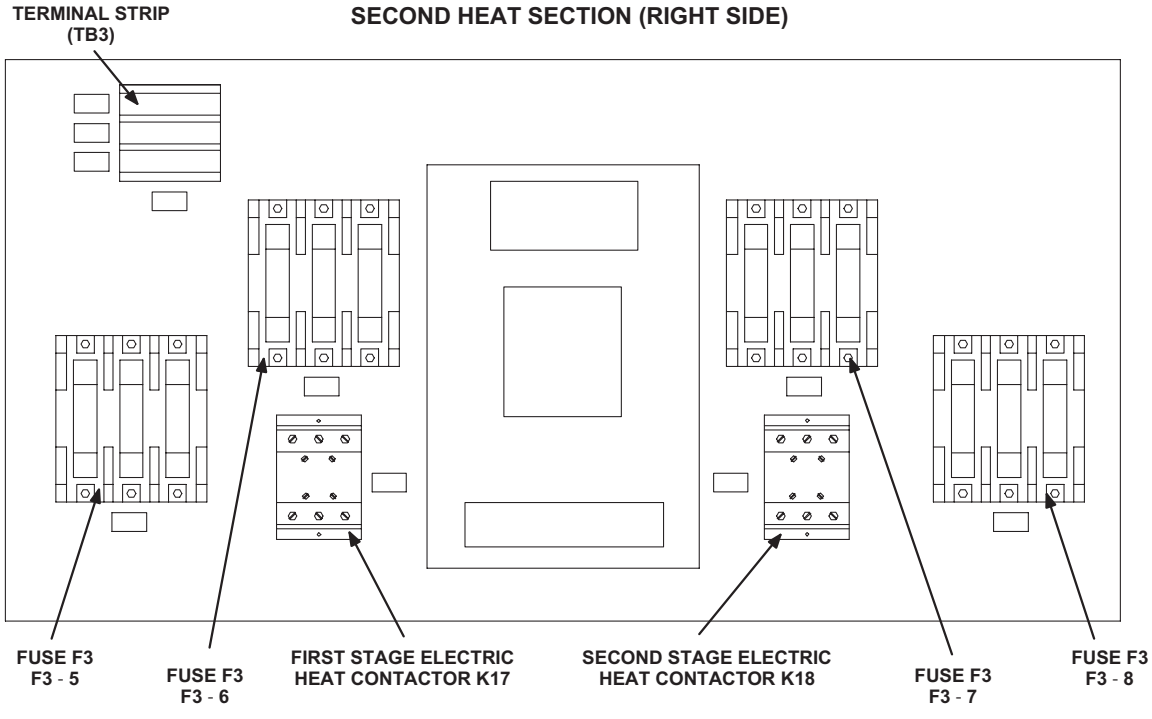


FIGURE 13

5-Electric Heat Transformer T2

All KCC series units with electric heat use a single line voltage to 24VAC transformer mounted in the electric heat control hat section in the control box. The transformer supplies power to all electric heat controls (contactors and coils). The transformer is rated at 70VA and is protected by a 3.5 amp circuit breaker CB13 located on the body of T2. The 208/230 (Y) voltage transformers use two primary voltage taps as shown in FIGURE 3. Transformer T2 is identical to T1.

Electric Heat Sections

6-Contactors K15, K16, K17 and K18

Contactors K15, K16, K17 and K18 are all three-pole double- break contactors located on the electric heat vestibule. K15 and K16 are located on the first electric heat section, while K17 and K18 are located on the second electric heat section. However, in the 15 and 30kW heaters, the first section houses all contactors and fuses. All contactors are equipped with a 24VAC coil. The coils in the K15, K16, K17 and K18 contactors are energized by the main panel A45. Contactors K15 and K17 energize the first stage heating elements, while K16 and K18 energize the second stage heating elements.

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 13 and TABLE 5 show the fuses used with each electric heat section. For simplicity, the service manual labels the fuses F3 - 1 through F3 - 8.

8-Terminal Strip TB3

Electric heat line voltage connections are made to terminal strip TB3 (or a fuse block on some models) located in the upper left corner of the electric heat vestibule.

9-High Temperature Limits S15 and S107

(Primary)

S15 and S107 are SPST N.C. auto-reset thermostats located on the back panel of the electric heat section below the heating elements. S15 is the high temperature limit for the first electric heat section, while S107 is the high temperature limit for the second electric heat section. Both thermostats are identical and are wired in series with the first stage contactor coil. When either S15 or S107 opens, indicating a problem in the system, contactor K15 is de-energized.

When K15 is de-energized, first stage and all subsequent stages of heat are de-energized. The thermostats used on EHA360-45- Y/G/J are factory set to open at 200F $\pm$ 5^0F (93.3^0C $\pm$ 2.8^0C) on a temperature rise and automatically reset at 160^0F $\pm$ 6^0F (71.1^0C $\pm$ 3.3^0C) on a temperature fall. All other electric heat section thermostats are factory set to open at 170^0F $\pm$ 5^0F (76.7^0C $\pm$ 2.8^0C) on a temperature rise and automatically reset at 130^0F $\pm$ 6^0F (54.4^0C $\pm$ 3.3^0C) on a temperature fall. The thermostats are not adjustable.

10-Heating Elements HE1 through HE14

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.

TABLE 5

KCC180/300 ELECTRIC HEAT SECTION FUSE RATING

EHA QUANTITY & SIZE	VOLTAGES	FUSE (3EACH)							
		F3-1	F3-2	F3-3	F3-4	F3-5	F3-6	F3-7	F3-8
(1) EHA240-7.5 & (1) EHA240S-7.5 (15 kW Total)	208/230	50 Amp 250V	-	-	-	-	--	-	-
	460	25 Amp 600V	-	-	-	-	-	-	-
	575	20 Amp 600V	-	-	-	-	-	-	-
(1) EHA360-15 & (1) EHA360S-15 (30 kW Total) or (1) EHA156-15 & (1) EHA156S-15	208/230	60 Amp 250V	60 Amp 250V	-	-	-	-	-	-
	460	50 Amp 600V	-	-	-	-	-	-	-
	575	40 Amp 600V	-	-	-	-	-	-	-
(2) EHA360-22.5 (45 kW Total) or (2) EHA156-22.5	208/230	50 Amp 250V	-	-	25 Amp 250V	50 Amp 250V	-	-	25 Amp 250V
	460	25 Amp 600V	-	-	15 Amp 600V	25 Amp 600V	-	-	15 Amp 600V
	575	20 Amp 600V	-	-	10 Amp 600V	20 Amp 600V	-	-	10 Amp 600V
(2) EHA150-30 (60 kW Total) or (2) EHA156-30	208/230	50 Amp 250V	-	-	50 Amp 250V	50 Amp 250V	-	-	50 Amp 250V
	460	25 Amp 600V	-	-	25 Amp 600V	25 Amp 600V	-	-	25 Amp 600V
	575	20 Amp 600V	-	-	20 Amp 600V	20 Amp 600V	-	-	20 Amp 600V
(2) EHA360-45 (90 kW Total)	208/230	50 Amp 250V	-	60 Amp 250V	60 Amp 250V	50 Amp 250V	-	60 Amp 250V	60 Amp 250V
	460	25 Amp 600V	-	-	50 Amp 600V	25 Amp 600V	-	-	50 Amp 600V
	575	20 Amp 600V	-	-	40 Amp 600V	20 Amp 600V	-	-	40 Amp 600V

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

1 - Remove coil covers before starting unit.

2 - Set thermostat or temperature control device fan switch to AUTO or ON. Set thermostat or temperature control device to initiate a first-stage cooling demand.

A first-stage (Y1) cooling demand will energize compressor 1 and outdoor fans 1 & 2. An increased cooling demand (Y2) will initiate compressor 2 and outdoor fans 3 & 4. On units with an economizer, when outdoor air is acceptable, a first-stage demand will energize the economizer; a second-stage demand will energize compressor 1 and outdoor fans 1 & 2.

3 - Refrigerant circuits are factory charged with R-410A refrigerant. See unit rating plate for correct amount of charge.

4 - Units contain two refrigerant circuits or systems. See FIGURE 14.

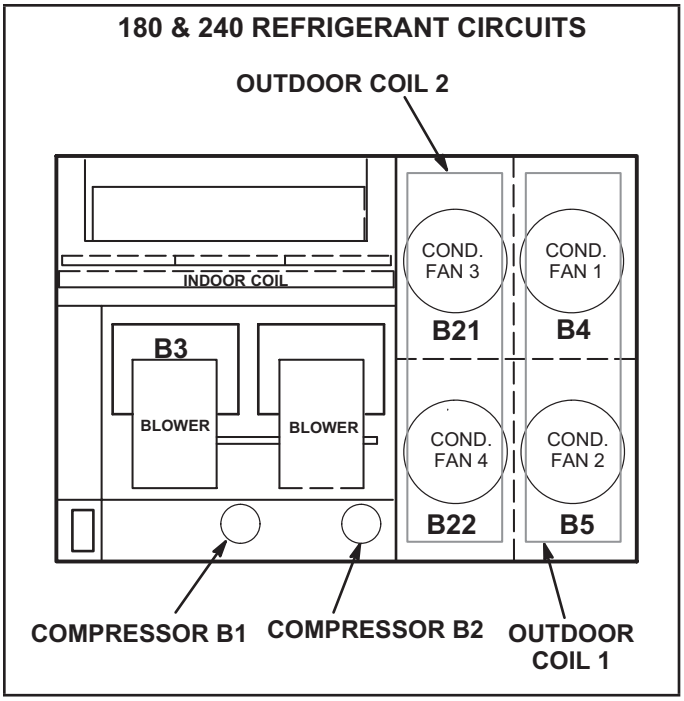


FIGURE 14

IV-CHARGING

⚠ WARNING

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

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

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). Make sure outdoor air dampers are closed.

2 - Check each system separately with all stages operating.

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

4 - Apply the outdoor temperature to TABLE 6 and TABLE 7 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.

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.

TABLE 6

KHC180 NORMAL OPERATING PRESSURES

Outdoor Coil Entering Air Temp^{0}F	Circuit 1		Circuit 2	
	Dis. ±10 psig	Suc. ±5 psig	Dis. ±10 psig	Suc. ±5 psig
65	253	137	265	133
75	288	140	304	135
85	330	142	346	138
95	376	144	385	141
105	423	147	445	144
115	475	150	499	147

TABLE 7

KHC240 NORMAL OPERATING PRESSURES

Outdoor Coil Entering Air Temp^{0}F	Circuit 1		Circuit 2	
	Dis. ±10 psig	Suc. ±5 psig	Dis. ±10 psig	Suc. ±5 psig
65	274	136	280	136
75	311	136	318	136
85	353	138	360	138
95	396	140	405	140
105	448	142	457	142
115	505	144	511	144

A-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 temperatures should match values in TABLE 8. An approach temperature greater than this value indicates an undercharge. An approach temperature less than this value indicates an overcharge.

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

TABLE 8

APPROACH TEMPERATURES

Unit	Liquid Temp. Minus Ambient Temp.	
	1st Stage	2nd Stage
180	3°F ± 1	8°F ± 1
240	5°F ± 1	9°F ± 1

V- SYSTEMS SERVICE CHECKS

A-Cooling System Service Checks

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 6 and TABLE 7.*

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

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.

⚠ CAUTION

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

⚠ WARNING

Product contains fiberglass wool.

Disturbing the insulation in this product during installation, maintenance, or repair will expose you to fiberglass wool. Breathing this may cause lung cancer. (Fiberglass wool is known to the State of California to cause cancer.)

Fiberglass wool may also cause respiratory, skin and eye irritation.

To reduce exposure to this substance or for further information, consult material safety data sheets available from address shown on unit nameplate or contact your supervisor.

A-Filters

Units are equipped with six 24 X 24 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 15.

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

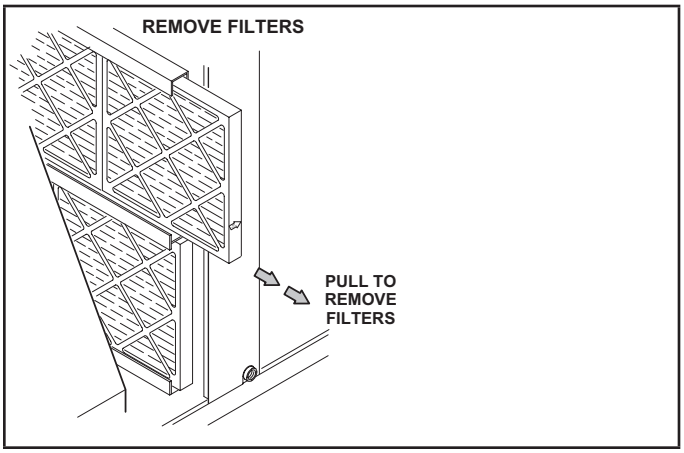


FIGURE 15

B-Lubrication

All motors used in these units are factory lubricated, no further lubrication is required.

Blower shaft bearings are prelubricated. For extended bearing life, relubricate at least once every two years with a lithium base grease such as Alvania 3 (Shell Oil), Chevron BRB2 (Standard OIl) or Regal AFB2 (Texas Oil). Use a hand grease gun for lubrication. Add only enough grease to purge through the bearings so that a bead of grease appears at the seal lip contacts.

C-Indoor 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-Supply Air Blower Wheel

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

E-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.

A-C1CURB, LARMF and LARMFH Mounting Frames

When installing units on a combustible surface for downflow discharge applications, the C1CURB40 (8-inch), or LARMF18/30S or 18/36 14-inch, 18-inch or 24-inch (356 mm or 610mm) roof mounting frame is used. An adjustable, pitched curb (L1CURB55C) is also available.

For horizontal discharge applications, use LARMFH18/24 26-inch or 37-inch (660mm or 940mm) roof mounting frame. This frame converts unit from downflow to horizontal air flow. The roof mounting frames are recommended in all other applications but not required. If the units are not mounted 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 mounted level within 1/16" per linear foot or 5mm per meter in any direction. The assembled mounting frame is shown in FIGURE 16. Refer to the roof mounting frame installation instructions for details of proper assembly and mounting. The roof mounting frame MUST be squared to the roof and level before mounting. Plenum system MUST be installed before the unit is set on the mounting frame. Typical roof curbing and flashing is shown in FIGURE 17. Refer to the roof mounting frame installation instructions for proper plenum construction and attachment.

B-Transitions

Optional supply/return transitions LASRT18 and LASRT21/ 24 are available for use with units utilizing optional

LARMF18/36 roof mounting frame. Transition must be installed in the mounting frame before setting the unit on the frame. Refer to the manufacturer's instructions included with the transition for detailed installation procedures.

C-Supply and Return Diffusers (all units)

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

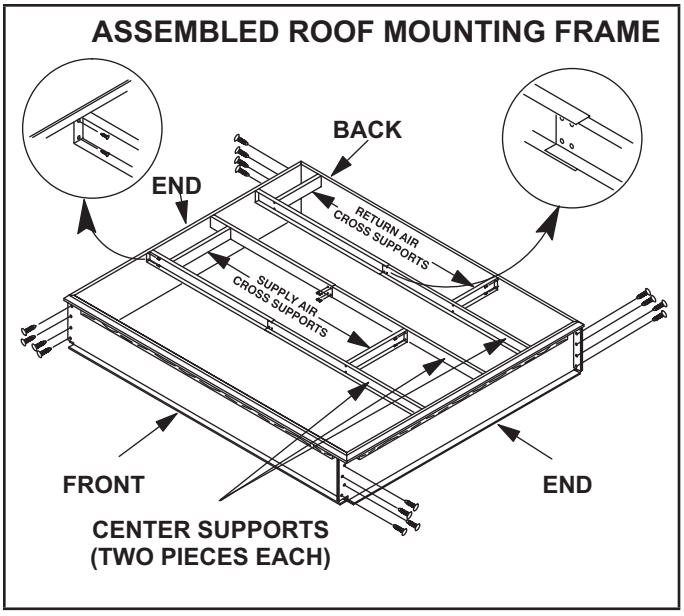


FIGURE 16

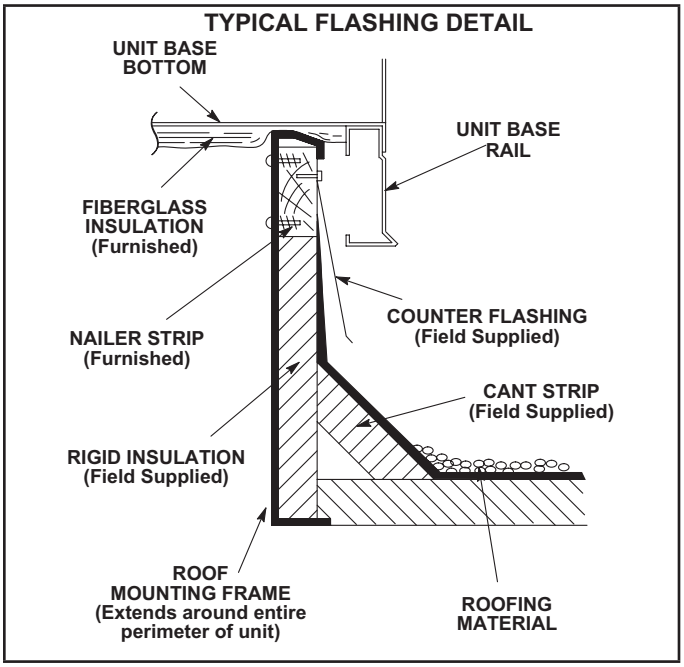


FIGURE 17

D- Economizer

Unit may contain an optional modulating economizer equipped with an A6 enthalpy control and an S175 outdoor temperature sensor or A7 enthalpy sensor. The economizer modulates to use outdoor air for free cooling when temperature is suitable.

The A6 enthalpy control is located in the economizer access area. See FIGURE 18. The S175 temperature sensor or A7 enthalpy sensor is located on the division panel between horizontal supply and return air sections.

Optional Sensors

An optional differential sensor (A62) may be used with the A7 outdoor sensor to compare outdoor air enthalpy to return air enthalpy. When the outdoor air enthalpy is below the return air enthalpy, outdoor air is used for free cooling.

A mixed air sensor (R1) is used in modulating the dampers to 55°F (13°C) blower compartment air temperature.

An optional IAQ sensor (A63) may be used to lower operating costs by controlling outdoor air based on CO2 level or room occupancy (also called demand control ventilation or DCV). Damper minimum position can be set lower than traditional minimum air requirements; dampers open to traditional ventilation requirements when CO2 level reaches DCV (IAQ) setpoint.

Refer to instructions provided with sensors for installation.

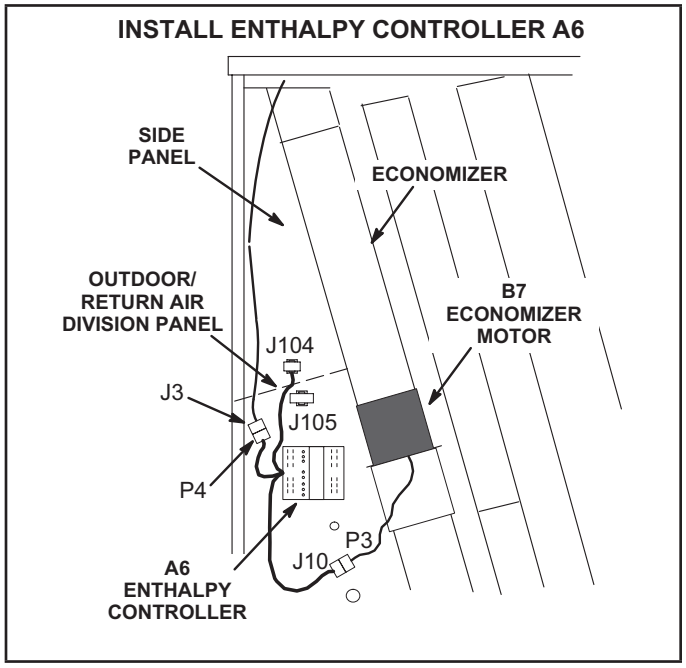


FIGURE 18

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 19.

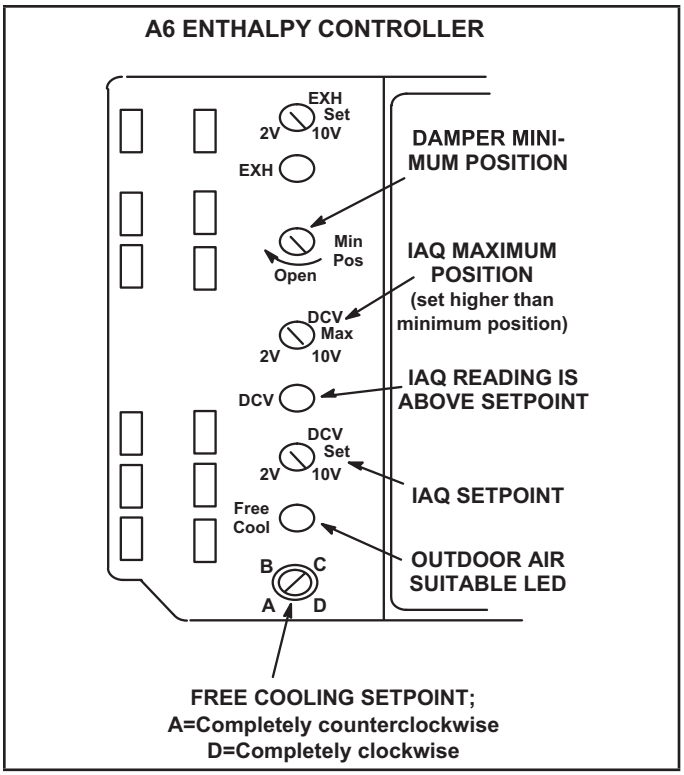


FIGURE 19

Free Cooling Setpoint

Single Temperature or Enthalpy Sensing:

The enthalpy control (A6) setpoint may be adjusted when an enthalpy (A7) sensor is used to determine outdoor air suitability, See FIGURE 19.

Free cooling will be enabled when outdoor air temperature or enthalpy are lower than the free cooling setpoint. The free cooling setpoints for sensible temperature sensors is 55°F. TABLE 9 shows the free cooling setpoints for enthalpy sensors. Use the recommended setpoint and adjust as necessary.

For example: At setting A (TABLE 9), free cooling will be enabled when outdoor air enthalpy is lower than 73°F and 50% RH. If indoor air is too warm or humid, lower the setpoint to B. At setting B, free cooling will be enabled at 70°F and 50% RH.

TABLE 9

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.

Differential Sensing:

Two sensors can be used to compare outdoor air to return air. When outdoor air is cooler than return air, outdoor air is suitable for free cooling. Adjust the free cooling setpoint to “D” in this application.

When return air is cooler than outdoor air, the damper will modulate to the minimum position.

Damper Minimum Position

NOTE - *A jumper is factory-installed between TB1 R and OC terminals to maintain occupied status (allowing minimum fresh air). See FIGURE 20. When using an electronic thermostat or energy management system with an occupied/ unoccupied feature, remove jumper. Make wire connections to R and OC as shown in literature provided with thermostat or energy management system literature. Either the jumper wire or optional device must be connected to R and OC for the economizer to function.*

TB1 TERMINAL R AND OC JUMPER

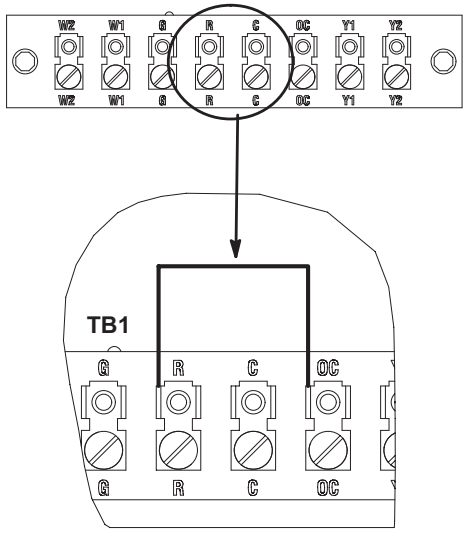


FIGURE 20

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.*

3 - Measure outdoor air temperature. Mark the point on the bottom line of chart 1 and label the point “A” (40^0F, 4^0C shown).

4 - Measure return air temperature. Mark that point on the top line of chart 1 and label the point “B” (74^0F, 23^0C shown).

5 - Measure mixed air (outdoor and return air) temperature. Mark that point on the top line of chart 1 and label point “C” (70^0F, 21^0C 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 clockwise (further open). If fresh air percentage is more than desired, adjust MIN POS SET potentiometer counterclockwise (less open). Repeat steps 3 through 8 until calculation reads desired fresh air percentage.

DCV Set and Max Settings

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 19.

The DCV MAX potentiometer is factory-set at approximately 50% of the potentiometer range or 6VDC. Dampers will open approximately half way when CO2 rises above setpoint. Adjust the DCV MAX potentiometer to the approximate setting specified by the controls contractor. Refer to FIGURE 19.

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

Economizer Operation

When the outdoor air is suitable, dampers will modulate between minimum position and full open to maintain 55^{0}F (12.8^{0}C) supply air.

See TABLE 10 for economizer operation when outdoor air is suitable. See TABLE 11 for economizer operation when outdoor air is NOT suitable.

IAQ Sensor

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 full-open position. The DCV MAX setting may override damper free cooling position when occupancy is high and outdoor air temperatures are low.

NOTE - *R1 senses mixed air temperature below 45^{0}F (7^{0}C), dampers will move to minimum position until mixed air temperature rises to 48F (9^{0}C).*

CHART 1
CALCULATE MINIMUM FRESH AIR PERCENTAGE

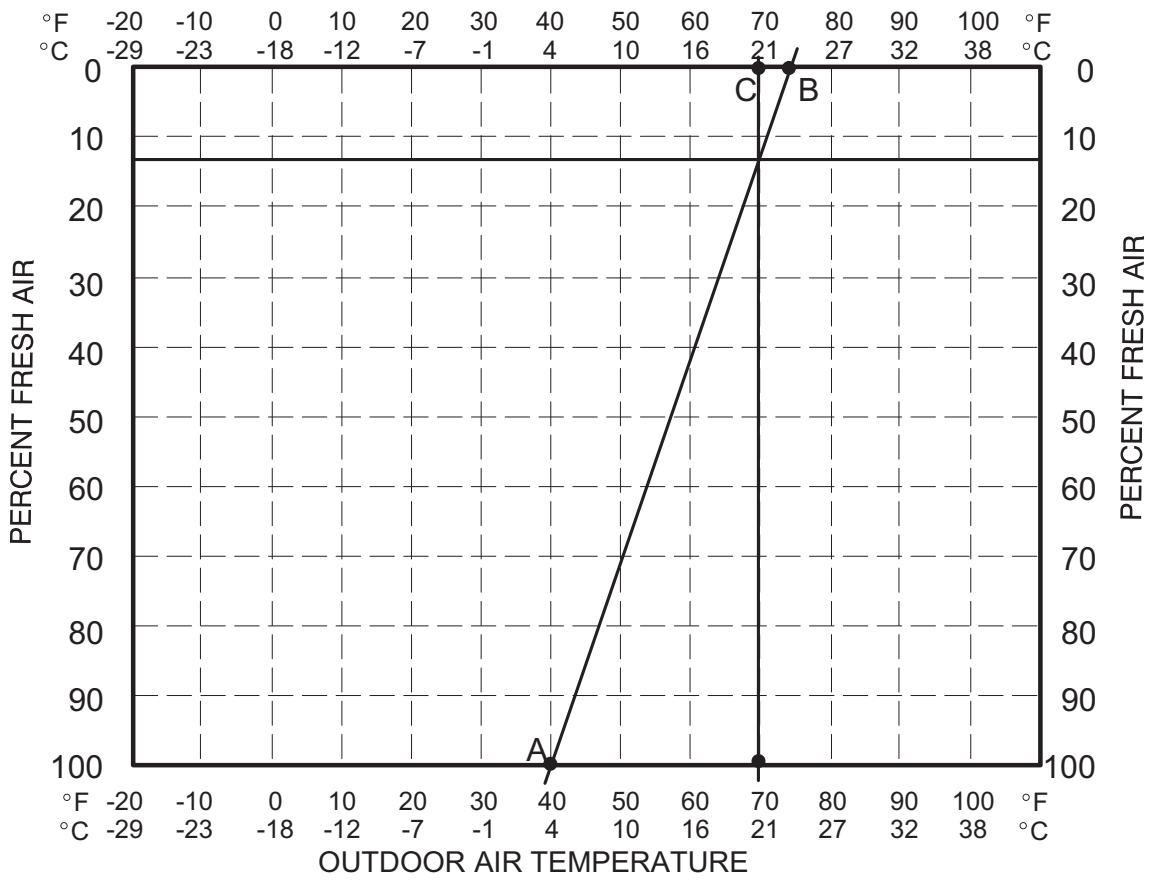


TABLE 10

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

TABLE 11

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.

Standard and High Performance

Economizer Minimum Position

NOTE - *24 volts must be provided at unit TB1 terminals R and OC to enable economizer operation (allowing minimum fresh air). Typically a separately ordered thermostat or energy management system with an occupied/unoccupied output is connected between TB1 R and OC terminals. The thermostat will provide 24 volts to the A6 economizer control during the occupied time period to enable economizer minimum position. If a device is not used to enablethe economizer, install a jumper wire between TB1 terminals R and OC to maintain minimum position continuously.*

Make wire connections to ***TB1*** *terminals* ***R*** *and* ***OC*** *as shown in literature provided with thermostat or energy management system.*

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

2 - Turn on the blower using the thermostat or a jumper between TB1 terminals R and G.

IMPORTANT - *On unit equipped with an inverter (VFD) driven supply air blower motor, the VFD control board controls the economizer minimum damper position. Refer to the unit installation instructions for additional setup requirements.*

3 - *Standard Economizers -*

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

High Performance Economizers-

On units with single-speed blowers, navigate to the "BASIC SETTINGS" menu and select "2FAN H ACT". Adjust value (2-10VDC) to the approximate desired fresh air percentage.

On units with two-speed blowers, once high speed minimum position is set (steps 4. through 11.), adjust "2FAN L ACT" in the same manner.

3.0 VDC 12% Open Damper
3.5 VDC 18% Open Damper
4.0 VDC 25% Open Damper
4.5 VDC 31% Open Damper
5.0 VDC 37% Open Damper
5.5 VDC 43% Open Damper
6.0 VDC 50% Open Damper

NOTE - *Damper minimum position can be set lower than traditional minimum air requirements when an IAQ sensor is specified.*

4 - High Performance Economizers -

Navigate through the "BASIC SETTINGS" menu and select "7DAMPER MIN POS". Damper will drive to the setpoint value stored in step 3.

5 - Measure outdoor air temperature. Mark the point on the bottom line of chart 1 (figure 21) and label the point "A" (40°F, 4°C shown).

6 - Measure return air temperature. Mark that point on the top line of chart 1 and label the point "B" (74°F, 23°C shown).

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

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

9 - Draw a vertical line through point C.

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

11. Standard Economizers -

If fresh air percentage is less than desired, adjust MIN POS SET potentiometer clockwise (further open). If fresh air percentage is more than desired, adjust MIN POS SET potentiometer counterclockwise (less open). Repeat steps 5. through 10. until calculation reads desired fresh air percentage.

High Performance Economizers -

If fresh air percentage is less than desired, use the A6 keypad to adjust “2FAN H ACT” values higher (further open). If fresh air percentage is more than desired, adjust “2FAN H ACT” values lower (less open). Repeat steps 4. through 10. until calculation reads desired fresh air percentage. On units with two-speed blowers, after high speed is adjusted, use “2FAN L ACT” in the same manner.

High Performance Economizer Installation

NOTE - *Refer to the General section when replacing a factory- installed economizer with shipping screws.*

DAMPERS

1 - Disconnect all power to unit and open filter access panel.

2 - Remove horizontal return air panel.

3 - Align bottom of economizer with economizer support bracket and slide economizer into unit. Make sure the flanges align as shown in FIGURE 24.

4 - Fit economizer end plate over end of economizer and secure end plate with #10 self drilling screws.

ECONOMIZER CONTROL (A6) INSTALLATION

1 - Install A6 economizer control on economizer side panel as shown in FIGURE 25. Secure with #6-32 X 7/8” TFS screws provided.

MIXED AIR SENSOR (R1) INSTALLATION

1 - Remove blower access panel.

2 - Install sensor on bracket as shown in FIGURE 22 and FIGURE 23.

OUTDOOR AIR SENSOR (RT26) INSTALLATION

1 - Install RT26 sensor onto the divider panel as shown in FIGURE 26. Use #6-32 X 7/8” TFS screws provided.

NOTE - *When enthalpy sensing is specified, A7 enthalpy sensor is installed in the same location as RT26.*

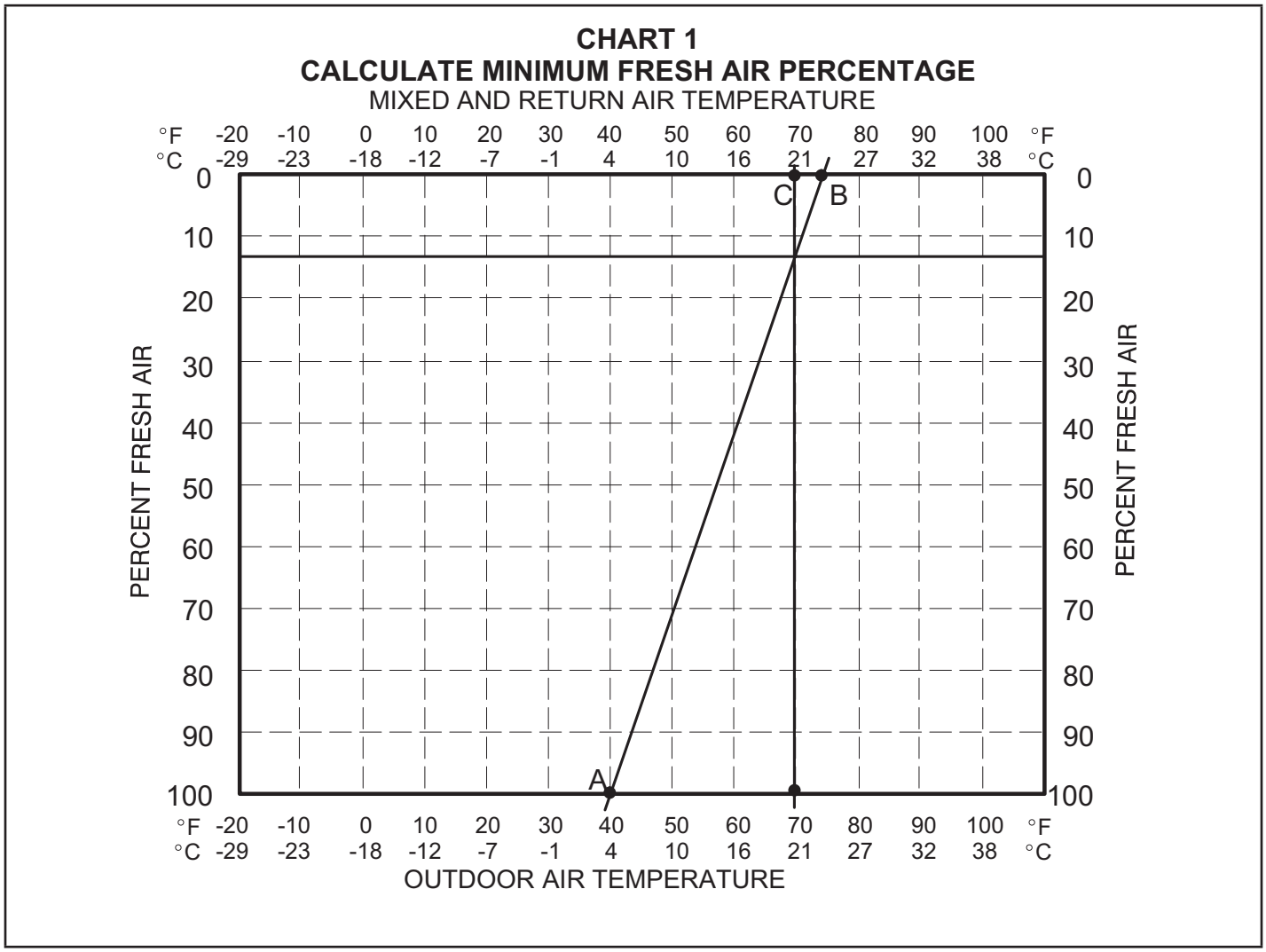


FIGURE 21

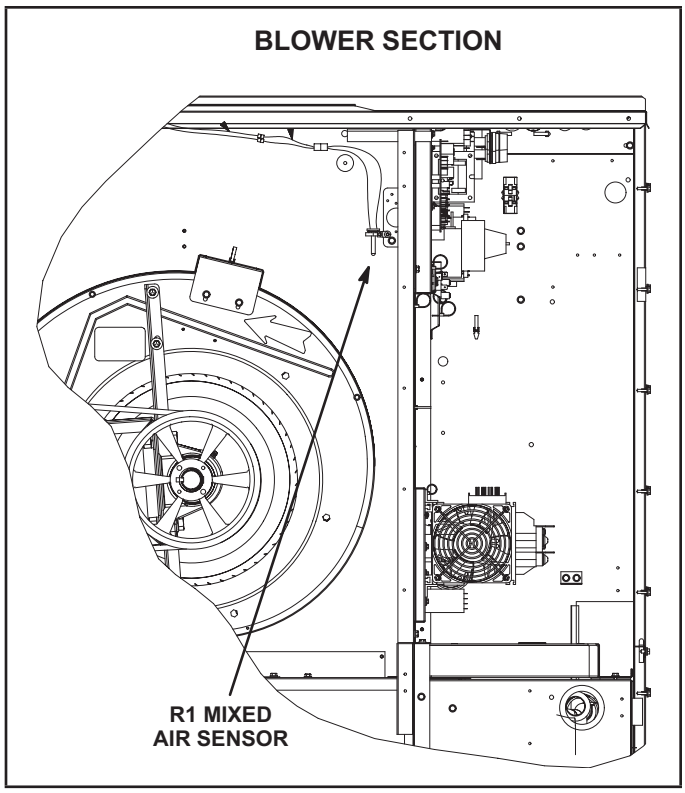


FIGURE 22

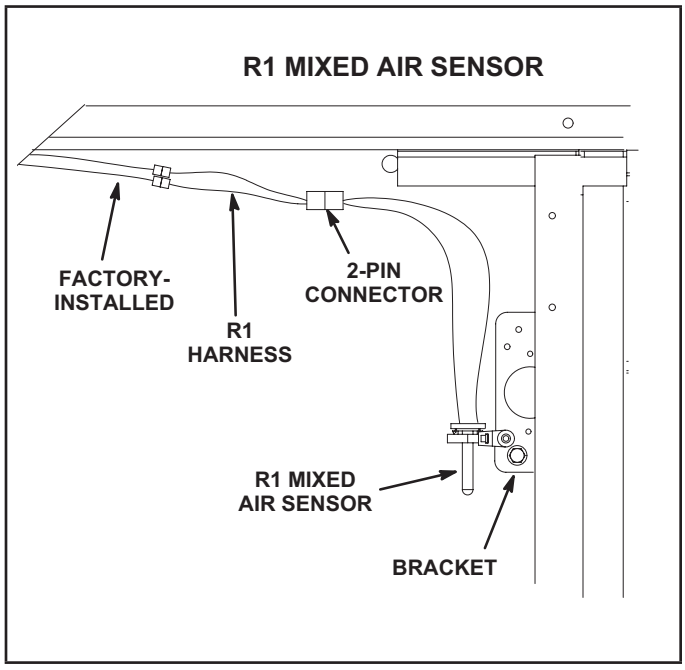


FIGURE 23

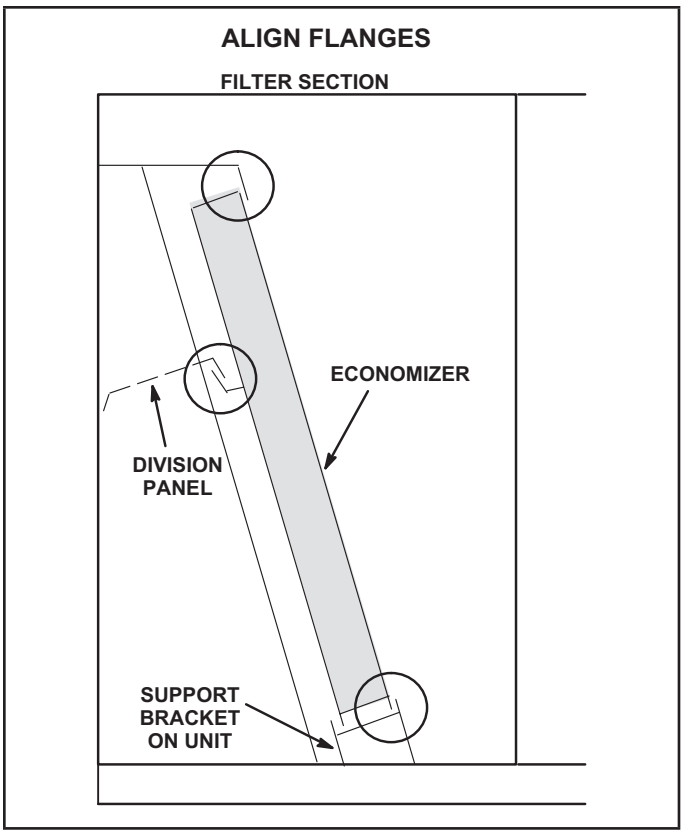


FIGURE 24

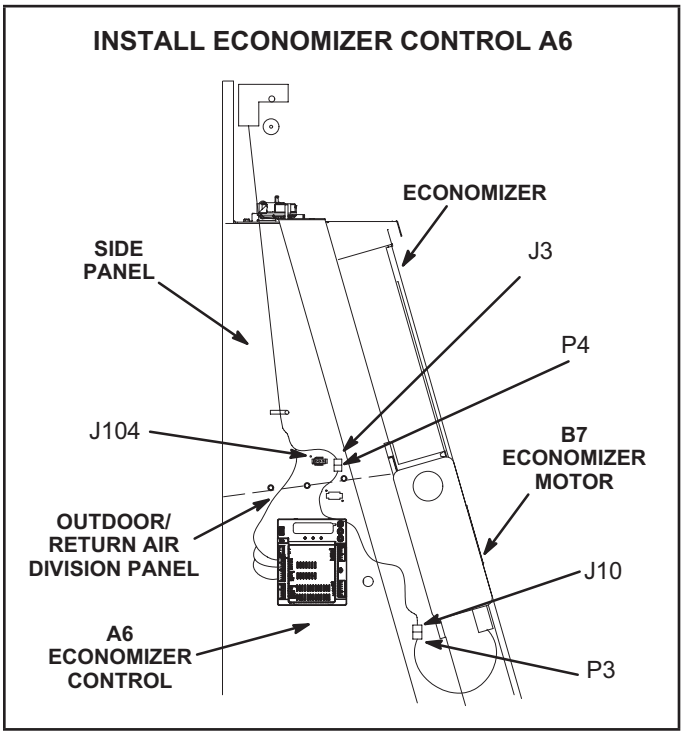


FIGURE 25

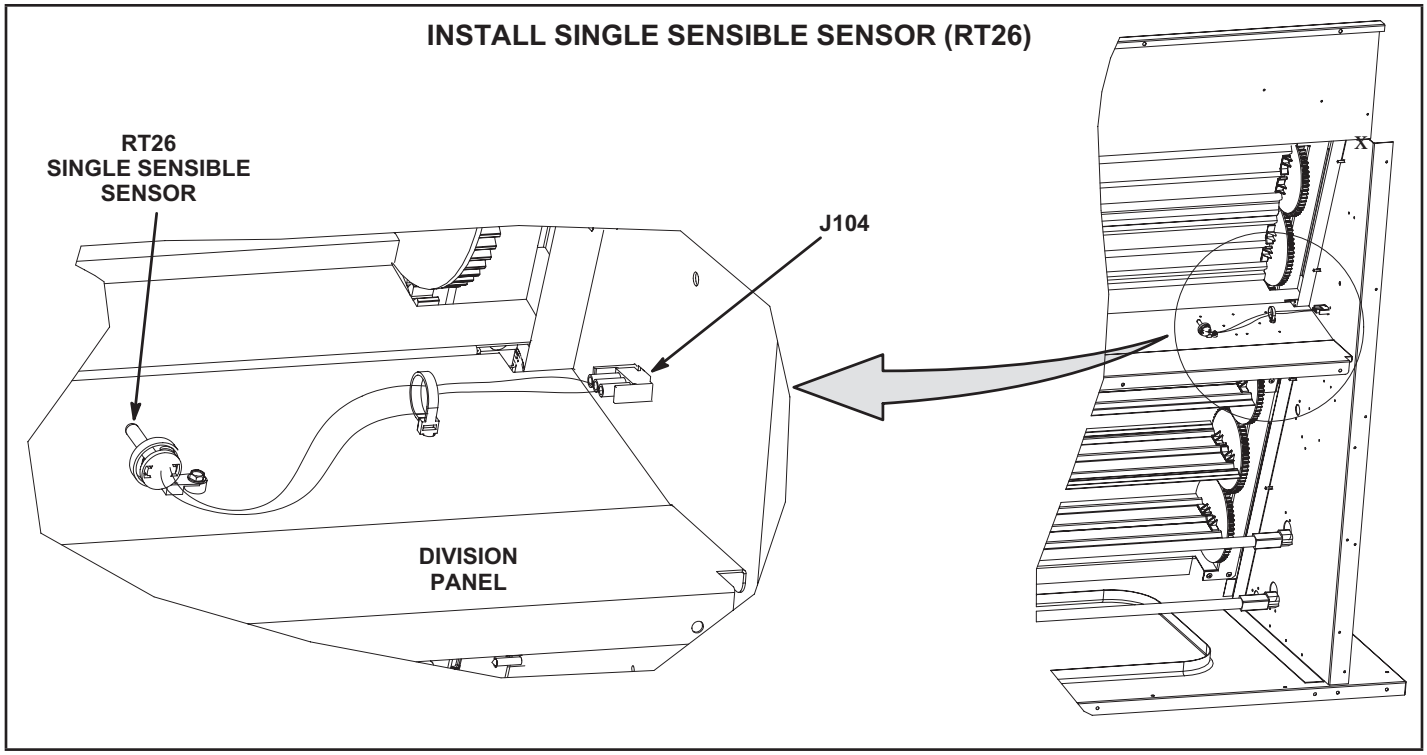


FIGURE 26

High Performance Economizer Electrical

ECONOMIZER CONTROL (A6) HARNESS CONNECTIONS

NOTE - *Wires marked P and P1 are hanging in the control section. These wires are connected on units equipped with standard economizers AND a VFD only.*

1 - Locate 15-pin J3 unit control harness hanging on left side of filter compartment. See FIGURE 25. Disconnect P3 jumper plug from J3 and retain jumper plug for future troubleshooting.

2 - Connect the 15-pin male plug P4 from the economizer control (A6) harness to the 15-pin female jack J3 on the unit control harness. See FIGURE 25.

3 - Locate brown and yellow kit harness with wires labeled J104-1 & J104-2 on one end and A6-OAT, A6-COM, & A6-AUX-A1 on the other end. Insert the connector with wires labeled J104-1 & 2 into the opening on economizer side panel and snap into place. See FIGURE 25.

4 - Connect the 15-pin female plug J10 to the 15-pin male plug P3 from the damper motor. See FIGURE 25.

5 - Affix D1 economizer wiring diagram section to inside of compressor access panel. Position diagram to the right of “C” control wiring diagram section

MIXED AIR SENSOR CONNECTION (R1)

1 - Locate two wires labeled R1 in wire bundle in top of blower section. Connect spade terminals on R1 harness to the wires from the bundle. Connect the R1 harness 2-pin connector to the R1 2-pin connector. See FIGURE 27. Make sure to secure wires away from moving parts.

RT26 HARNESS CONNECTIONS (Single Sensible Sensing)

1 - Locate brown and white kit harness with wires labeled P104-1 & P104-2 one one end and RT26-1 & 2 on the other end. Insert the connector with wires labeled P104-1 & 2 into J104 jack previously installed on the side of the economizer. See figure 40. Connect wires on other end of P104 harness to RT26 on divider panel. See FIGURE 31.

A63 OPTIONAL SENSOR CONNECTIONS (CO2 Sensing)

An optional CO2 sensor (A63) can be added for demand control ventilation (DCV). The IAQ sensor must provide a 0-10VDC signal to the A6 controller.

Refer to installation instructions shipped with optional sensor for more details.

1 - Locate the blue wire labeled A63-8 and brown wire labeled A63-7 from the harness in the control section. Strip ends.

2 - Connect blue A63-8 wire to CO2 sensor Vout lead. Connect brown A63-7 wire to CO2 sensor COM lead. Securewith wire nut. See FIGURE 27.

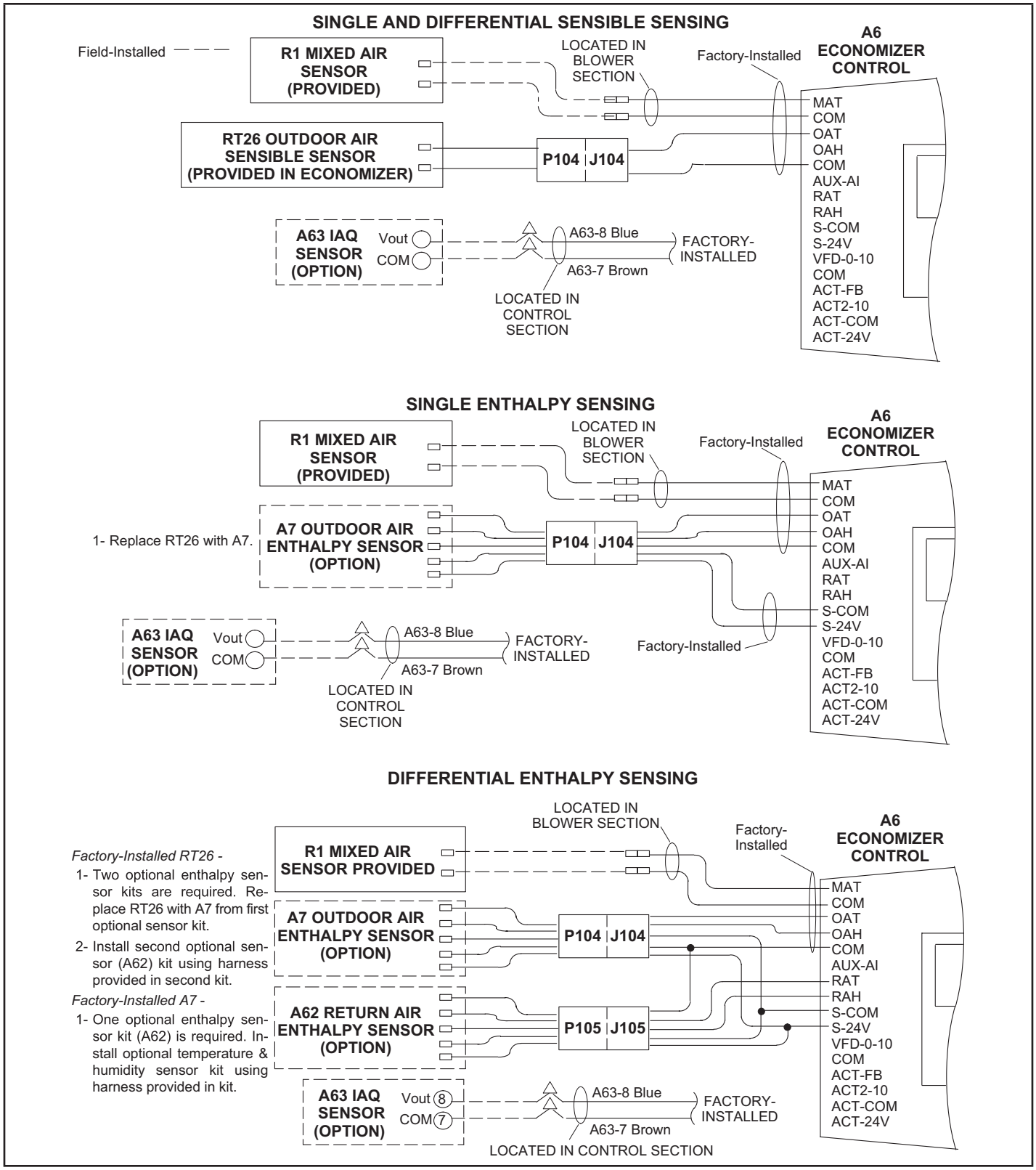

SINGLE AND DIFFERENTIAL SENSIBLE SENSING
Field-Installed
R1 MIXED AIR SENSOR (PROVIDED)
LOCATED IN BLOWER SECTION
Factory-Installed
A6 ECONOMIZER CONTROL
RT26 OUTDOOR AIR SENSIBLE SENSOR (PROVIDED IN ECONOMIZER)
P104 J104
MAT
COM
OAT
OAH
COM
AUX-AI
RAT
RAH
S-COM
S-24V
VFD-0-10
COM
ACT-FB
ACT2-10
ACT-COM
ACT-24V
A63 IAQ SENSOR (OPTION)
Vout
COM
A63-8 Blue
A63-7 Brown
FACTORY-INSTALLED
LOCATED IN CONTROL SECTION
SINGLE ENTHALPY SENSING
R1 MIXED AIR SENSOR (PROVIDED)
LOCATED IN BLOWER SECTION
Factory-Installed
A6 ECONOMIZER CONTROL
1- Replace RT26 with A7.
A7 OUTDOOR AIR ENTHALPY SENSOR (OPTION)
P104 J104
A63 IAQ SENSOR (OPTION)
Vout
COM
A63-8 Blue
A63-7 Brown
FACTORY-INSTALLED
LOCATED IN CONTROL SECTION
Factory-Installed
DIFFERENTIAL ENTHALPY SENSING
LOCATED IN BLOWER SECTION
Factory-Installed
A6 ECONOMIZER CONTROL
Factory-Installed RT26 -
1- Two optional enthalpy sensor kits are required. Replace RT26 with A7 from first optional sensor kit.
2- Install second optional sensor (A62) kit using harness provided in second kit.
Factory-Installed A7 -
1- One optional enthalpy sensor kit (A62) is required. Install optional temperature & humidity sensor kit using harness provided in kit.
R1 MIXED AIR SENSOR PROVIDED
A7 OUTDOOR AIR ENTHALPY SENSOR (OPTION)
P104 J104
A62 RETURN AIR ENTHALPY SENSOR (OPTION)
P105 J105
A63 IAQ SENSOR (OPTION)
Vout 8
COM 7
A63-8 Blue
A63-7 Brown
FACTORY-INSTALLED
LOCATED IN CONTROL SECTION

FIGURE 27

High Performance Economizer Control

USER INTERFACE

See FIGURE 28.

1 - One-line LCD. After a period of inactivity, the controller displays the default HMI screen (free cooling status: “1FREECOOL YES” or “1FREECOOL NO”).

2 - Operation button (Up button) - Move to the previous value, step or category.

3 - Operation button (Down button)- Move to the next value, step or category.

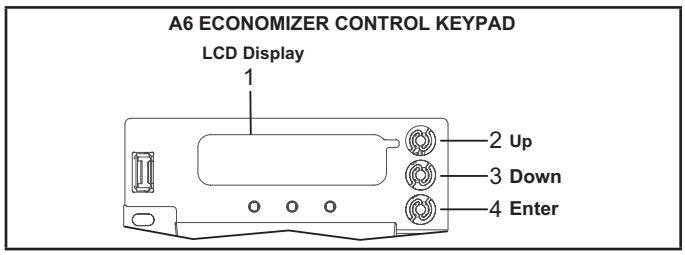


FIGURE 28

4 - Operation button (Enter button):

- Press to edit the current value or option.
- Press to confirm a newly selected value or option.
- Press Enter + Up to jump up one entire category.
- Press Enter + Down to jump down one entire category.

MENU STRUCTURE

See FIGURE 29.

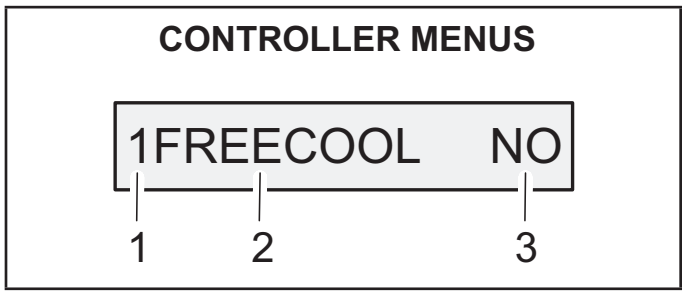


FIGURE 29

1 - Menus are displayed in the Economizer Controller as per categories. There are eight first-level menus. Each menu is represented by a number at the beginning of the line on the LCD. Press Enter + Up or Down to toggle between different first-level menus.

- 1: Status Display
- 2: Basic Settings
- 3: Advanced Settings
- 4: Alarms
- 5: Enter Configuration State and Reset
- 6: I/O Config.
- 7: Testing
- 8: Enter Running State

2 - Sub-menus follow the numbered first-level menus closely. Pressing Up or Down can toggle between different sub-menus.

3 - At the end of the line, the LCD displays the value of the current sub-menu (if any). Enter the Edit mode by pressing Enter (if the value is editable). Press Up or Down to change the highlighted value. Press Enter to confirm the change and exit the Edit mode.

For a complete list of parameters refer to the Siemens installation manual provided in this kit.

FREE COOLING SETPOINT

Single OA Sensible Sensing (Default)

The default free cooling setpoint or high limit setpoint is 63^0F. This means that the outdoor air is suitable for free cooling at 62^0F and below and not suitable at 64^0F and above. This setpoint is adjustable.

For California Title 24 compliance, adjust the free cooling setpoint based on:

-The climate zone where the unit is installed. See TABLE 12.

-The setpoint requirement published by the California Energy Commission. See Section 140.4 - Prescriptive Requirements for Space Conditioning Systems of the 2013 Building Energy Efficiency Standards.

NOTE - *Values in the referenced standard will supersede values listed in TABLE 12.*

TABLE 12

FREE COOLING SETPOINT - SINGLE SENSIBLE

Climate Zone	Set point °F
1, 3, 5, 11-16	75
2, 4, 10	73
6, 8, 9	71
7	69

To adjust the setpoint, navigate to the “BASIC SETTINGS” menu and change the “2TEMP OFF” parameter accordingly.

Single OA Enthalpy Sensing (Optional) -

To adjust the enthalpy setpoint, navigate to the “BASIC SETTINGS” menu and change the “2ENTH OFF” parameter accordingly.

Differential Sensing (Optional)

Two sensors can be used to compare outdoor air to return air. When outdoor air is cooler than return air, outdoor air is suitable for free cooling. When return air is cooler than outdoor air, the damper will modulate to the minimum position.

SETUP AND CONFIGURATION - FACTORY-INSTALLED ECONOMIZER

Program the following parameters into the controller. Navigate to the specific menus to make the changes required.

1INS

- (MM/DD/YY) enter installation date

2FAN L ACT*

- ( ) adjust VDC value until desired resh air setpoint is reached when fan runs at low speed. *Appears only *if unit is configured as 2SPEED.*

2FAN H ACT

- ( ) adjust VDC value until desired fresh air setpoint is reached

SETUP AND CONFIGURATION - FIELD-INSTALLED ECONOMIZER

Program the following parameters into the controller. Navigate to the specific menus to make the changes required.

IMPORTANT - Before setup and configuration, it is recommended to obtain some location-based values such as shutoff points or utilize the location services in the Climatix mobile application.

Menus are displayed in the Economizer Controller as per categories. There are eight first-level menus. Each of them is represented by a number at the beginning of the line on the LCD. Press Enter + Up or Down to toggle between different first-level menus.

Navigate to the applicable menus and set the following parameters based on the unit configuration:

1INS

- (MM/DD/YY) enter installation date

2FAN L ACT

- ( ) adjust VDC value until desired fresh ir set point is reached when fan runs at low speed (*Appears only if unit is configured as 2SPEED)

2FAN H ACT

- ( ) adjust VCD value until desired fresh air set point is reached

3DIF T LOC (LAT)

3STG3 DLY (120)

6Y2O

- (NONE) For single-stage units
- (COOL 2) For 2-stage units

6FAN

- (1 SPEED) For CAV units
- (2 SPEED) For MSAV units

ALARM MONITORING

The controller is equipped with a 24V output signal that can be configured for remote alarm monitoring. Field-wire to provided blue wire marked “Aux2-O” near the controller for remote alarm monitoring.

Note - *Newer units are factory-wired to facilitate feedback wiring connections when a BACnetTM option is installed. Newer units can be identified by a P372 plug located near TB1 in the control box. One white and one gray wire are connected to P372. On older units, call 1-800-453-6669 for wiring assistance.*

DEMAND CONTROL VENTILATION (DCV)

When a 010VDC CO2 sensor is wired to the POL224.00 economizer control A6 (leads provided), the 2DCV, 2VENTMAX L, 2VENTMAX H, 2 VENTMIN L and 2VENTMIN H parameters will appear under “BASIC SETTINGS“ menu. Navigate to the “BASIC SETTINGS“ menu to adjust setpoints as desired. Refer to the Siemens manual provided for more details.

For proper operation, the IAQ sensor must provide a 0-10VDC signal to the A6 controller.

CO_2 Sensor Used With High Performance Economizers-

When using any 0-10VDC sensor, set the ppm range using the POL224.00 economizer control A6 menu. Set the 6CO2 Rng L to 400 ppm and the 6CO2 Rng H to 1600 ppm.

High Performance Economizer Sequence of Operation

Refer to TABLE 13, TABLE 14, TABLE 15 or TABLE 16.

When the outdoor air is suitable and a thermostat demand calls for 1st. stage cooling (Y1), the economizer will modulate the dampers between the minimum and fully open positions to maintain a 55^0F (12.8^0C) mixed air temperature. When there is an increased thermostat demand for second stage cooling (Y2), the economizer damper opens 100% and the economizer controller (A6) will bring on the compressor. The damper will stay open 100% with the compressor running simultaneously until Y2 demand is met.

NOTE – *If a two-speed fan is installed, the economizer controller (A6) will delay the compressor start for 5 minutes (default). To adjust the delay from 1 to 20 minutes, adjust the “2FAN DLY” setting.*

NOTE – *When there is a Y1 cooling demand, the economizer controller (A6) will display the mixed air temperature (R1). When there is a Y2 cooling demand and compressors are operating, the economizer controller (A6) will display the outdoor air temperature (RT26 or A7). In either case, the economizer controller (A6) will use the mixed air sensor for low temperature lock-out.*

TROUBLESHOOTING, ALARMS AND\ CHECKOUT TESTS

Refer to the Siemens manual provided for details.

TABLE 13

ECONOMIZER OPERATION - NO DCV (CO2 SENSOR, 1-SPEED SUPPLY FAN)

DCV	OA Good to Economize ?	Y1-I	Y2-I	Y1-0	Y2-0	Occupied	Unoccupied
None	No	Off	Off	0-v/Off	0-v/Off	MIN POS	Closed
		On	Off	24-v/On	0-v/Off	MIN POS	Closed
		On	On	24-v/On	24-v/On	MIN POS	Closed
None	Yes	Off	Off	0-v/Off	0-v/Off	MIN POS	Closed
		On	Off	0-v/Off	0-v/Off	MIN POS to Full-Open	Closed to Full-Open
		On	On	24-v/On	0-v/Off	Full-Open	Full-Open

TABLE 14

ECONOMIZER OPERATION - WITH DCV (CO2 SENSOR, 1-SPEED SUPPLY FAN)

DVC	OA Good to Economize ?	Y1-I	Y2-I	Y1-0	Y2-0	Occupied	Unoccupied
Below Set	No	Off	Off	0-v/Off	0-v/Off	VENTMIN	Closed
		On	Off	24-v/On	0-v/Off	VENTMIN	Closed
		On	On	24v-/On	24-v/On	VENTMIN	Closed
	Yes	Off	Off	0-v/Off	0-v/Off	VENTMIN	Closed
		On	Off	0-v/Off	0-v/Off	VENTMIN to Full Open	Closed to Full Open
		On	On	24-v/On	0-v/Off	Full Open	Full Open
Above Set	No	Off	Off	0-v/Off	0-v/Off	VENTMIN to VENTMAX	Closed
		On	Off	24-v/On	0-v/Off	VENTMIN to VENTMAX	Closed
		On	On	24-v/On	24-v/On	VENTMIN to VENTMAX	Closed
	Yes	Off	Off	0-v/Off	0-v/Off	VENTMIN to VENTMAX	Closed
		On	Off	0-v/Off	0-v/Off	VENTMIN to Full Open	Closed to Full Open
		On	On	24-v/On	0-v/Off	Full-Open	Full-Open

TABLE 15

ECONOMIZER OPERATION - NO DCV (CO2 SENSOR, 2-SPEED SUPPLY FAN)

DCV	OA Good to Economize ?	Y1-I	Y2-I	Fan Speed	Y1-0	Y2-0	Occupied	Unoccupied
None	No	Off	Off	Low	0-v/Off	0-v/Off	MIN POS L	Closed
		On	Off	Low	24-v/On	0-v/Off	MIN POS L	Closed
		On	On	High	24-v/On	24-v/On	MIN POS H	Closed
None	Yes	Off	Off	Low	0-v/Off	0-v/Off	MIN POS L	Closed
		On	Off	High	0-v/Off	0-v/Off	MIN POS L to Full-Open	Closed to Full-Open
		On	On	High	Delay (b) -v/On	0-v/Off	Full-Open	Full-Open

(b) With 2FAN DLY (Basic Settings Menu), when in the economizing mode, there is a delay for the high speed fan to try to satisfy the call for second-stage cooling by turning on the fan to high and opening the OA dampers to 100% before the first-stage mechanical cooling is enabled.

TABLE 16

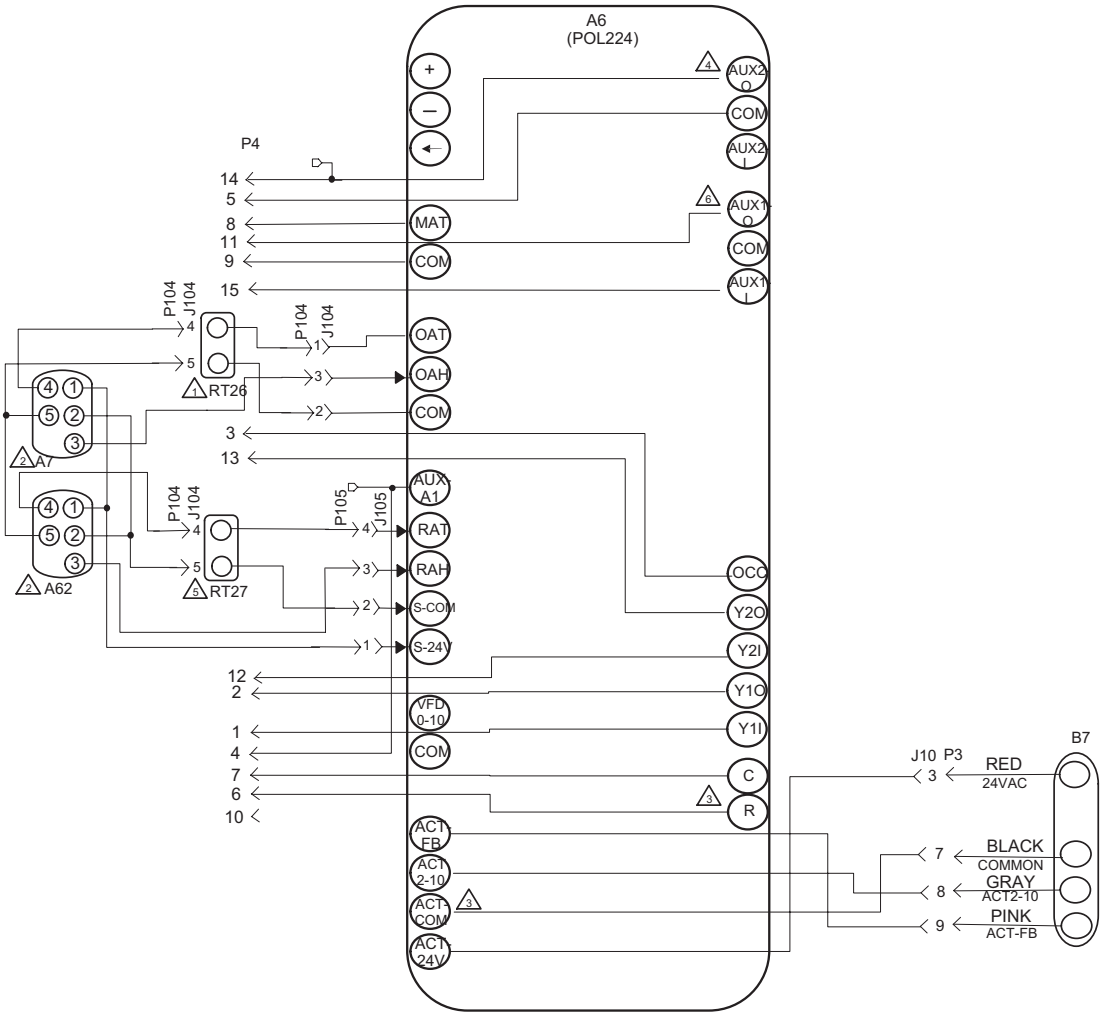
ECONOMIZER OPERATION - WITH DCV (CO2 SENSOR, 2-SPEED SUPPLY FAN)

DVC	OA Good to Economize ?	Y1-I	Y2-I	Fan Speed	Y1-0	Y2-0	Occupied	Unoccupied
Below Set	No	Off	Off	Low	0-v/Off	0-v/Off	VENTMIN L	Closed
		On	Off	Low	24-v/On	0-v/Off	VENTMIN L	Closed
		On	On	High	24v-/On	24-v/On	VENTMIN H	Closed
	Yes	Off	Off	Low	0-v/Off	0-v/Off	VENTMIN L	Closed
		On	Off	High	0-v/Off	0-v/Off	VENTMIN L to Full Open	Closed to Full Open
		On	On	High	Delay (b) 24-v/On	0-v/Off	Full Open	Full Open
Above Set	No	Off	Off	Low	0-v/Off	0-v/Off	VENTMIN L to VENTMAX	Closed
		On	Off	Low	24-v/On	0-v/Off	VENTMIN L to VENTMAX	Closed
		On	On	High	24-v/On	24-v/On	VENTMIN H to VENTMAX	Closed
	Yes	Off	Off	Low	0-v/Off	0-v/Off	VENTMIN L to VENTMAX	Closed
		On	Off	High	0-v/Off	0-v/Off	VENTMIN L to Full Open	Closed to Full Open
		On	On	High	Delay (b) 24-v/On	0-v/Off	Full-Open	Full-Open

(b) With 2FAN DLY (Basic Settings Menu), when in the economizing mode, there is a delay for the high speed fan to try to satisfy the call for second-stage cooling by turning on the fan to high and opening the OA dampers to 100% before the first-stage mechanical cooling is enabled.

High Performance Economizer Wiring Diagram

TYPICAL ECONOMIZER WIRING DIAGRAM - KG, KC & KH UNITS



KEY	COMPONENT
A6	CONTROL - ECONOMIZER
A7	SENSOR - OUTDOOR ENTHALPY
A62	SENSOR - INDOOR ENTHALPY
B7	MOTOR - DAMPER ECONOMIZER
J10	JACK - ECONOMIZER MOTOR
J104	JACK - SENSOR OUTDOOR
J105	JACK - SENSOR RETURN AIR
P3	PLUG - ECONOMIZER MOTOR
P4	PLUG - ECONOMIZER
P104	PLUG - SENSOR OUTDOOR
P105	PLUG - SENSOR RETURN AIR
RT26	SENSOR - OUTDOOR AIR TEMP
RT27	SENSOR - RETURN AIR TEMP

<--> DESIGNATES OPTIONAL WIRING

— — — CLASS II FIELD W

1. OUTDOOR AIR TEMP SENSOR RT26 OR OUTDOOR AIR ENTHALPY SENSOR A7 MAY BE USED.
2. FOR DIFFERENTIAL ENTHALPY SENSING USE OUTDOOR ENTHALPY SENSOR A7 AND RETURN AIR ENTHALPY SENSOR A62.
3. REFER ALSO TO MAIN UNIT WIRING DIAGRAM SECTION C.
4. PROGRAMMABLE, USE FOR SYSTEM ALARM OUTPUT.
5. FOR DIFFERENTIAL TEMPERATURE SENSING USE RT26 & RT27 SENSORS.
6. PROGRAMMABLE, USE FOR POWER EXHAUST FAN 2 OUTPUT.

E-Barometric Relief / Gravity Exhaust Dampers

C1DAMP50 (FIGURE 30) are used in downflow and LAGEDH18/24 are used in horizontal air discharge applications to provide barometric relief / gravity exhaust for the system. LAGEDH barometric relief / gravity exhaust dampers are installed in the return air plenum . The dampers must be used any time an economizer or power exhaust fans are installed.

Barometric relief / gravity exhaust dampers allow exhaust air to be discharged from the system when an economizer and/or power exhaust is operating. These dampers also prevent outdoor air infiltration during unit off cycle. See installation instructions for more detail.

F-C1PWRE10C Power Exhaust Fans

C1PWRE10C power exhaust fans are used in downflow applications only. The fans require optional downflow barometric relief / gravity exhaust dampers and K1ECON economizers. Power exhaust fans provide exhaust air pressure relief and also run when return air dampers are closed and supply air blowers are operating. FIGURE 30 shows the location of the C1PWRE. See installation instructions for more detail.

G-Control Systems

Three different types of control systems may be used. All thermostat wiring is connected to terminal block TB1 located in the control box of the unit. Each thermostat has additional control options available. See thermostat installation instructions for more detail.

1 - Electro-mechanical thermostat (13F06)

The electro-mechanical thermostat is a two-stage heat / two-stage cool thermostat with dual temperature levers. A non-switching or manual system switch subbase may be used.

2 - Electronic thermostat (see price book)

Any two-stage heat / two-stage cool electronic thermostat may be used.

3 - Honeywell T7300 thermostat (81G59)

The Honeywell T7300 thermostat is a programmable, internal or optional remote temperature sensing thermostat. The T7300 provides occupied and unoccupied changeover control.

H-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 section.

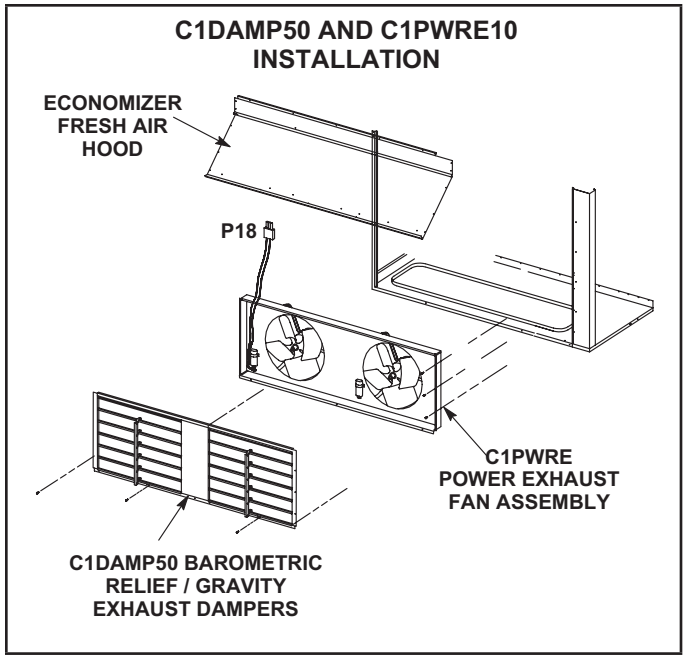


FIGURE 30

I-Indoor Air Quality (CO2) Sensor A63

The indoor air quality sensor monitors CO2 levels and reports the levels to the economizer control module A6. The board adjusts the economizer dampers according to the CO2 levels. The sensor is mounted next to the indoor thermostat or in the return air duct. Refer to the indoor air quality sensor installation instructions for proper adjustment.

J-UVC Kit

UVC germicidal lamps are a field-installed option. The lamp emits ultraviolet light that greatly reduces the growth and proliferation of mold and other bio-aerosols on illuminated surfaces. The lamp is mounted in the blower compartment with the light directed towards the indoor coil. For more details refer to the installation instructions provided with the UVC lamp.

K-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.

L-Supply Air Inverter Start-Up

NOTE - *Units equipped a Variable Frequency Drive (VFD) are designed to operate on balanced, three-phase power. Operating units on unbalanced three-phase power will reduce the reliability of all electrical components in the unit. Unbalanced power is a result of the power delivery system supplied by the local utility company. Factory-installed inverters are sized to drive blower motors with an equivalent current rating using balanced three-phase power. If unbalanced three-phase power is supplied; the installer must replace the existing factory-installed inverter with an inverter that has a higher current rating to allow for the imbalance. Refer to the installation instructions for additional information and available replacements.*

A-General

VFD units are available which provide 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. VFD units will operate at high speed during ventilation (blower "G" only signal) but can be adjusted to operate at low speed. 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.

C-Set Blower Speed During Ventilation

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 31.

NOTE - *On units equipped with an 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.*

D-Set Damper Minimum Position (Units W/ Economizer)

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 32.

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 31.

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

5 - Check the power LED on the board. See FIGURE 32.

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(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 17.

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

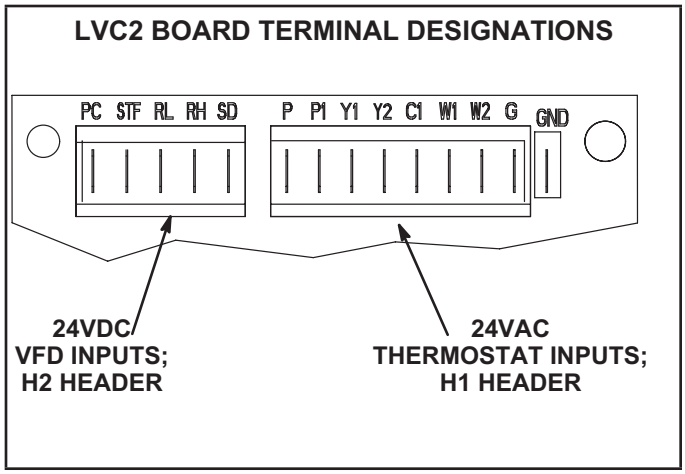


FIGURE 31

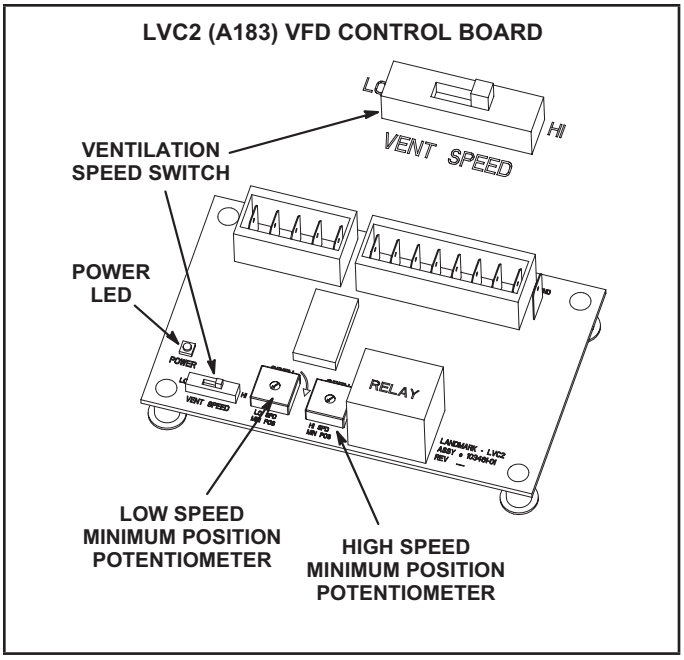
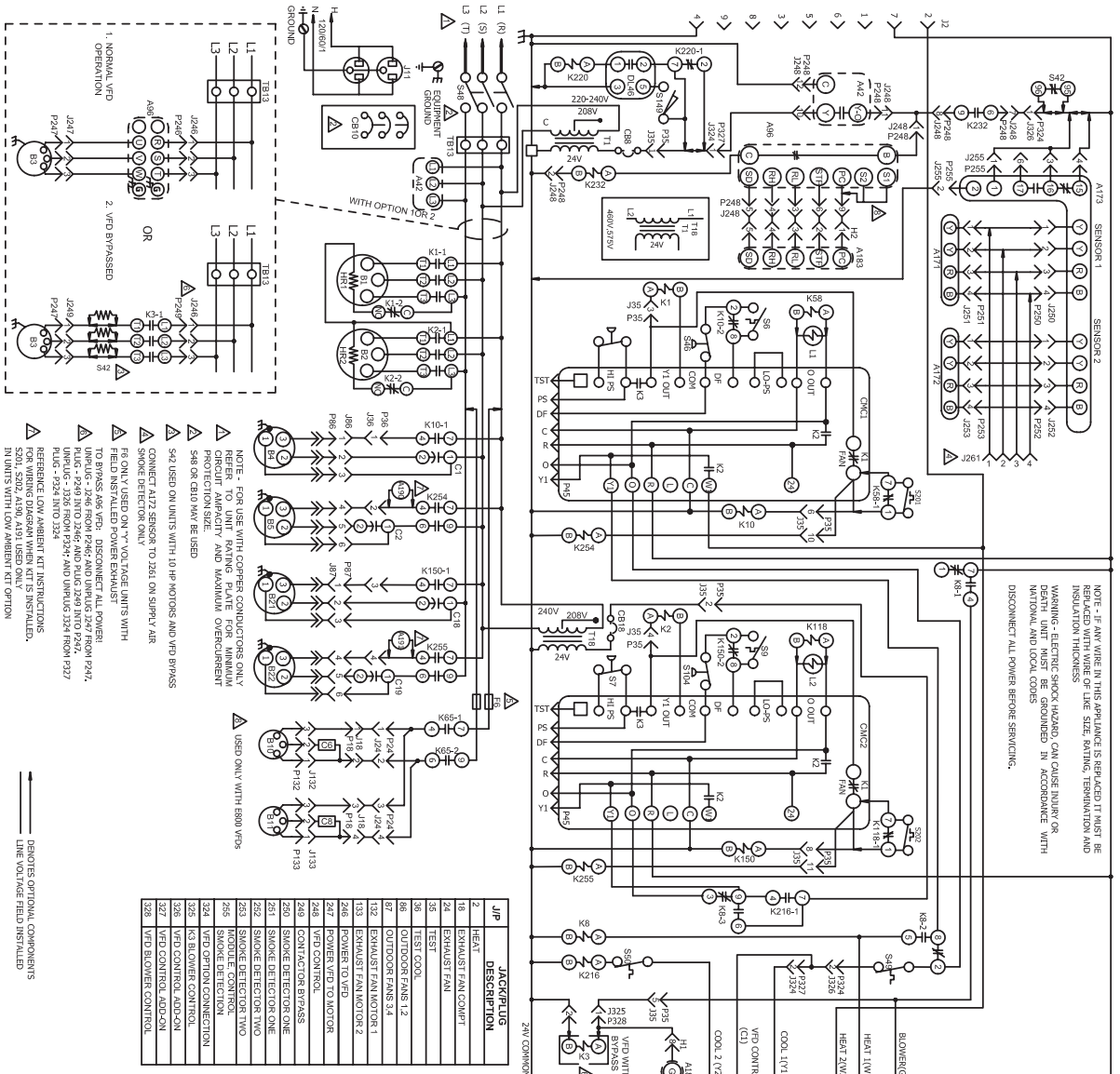


FIGURE 32

TABLE 17

OutputTerminals	Voltage	Blower Operation
RL-SD	1VDC	Low Speed
RH-SD	24VDC	
RL-SD	24VDC	High Speed
RH-SD	1VDC	
RL-SD	1VDC	Illegal Sate (replace board)
RH-SD	VDC	
RL-SD	24VDC	Blower Off (replace board)
RH-SD	24VDC	

KHC180, 240 UNIT DIAGRAM



J/P	JACK/PLUG DESCRIPTION
2	HEAT
18	EXHAUST FAN COMPT
24	EXHAUST FAN
35	TEST COOL
36	TEST COOL
86	OUTDOOR FANS 1,2
87	OUTDOOR FANS 3,4
132	EXHAUST FAN MOTOR 1
133	EXHAUST FAN MOTOR 2
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 TO MODULE SMOKE DETECTION
324	VFD OPTION CONNECTION
325	K3 BLOWER CONTROL
326	VFD CONTROL ADD-ON
327	VFD CONTROL ADD-ON
328	VFD BLOWER CONTROL

KEY	COMPONENT
A42	MONITOR, PHASE PROTECTION
A66	CONTROL INVERTER
A171	SENSOR ONE, SMOKE, RETURN AIR
A172	SENSOR TWO, SMOKE, SUPPLY AIR
A173	MODULE, CONTROL SMOKE DETECTION
A183	CONTROL, VFD BOARD
A190	PRESSURE CONTROLLER COMP 1, LOW AMBIENT KIT
A191	PRESSURE CONTROLLER COMP 2, LOW AMBIENT KIT
B1	COMPRESSOR 1
B2	COMPRESSOR 2
B3	MOTOR, BLOWER
B4	MOTOR, OUTDOOR FAN 1
B5	MOTOR, OUTDOOR FAN 2
B10	MOTOR, EXHAUST FAN 1
B11	MOTOR, EXHAUST FAN 2
B21	MOTOR, OUTDOOR FAN 3
B22	MOTOR, OUTDOOR FAN 4
C1	CAPACITOR, OUTDOOR FAN 1
C2	CAPACITOR, OUTDOOR FAN 2
C6	CAPACITOR, EXHAUST FAN 1
C8	CAPACITOR, EXHAUST FAN 2
C18	CAPACITOR, OUTDOOR FAN 3
C19	CAPACITOR, OUTDOOR FAN 4
CB8	CIRCUIT, BREAKER T1
CB10	CIRCUIT, BREAKER MAIN DISCONNECT
CB18	CIRCUIT, BREAKER T18
CMC1	TIMER, DEFROST, COMPRESSOR 1
CMC2	TIMER, DEFROST, COMPRESSOR 2
DL46	DELAY, OVERFLOW SWITCH
FE	FUSE, EXHAUST FAN
H1, H2	HEADER 2, LVC2 BOARD
HR1	HEATER, COMPRESSOR 1
HR2	HEATER, COMPRESSOR 2
J11	JACK, GFI, RECEPTICLE
J261	JACK, SMOKE DETECTOR JUMPER
K1-1,2	CONTACTOR, COMPRESSOR 1
K2-1,2	CONTACTOR, COMPRESSOR 2
K3-1	CONTACTOR, BLOWER
K8-1, 2, 3	RELAY, TRANSFER 1
K10-1,2	RELAY, OUTDOOR FAN
K58-1	RELAY, LOW AMBIENT KIT COMP 1
K58-2	RELAY, LOW AMBIENT KIT COMP 2
K65-1, 2	RELAY, EXHAUST FAN
K118-1	RELAY, LOW AMBIENT KIT FAN 3
K150-1	RELAY, OUTDOOR FAN 3
K216 -1	RELAY, COOL TWO
K203 -2	RELAY, VFD RUN
K220 -1	RELAY, OVERFLOW SWITCH
K232	RELAY, INVERTER PROTECTION
K254	RELAY, LOW AMBIENT KIT FAN 2
K255	RELAY, LOW AMBIENT KIT FAN 4
L1	VALVE, REVERSING 1
L2	VALVE, REVERSING 2
S4	SWITCH, LIMIT HI PRESS COMPRESSOR 1
S6	SWITCH, DEFROST COMPRESSOR 1
S7	SWITCH, LIMIT HI PRESS COMPRESSOR 2
S9	SWITCH, DEFROST COMPRESSOR 2
S42	SWITCH, OVERLOAD RELAY, BLOWER MOTOR
S46	SWITCH, DEFROST TERMINATION 1
S48	SWITCH, DISCONNECT
S49	SWITCH, FREEZESTAT 1
S50	SWITCH, FREEZESTAT 2
S104	SWITCH, DEFROST TERMINATION 2
S149	SWITCH, OVERFLOW
S201	SWITCH, LOW AMBIENT TEMP SENSOR 1
S202	SWITCH, LOW AMBIENT TEMP SENSOR 2
T1	TRANSFORMER, CONTROL
T18	TRANSFORMER, CONTACTOR CONTROL
TB13	TERMINAL STRIP, POWER DISTRIBUTION

2022/10

WIRING DIAGRAM

22/10

538269-01

HEAT/COOL - MSAV

KH C-BOX - 180-240S - G, J, Y VOLT

SECTION B

REV. 2

Supersedes

New Form No. 538269-01

KHC180, 240 SEQUENCE OF OPERATION G, J, M &Y

Power:

1 - Line voltage from TB13 energizes transformer T1 and T18. T1 provides 24VAC to the unit cooling, heating, blower controls, CMC1, CMC2, reversing valve L1 and TB1. T18 provides 24VAC to reversing valve L2.

Blower Operation:

2 - TB1 receives a demand from thermostat terminal G and energizes blower contactor K3 24VAC.

3 - N.O. K3 closes, energizing blower B3.

Optional Power Exhaust Operation:

4 - The economizer control module receives a demand and energizes exhaust fan relay K65 with 24VAC at 50% outside air damper open (adjustable).

5 - N.O. K65-1 and N.O. K65-2 both close, energizing exhaust fan motors B10 and B11.

1st Stage Cooling (compressor B1)

6 - First stage cooling demand routed from thermostat provides 24VAC to Y1 and G on TB1. G energizes blower (see step 3-)

7 - 24VAC routed from T1 energizes reversing valve L1.

8 - 24VAC routed from CMC1 proving N.C. high pressure switch S4 and N.C. freezestat S49. Compressor contactor K1 is energized.

9 - K1 closes energizing compressor B1.

10 - N.O. contacts K10 and K254 close energizing condenser fan B4 and B5 respectively.

2nd Stage Cooling (compressor B2 is energized)

11 - Second stage cooling demand energizes Y2.

12 - 12- 24VAC routed from T18 energizes reversing valve L2.

13 - 24VAC is routed from CMC2 proving N.C. high pressure switch S7 to energize compressor contactor K2.

14 - N.O. K2 closes energizing compressor B2.

15 - N.O. contacts K150 and K255 close energizing condenser fan B21 and B22 respectively.

First Stage Heat (compressors B1 and B2)

NOTE: *On first heating demand after unit has been in cooling mode, unit will de-energize reversing valves L1 and L2.*

16 - Heating demand energizes W1 in the thermostat.

17 - CMC1 and CMC2 prove N.C. high pressure switches S4 and S7 and N.C. freezestats S49 and S50; compressor contactors K1 and K2 are energized.

18 - K1 and K2 close energizing compressor B1 and B2.

19 - K10, K254, K150 and K255 close energizing outdoor fans B4, B5, K21 and K22 respectively.

Second Stage Heat (electric heat):

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

21 - See sequence of operation for electric heat.

Defrost Mode

22 - 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).

23 - When defrost begins, the reversing valve L1 or L2 is energized. Supplemental electric heat (W2) is energized when stage 1 is in defrost mode.

24 - When L1 energizes outdoor fan relays K10 and K254, outdoor fans B4 and B5 are de-energized. When L2 energizes outdoor fan relay K150 and K255, outdoor fans B21 and B22 are de-energized.

25 - 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.

MSAV BLOWER OPERATION

Cooling and heating operate the same as non-MSAV units except for blower operation.

During ventilation, the blower speed is determined by the low/high switch on the A183 VFD control board.

During heating, the blower operates on high speed. See TABLE 18 for blower speed during cooling.

TABLE 18

Diagram Reference No.	Diagram Reference No.	Thermostat Demand	A183 Terminals Energized	Blower Speed
1	Not Suitable (or no economizer)	Y1	Y1 and C1*	Low
2	Suitable	Y1	Y1	High
3	Not Suitable (or no economizer)	Y1 and Y2	Y1, C1* and Y2	High
4	Suitable	Y1 and Y2	Y1, C1* and Y2	High

*C1 is energized via A6 enthalpy control.

Y1 thermostat demand, outdoor air NOT suitable for free cooling (or no economizer):

1 - 24v is routed to A183 VFD control board Y1 and C1 (via A6-2) terminals. A183 operates the blower in low speed.

Y1 thermostat demand, outdoor air SUITABLE for free cooling:

2 - 24v is routed to A183 VFD control board Y1 terminal. A183 operates the blower in high speed.

Y1 and Y2 thermostat demand, outdoor air NOT suitable for free cooling (or no economizer)

3 - 24v is routed to A183 VFD control board Y1, Y2 and C1 (via A6-2) terminals. A183 operates the blower in high speed.

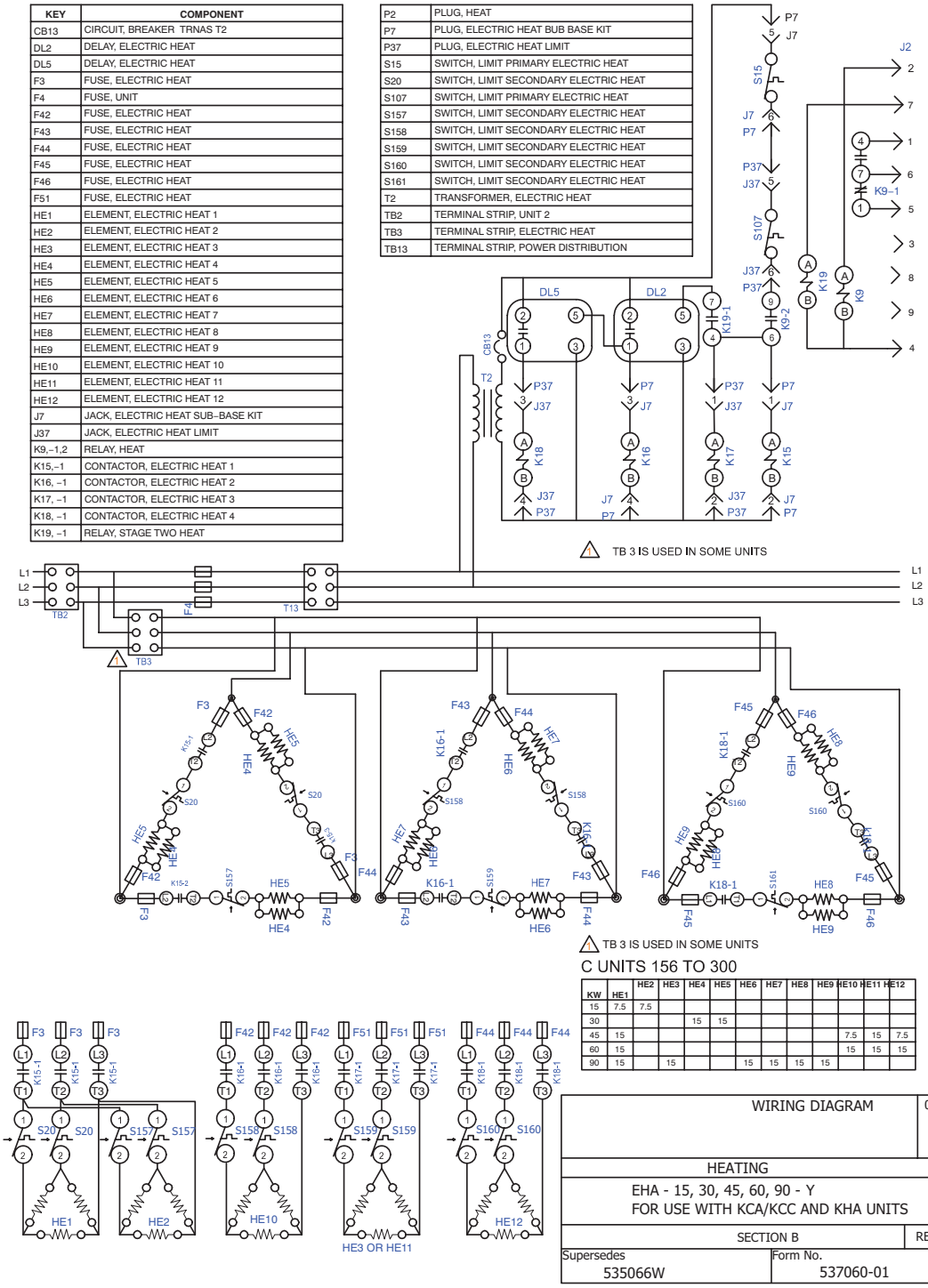
Y1 and Y2 thermostat demand, outdoor air SUITABLE for free cooling:

4 - 24v is routed to A183 VFD control board Y1, Y2 and C1 (via A6-3) terminals. A183 operates the blower in high speed.

EHA-15, 30, 45, 60, 90kW Y VOLTAGE

KEY	COMPONENT
CB13	CIRCUIT, BREAKER TRNAS T2
DL2	DELAY, ELECTRIC HEAT
DL5	DELAY, ELECTRIC HEAT
F3	FUSE, ELECTRIC HEAT
F4	FUSE, UNIT
F42	FUSE, ELECTRIC HEAT
F43	FUSE, ELECTRIC HEAT
F44	FUSE, ELECTRIC HEAT
F45	FUSE, ELECTRIC HEAT
F46	FUSE, ELECTRIC HEAT
F51	FUSE, ELECTRIC HEAT
HE1	ELEMENT, ELECTRIC HEAT 1
HE2	ELEMENT, ELECTRIC HEAT 2
HE3	ELEMENT, ELECTRIC HEAT 3
HE4	ELEMENT, ELECTRIC HEAT 4
HE5	ELEMENT, ELECTRIC HEAT 5
HE6	ELEMENT, ELECTRIC HEAT 6
HE7	ELEMENT, ELECTRIC HEAT 7
HE8	ELEMENT, ELECTRIC HEAT 8
HE9	ELEMENT, ELECTRIC HEAT 9
HE10	ELEMENT, ELECTRIC HEAT 10
HE11	ELEMENT, ELECTRIC HEAT 11
HE12	ELEMENT, ELECTRIC HEAT 12
J7	JACK, ELECTRIC HEAT SUB–BASE KIT
J37	JACK, ELECTRIC HEAT LIMIT
K9,–1,2	RELAY, HEAT
K15,–1	CONTACTOR, ELECTRIC HEAT 1
K16, –1	CONTACTOR, ELECTRIC HEAT 2
K17, –1	CONTACTOR, ELECTRIC HEAT 3
K18, –1	CONTACTOR, ELECTRIC HEAT 4
K19, –1	RELAY, STAGE TWO HEAT

P2	PLUG, HEAT
P7	PLUG, ELECTRIC HEAT BUB BASE KIT
P37	PLUG, ELECTRIC HEAT LIMIT
S15	SWITCH, LIMIT PRIMARY ELECTRIC HEAT
S20	SWITCH, LIMIT SECONDARY ELECTRIC HEAT
S107	SWITCH, LIMIT PRIMARY ELECTRIC HEAT
S157	SWITCH, LIMIT SECONDARY ELECTRIC HEAT
S158	SWITCH, LIMIT SECONDARY ELECTRIC HEAT
S159	SWITCH, LIMIT SECONDARY ELECTRIC HEAT
S160	SWITCH, LIMIT SECONDARY ELECTRIC HEAT
S161	SWITCH, LIMIT SECONDARY ELECTRIC HEAT
T2	TRANSFORMER, ELECTRIC HEAT
TB2	TERMINAL STRIP, UNIT 2
TB3	TERMINAL STRIP, ELECTRIC HEAT
TB13	TERMINAL STRIP, POWER DISTRIBUTION



C UNITS 156 TO 300

KW	HE1	HE2	HE3	HE4	HE5	HE6	HE7	HE8	HE9	HE10	HE11	HE12
15	7.5	7.5										
30				15	15							
45	15									7.5	15	7.5
60	15									15	15	15
90	15		15			15	15	15	15			

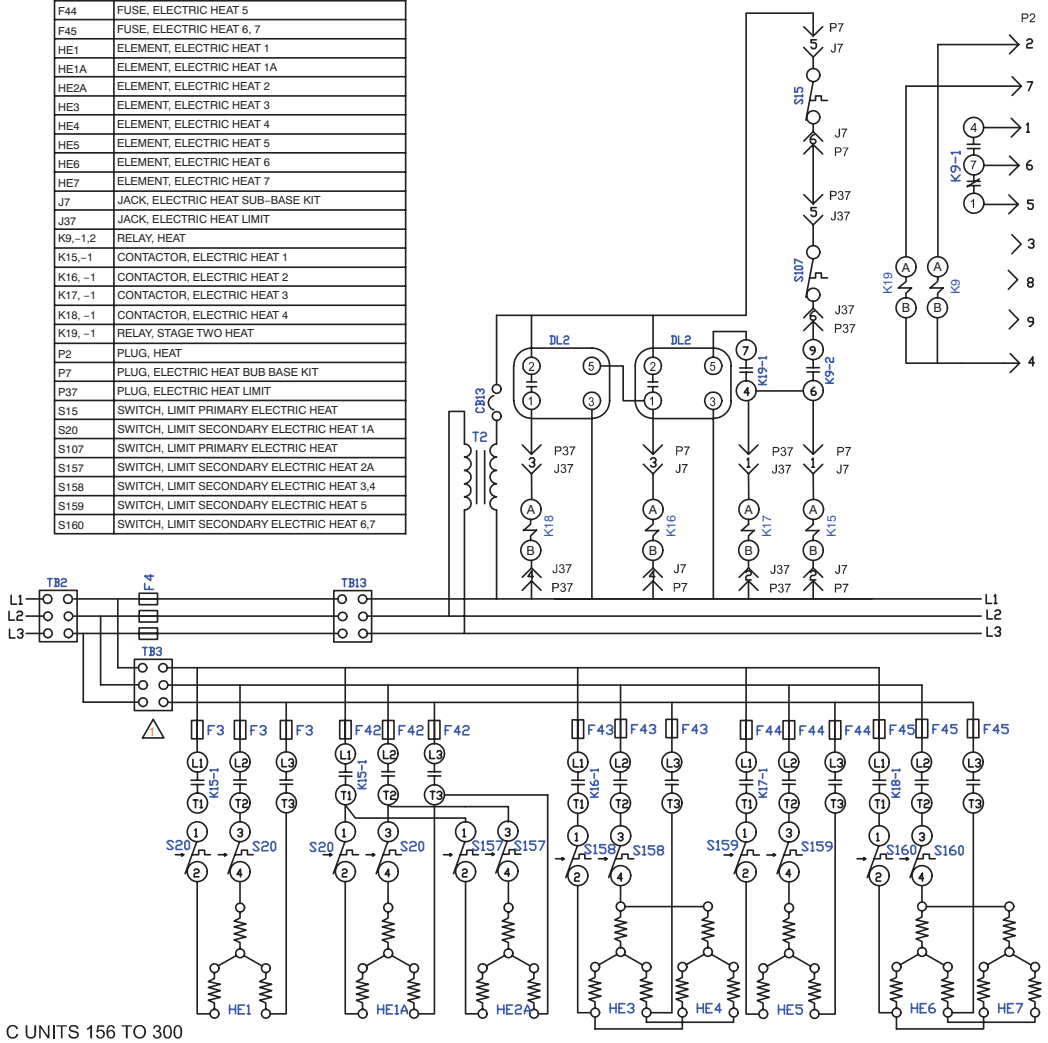
WIRING DIAGRAM	02/18
HEATING	
EHA - 15, 30, 45, 60, 90 - Y FOR USE WITH KCA/KCC AND KHA UNITS	
SECTION B	REV. 3
Supersedes: 535066W	Form No.: 537060-01

EHA-15, 30, 45, 60, 90kW - G, J, M VOLTAGE

KEY	COMPONENT
CB13	CIRCUIT, BREAKER TRNAS T2
DL2	DELAY, ELECTRIC HEAT
DL5	DELAY, ELECTRIC HEAT
F3	FUSE, ELECTRIC HEAT 1, 1A, 2A
F4	FUSE, UNIT
F43	FUSE, ELECTRIC HEAT 3, 4
F44	FUSE, ELECTRIC HEAT 5
F45	FUSE, ELECTRIC HEAT 6, 7
HE1	ELEMENT, ELECTRIC HEAT 1
HE1A	ELEMENT, ELECTRIC HEAT 1A
HE2A	ELEMENT, ELECTRIC HEAT 2
HE3	ELEMENT, ELECTRIC HEAT 3
HE4	ELEMENT, ELECTRIC HEAT 4
HE5	ELEMENT, ELECTRIC HEAT 5
HE6	ELEMENT, ELECTRIC HEAT 6
HE7	ELEMENT, ELECTRIC HEAT 7
J7	JACK, ELECTRIC HEAT SUB-BASE KIT
J37	JACK, ELECTRIC HEAT LIMIT
K9,-1,2	RELAY, HEAT
K15,-1	CONTACTOR, ELECTRIC HEAT 1
K16, -1	CONTACTOR, ELECTRIC HEAT 2
K17, -1	CONTACTOR, ELECTRIC HEAT 3
K18, -1	CONTACTOR, ELECTRIC HEAT 4
K19, -1	RELAY, STAGE TWO HEAT
P2	PLUG, HEAT
P7	PLUG, ELECTRIC HEAT BUB BASE KIT
P37	PLUG, ELECTRIC HEAT LIMIT
S15	SWITCH, LIMIT PRIMARY ELECTRIC HEAT
S20	SWITCH, LIMIT SECONDARY ELECTRIC HEAT 1A
S107	SWITCH, LIMIT PRIMARY ELECTRIC HEAT
S157	SWITCH, LIMIT SECONDARY ELECTRIC HEAT 2A
S158	SWITCH, LIMIT SECONDARY ELECTRIC HEAT 3,4
S159	SWITCH, LIMIT SECONDARY ELECTRIC HEAT 5
S160	SWITCH, LIMIT SECONDARY ELECTRIC HEAT 6,7

T2	TRANSFORMER, ELECTRIC HEAT
TB 2	TERMINAL STRIP, UNIT 2
TB 3	TERMINAL STRIP, ELECTRIC HEAT
TB15	TERMINAL STRIP, UNIT 2

⚠ TB3 IS USED IN SOME UNITS



C UNITS 156 TO 300

KW	HE1	HE1A	HE2A	HE3	HE4	HE5	HE6	HE7
15		7.5	7.5					
30		15	15					
45	15			7.5		15	7.5	
60	15			15		15	15	
90	15			15	15	15	15	15

WIRING DIAGRAM	02/18
HEATING	
EHA - 15,30,45,60,90 - G,J FOR USE WITH KCA/KCC AND KHA UNITS	
SECTION B	REV. 1
Supersedes	New Form No. 537059-02

NOTE: *This sequence of operation is for all Electric Heat kW ratings Y, G, J and M voltages.*

HEATING ELEMENTS:

1 - Terminal Strip TB2 supplies power to TB3. TB3 supplies line voltage to electric heat elements HE1 through HE7 in G, J and M volt units. TB3 supplies line voltage to electric heat elements HE1 through HE12 in Y volt units. Each element is protected by fuse F3.

SECOND STAGE HEAT DEMAND:

Heating demand initiates at W2 in thermostat.

2 - 24VAC is routed from T2, proving N.C. primary limits S15 (first heat section) and S107 (second heat section). Voltage then energizes contactors K15 and K17. 24VAC is routed through P2 energizing relays K9 and K19. N.O. K9-2 and K19-1 close.

3 - N.O. contact K15-1 closes allowing the first bank of elements to be energized. N.O. K17-1 closes allowing the second bank of elements to be energized.

4 - Relay K19 is energized. N.O. contacts K19-1 close energizing timer DL2.

With the first stage heat operating, an additional heating demand initiates at W2 in the thermostat.

5 - After a 30 second delay, DL2 closes energizing contactor K16 and timer DL5.

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

7 - After a 30 second delay, DL5 closes energizing contactorK18. K18-1 closes allowing the fourth bank of elements to be energized.

SECOND STAGE HEAT DEMAND SATISFIED:

Heating demand is satisfied. Terminal W2 in the thermostat is de-energized.

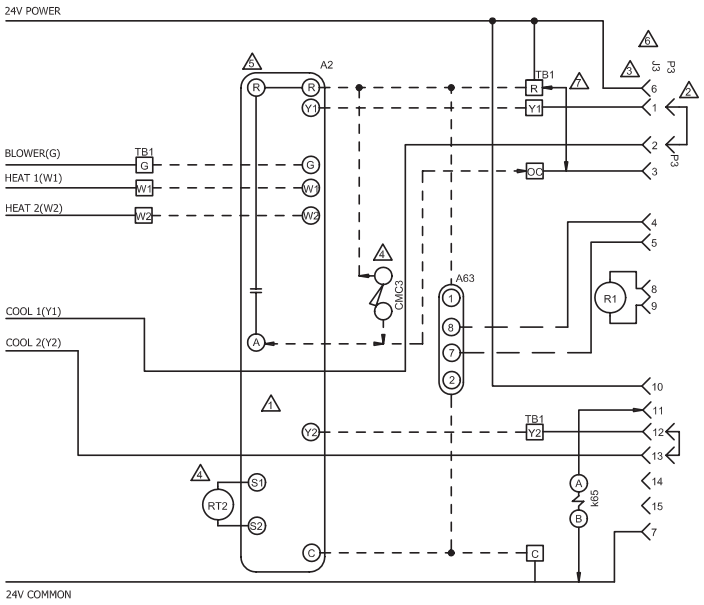
8 - Electric heat contactors K15 and K17 are de-energized.

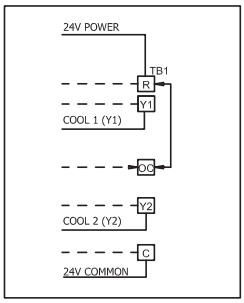
9 - The second and first set of elements are de-energized.

10 - Electric heat contactors K16 and K18 are de-energized.

11 - The fourth and third set of elements are de-energized. Heating demand is satisfied. Terminal W2 in the thermostat is de-energized.

ELECTRONIC OR ELECTROMECHANICAL THERMOSTAT





CONNECTION SCHEME FOR KCA, KGA AND KHA 092 THROUGH 150 UNITS WITHOUT ECONOMIZER ONLY

KEY	COMPONENT
A2	SENSOR, ELECTRONIC THERMOSTAT
A63	SENSOR, CO2
CMC3	CLOCK, TIME
J3	JACK, UNIT ECONOMIZER
K65	RELAY, EXHAUST FAN
P3	PLUG, ECONOMIZER BYPASS
R1	SENSOR, MIXED AIR OR SUPPLY AIR
RT2	SENSOR, REMOTE THERMOSTAT
TB1	TERMINAL STRIP, CLASS II VOLTAGE

1. THERMOSTAT SUPPLIED BY USER
2. REMOVE P3 WHEN ECONOMIZER IS USED, ONLY ON KCA, KGA AND KHA 180 THROUGH 300 UNITS.
3. J3 MAXIMUM LOAD 20VA 24VAC CLASS II
4. TIME CLOCK CONTACTS (OPT) CLOSED OCCUPIED
5. TOUCHSCREEN THERMOSTAT
6. J3 AND P3 ARE NOT USED ON KCA, KGA AND KHA 092 THROUGH 150 UNITS WITHOUT ECONOMIZER
7. REMOVE JUMPER BETWEEN TB1-R AND TB1-OCP WHEN USING A NITE SETBACK THERMOSTAT

DENOTES OPTIONAL COMPONENTS
CLASS II FIELD WIRING

LANDMARK WIRING DIAGRAM	10/11
ACCESSORIES	
ELECTRONIC OR ELECTROMECHANICAL THERMOSTAT	
SECTION C	REV 0
Supersedes	New Form No. 537077-02

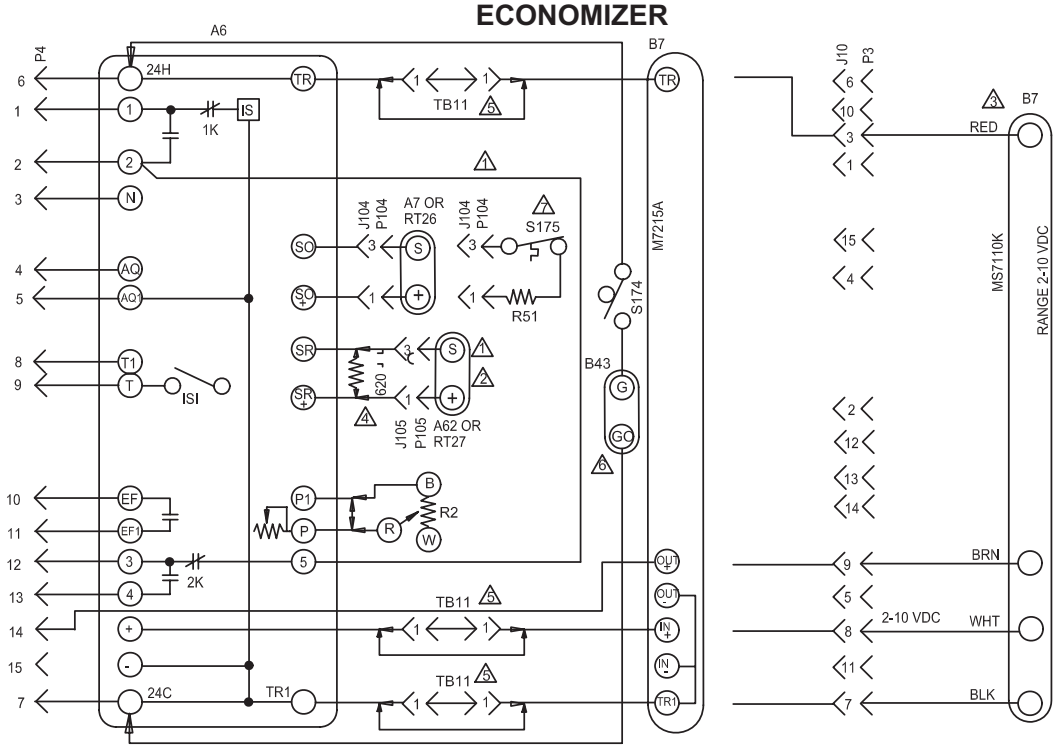
POWER:

1- Terminal strip TB1 found on the control panel energizes thermostat components with 24VAC.

OPERATION:

2- TB1 receives data from the electronic thermostat A2 (Y1, Y2, W1, W2, G, OCP)
TB1 energizes the appropriate components for heat or cool demand.

ECONOMIZER



DESCRIPTION	
KEY	COMPONENT
A6	CONTROL-SOLID STATE ENTHALPY
A7	SENSOR-SOLID STATE ENTHALPY
A62	SENSOR-ENTHALPY, INDOOR
B7	MOTOR-DAMPER, ECONOMIZER
B43	MOTOR-EXHAUST DAMPER
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
S174	SWITCH-EXHAUST DAMPER
TB11	TERMINAL STRIP-CLASS II VOLT

7 OPTIONAL OUTDOOR THERMOSTAT TO REPLACE RT26 SENSIBLE SENSOR

6 OPTIONAL EXHAUST DAMPER TO HOLD EXHAUST DAMPER CLOSED WHEN OUTSIDE AIR DAMPER IS CLOSED

5 TB11 USED ON "C" BOX ONLY WITH MOTOR M7215A

4 REPLACE A7 OR RT26 WITH 620 OHM RESISTOR FOR CONTROLS WITH GLOBAL ECON

3 USED ON C BOX UNITS

2 A62 ENTHALPY SENSOR OR RT27 USED FOR DIFFERENTIAL SENSING

1 RT26 AND RT27, TEMPERATURE SENSORS MAY BE USED INSTEAD OF A7 AND A62 ENTHALPY SENSORS

DESIGNATES OPTIONAL WIRING

CLASS II FIELD WIRING

WIRING DIAGRAM	5/09
ACCESSORIES	
ECONOMIZER	
ECONOMIZER SECTION D1	
Supersedes Form No.	New Form No. 537080-01

SEQUENCE OF OPERATION

POWER:

1- Economizer control module A6 is energized through P4 when contactor K3 is energized.

OPERATION:

2- Temperature sensor S175 or enthalpy sensor A7 and A62 (if differential enthalpy is used) communicates to the economizer control module A6 when to power the damper motor B7.

3- Economizer control module A6 supplies B7 with 0 - 10 VDC to control the positioning of economizer.

4- The damper actuator provides 2 to 10 VDC position feedback.