MS Series

MEDIUM PROFILE UNIT COOLERS

Installation and Operation Manual

Part Number: E270190_H

Products that provide lasting solutions.

BEFORE YOU BEGIN

Read these instructions completely and carefully.

ANSI Z535.5 DEFINITIONS

- DANGER – Indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury.
- WARNING – Indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury.
- CAUTION – Indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury.
- NOTICE – Not related to personal injury – Indicates[s] situations, which if not avoided, could result in damage to equipment.

Environmental Concerns

Hussmann recommends responsible handling of refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those that contain Hydrogen, Chlorine, Fluorine, and Carbon (HCFCs). Only certified technicians may handle these refrigerants. All technicians must be aware and follow the requirements set forth by the Federal Clean Air Act (Section 608) for any service procedure being performed on this equipment that involves refrigerant. Additionally, some states have other requirements that must be adhered to for responsible management of refrigerants.

FOR CALIFORNIA INSTALLATIONS ONLY:

WARNING:

Cancer and Reproductive Harm
www.P65Warnings.ca.gov

August 31, 2018 3069575

This warning does not mean that Hussmann products will cause cancer or reproductive harm, or is in violation of any product-safety standards or requirements. As clarified by the California State government, Proposition 65 can be considered more of a 'right to know' law than a pure product safety law. When used as designed, Hussmann believes that our products are not harmful. We provide the Proposition 65 warning to stay in compliance with California State law. It is your responsibility to provide accurate Proposition 65 warning labels to your customers when necessary. For more information on Proposition 65, please visit the California State government website.

WARNING

PERSONAL PROTECTION EQUIPMENT (PPE)

Only qualified personnel should install and service this equipment. Personal Protection Equipment (PPE) is required whenever servicing this equipment. Wear safety glasses, gloves, protective boots or shoes, long pants, and a long-sleeve shirt when working with this equipment. Observe all precautions on tags, stickers, labels and literature attached to this equipment.

CAUTION

This manual was written in accordance with originally prescribed equipment that is subject to change. Hussmann reserves the right to change all or part of the equipment for future stores such as, but not limited to, controllers, valves and electrical specifications. It is the installers responsibility to reference the refrigeration drawings supplied for each installation, as directed by the Engineer of Record.

CAUTION

Contractors shall strictly adhere to specifications provided by the Engineer of Record (EOR), as well as US Environmental Protection Agency regulations, OSHA regulations, and all other federal, state and local codes. This work should only be done by qualified, li- censed contractors. There are numerous hazards, not limited to, but including: burns due to high temperatures, high pressures, toxic substances, electrical arcs and shocks, very heavy equipment with specific lift points and structural constraints, possible acid exposure, food and product damage, public safety, noise, and possible environmental damage. Never leave operating compressors unattended during the manual soft-start process. Always power rocker switches off when unattended.

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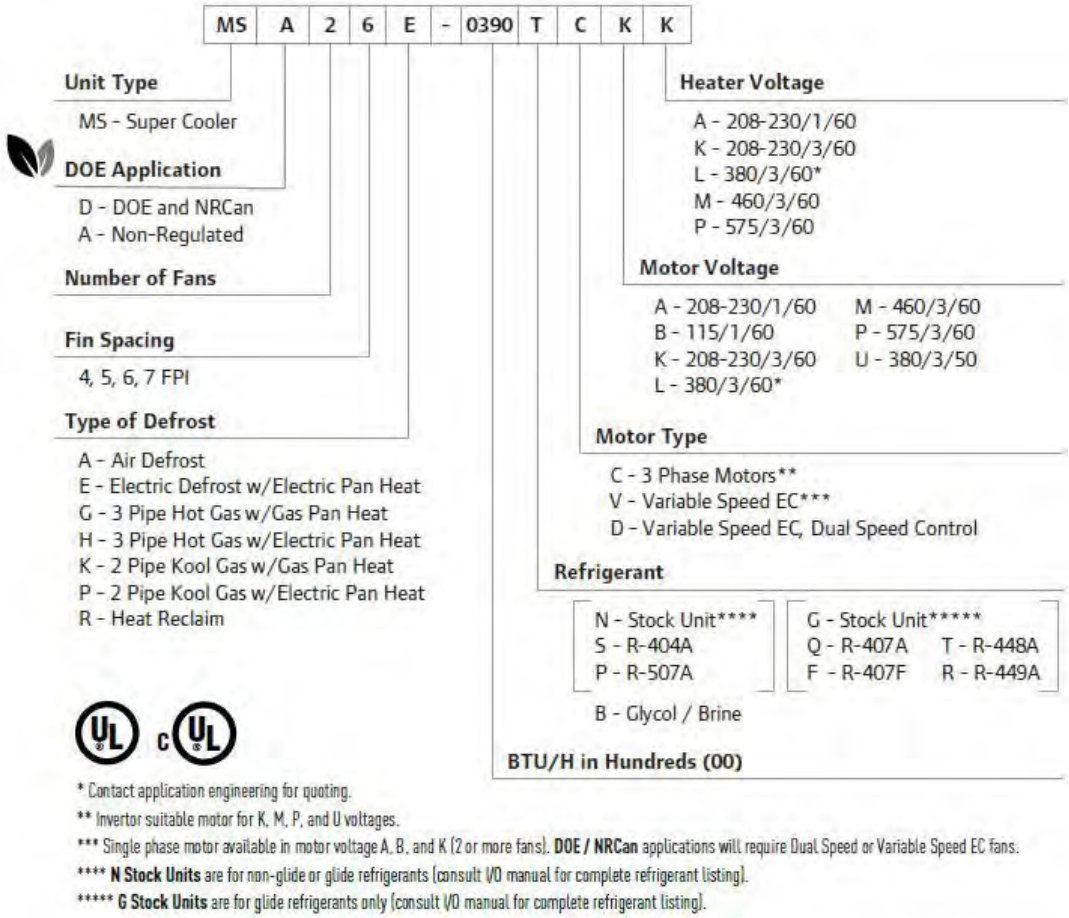
FIGURES

1 UNIT INFORMATION AND DIMENSIONS

1.1 *MODELS COVERED*

MS Series medium profile unit coolers.
The MS series designed for walk-in coolers with ceiling heights of 10 to 14 feet that require high airflow.
The MS series handles medium to low temperature requirements and has three defrost options – air, electric and hot gas. Consult the drawing that was sent with each unit to determine the temperature and defrost type.



Additional refrigerants are shown in the TABLE classified as Glide and Non-Glide for selection of two speed or variable speed motors to meet DOE/NRCan regulations.

Glide Refrigerants	
Dewpoint to bubble	TD
R-401A	9.8
R-401B	9.4
R-407A	10.5
R-407F	10.6
R-407H	11.4
R-409A	14.8
R-409B	13.5
R-417A	7.6
R-422A	7
R-422D	7
R-438A	10.8
R-448A	10.5
R-449A	9.7

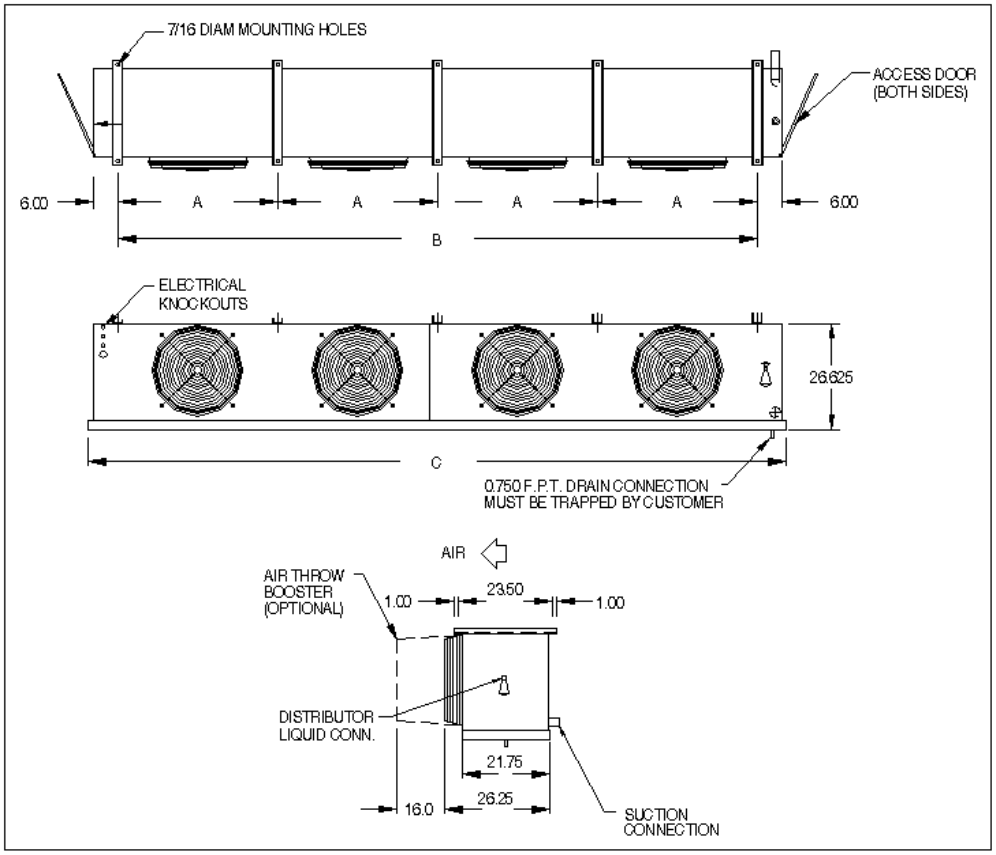
Non-glide refrigerants	
Dewpoint to bubble	TD
R-134a	0
R-22	0
R-402A (HP80)	2.6
R-402B	3.1
R-404A	1
R-408A	0.7
R-410A	0.2
R-502	0
R-507A	0
R-513A	0.1

1.2 *UNIT DIMENSIONS*

TABLE 1: UNIT DIMENSIONS

Fan Q-ty	A	B	C
1	45.00	45.00	57.00
2	45.00	90.00	102.00
3	39.00	117.00	129.00
4	39.00	156.00	168.00

FIGURE 1: UNIT DIMENSIONS



2 RECEIPT OF EQUIPMENT

2.1 *INSPECTION*

All equipment should be carefully checked for damage or shortages as soon as it is received. Each shipment should be carefully checked against the bill of lading. If any damage or shortage is evident, a notation must be made on the delivery receipt before it is signed and a claim should then be filed against the freight carrier.

2.2 *LOSS OF GAS HOLDING CHARGE*

Each unit cooler is leak tested, evacuated to remove moisture and then shipped with a gas holding charge. Absence of this charge may indicate a leak has developed in transit. The system should not be charged with refrigerant until it is verified that there is no leak or the source of the leak is located.

3 ASSEMBLY OF COMPONENTS

3.1 *SHIPPED LOOSE PARTS - LONG THROW ADAPTERS*

Long Throw Adapters are shipped loose. They should be mounted on the unit before the unit is installed. The evaporator fan cabinet contains through-bolts with the threaded end pointing out away from the fan cabinet. The bolts have two ½" nuts, flat washers, and a lock washer on them. Remove the outer most nut, lock washer, and one flat washer on each bolt. Place Long Throw Adapter on the top bolts braced against the remaining flat washer. While holding the adapter with one hand place the flat washers, then the lock washers, and then thread the nuts on the top two bolts to hold the guard and adapter in place. Repeat procedure on the bottom two bolts. Secure with a wrench.

3.2 *REFRIGERANT DISTRIBUTOR NOZZLES*

Direct expansion unit coolers are piped using a refrigerant distributor with a **changeable nozzle** design to equally distribute refrigerant to each circuit of the evaporator coil. Distributor nozzles are installed at the factory.

The nozzles provided with the unit have been selected for design conditions of 10°F T.D. and 95°F liquid refrigerant at the expansion valve inlet or the conditions supplied to the factory at the time of order. If the unit will be operated at conditions that are substantially different from these conditions, it may be necessary to select a different size nozzle. Contact the factory for advice.

The nozzle must be installed in the distributor or the auxiliary side connector before installing the expansion valve. There are nozzle identification numbers stamped on one side of the nozzle. Be sure to insert the nozzle into the distributor with these numbers visible in case identification is required later. The nozzle is held in place by a retainer ring that is easily inserted or removed with a pair of needle nose pliers.

3.3 *EXPANSION VALVE*

Before mounting the unit, install the expansion valve and connect the equalizer tube. The expansion valve should be installed directly to the distributor body or as close as possible with no elbows or bends. Locate the expansion valve bulb on a horizontal length of suction line as close to the suction header as possible. Position the bulb in a 3, 4 or 8, 9 o'clock position (do not position on the bottom side of the pipe). Clamp the bulb down flush and tight against the pipe and insulate. Never locate the bulb in a trap or downstream from a trap.

Expansion valves are adjusted at the factory prior to shipment. The setting will be correct for many applications, but in other applications adjustments may be needed. It is important that the operation of the expansion valve be checked after the system has balanced out at the desired room temperature. If the coil is being starved it is necessary to reduce the superheat setting of the valve by turning the adjusting stem counter-clockwise. If the superheat is too low it is necessary to increase the superheat setting of the valve by turning the adjusting stem clockwise. It is recommended that for a 10°F to 12°F T.D. system, the valve should be adjusted to maintain 5°F to 6°F superheat.

3.4 *CHECK VALVE*

Check valves kit brazed to the pipe at the field, refer to FIGURE 6.

TABLE 2: CHECK VALVES KITS

Model	Check Valve Kit	Gas Inlet Diameter
166, 178, 195, 212, 223, 239, 323, 356, 390, 424	CE269381	0.500
444, 445, 487, 502, 532		0.875
594, 602, 643, 669, 685, 710, 803, 858, 914	CE269382	0.875

4 RIGGING INSTRUCTIONS

4.1 *RIGGING INSTRUCTIONS*

MS units tend to be a long and heavy object. Jobsite requirements will affect the method of moving and lifting the unit into place. Carefully consider the support that is required to lift and move the unit. Under no circumstances should the shipping skid be used for lifting the unit. To ensure that the unit is not bowed or damaged when being lifted into place from above, all leg or hanger points should be used. If the unit is being lifted into place from underneath, a level support directly under all of the shipping legs is required to adequately steady the unit as it is lifted to the hanger rods.

5 UNIT LOCATION AND MOUNTING

5.1 *UNIT LOCATION*

Unit coolers must be located to provide good air circulation to all areas of the cooler. The unit cooler should be positioned to blow away from the wall and directed down an aisle rather than into and through shelves. For best performance it is desirable to arrange the air discharge toward the door of the cooler to minimize the entrance of warm moist air when the door is open. Light fixtures, shelving and product boxes must be located so that they do not block the air intake or air discharge from the unit cooler.

IMPORTANT:
The coil face must be located a minimum of 27” from the wall to assure unrestricted air intake.

5.2 *MOUNTING*

Install the expansion valve and equalizer connection before hanging the unit cooler. See section 2.3.

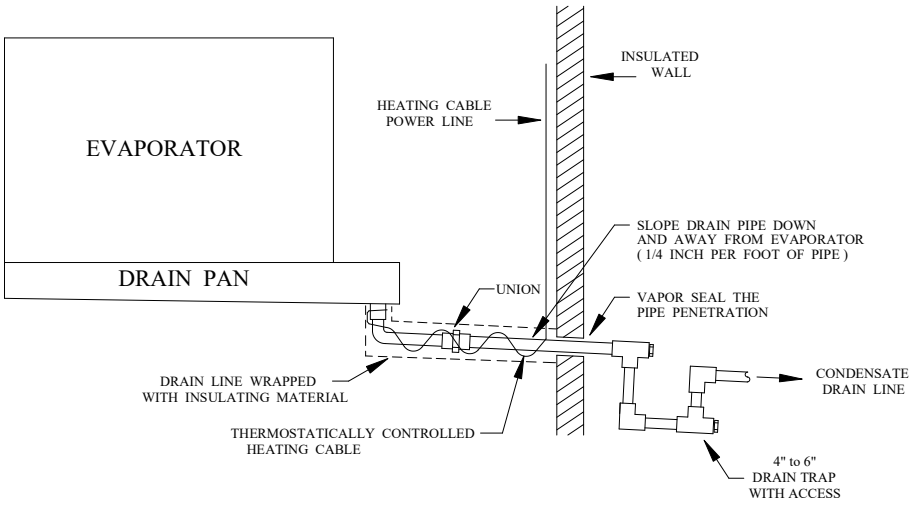
The unit cooler should be suspended with 3/8” diameter rods. Rods should have double nuts on the top and bottom. Adequate support must be provided to hold the weight of the unit.
The unit must be mounted so that the drain pan end is approximately 1” lower than the bottom of the electrical end of the unit. If mounted to a level ceiling the hanging brackets provide the slope. Mount to ceiling with hanging brackets provided. Suspended units must have sufficient clearance above the unit for cleaning the top. Remove shipping legs after installation.

6 PIPING INSTALLATION

6.1 *DRAIN LINE*

The drain line should be as short and as steeply pitched as possible with a minimum of ¼" drop per running foot. A drain line trap should be installed to prevent warm moist air from migrating through the drain line. If the temperature surrounding the drain line and trap is below freezing (32°) it must be wrapped with a drain line heater and insulation. Be sure to also wrap the drain pan coupling. The drain line heater must be energized continuously. Be sure to follow the manufacturer's recommendation when installing the drain line heat tape.

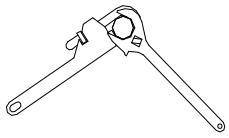
FIGURE 2: Drain Line



A union at the drain connection in the drain pan is recommended for ease of installation and future servicing. The union should be located as close to the drain pan as possible, but outside the drain pan space. Use two wrenches when tightening to prevent the drain fitting from twisting and damaging the unit.

Use drain line hangers to avoid damage to the drain pan with long runs of drain line, i.e. more than a few feet.

FIGURE 3: PIPE JOINING



6.2 *REFRIGERATION PIPING*

System design must conform to all local and national codes, laws and regulations applying to the site of installation. In addition, the safety code for mechanical refrigeration, ASME B31.5, should be followed as a guide to safe installation and operation practice.

Refrigerant line sizes and piping techniques should be obtained from the ASHRAE guide or equivalent reference. Under no circumstances should the refrigerant connection size of the unit be used as the basis for sizing the lines.

The horizontal suction line should slope away from the unit cooler toward the compressor. Vertical suction risers may require a trap at the bottom of the riser for proper oil return.

When connecting multiple unit coolers in series using a common suction line, the branch suction lines must enter the top of the common suction line. The branch lines must be sized for the evaporator capacity and the common suction line to be sized for the total system capacity.

To properly protect and control systems using pumped liquid overfeed R744, the solenoid, isolation, and pressure relief valves shall be arranged as shown in either FIGURE 4 or 5, according to the solenoid valve arrangement. To handle the requirements of liquid R744 high pressure solenoid valves are to be used.

FIGURE 4: MULTIPLE UNIT COOLERS CONTROLLED BY A SINGLE SOLENOID

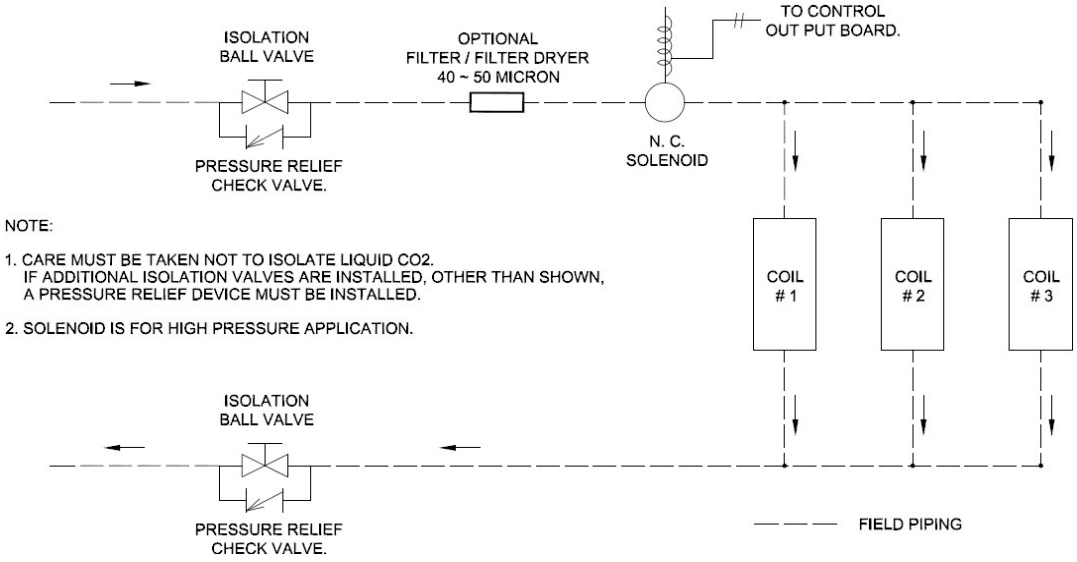
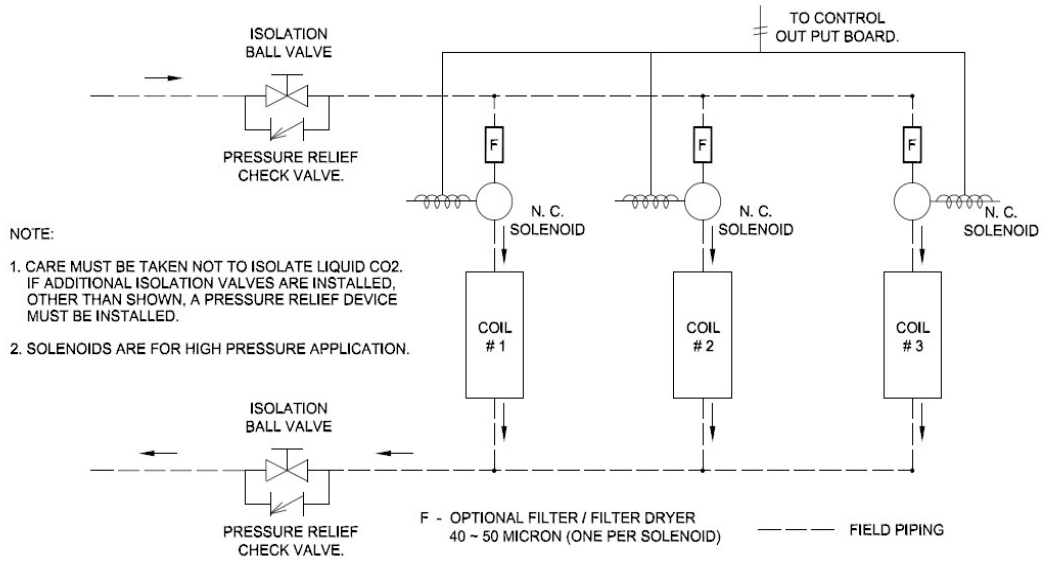


FIGURE 5: MULTIPLE UNIT COOLERS CONTROLLED BY MULTIPLE SOLENOIDS



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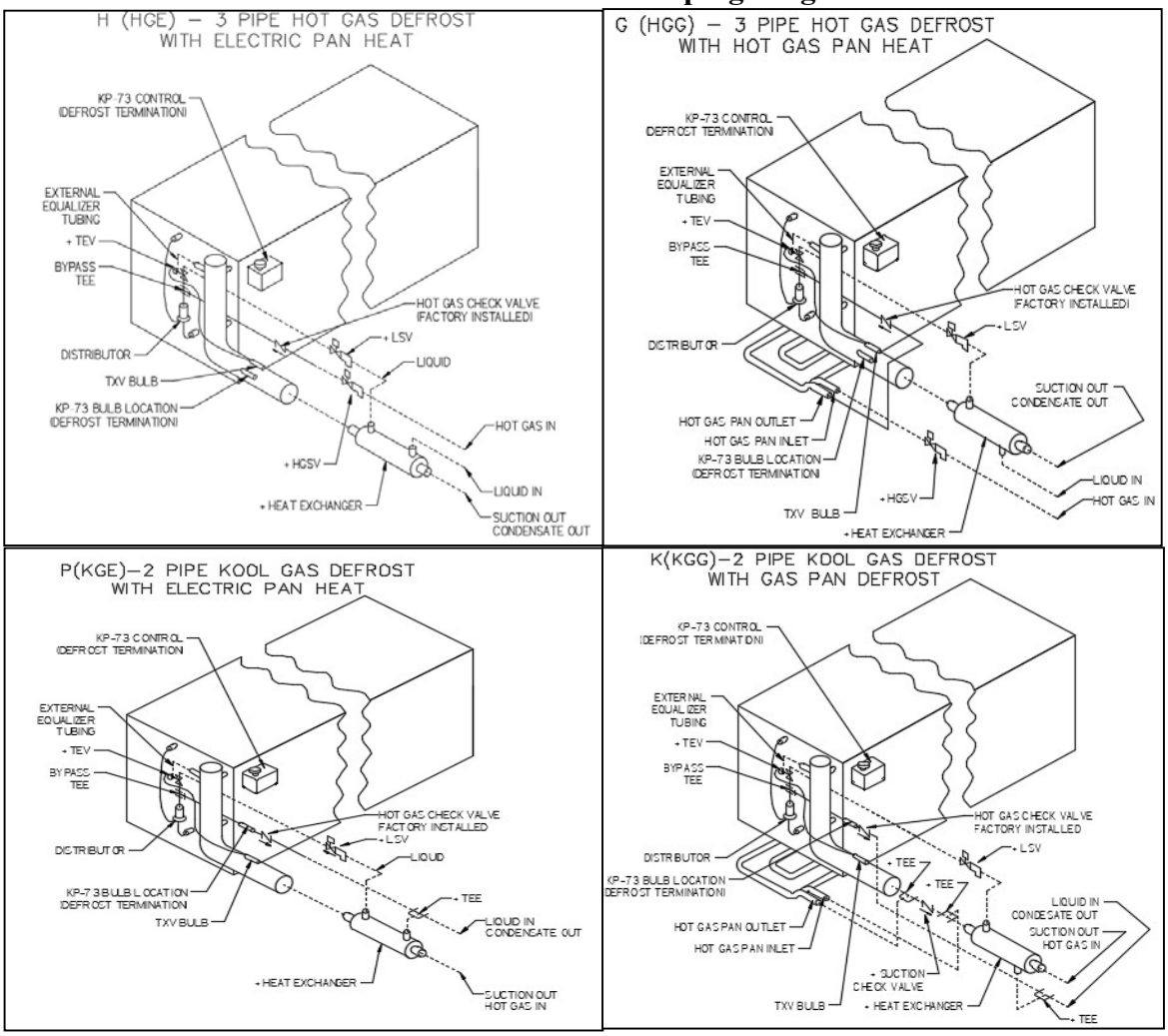
6.3 *EVACUATION AND LEAK TEST*

When all refrigeration connections have been completed, the entire system must be tested for leaks and then evacuated. Refer to the instructions provided with your systems condensing unit for information on performing the leak test and evacuation.

6.4 *MS GAS DEFROST PIPING*

FIGURE 6: Gas Defrost Piping Diagrams



6.5 *REFRIGERANT DISTRIBUTOR NOZZLES*

Direct expansion unit coolers are piped using a refrigerant distributor with a **changeable nozzle** design to equally distribute refrigerant to each circuit of the evaporator coil. Distributor nozzles are installed at the factory.

The nozzles provided with the unit have been selected for design conditions of 10°F T.D. and 95°F (95°F electric and hot gas defrost) liquid refrigerant at the expansion valve inlet. If the unit will be operated at conditions that are substantially different from these conditions, it may be necessary to select a different size nozzle. Contact the factory for advice.

The nozzle must be installed in the distributor or the auxiliary side connector before installing the expansion valve. There are nozzle identification numbers stamped on one side of the nozzle. Be sure to insert the nozzle into the distributor with these numbers visible in case identification is required later. The nozzle is held in place by a retainer ring that is easily inserted or removed with a pair of needle nose pliers.

TABLE 1: DISTRIBUTOR NOZZLE CAPACITIES – TONS OF REFRIGERANT

DISTRIBUTOR NOZZLE NUMBER	R404A					R407A				
	EVAPORATOR TEMPERATURE (°F)									
	40°	20°	0°	-20°	-40°	40°	20°	0°	-20°	-40°
1/9	0.09	0.07	0.05	0.04	0.04	0.11	0.08	0.07	0.06	0.05
1/6	0.14	0.11	0.08	0.07	0.05	0.17	0.13	0.1	0.09	0.07
1/4	0.23	0.17	0.13	0.11	0.09	0.27	0.21	0.17	0.14	0.12
1/3	0.3	0.23	0.18	0.14	0.11	0.35	0.27	0.22	0.18	0.15
1/2	0.41	0.31	0.24	0.19	0.16	0.48	0.38	0.3	0.25	0.21
3/4	0.62	0.47	0.37	0.29	0.24	0.72	0.57	0.46	0.38	0.32
1	0.83	0.63	0.49	0.39	0.32	0.97	0.76	0.61	0.5	0.43
1/1/2	1.2	0.92	0.71	0.57	0.46	1.41	1.1	0.89	0.73	0.62
2	1.65	1.26	0.98	0.78	0.64	1.94	1.51	1.22	1	0.85
2/1/2	2.06	1.57	1.22	0.97	0.79	2.41	1.88	1.52	1.25	1.06
3	2.47	1.88	1.47	1.17	0.95	2.9	2.26	1.82	1.5	1.28
4	3.31	2.52	1.96	1.56	1.27	3.88	3.03	2.43	2.01	1.71
5	4.08	3.11	2.42	1.93	1.57	4.78	3.73	3	2.48	2.11
6	4.89	3.72	2.91	2.31	1.88	5.73	4.48	3.6	2.98	2.53
8	5.89	4.49	3.5	2.79	2.27	6.91	5.39	4.34	3.58	3.05
10	6.6	5.03	3.92	3.12	2.54	7.74	6.05	4.86	4.02	3.42
12	8.16	6.21	4.84	3.86	3.14	9.56	7.47	6	4.96	4.22
15	10.1	7.7	6.01	4.78	3.89	11.9	9.26	7.45	6.15	5.23
17	11.3	8.61	6.72	5.35	4.35	13.3	10.4	8.33	6.88	5.85
20	13.6	10.4	8.1	6.45	5.24	16	12.5	10	8.29	7.05
25	17.1	13.1	10.2	8.11	6.6	20.1	15.7	12.6	10.4	8.87
30	19.6	14.9	11.6	9.27	7.54	23	17.9	14.4	11.9	10.1
35	23.6	17.9	14	11.1	9.07	27.6	21.6	17.3	14.3	12.2
40	26.4	20.1	15.7	12.5	10.2	31	24.2	19.5	16.1	13.7
50	34.3	26.1	20.4	16.2	13.2	40.2	31.4	25.2	20.9	17.7

DISTRIBUTOR NOZZLE NUMBER	R507					R448A/R449A				
	EVAPORATOR TEMPERATURE (°F)									
	40°	20°	0°	-20°	-40°	40°	20°	0°	-20°	-40°
1/9	0.09	0.07	0.05	0.04	0.03	0.08	0.06	0.05	0.04	0.03
1/6	0.14	0.11	0.08	0.07	0.05	0.12	0.09	0.07	0.06	0.05
1/4	0.23	0.17	0.13	0.11	0.09	0.19	0.15	0.12	0.09	0.08
1/3	0.29	0.22	0.17	0.14	0.11	0.25	0.20	0.15	0.12	0.10
1/2	0.41	0.31	0.24	0.19	0.16	0.35	0.27	0.21	0.17	0.14
3/4	0.61	0.47	0.36	0.29	0.23	0.53	0.41	0.32	0.26	0.21
1	0.82	0.62	0.49	0.39	0.31	0.70	0.54	0.43	0.35	0.29
1/1/2	1.2	0.91	0.71	0.56	0.46	1.02	0.79	0.63	0.50	0.42
2	1.64	1.25	0.97	0.77	0.62	1.40	1.09	0.86	0.69	0.57
2/1/2	2.05	1.56	1.21	0.96	0.78	1.75	1.35	1.07	0.86	0.71
3	2.46	1.87	1.45	1.15	0.93	2.10	1.63	1.28	1.04	0.86
4	3.29	2.5	1.94	1.54	1.25	2.81	2.18	1.72	1.39	1.15
5	4.06	3.08	2.4	1.9	1.54	3.47	2.68	2.12	1.71	1.41
6	4.86	3.69	2.87	2.28	1.85	4.16	3.22	2.54	2.05	1.70
8	5.86	4.45	3.46	2.75	2.23	5.01	3.88	3.06	2.47	2.04
10	6.57	4.99	3.88	3.08	2.5	5.62	4.34	3.43	2.77	2.29
12	8.11	6.16	4.79	3.8	3.08	6.94	5.37	4.24	3.42	2.83
15	10.1	7.64	5.94	4.72	3.83	8.60	6.65	5.26	4.24	3.51
17	11.2	8.54	6.64	5.27	4.28	9.62	7.44	5.88	4.74	3.92
20	13.6	10.3	8.01	6.36	5.16	11.60	8.97	7.08	5.71	4.72
25	17.1	12.9	10.1	8	6.48	14.60	11.30	8.91	7.19	5.94
30	19.5	14.8	11.5	9.13	7.41	16.70	12.90	10.20	8.21	6.79
35	23.4	17.8	13.8	11	8.91	20.00	15.50	12.20	9.88	8.17
40	26.3	20	15.5	12.3	9.99	22.50	17.40	13.70	11.10	9.16
50	34.1	25.9	20.1	16	13	29.20	22.50	17.80	14.40	11.90

6.6 EXPANSION VALVE

Before mounting the unit, install the expansion valve and connect the equalizer tube. The expansion valve should be installed directly to the distributor body or as close as possible with no elbows or bends. Locate the expansion valve bulb on a horizontal length of suction line as close to the suction header as possible. Position the bulb in a 3, 4 or 8, 9 o'clock position (do not position on the bottom side of the pipe). Clamp the bulb down flush and tight against the pipe and insulate. Never locate the bulb in a trap or downstream from a trap.

Expansion valves are adjusted at the factory prior to shipment. The setting will be correct for many applications, but in other applications adjustments may be needed. It is important that the operation of the expansion valve be checked after the system has balanced out at the desired room temperature. If the coil is being starved, it is necessary to reduce the superheat setting of the valve by turning the adjusting stem counter-clockwise. If the superheat is too low it is necessary to increase the superheat setting of the valve by turning the adjusting stem clockwise. It is recommended that for a 10°F to 12°F T.D. system, the valve should be adjusted to maintain 5°F to 6°F superheat.

7 ELECTRICAL

7.1 *FIELD WIRING*

Field wiring should comply with NEC and local codes. The power supply voltage, phase and frequency must match what is shown on the unit cooler data plate.
The field-wiring compartment is constructed as part of the unit cooler enclosure. The wiring diagram for each unit is located on the inside of the electrical panel door. Wiring connections are made at the terminal block(s) provided inside the unit on the end opposite the refrigerant connections. The unit must be grounded. Refer to TABLE's 4 and 5 for motor and heater electrical information.

Special consideration must be taken when wiring single-phase fan motors and defrost heaters. If the total amp draw of the motors or heaters exceed the amp rating of the fan delay or heater safety switch then a contactor must be installed.

7.2 *ELECTRICAL DATA*

TABLE 2: MS MOTOR ELECTRICAL DATA (AMPS)

FAN	Motor Type C				Motor Type V and D		
Q-ty	230/3/60	460/3/60	575/3/60	380/3/50	115/1/60	230/1/60	230/3/60
1	2.0	1.0	0.8	1.1	4.0	7.0	-
2	4.0	2.0	1.6	2.2	8.0	14.0	7.0
3	6.0	3.0	2.4	3.3	12.0	21.0	7.0
4	8.0	4.0	3.2	4.4	16.0	28.0	10.6

TABLE 3: (E) EDL HEATERS ELECTRICAL DATA And (P) KGE & (H) HGE HEATERS ELECTRICAL DATA

MODEL	ELECTRICAL DEFROST UNIT (E)								ELECTRICAL DEFROST PAN (H,P)							
	AMP				kW				AMP				kW			
	230/3	380/3	460/3	575/3	230/3	380/3	460/3	575/3	230	380	460	575	230	380	460	575
MS*14()-162	15.2	6.3	7.6	6.0	5.1	3.5	5.1	5.1	4.4	1.8	2.2	1.8	1.0	0.7	1.0	1.0
MS*15()-178	15.2	6.3	7.6	6.0	5.1	3.5	5.1	5.1	4.4	1.8	2.2	1.8	1.0	0.7	1.0	1.0
MS*16()-195	15.2	6.3	7.6	6.0	5.1	3.5	5.1	5.1	4.4	1.8	2.2	1.8	1.0	0.7	1.0	1.0
MS*14()-212	15.2	6.3	7.6	6.0	6.1	4.1	6.1	6.1	4.4	1.8	2.2	1.8	1.0	0.7	1.0	1.0
MS*15()-223	15.2	6.3	7.6	6.0	6.1	4.1	6.1	6.1	4.4	1.8	2.2	1.8	1.0	0.7	1.0	1.0
MS*16()-239	15.2	6.3	7.6	6.0	6.1	4.1	6.1	6.1	4.4	1.8	2.2	1.8	1.0	0.7	1.0	1.0
MS*24()-323	30.4	12.6	15.2	14.0	10.1	6.9	10.1	11.0	8.8	3.6	4.4	3.8	2.0	1.4	2.0	2.2
MS*25()-356	30.4	12.6	15.2	14.0	10.1	6.9	10.1	11.0	8.8	3.6	4.4	3.8	2.0	1.4	2.0	2.2
MS*26()-390	30.4	12.6	15.2	14.0	10.1	6.9	10.1	11.0	8.8	3.6	4.4	3.8	2.0	1.4	2.0	2.2
MS*24()-424	30.4	12.6	15.2	14.0	12.1	8.3	12.1	14.0	8.8	3.6	4.4	3.8	2.0	1.4	2.0	2.2
MS*25()-444	30.4	12.6	15.2	14.0	12.1	8.3	12.1	14.0	8.8	3.6	4.4	3.8	2.0	1.4	2.0	2.2
MS*26()-478	30.4	12.6	15.2	14.0	12.1	8.3	12.1	14.0	8.8	3.6	4.4	3.8	2.0	1.4	2.0	2.2
MS*34()-445	38.7	16.0	19.4	16.8	12.9	8.8	12.9	14.0	11.2	4.6	5.6	4.9	2.6	1.8	2.6	2.8
MS*35()-502	38.7	16.0	19.4	16.8	12.9	8.8	12.9	14.0	11.2	4.6	5.6	4.9	2.6	1.8	2.6	2.8
MS*36()-532	38.7	16.0	19.4	16.8	12.9	8.8	12.9	14.0	11.2	4.6	5.6	4.9	2.6	1.8	2.6	2.8
MS*34()-602	38.7	16.0	19.4	16.8	15.4	10.5	15.4	16.8	11.2	4.6	5.6	4.9	2.6	1.8	2.6	2.8
MS*35()-643	38.7	16.0	19.4	16.8	15.4	10.5	15.4	16.8	11.2	4.6	5.6	4.9	2.6	1.8	2.6	2.8
MS*36()-685	38.7	16.0	19.4	16.8	15.4	10.5	15.4	16.8	11.2	4.6	5.6	4.9	2.6	1.8	2.6	2.8
MS*44()-594	2(26.3)*	21.7	26.3	22.9	17.4*	11.9	17.4	18.9	15.2	6.3	7.6	6.6	3.5	2.4	3.5	3.8
MS*45()-669	2(26.3)*	21.7	26.3	22.9	17.4*	11.9	17.4	18.9	15.2	6.3	7.6	6.6	3.5	2.4	3.5	3.8
MS*46()-710	2(26.3)*	21.7	26.3	22.9	17.4*	11.9	17.4	18.9	15.2	6.3	7.6	6.6	3.5	2.4	3.5	3.8
MS*44()-803	2(26.3)*	21.7	26.3	22.9	2(10.5)*	14.3	20.9	22.7	15.2	6.3	7.6	6.6	3.5	2.4	3.5	3.8
MS*45()-858	2(26.3)*	21.7	26.3	22.9	2(10.5)*	14.3	20.9	22.7	15.2	6.3	7.6	6.6	3.5	2.4	3.5	3.8
MS*46()-914	2(26.3)*	21.7	26.3	22.9	2(10.5)*	14.3	20.9	22.7	15.2	6.3	7.6	6.6	3.5	2.4	3.5	3.8

7.3 *AIR DEFROST SEQUENCE OF OPERATION*

SEQUENCE OF OPERATION

1. The unit cooler fan motors are energized and the fans operate continually.
2. The room thermostat calls for cooling. The liquid solenoid valve opens allowing liquid to flow to the unit cooler. The suction pressures rises and starts the compressor.
3. When the room temperature is satisfied the thermostat opens and closes the liquid solenoid. The compressor continues to run until the suction pressure reaches the low-pressure cutout setting and shuts off the compressor.
4. The fan circulates air over the coil and frost melts.

For air defrost to work properly the compressor run time should not exceed 40 minutes per hour.

AIR DEFROST WIRING

FIGURE 7: MOTOR TYPE C

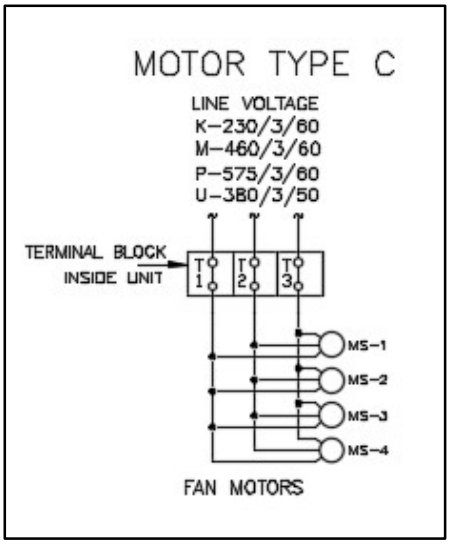


FIGURE 8: MOTOR TYPE D

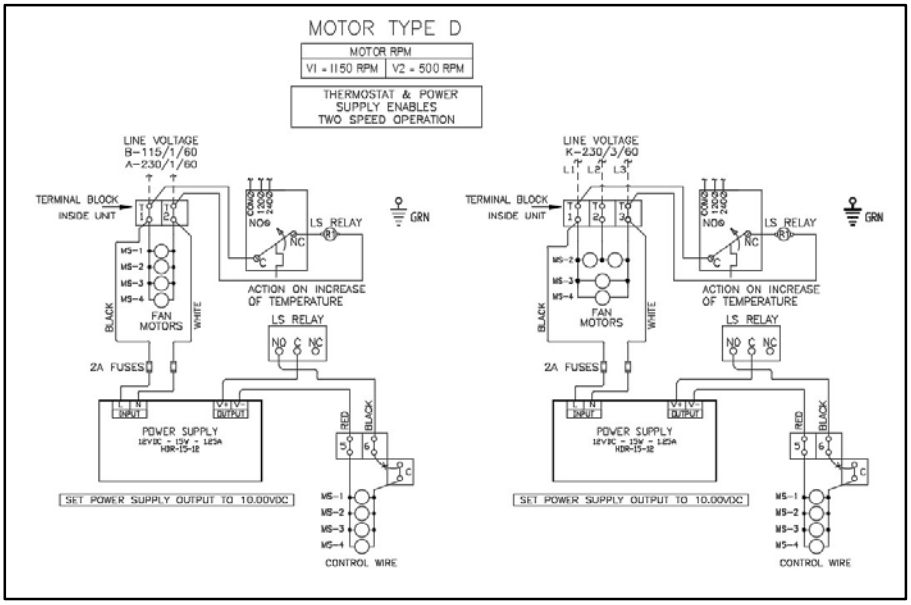
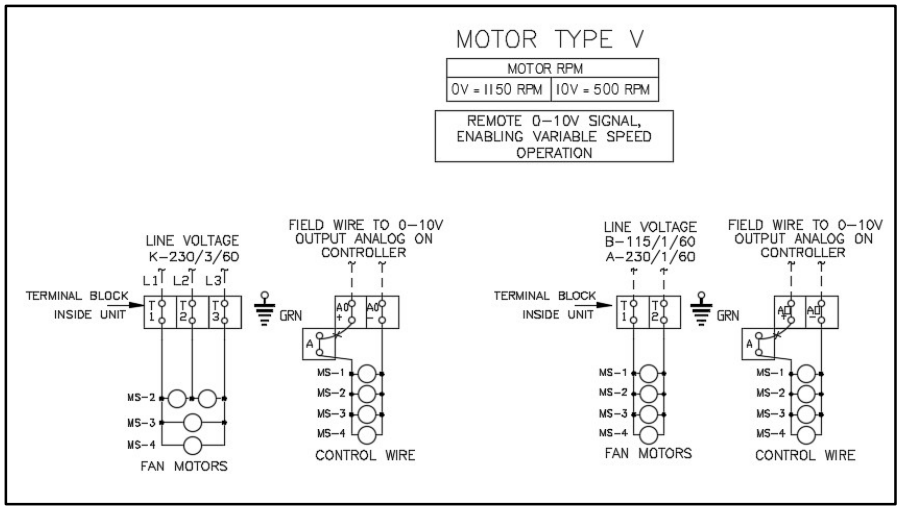


FIGURE 9: MOTOR TYPE V



7.4 *ELECTRIC DEFROST SEQUENCE OF OPERATION*

The electric defrost cycle is time clock initiated and temperature terminated with a timer and or high temperature over-ride. For systems with multiple unit coolers and a single defrost time clock the defrost termination thermostat must be wired in series. Reference FIGURE's 10 Through 14 for electric defrost wiring diagrams.

SEQUENCE OF OPERATION

STEP A: Normal Refrigeration Cycle

1. Power is supplied to terminals "N' and "4" on the defrost timer.
2. The heater safety and fan delay thermostat are closed, the defrost termination thermostat is off and the defrost heaters are off.
3. The unit cooler fan motors are energized, and the fans operate continually.
4. The systems compressor operates in accordance with the demand of the room thermostat.
5. Frost slowly builds up on the evaporator fins.

STEP B: Defrost Cycle

The timer starts defrosting of the evaporator coil at a predetermined interval. A typical setting would be two defrost periods per 24-hour day.

1. Upon initiation of the defrost cycle, the timer mechanically disconnects power to terminal "4" thus closing the liquid line solenoid valve and shutting off the fan motors. Simultaneously power is connected to terminal "3" which allows current to flow to the defrost heaters.
2. The heaters, embedded in slots in the coil face, give up heat directly to the evaporator fins. This heat raises the coil temperature to 32°F causing the frost to melt.
3. As the frost melts it drops into the drain pan and flows down the drain.
4. When the frost has completely melted from the coil the temperature of the coil will start to rise above 32°F.
5. When the coil reaches the temperature setting of the defrost termination thermostat (75°F for fixed Klixon), the thermostat closes which allows current to flow to terminal "X" on the timer which energizes the switching solenoid in the timer. The timer disconnects power to terminal "3" thus turning off the defrost heaters. At the same, instant power is connected to terminal "4" of the timer.
6. Because there is power at terminal "4" the liquid line solenoid opens and the compressor restarts.
7. The evaporator fan motor(s) remain off because the fan delay thermostat is still open. This prevents warm air from being blown into the refrigerated area.
8. The evaporator coil cools down approaching operating temperature.
9. When the coil temperature reaches 25°F (approximately 2 to 3 minutes after defrost termination) the fan delay thermostat closes, thus allowing the fan motors to restart. The unit is now back in operation.
10. The heater safety thermostat will only open if the defrost termination thermostat fails to close at its set temperature. The heater safety thermostat is set to open at 80°F. The timer also has a fail-safe (inner dial) timeout; the recommended setting is for 30 minutes.

NOTE: On systems where the room temperature is above +25°F the fan delay thermostat may not close for an extended period of time. If the fan delay time is too long, it is permissible to install a jumper wire between terminals "F" and "B" at the unit cooler. This allows the fans to turn on immediately after the defrost period.

ELECTRIC DEFROST WIRING WITH DEFROST TIMER

FIGURE 10: MOTOR TYPE C

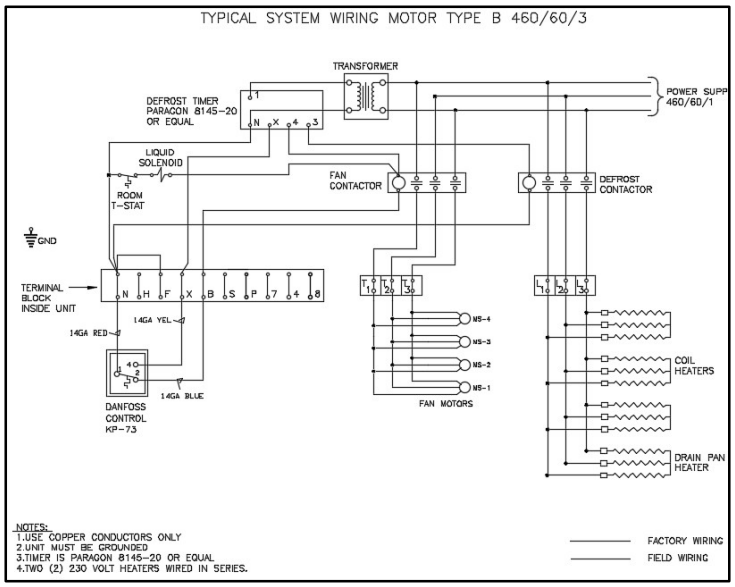


FIGURE 11: MOTOR TYPE D

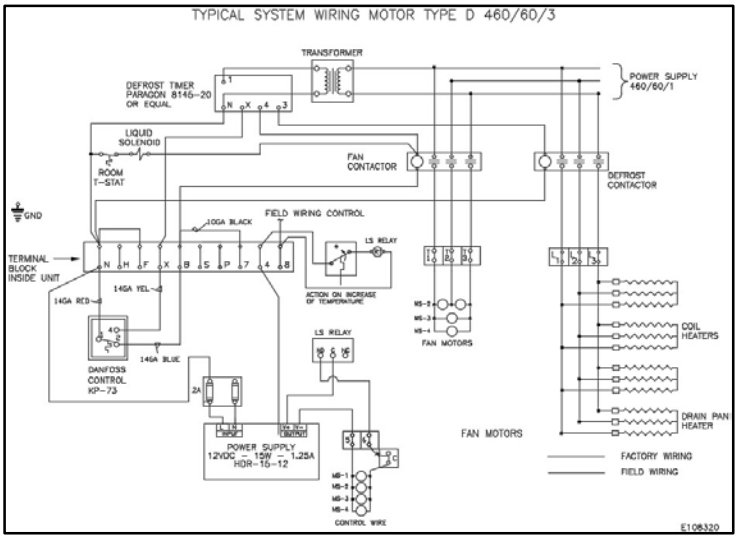


FIGURE 12: MOTOR TYPE V

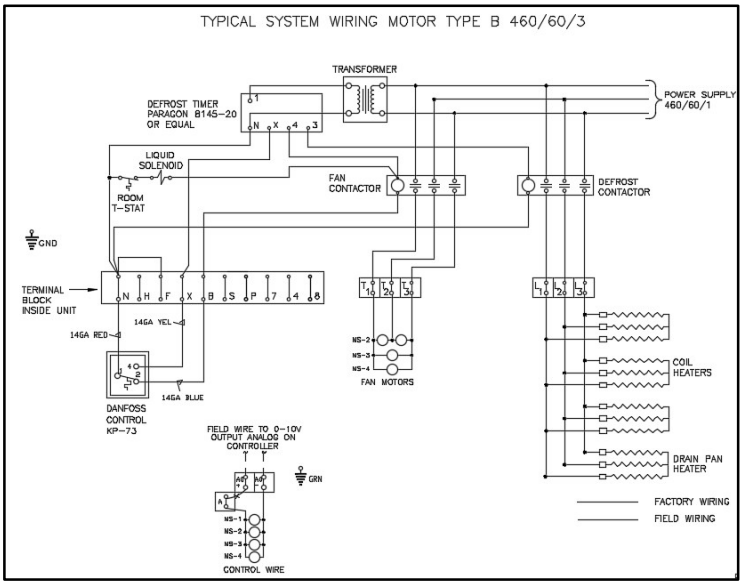


FIGURE 13: (E) EDL ELECTRIC DEFROST WIRING 1 PH

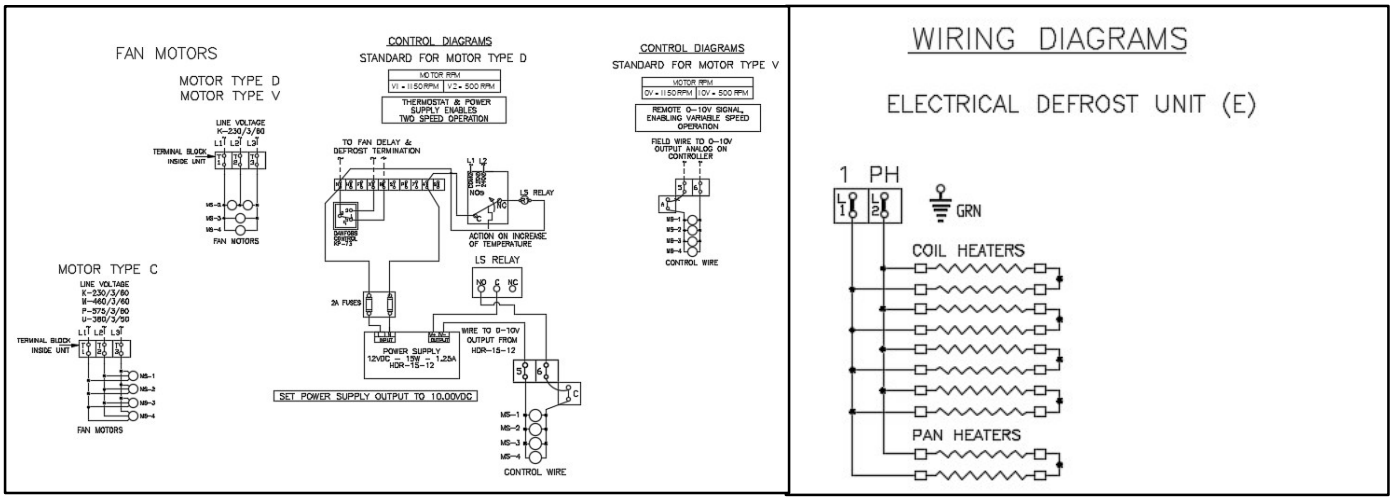
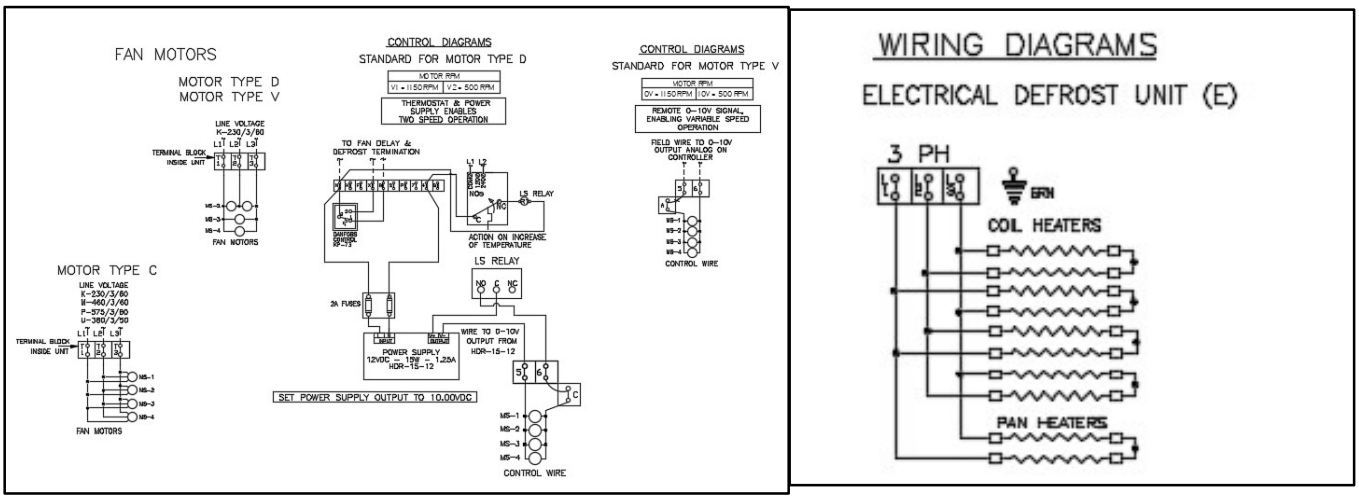


FIGURE 8: (E) EDL ELECTRIC DEFROST WIRING 3 PH



7.5 *GAS DEFROST SEQUENCE OF OPERATION*

The gas defrost cycle is time is field controller initiated and terminated

(H) HGE/(G) HGG THREE PIPE HOT GAS DEFROST

Three pipe hot gas defrost systems distribute compressor discharge gas through a separate hot gas line, controlled by a solenoid valve, through a check valve to the refrigerant distributor auxiliary side connection. Defrost condensate and gas vapor is evaporated in a re-evaporator outside the MS unit prior to returning to the compressor through the suction line.

(P) KGE/(K) KGG REVERSE CYCLE (2 PIPE) HOT GAS DEFROST

Reverse cycle (2 pipe) defrost systems distribute compressor discharge gas through the suction line during defrost. Defrost condensate flows through the refrigerant distributor auxiliary side connection and a check valve, bypassing the expansion valve and the liquid line solenoid valve into the liquid line, which is reduced in pressure.

SEQUENCE OF OPERATION - GAS DEFROST WITH ELECTRIC DRAIN PAN HEATER

Step A – Power is supplied to the unit cooler continuously.
Step B – In Case of H defrost hot gas is supplied to the unit via liquid line and in Case of P defrost Kool Cas is supplied to the suction line. A factory mounted thermostat (KP73) senses a rise in the coil temperature. The SPDT control turns off the fan motors. If the unit has a drain pan heater, the other portion of the SPDT control is now closed and the drain pan heater is energized.

Step C – When the defrost is complete, the hot gas supply is stopped. The liquid line solenoid is energized, and the coil temperature begins to fall.
Step D – The factory mounted thermostat senses the drop in coil temperature. The SPDT thermostat opens the circuit to the drain pan heater (when supplied) and closes the circuit to the fan motors.

Recommended (SPDT) fan delay/drain pan heater thermostat settings:

Room	Range	Differential
0°F to +35°F	45°F	15°F
Below 0°F	20°F	10°F

(Note: Fan delay set point = Range – Differential)

A separate SPDT thermostat (KP73) is provided in the coil which can provide a digital defrost termination input.

SEQUENCE OF OPERATION - GAS DEFROST WITH GAS DRAIN PAN HEATER

Step A – Power is supplied to the unit cooler continuously.
Step B – In Case of H defrost hot gas is supplied to the unit via liquid line and in Case of P defrost Kool Cas is supplied to the suction line. A factory mounted thermostat (Klixon) senses a rise in the coil temperature. The SPDT control turns off the fan motors.
Step C – When the defrost is complete, the hot gas supply is stopped. The liquid line solenoid is energized, and the coil temperature begins to fall.
Step D – The factory mounted thermostat senses the drop in coil temperature and closes the circuit to the fan motors.

A separate SPDT thermostat (KP73) is provided in the coil which can provide a digital defrost termination input.

FIGURE 9: (H) HGE (3 PIPE) HOT GAS COIL AND ELECTRIC DRAIN PAN WIRING

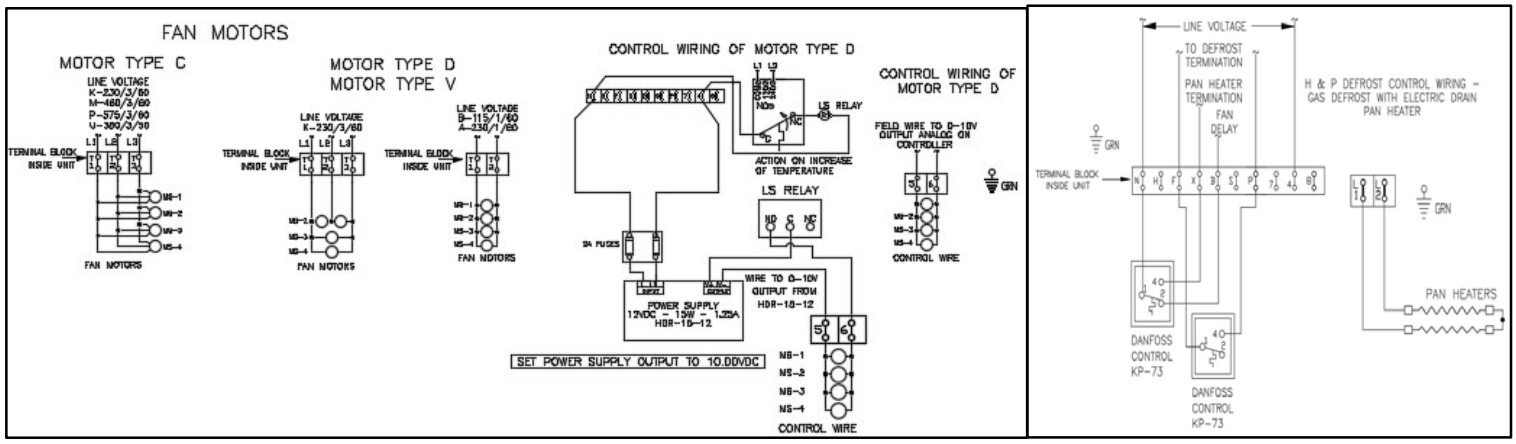


FIGURE 106: (G) HGG (3 PIPE)/(K) KGG (2 PIPE) GAS COIL AND GAS DRAIN PAN WIRING

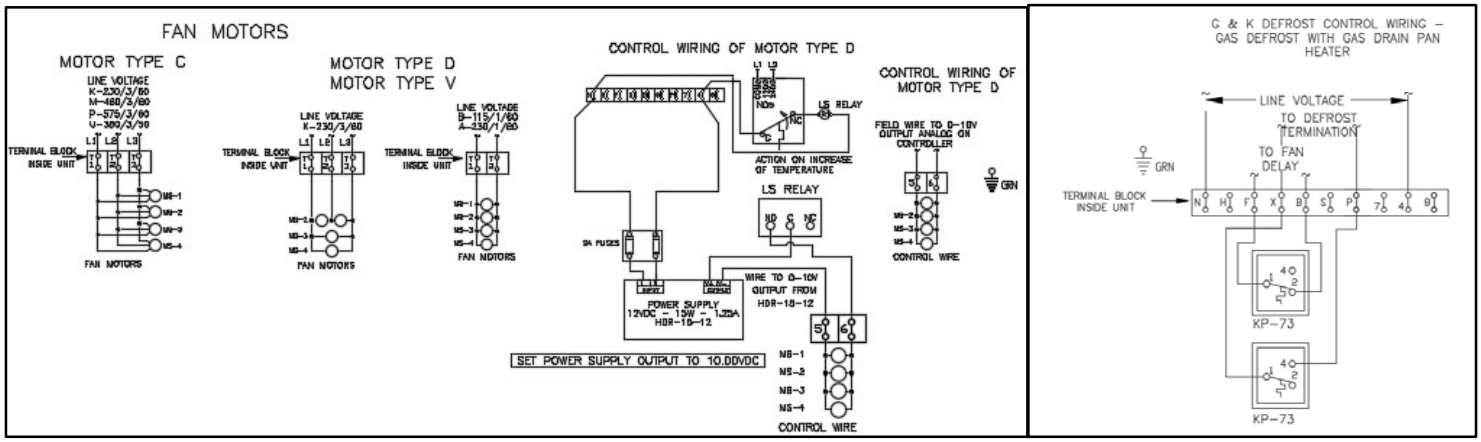
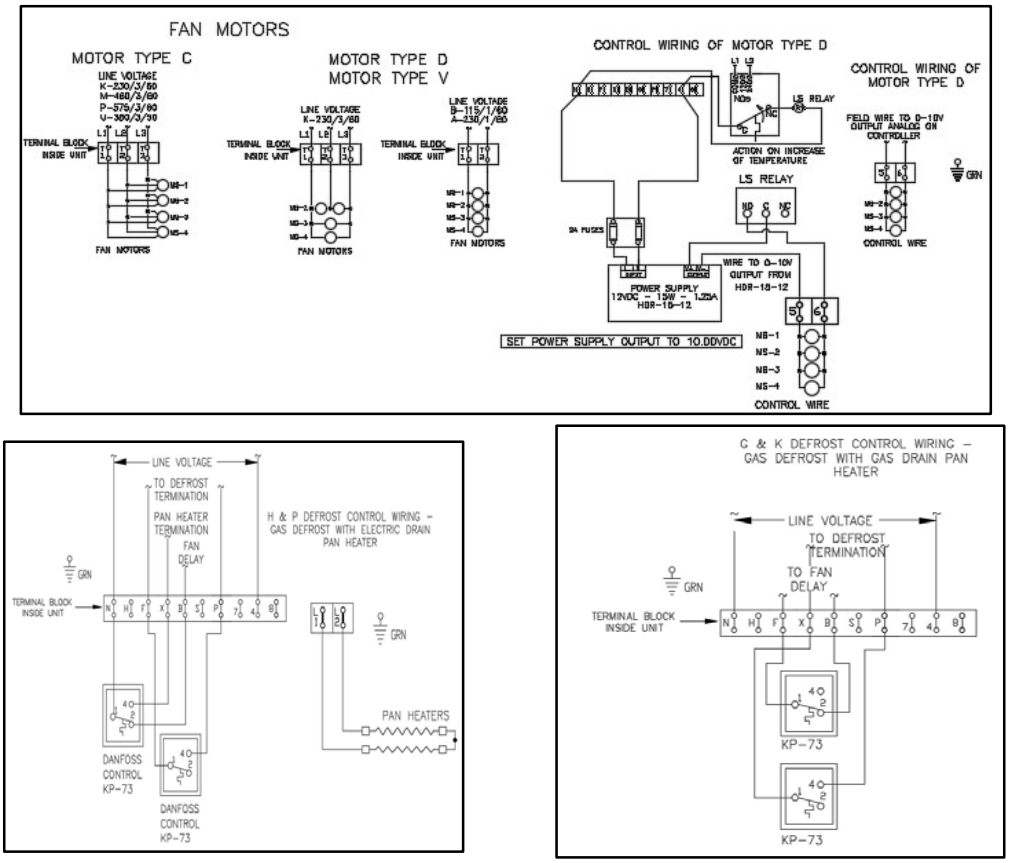


FIGURE 17: (P) KGE (2 PIPE) COOL GAS COIL AND ELECTRIC DRAIN PAN WIRING AND (K) KGG (2 PIPE) COOL GAS COIL AND ELECTRIC DRAIN PAN WIRING



7.6 *TWO SPEED MOTOR SEQUENCE OF OPERATION –*

MS coils use DUAL SPEED EC motors for fans in DOE applications, default being the High speed, the second speed is set as Minimum speed. Fans will be in Min speed/Full speed Or Off on below mentioned scenarios.

Minimum speed

- When the room temperature or the refrigeration setpoint is met the fan should operate at half speed.

Full Speed

- When the room temperature or refrigeration setpoint Is not met and the fan should run at full speed

Fan off

- For EL/Gas defrost evaporators, during defrost fans should turn off

Krack gives the option of field control for this motor to run at minimum speed or it also gives the option of installed room thermostat to operate this as DUAL SPEED motor. When using the option of installed room thermostat, do not use the same thermostat to control the LLSV.

For DUAL SPEED operation MS coils comes with 10V power supply and a Relay named LS relay installed in the panel. When using installed thermostat, the SPDT switch of the thermostat will energize the LS Relay. This relay will close the contact of the 10V power supply to the motor, thus supplies 10V to motor and Motor will run in low speed. When the room temperature is above the setpoint and will not energize the LS relay, when the room temperature is met the SPDT switch of the thermostat will energize the LS relay and send 10V signal to motor and make motor to run at minimum speed.

When using the field controller, the motor low speed is controlled through an output, the output may energize or de-energized based on room temperature input. LS relay will be energized only when the controller energized or de-energized the connected output.

When using the field-installed thermostat, the same concept of installed thermostat will be applicable.

7.7 *VARIABLE SPEED MOTOR SEQUENCE OF OPERATION*

Variable speed motor need 0-10V signal from filed, 0-10V signal wires will be connected to terminal allotted in the Evaporator panel (Terminal A0+ & A0-). 0V being the Maximum speed and 10V being minimum speed. Speed varies based on the analog signal received by motor,

7.8 *VARIABLE SPEED MOTOR WITH SYSTEM 450 – SEQUENCE OF OPERATION*

An installed System 450 C450CPN-4 controller will be utilized to supply 0-10V signal to Variable speed motor. Temperature sensor installed in the evaporator and wired to the System 450 control module will be utilized to measure the box temperature.

7.6.1 SYSTEM 450 PARAMETERS –

Set Point (SP) – is the target value that the control system drives toward. Set point at which Fan motor will run at full speed. – Target Box Temperature

End Point (EP) – is the maximum deviation from the target value. Setpoint at which Fan motors will run at Minimum speed **– Target Box Temperature – 5°F**

Output at Setpoint (OSP) – is the signal strength level of the analog output when the input sensor is at Setpoint (SP). The OSP is expressed as a percentage (0 to 100%) of the full-scale output. **Output signal strength at setpoint, i.e. Analog signal at setpoint. 0% - 0V**

Output at Endpoint (OEP) – value (OEP) is the signal strength level of the analog output when the input sensor is at the End Point (EP). The OEP is expressed as a percentage (0 to 100%) of the full-scale output. **Output signal strength at endpoint, i.e Analog signal at endpoint. 100% - 10V**

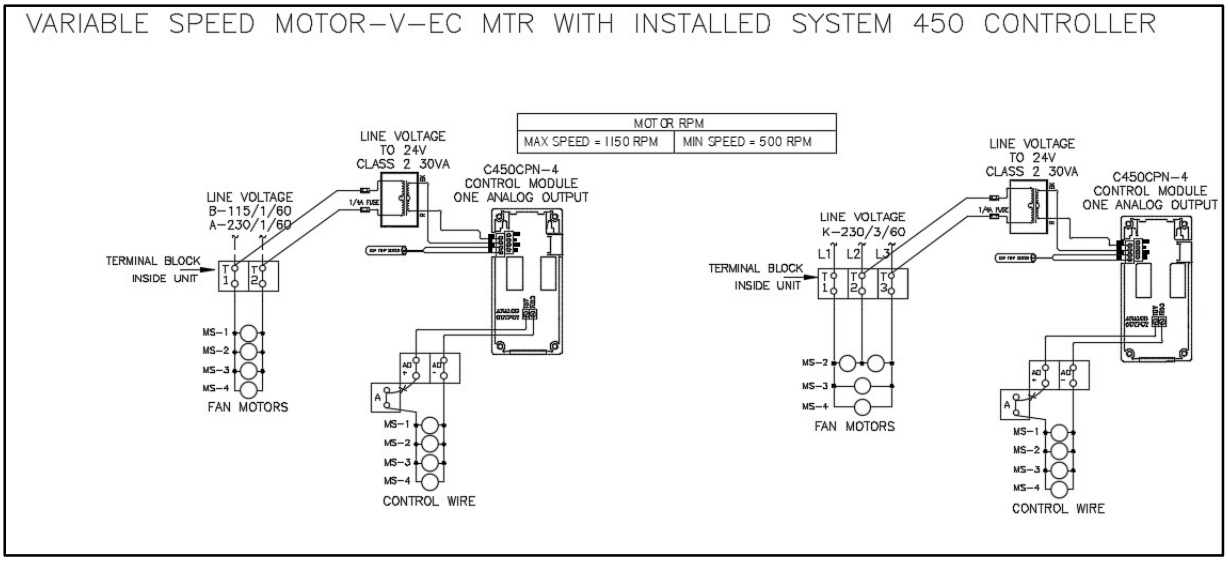
Fan motor will receive 0V signal at Setpoint (SP) from system 450 controller, so the fans will run at full speed. At Endpoint (EP) fans will receive 10V signal, so the fans will run at minimum speed.
The analog signal varies between setpoint to endpoint proportionally based on the box temperature measured by installed temperature sensor thus varies the fan speed proportionally.

Signal amplifier is used enhance the analog signal strength from System 450 and then feed the signal to Motor to vary the fan speed. (Signal amplifier needed for KR, GH, GL and LH evaporator coils only)

Sensor Failure Mode –

System 450 allows you to select the mode of operation for your control system outputs in the event of a sensor (or sensor wiring) failure of the sensor that the outputs reference. Set **SNF as OFF.** Analog output SNF OFF = Output Signal Strength at Setpoint (OSP). i.e Analog out put will fail at OSP setpoint. Sending 0V signal to motor.

7.6.2 FIGURE 18: - WIRING DRAWING OF EVAPORATOR WITH SYSTEM 450 –

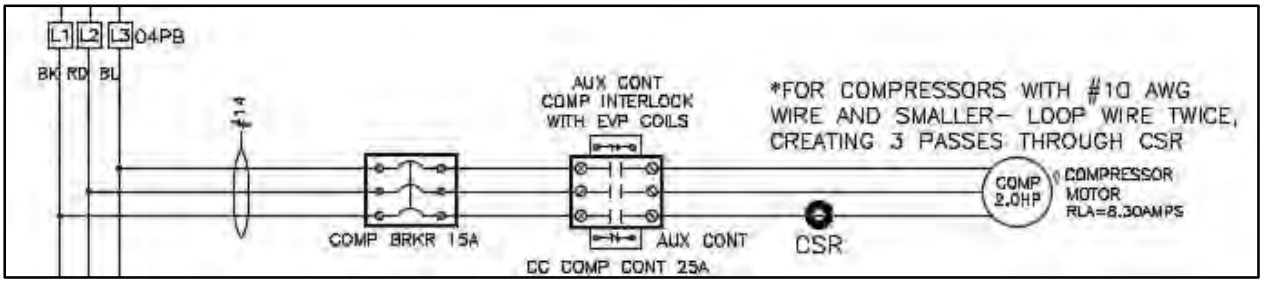


7.9 *INTERLOCKING SINGLE COMPRESSOR UNIT WITH KRACK COIL*

When a single compressor unit utilized with Krack evaporators, Evaporator fan should run at full speed whenever the compressor is running. i.e, when using evaporator with DUAL SPEED motor fans, and variable speed motor fans the fan speed should not modulate when the compressor is running, fan speed can modulate only when compressor is turned off due to system operation.

When Krack Evaporator coils used with Single compressor units from Hussmann (H series and C series), there is provision given to interlock the compressor with evaporator fans. Single compressor units use contactor for compressor operation, a NC Aux contact attached to the main contactor and will be used to interlock.

FIGURE 19: SETUP IN SINGLE COMPRESSOR UNIT: -



Aux contact wired to 2 terminal pins.

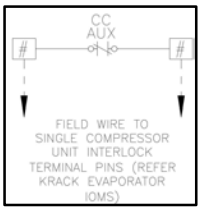
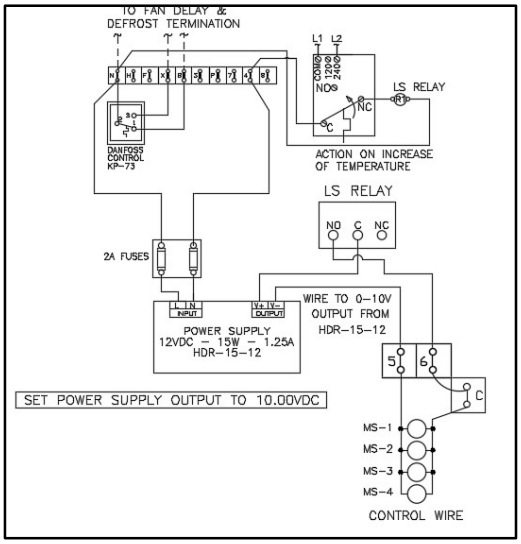
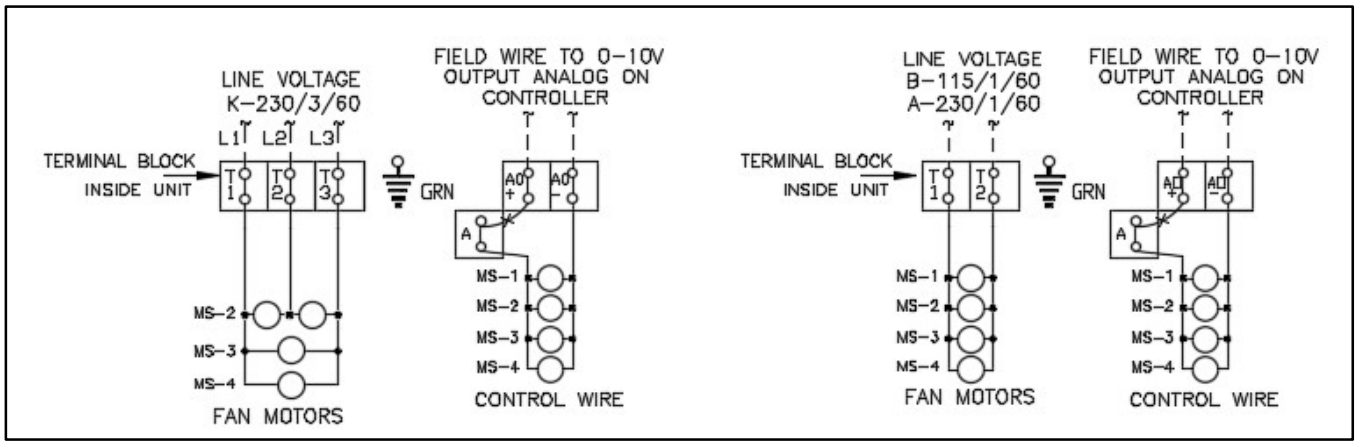


FIGURE 20: DUAL SPEED MOTOR EVAPORATER COILS – (MOTORS WITH 10V EXTERNAL POWER SUPPLY)



In case of s DUAL SPEED Motor coils with 10V power supply – the Jumper between terminal 6 and C should be removed and then and then aux contact from single compressor unit wired in series. Whenever the compressor contactor energized the Aux contact energizes, and NC contacts changes state to NO, there by OPEN the 10V power supply circuit. So, whenever compressor is ON, fans will never go to low speed mode, even getting signal from Room thermostat or filed controller.

FIGURE 21: VARIABLE SPEED MOTOR EVAPORATER COILS –



In Case of Variable speed motor coils – the Jumper between terminal A0+ and A should be removed and then and then aux contact from single compressor unit wired in series.

Whenever the compressor contactor energized the Aux contact energizes, and NC contacts changes state to NO, there by OPEN the analog 10V signal circuit. So, whenever the Controller sends the 10V signal it goes through Aux contact, and make sure that compressor is ON and there by deactivates the analog signal circuit. So, when compressor is ON then fans will never be able to modulate, though Controller telling fans to modulate.

8 START UP

8.1 *PRE-STARTUP*

After the installation is complete, a review of the following items should be performed before the system is placed into operation:

Check electrical connections, fan blade set screws, fan motors, guards and all other fasteners for tightness. Be sure the thermostatic expansion valve bulb is properly located, strapped and insulated.

With the system operating, check the supply voltage. It must be within +/- 10% of the voltage marked on the unit nameplate.

For electric defrost systems check the defrost timer to see that is set for the correct time of day and the starting pins have been installed (normally two per day). The defrost should be scheduled for times when the freezer doors are not likely to be open.

When the system is first started up, the box temperature is typically above the opening temperature of the fan delay thermostat. The fans may remain off for a lengthy period of time. To prevent this, it is permissible to install a temporary jumper wire between terminals “F” and “B” or “N” and “B” depending on the unit wiring arrangement. Once the box temperature is below +25°F the jumper wire should be removed.

8.2 *OPERATION CHECKOUT*

With the system operating, check the supply voltage. The voltage must be within +/- 10% of the voltage marked on the unit nameplate and the phase to phase unbalance should be 2% or less.

LISTEN CAREFULLY to the unit to make sure there are no unusual sounds. Sounds such as a noisy motor, the fan(s) scraping on the housing, or loose fasteners allowing parts to rattle need to be addressed immediately before continued unit operation.
Check the room THERMOSTAT setting. Be sure it functions properly.

For DIRECT EXPANSION systems let the system balance out at the desired room temperature and check the operation of the expansion valve by properly measuring the superheat at the sensing bulb. As much as thirty minutes may be required for the new balance to take place after an adjustment is made.

For BRINE or GLYCOL COOLING systems keep the closest vent to the coil open while the fluid fills the coil to allow trapped air to escape. Close the vent valve once fluid flows out of the valve and check for water hammer in the coil.

With HOT GAS DEFROST systems allow the coil to frost, then manually advance the defrost timer to initiate a defrost cycle. Observe the defrost cycle to see if all controls are functioning properly and that the coil is clear of all frost before the system returns to refrigeration. Adjust the time clock pins if necessary. Reset the defrost timer to the correct time of day. A defrost cycle is only needed when the frost build up is such that it impedes the airflow through the coil. The defrost requirements will vary on each installation and may change depending on the time of the year and other conditions.

With ELECTRIC DEFROST systems allow the coil to frost then manually advance the defrost timer to initiate a defrost cycle. Observe the defrost cycle to see if all controls are functioning properly and that the coil is clear of all frost before the system returns to refrigeration. Adjust the time clock pins if necessary. Reset the defrost timer to the correct time of day. A defrost cycle is only needed when the frost build up is such that it impedes the airflow through the coil. The defrost requirements will vary on each installation and may change depending on the time of the year and other conditions.

9 PREVENTATIVE MAINTENANCE

A preventive maintenance schedule should be established as soon as the MS Series unit is installed. The unit should be inspected periodically for proper operation and build up of frost and debris.
WARNING: All power supply to the unit must be shut off before opening any compartments, cleaning or performing maintenance.

9.1 *DRAIN PAN*

Inspect and clean the drain pan to insure free drainage of condensate. The drain pan should be cleaned regularly with warm water and soap.

If the drain pan needs to be removed, support the long dimension of the pan from underneath, so the outer sheet metal skin does not buckle and become damaged. **Do not point load the center of the support beam.** For longer pans more than one lifting device may be needed to keep the pan balanced when lifting. If the drain pan uses hot gas defrost make sure the coil is completely pumped out and isolated with hand valves to prevent refrigerant from escaping to the atmosphere. Remove electric wires if the unit has an electric defrost drain pan. Remove the drain line so that it is out of the way of the pan when it is being lowered. Remove the drain pan attachment bolts from the bottom of the evaporator unit and slowly lower the pan from the unit. Assemble pan in reverse order.

9.2 *COIL AND CABINET*

Clean the coil, fan cabinet, fans, and fan guards with warm water and soap. A low-pressure water hose is recommended to avoid water entering into electrical components and causing equipment failure.

The evaporator coil should be checked once a month for proper defrosting. Many variables affect coil frosting such as room temperature, type of product being stored or processed, how often new product is brought in, and the length of time the door to the room remains open. Summer conditions of high humidity can cause heavier frost loads and it may be necessary to change the number of defrost cycles seasonally.

9.3 *FAN GUARD OR LONG THROW ADAPTER REPLACEMENT*

To remove a fan guard or long throw adapter for fan-motor maintenance, or for guard or adapter replacement, make sure all electrical power to the unit has been turned off before any work is performed. Remove the two nuts on the lowest part of the guard or adapter first. While supporting the guard or adapter to the unit remove the top two nuts. Remove the guard or adapter. Reassemble in the reverse order.

9.4 *FAN REPLACEMENT*

If a fan is out of balance, damaged, or needs to be replaced, the unit does not need to be at floor level for maintenance. Make sure all electrical power to the unit has been turned off before any work is performed. Remove the fan guard as described in Section 10.3. Mark the location of the fan on the motor shaft. Loosen the fan hub set screws that hold the fan onto the motor shaft. Remove the fan. Clean and deburr the motor shaft if necessary.

Place the new fan onto the motor shaft, tighten fan hub set screws. Reattach the fan guard.

9.5 *UNIT MOTOR REPLACEMENT*

Make sure all electrical power to the unit has been turned off before any work is performed. The motor weight about 30 lbs. so caution when lifting is required. Remove the fan guard and fan as described in Sections 10.3 and 10.4. Remove the motor electrical cover and disconnect the motor leads and wire conduit from the motor.

Mark the belly band location on the motor, then loosen the belly band bolts holding the motor. Remove motor. Transfer mark from old motor to new motor and reassemble in to the belly band.
Connect the wires to the motor following the wiring schematic for the motor. Make certain the motor is wired for the correct supply voltage. Replace the motor electrical cover. Attach fan and guard as described in section 10.3 and 10.4.

When starting the motor make sure the fan is rotating in the proper counterclockwise direction. If the fan rotates clockwise, stop the motor, shut off all power to the unit, and change the motor wiring for counterclockwise rotation.

9.6 *ELECTRIC DEFROST HEATERS*

Electric defrost heater replacement on face of coil.

Make sure all electrical power to the unit is off and locked out before performing any work.

Open the hinged access door on each end of the MS unit. Disconnect the heater wiring at each end of the unit. Using pliers remove heater retaining clips on the face of the coil for the heater being replaced. Pull the heater out from the end of the unit with the bent end of the heater. Move identification tag from old to new heater. Install new heater in the same location as the old heater, straight end first. Install retainer clips then attach wires to terminal blocks. Run defrost cycle to make sure heaters work.

Electric defrost heater replacement on bottom of coil.

Disconnect drain pan line then open the hinged doors on the end of the unit. Lower the drain pan. Follow the same procedure as the coil face heaters.

Electric defrost drain pan heater replacement.
Disconnect drain line then open the hinged doors on the ends of the unit. Lower the drain pan. Disconnect heater wiring on both ends. Remove each retainer bracket individually starting on one end. Slightly lift the heater to be replaced and replace the retainer bracket to hold the other heaters in place. Do the same procedure along the length of the pan. Install new heater in reverse order.

10 TROUBLESHOOTING CHART

TABLE 6: TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
Fans will not operate.	Unit not wired properly. Defective motor. Defective defrost timer, termination thermostat or fan delay switch. Room temperature too high for use of fan delay switch.	Check wiring. Replace motor. Replace defective component. Jumper fan delay switch. Terminals F to B.
Ice forming on ceiling. Steaming during defrost.	Too many defrosts per day. Defective termination Thermostat or defrost timer.	Observe frost build up on coil, change to fewer defrost per day. Replace defective component.
Excessive buildup of frost on coil.	Too few defrost times. Defrost cycle too short. Too high humidity in cooler.	Add more defrost cycles to timer. Extend defrost time on timer. Limit access to cooler, do not prop doors open during stocking.
Accumulation of ice in drain pan.	Drain line plugged. Defective heater.	Clean drain line. Make sure drain line is insulated properly. Replace heater.

11 REPLACEMENT PARTS LIST

FIGURE 22: –

Listed below are the major replacement parts. When ordering parts, it is imperative that you obtain the complete model and serial number of the unit.

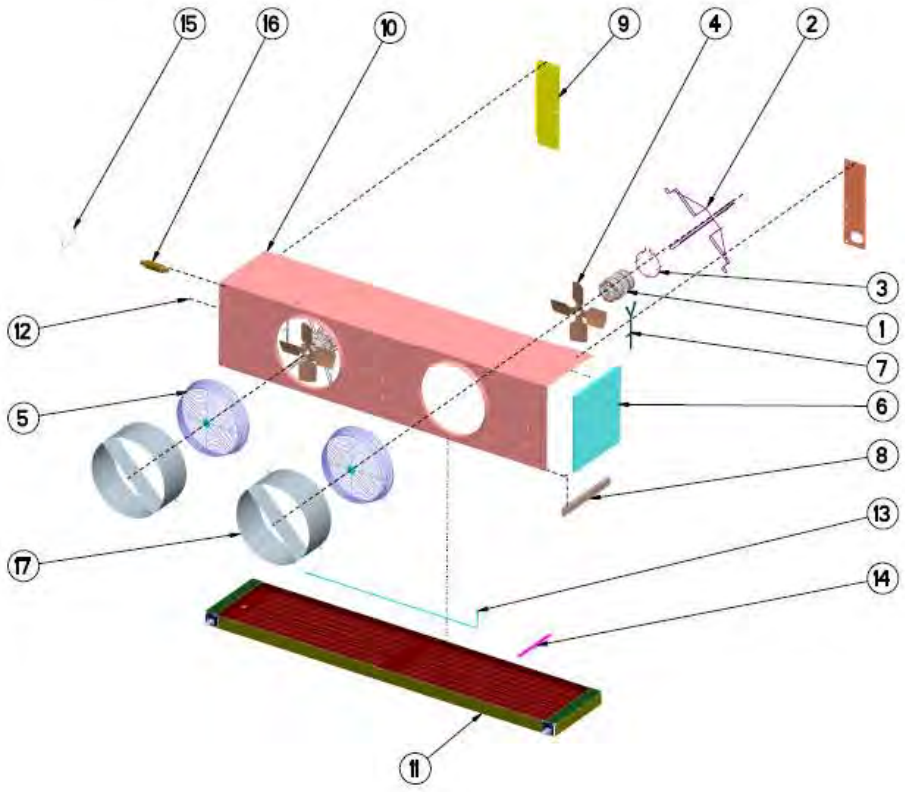


TABLE 7:

REPLACEMENT PARTS LIST

Item	General Description	Options Description	Krack BOM Part Number
1	MOTOR	1/2HP 208/230/460/50/60/3/11440	11096IN
		1/2HP 575/60/3/1140	11506IN
		1/2 HP 115/208/230/50/60/1/1075	E316796
		MOTOR-373W 120-230V 60HZ 1PH 1150-500 2-SPD	3115921
2	MOTOR MOUNT		BF0302000
3	MOTOR RING	3 PH MTR 56 FRAME	80034
4	FAN BLADE	20" 17 DEG CW 5/8"BORE	BF0102800
5	FAN GUARD		BF0202200
6	ACCESS DOOR	ALUM	1112700
		GALV	1112700G
7	WIRE HARNESS	1 FAN	80576
		2 FAN	80577
		3 FAN	80579
		4 FAN	80581
8	ACCESS DOOR PART	1-4 FAN	E270054
9	CORNER PANEL	1-4 FAN ALUM BACK SIDE LEFT	E270033
		1-4 FAN ALUM BACK SIDE RIGHT	E270032
		1-4 FAN GALV BACK SIDE LEFT	E270033G
		1-4 FAN GALV BACK SIDE RIGHT	E270032G
10	FRONT AND TOP PANEL	1 FAN ALUM FRONT AND TOP PANEL	E270112
		2 FAN ALUM FRONT & TOP PANEL	E270023
		3 FAN ALUM FRONT & TOP PANEL	E270073
		4 FAN ALUM FRONT PANEL	E270076
		4 FAN ALUM FRONT PANEL PART B	E270077
		4 FAN ALUM TOP PART A	E270074
		4 FAN ALUM TOP PART B	E270075
		1 FAN GALV FRONT AND TOP PANEL	E270112G
		2 FAN GALV FRONT & TOP PANEL	E270023G
		3 FAN GALV FRONT & TOP PANEL	E270073G
		4 FAN GALV FRONT PANEL	E270076G
		4 FAN GALV FRONT PANEL PART B	E270077G
		4 FAN GALV TOP PART A	E270074G
		4 FAN GALV TOP PART B	E270075G
11	DRAIN PAN	2 FAN ALUM NON-INSULATED	CE270024
		3 FAN ALUM NON-INSULATED	CE270025
		4 FAN ALUM NON-INSULATED	CE270026
		2 FAN GALV NON-INSULATED	CE270024G
		3 FAN GALV NON-INSULATED	CE270025G
		4 FAN GALV NON-INSULATED	CE270026G
		2 FAN ALUM INSULATED	CE270009
		3 FAN ALUM INSULATED	CE270012
		4 FAN ALUM INSULATED	CE270015
		2 FAN GALV INSULATED	CE270009G
		3 FAN GALV INSULATED	CE270012G
		4 FAN GALV INSULATED	CE270015G
		1 FAN ALUM 575/3 V	CE270113
		2 FAN ALUM 230/3 V	CE270000
		2 FAN ALUM 460/3 V	CE270046
		2 FAN ALUM 575/3 V	CE270047

		3 FAN ALUM 230/3 V	CE270003
		3 FAN ALUM 460/3 V	CE270049
		3 FAN AMUM 575/3 V	CE270050
		4 FAN ALUM 230/3 V	CE270006
		4 FAN ALUM 460/3 V	CE270052
		4 FAM ALUM 575/3 V	CE270053
		1 FAN GALV 575/3 V	CE270113G
		2 FAN GALV 230/3 V	CE270000G
		2 FAN GALV 460/3 V	CE270046G
		2 FAN GALV 575/3 V	CE270047G
		3 FAN GALV 230/3 V	CE270003G
		3 FAN GALV 460/3 V	CE270049G
		3 FAN GALV 575/3 V	CE270050G
		4 FAN GALV 230/3 V	CE270006G
		4 FAN GALV 460/3 V	CE270052G
		4 FAM GALV 575/3 V	CE270053G
12	THERMOSTATS	DEFROST TERM (14T32)	E206100
		HEATER SAFETY (14T21)	10956
		FAN DELAY (14T31)	E201818
		KP-73	E205004
13	COIL/PAN HEATERS	1 FAN 230V	BR01091
		1 FAN 460V	BR01110
		1 FAN 575V	BR01090
		2 FAN 230V	BR01095
		2 FAN 460V	BR01112
		2 FAN 575V	BR01094
		3 FAN 230V	BR01097
		3 FAN 460V	BR01113
		3 FAN 575V	BR01096
		4 FAN 230V	BR01101
		4 FAN 460V	BR01115
		4 FAN 575V	BR01100
14	DRAIN PAN HEATER BRACKET		E269334
15	SUPPORT BRACKET	FACE	66317
		BOTTOM	66318
16	CHECK VALVE	1/2”	11852
		5/8”	11853
		7/8”	10930
17	AIR BOOSTER		CE207243
18	RELAY 240V	RELAY-30AMP DP/ST N.O. 120V RELAY TYCO T92P7A22-240V	0459304 1804241
19	10V POWER SUPPLY	POWER SUPPLY-10 VDC HDR-15-12	3115218
20	ROOM THERMOSTAT	RT 3 (Electronic) ETC111000	E206766
21		BRACKET-FRAME MOTOR 48	3097933
22		RING- FRAME MOTOR MS 48	3097934
23		HARNESS -MS VS 1F CTRL	3119823
24		HARNESS -MS VS 2F CTRL	3119824
25		HARNESS -MS VS 3F CTRL	3119825
26		HARNESS -MS VS 4F CTRL	3119826
27	Temp Sensor for Box	A99BC-300 TEMP SENSOR(set189a)	E205564
28	Controller for VS speed motors	CTRL MODULE W/1 AO C45CPN4C	3059162
32	AUX CONTACT FOR SINGLE COMP INTERLOCK	C320KG2 AUX CONT 1 NC 25-75A C320DPG01 AUX CONT 1 NC 90A	E209975002 E209976002

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Krack, a Hussmann Corporation brand
1049 Lily Cache Lane, Suite A
Bolingbrook, Illinois 60440
Ph: 630.629.7500

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