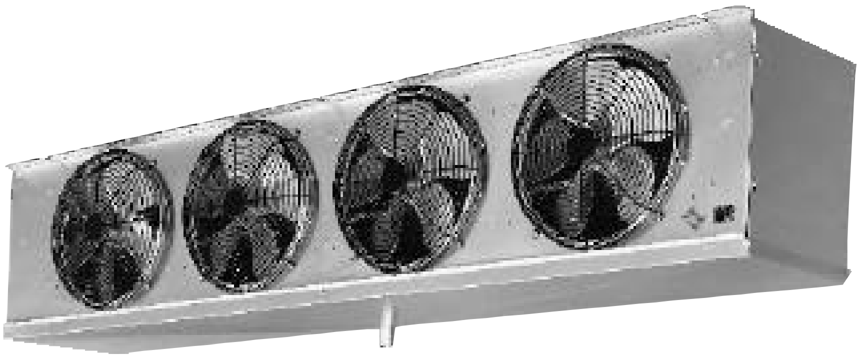
IOM 410

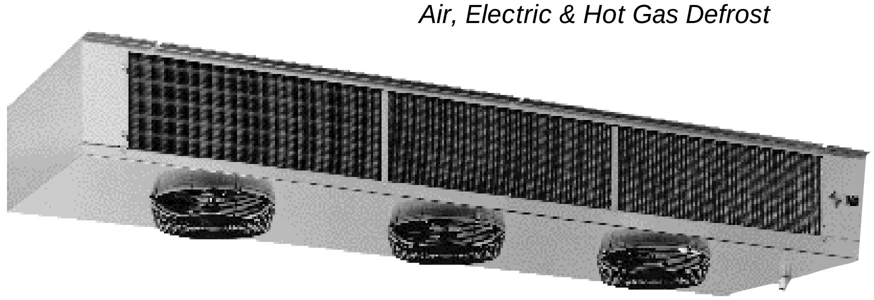
Installation Operation Maintenance Information



UNIT COOLERS

Super-Flo (SD Models)
Easy-Flo (EF Models)

Air, Electric & Hot Gas Defrost



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WITT • P.O. Box 580 • Collierville, TN 38027 • (901) 853-2770 • Fax (901) 853-8622

INSPECTION

Equipment listed on the Bill of Lading but not received, along with any equipment damaged in transit, should be reported immediately to the carrier and a claim filed. Also, check unit nameplates to make sure the voltage is correct before installing.

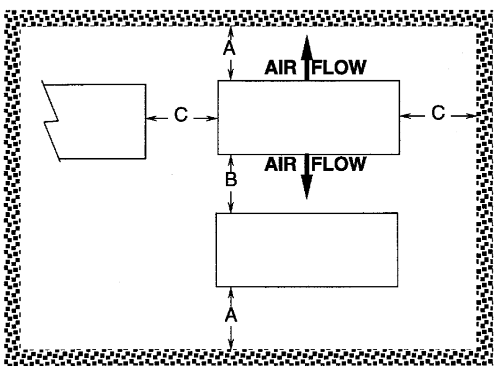
GENERAL SAFETY INFORMATION

1. Installation and maintenance are to be performed by qualified personnel who are familiar with this type of equipment.
2. Make sure all field wiring conforms to the equipment requirements and all applicable national and local codes.
3. Avoid contact with sharp edges and coil surfaces. They are a potential injury hazard.
4. Disconnect all power sources before performing service or maintenance.

INSTALLATION

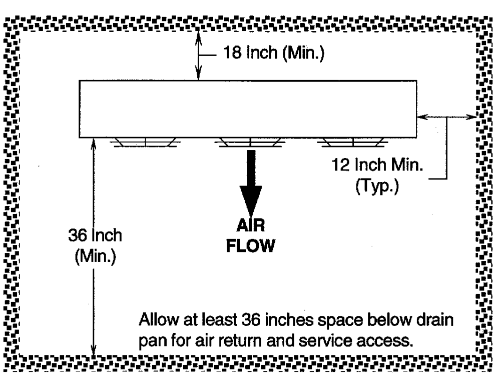
Witt SD unit coolers are designed to draw air in through the coil and discharge it through the fans while Witt EF unit coolers are designed to draw air in through the fan guards and discharge it through the coil surface. For most efficient operation, units should be located so that air from an open door cannot be drawn directly into the fans.

FIGURE 1: MODEL EF — TOP VIEW



Dimension—Ft.	*A*	*B*	*C*
Minimum	5	10	1 1/2
Maximum	15	30	10

FIGURE 2: MODEL SD — TOP VIEW



When mounting the units, lift and handle them by the cabinet or hanger flanges only. Do not attempt to lift the units by the tubing or fan guards or damage may result. See Figure 1 (EF) or Figure 2 (SD) for location recommendations.

These two drawings show the air flow direction and recommended minimum clearances to walls or other obstructions or other unit coolers.

The units should be lifted into position by grasping underneath at each end. Care should be taken so that the drain pan is not damaged. The units can be mounted directly to the ceiling using 5/16” lag bolts, or they may be hung below the ceiling using 5/16” threaded rod. If the unit is hung below the ceiling, adequate space must be provided to allow cleaning per UL Sanitation requirements.

> ***IMPORTANT:*** *The units must be mounted level in order to drain properly. Use a spirit level to make sure the unit is level in both directions. Proper pitch is provided in the drain pan so the unit will drain when mounted level.*

Drain Line

All units are furnished with a 3/4” FPT drain connection. The drain should be run with a minimum of 1/2” of slope per foot of horizontal run. Keep the length of drain line within the refrigerated space as short as possible. Provide a trap in the line outside of the refrigerated space. On freezer applications, the drain line within the refrigerated space must be wrapped with a heat tape and insulated to prevent water from freezing in the line during the defrost cycle.

Table Liquid Line Selection

Line Size (O.D.)	Equiv. Lgth. (Ft.)	Unit Cooler Capacity BTUH R-22	R404A & R507
3/8	25	48,000	30,000
	50	30,500	20,000
	100	18,000	12,000
	150	15,200	10,000
1/2	25	90,350	60,000
	50	61,450	38,650
	100	42,100	26,420
	150	33,650	21,150
5/8	25	165,100	107,650
	50	112,350	73,500
	100	80,000	53,000
	150	61,450	40,150
7/8	25	438,000	284,120
	50	299,150	193,150
	100	204,100	132,100
	150	163,100	106,150

† These line capacities are also suitable for R502

Table 2: Suction Line Selection

Line Size (O.D.)	Equiv. Lgth. (Ft.)	Unit Cooler Capacity — BTUH: R-22, Suction Temperature °F -20	0	20	R404a (HP-62), 507 (AZ-50), Suction Temperature °F -40	-20	0	20
5/8	25	7,800	12,000	18,000	4,000	6,000	10,500	15,500
	50	3,575	5,500	12,000	3,000	4,000	7,500	9,500
	100	2,600	4,000	9,000	2,000	3,000	5,500	6,500
	150	2,275	3,500	6,500	1,000	1,500	2,500	4,500
7/8	25	16,835	25,900	48,000	12,100	18,200	27,000	35,500
	50	11,700	18,000	30,200	6,500	12,200	18,500	24,500
	100	9,880	15,200	24,100	4,000	6,200	14,500	18,500
	150	7,865	12,100	18,200	3,500	4,200	10,500	15,000
1 1/8	25	44,700	68,150	103,650	20,000	36,200	58,100	88,100
	50	30,500	46,500	70,750	14,300	24,800	39,600	60,200
	100	21,100	32,100	48,450	9,700	16,700	27,050	41,300
	150	16,750	25,400	38,820	7,900	13,400	21,500	33,000
1 3/8	25	77,350	118,550	180,750	38,000	64,550	101,000	154,500
	50	53,000	81,000	124,120	25,750	44,100	69,100	106,100
	100	36,200	55,120	84,100	17,650	30,150	47,050	72,250
	150	29,500	44,350	67,150	14,100	24,120	38,550	57,820
1 5/8	25	123,120	186,100	264,100	67,650	105,100	164,100	245,700
	50	84,150	127,000	180,100	42,100	71,500	112,250	168,100
	100	57,400	87,100	123,200	28,650	48,800	76,350	114,700
	150	46,120	69,500	98,750	23,100	38,500	61,150	91,750
2 1/8	25	257,100	391,100	597,000	131,750	220,100	248,100	520,000
	50	175,000	267,100	408,100	90,100	150,000	237,500	354,500
	100	120,100	182,100	278,120	61,350	102,150	162,100	242,500
	150	96,150	146,100	223,110	49,150	82,100	129,650	193,600

Refrigerant Piping

Install all refrigeration components in accordance with accepted piping practices. Liquid and suction lines may be sized using the suggestions on Page 3, however ASHRAE recommendations must be considered the final authority.

All horizontal suction lines should be sloped toward the compressor at the rate of 1/8” per foot for good oil return. Vertical suction risers of more than five feet should be trapped with a P-Trap at the bottom.

Table 3: Other Refrigerants

Refrigerant	Capacity Multiplier: Use R-22 Table, Liquid	Use R-22 Table, Suction	Use R404a Table, Liquid	Use R404a Table, Suction
R-134a, MP-39 †	0.75	0.60	—	—
HP-80 ††	—	—	1.10	1.15

† R-401A
†† R-402A

Table 3 lists the multipliers to convert R-22 piping capacities to R-134a or MP-39; and to convert R-404a piping capacities to HP-80. Use the following procedure to avoid tedious ‘trial and error’ pipe sizing.

Find the appropriate factor from Table 3. Divide the BTUH requirement by the Table 3 factor, then select the pipe size directly from Table 1 or 2.

Example: Select the correct suction line size for 40,000 BTUH of MP-39 at +20°F. suction temperature and 100 equivalent feet of tubing.

1. Find the factor 0.60 in the R-22 (Suction) column opposite the MP-39 side heading of Table 3.

2. Divide 40,000 BTUH by 0.60 to find the corrected capacity.

Corr. Capacity = 40,000 BTUH ÷ 0.60 = 66,667 BTUH (i.e., 100 equivalent feet of tubing large enough for 66,667 BTUH of R-22 will be suitable for 40,000 BTUH with MP-39).

3. Refer to Table 2 and find 84,100 BTUH in the R-22 (+20° Suction Temp.) column opposite the 1-3/8” (100 Equiv. Lgth.) side heading. The correct line size is 3/8” OD. It will be noted that 100’ of 1-1/8” is suitable for only 48,450 BTUH.

Hot Gas Piping

Hot gas defrost systems can be described as either Re-Evap (three-pipe) or Reverse Cycle (two-pipe) types. Figures 4 thru 7 represent typical piping arrangements for hot gas defrost units.

SDG and EFG units may be ordered for either of the two system types mentioned above. *LOW TEMPERATURE SDG units only are equipped with a hot gas drain pan loop.*

Re-Evap System—Uses three pipes as shown in Figures 6, 7 & 9—one for the liquid, one for the suction and one for the hot gas. In addition, a heat exchanger/re-evaporator (Figure 3) is used at the suction line outlet of the evaporator and is piped exactly the same as an ordinary liquid/suction heat exchanger.

The hot gas is taken from the discharge line between the compressor and the condenser, through a hot gas solenoid valve, then through the hot gas line to the unit cooler.

> On low temperature SDG units (Fig. 6), the hot gas enters the unit at the drain pan loop before going to the side inlet of the distributor.
>
> On all medium temperature units the hot gas goes directly to the side inlet of the distributor. See Fig. 7 (SDG) and Fig. 9 (EFG).

The hot gas for all units then goes thru the coil in the same direction as the normal refrigeration flow. The condensed refrigerant is trapped in the re-evaporator as it leaves the coil, there to be metered as a heavy vapor into the suction line flow back to the compressor.

Reverse Cycle—Is a technique in which the hot gas flows backwards (i.e. opposite to the normal refrigerating flow) through the evaporator. Systems employing the reverse cycle principle are divided into two types — Alternating Evaporator and Heat Pump systems.

Alternating Evaporator System—This is the system commonly referred to as "Reverse Cycle Defrost". It must have multiple evaporator coils on the same system to operate.

Evaporator coils are defrosted in groups of one or more coils per group. 65% to 75% of the coils will continue to refrigerate while 25% to 35% are on defrost. The defrosting coils produce liquid refrigerant which is used to operate the coils which are still refrigerating.

The simplest design is a system with one condensing unit and three evaporator coils. One coil will defrost at a time, while the other two continue to refrigerate.

A hot gas line is run from the discharge line of the compressor close to the junction of the main suction line with the three individual suction lines. There the hot gas line branches into three hot gas lines. Each of these three lines has a hot gas solenoid valve; the leaving side of each solenoid valve is teed into one of the three branch suction lines. Each suction line has a suction-stop valve installed between the main suction line and the hot gas tee-in to keep hot gas from entering the main suction line to the compressor. In this way, each evaporator coil has a source for hot gas, controlled by its own defrost solenoid valve. A modular multi-circuit defrost timer is normally employed to synchronize the three defrosts.

The timer initiates defrost on a given coil, opening its hot gas solenoid (and closing its suction-stop valve), allowing hot gas to flow backwards through the suction line towards the coil.

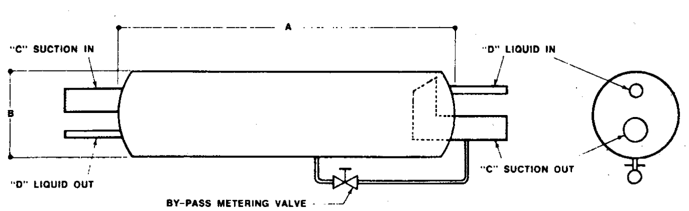
> *On low temperature SDG units (Fig. 4*), the hot gas enters the unit at the drain pan loop before going into the suction side of the coil itself.
>
> *On all medium temperature units*, the hot gas goes directly into the suction side of the coil. See Fig. 5 (SDG) and Fig. 8 (EFG).

As it leaves the coil, the condensed liquid flows through a bypass line around the expansion valve into the liquid line. It flows backwards through the branch liquid line until it reaches the main liquid line, where it is re-introduced into the refrigerating part of the system. The main liquid line is made to operate at a lower pressure during defrost so that it will accept the liquid from the defrosting coil.

A much larger Alternating Evaporator system will still operate in much the same way. Such a system might have a larger compressor or a parallel compressor rack operating with many more evaporator coils than described above. Now there will be a *group of coils* defrosting at once instead of just one. It is important, however, that no one defrost group is larger in refrigerating capacity than 25% to 35% of the total. A given hot gas line and solenoid valve will now service its evaporator group instead of only one evaporator.

Heat Pump System—Usually employs a single condensing unit and single evaporator. Primarily used in the HVAC industry to transform the (Summertime) DX cooling coil into a (Wintertime) heating coil. A DX coil can be defrosted in this way when used in a specialized system.

FIGURE 3
Heat-Exchanger/Accumulator



NOTE: Level-mount the Heat-Exchanger/Accumulator within refrigerated space as close to the evaporator as possible. The metering valve is to be in the down position as shown.

CAPACITY AND DIMENSIONS

EVAPORATOR CAPACITY	MODEL NO.	A	B	C (OD)	D (OD)
Up to 6,000	HEA-1A	9-3/4	5	7/8	3/8
6,000 to 12,000	HEA-2A	15-3/4	5	1-1/8	1/2
12,000 to 24,000	HEA-3A	27-3/4	5	1-3/8	1/2
24,000 to 36,000	HEA-4A	37-3/4	5	1-5/8	5/8
36,000 to 55,000	HEA-5A	45-3/8	6	2-1/8	5/8
55,000 to 80,000	HEA-6A	64-3/8	6	2-5/8	7/8

Super-Flo Units

Reverse-Cycle (Two-Pipe) Systems

Figure 4—Low Temp. Units
(With Drain Pan Loop)

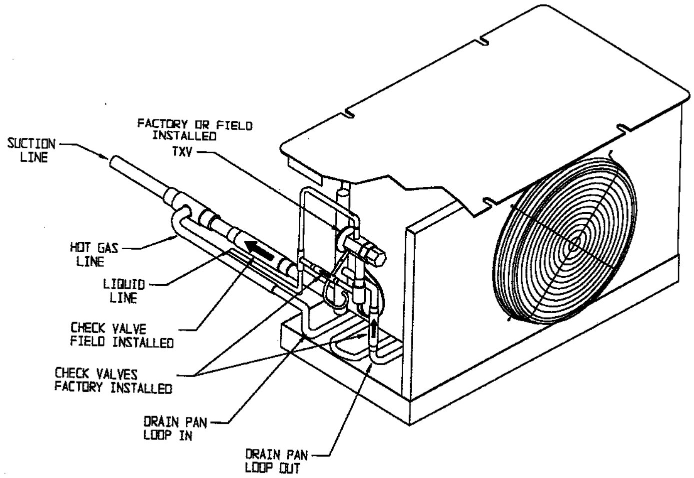
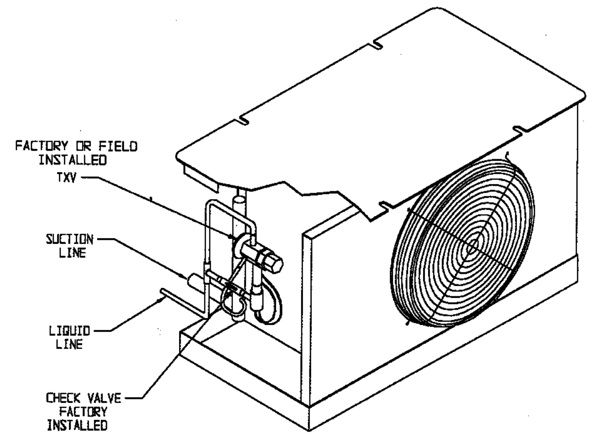


Figure 5—Medium Temp. Units
(without drain pan loop



Re-Evap (Three-Pipe) Systems

Figure 6—Low Temp. Units
(With Drain Pan Loop)

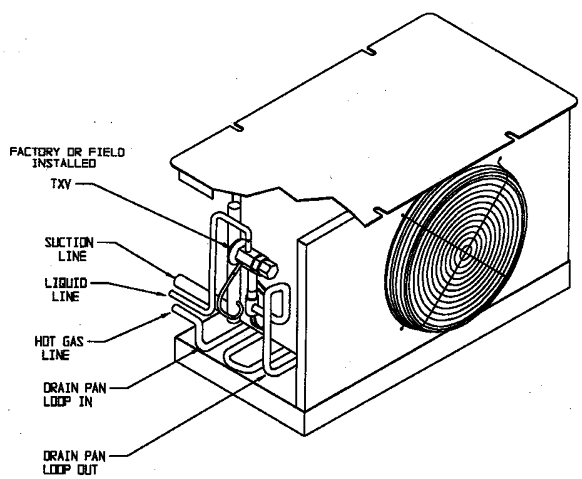
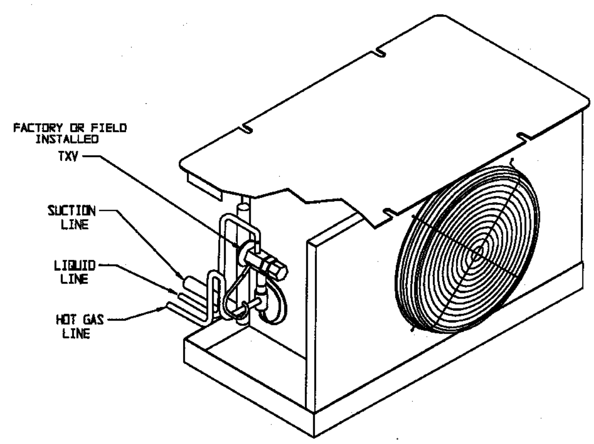


Figure 7—Medium Temp. Units
(With Drain Pan Loop)



Easy-Flo—Medium Temp. (without drain pan loop)

Figure 8—Reverse-Cycle (Two-Pipe) Systems

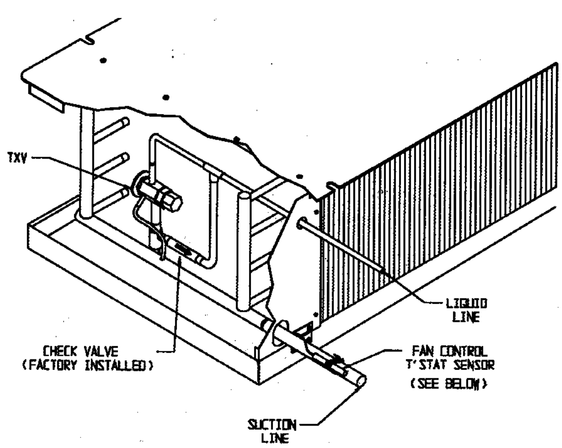
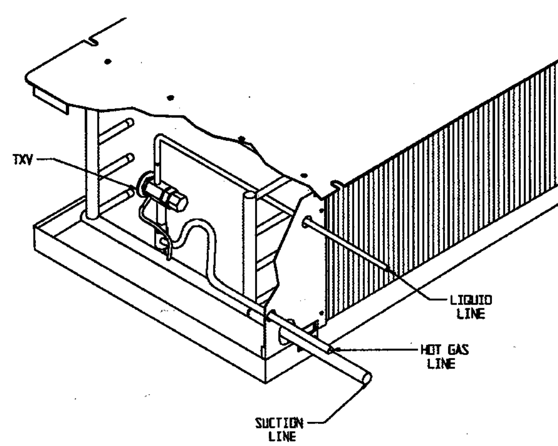


Figure 9—Re-Evap (Three-Pipe) Systems



Expansion Valve Installation

All units use an externally equalized type valve. See Table 4 and 5 for expansion valve selection.

NOTE: All units have 1/2" OD male sweat inlet connections except Super-Flo Models 220L, 240L, 260L and 300L which are 7/8" OD male sweat.

Locate the valve inside the end compartment of the unit. If the unit has a distributor, make sure it is in the vertical position for best refrigerant distribution. Some units are shipped with more than one size nozzle for the distributor. Follow instructions in unit for selecting and installing the correct nozzle before expansion valve installation.

Sweat the outlet of the valve to the inlet of the distributor, or on one circuit coils, to the coil inlet connection. Connect the external equalizer to the valve. Follow valve manufacturers instructions for protecting the valve from overheating during installation.

Locate valve sensing bulb (at 4 or 8 o'clock position) on a horizontal length of suction line as close to the unit as possible. Make sure that there is full length contact between the bulb and the suction tubing. If there is a P-trap in the suction line, locate the bulb between the unit and the trap.

NOTE: Install a 1/4 inch male flare access fitting in the suction line near the unit to use when taking superheat readings. See "Super Heat Adjustment" section of this manual for information on super-heat check and adjustment.

Table 4: Expansion Valve Selections @ -20°F. Suction Temp. and 100°F. Liquid Temp.

Sporlan Valves

R-22			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*
2040	7980	5010	EBFVEAAZP
3600	14280	8940	EBFVEAZP
6720	26400	16560	EBFVEBZP
12000	47400	29700	EBFVECZP

R-507 (AZ50)			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*
1440	5580	3510	EBFREAAZP
3480	13560	8520	EBFREAZP
5100	19800	12450	EBFREBZP
7800	30240	19020	EBFRECZP
15600	60600	38100	EBSRE71/2ZP

R-402A (HP80)			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*
1500	5820	3660	EBFREAAZP
3600	14280	8940	EBFREAZP
5340	20760	13050	EBFREBZP
8160	31800	19980	EBFRECZP

R-404A (HP62)			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*
1440	5580	3510	EBFREAAZP
3480	13680	8580	EBFREAZP
5040	19800	12420	EBFREBZP
7680	30300	18990	EBFRECZP

Alco Valves

R-22			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Alco Valve Type*
1380	2484	1932	HFES1/4HW35
2595	4671	3633	HFES1/2HW35
4620	8316	6468	HFES1HW35
7050	12690	9870	HFES1 1/2HW35
9475	17055	13265	HFES 2HW35
12160	21888	17024	HFES2 1/2HW35
16050	28890	22470	HFES 3HW35

R-404A (HP-62)			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Alco Valve Type*
860	1548	1204	HFES 1/8SW45
1625	2925	2275	HFES 1/4SW45
2890	5202	4046	HFES 1/2SW45
4410	7938	6174	HFES 1 SW45
5930	10674	8302	HFES1 1/4 SW45
7610	13698	10654	HFES1 1/2 SW45
10040	18072	14056	HFES 2 SW45
17855	32139	24997	HFES3 1/2 SW45

R-402A (HP-80)			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Alco Valve Type*
895	1611	1253	HFES 1/4LW45
1685	3033	2359	HFES 1/2LW45
3000	5400	4200	HFES 3/4LW45
4580	8244	6412	HFES 1LW45
6155	11079	8617	HFES 1 1/4LW45
7900	14220	11060	HFES1 1/2LW45
10425	18765	14595	HFES 2LW45
18535	33363	25949	HFES 4 LW45

R-507 (AZ50)			
Minimum BTU	Maximum BTU	Mean BTU	Alco Valve Type
875	1575	1225	HFES 1/8RW45
1650	2970	2310	HFES 1/4RW45
2940	5292	4116	HFES 1/2 RW45
4490	8082	6286	HFES 1 RW45
6035	10863	8449	HFES 1 1/4RW45
7740	13932	10836	HFES 1 1/2RW45
10220	18396	14308	HFES 2 RW45
18170	32706	25438	HFES3 1/2RW45

Table 5: Expansion Valve Selections @ 25°F Suction Temp. and 100°F Liquid Temp.

Sporlan Valves

R-22				*R-134a*				*R-401A (MP39, R-12)*			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*	*Minimum BTU*	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*	*Minimum BTU*	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*
2640	11100	6870	EBFVEAAC	1740	7380	4560	EBFFEAAC	2100	8880	5490	EBFFEAAC
5640	23760	14700	EBFVEAC	3840	16500	10170	EBFFEAC	4620	19680	12150	EBFFEAC
9900	41700	25800	EBFVEBC	6600	27900	17250	EBFFEBC	7800	33360	20580	EBFFEBC
18600	77100	47850	EBFVECC	11880	49200	30540	EBFFECC	13800	59100	36450	EBFFECC

R-404A (HP62)				*R-507 (AZ50)*				*R-402A (HP80)*			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*	*Minimum BTU*	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*	*Minimum BTU*	*Maximum BTU*	*Mean BTU*	*Sporlan Valve Type*
1740	7440	4590	EBFREAAC	1740	7380	4560	EBFREAAC	1800	7680	4740	EBFREAAC
3900	16800	10350	EBFREAC	3900	16620	10260	EBFREAC	4080	17280	10680	EBFREAC
7200	30300	18750	EBFREBC	7200	30000	18600	EBFREBC	7500	31500	19500	EBFREBC
10800	45900	28350	EBFRECC	10800	45600	28200	EBFRECC	11400	47400	29400	EBFRECC

Alco Valves

R-22				*R-134a*				*R-404A (HP-62)*			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Alco Valve Type*	*Minimum BTU*	*Maximum BTU*	*Mean BTU*	*Alco Valve Type*	*Minimum BTU*	*Maximum BTU*	*Mean BTU*	*Alco Valve Type*
2030	3654	2842	HFES1/4HC	1505	2709	2107	HFES 1/4MC	1300	2340	1820	HFES 1/8SC
3820	6876	5348	HFES1/2HC	2835	5103	3969	HFES 1/2MC	2445	4401	3423	HFES 1/4SC
6815	12267	9541	HFES1HC	5055	9099	7077	HFES 3/4MC	4350	7830	6090	HFES 1/2SC
10390	18702	14546	HFES1 1/2HC	7715	13887	10801	HFES 1 MC	6650	11970	9310	HFES 1 SC
13960	25128	19544	HFES 2HC	10365	18657	14511	HFES1 1/2MC	8935	16083	12509	HFES1 1/4 SC
17915	32247	25081	HFES2 1/2HC	13300	23940	18620	HFES1 3/4MC	11465	20637	16051	HFES1 1/2 SC
23650	42570	33110	HFES 3HC	17555	31599	24577	HFES2 1/2MC	15135	27243	21189	HFES 2 SC
				31210	56178	43694	HFES 4MC	26905	48429	37667	HFES3 1/2 SC

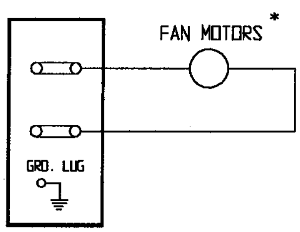
R-507 (AZ50)				*R-401 (MP-39, R12)*			
Minimum BTU	*Maximum BTU*	*Mean BTU*	*Alco Valve Type*	*Minimum BTU*	*Maximum BTU*	*Mean BTU*	*Alco Valve Type*
1290	2322	1806	HFES 1/8RC	1660	2988	2324	HFES 1/4XC
2430	4374	3402	HFES 1/4RC	3130	5634	4382	HFES 1/2XC
4330	7794	6062	HFES 1/2 RC	5575	10035	7805	HFES 3/4 XC
6605	11889	9247	HFES 1 RC	8505	15309	11907	HFES 1 XC
8875	15975	12425	HFES 1 1/4RC	11430	20574	16002	HFES 1 1/2 XC
11390	20502	15946	HFES 1 1/2RC	14665	26397	20531	HFES 2 XC
15035	27063	21049	HFES 2 RC	19360	34848	27104	HFES 2 1/2 XC
26730	48114	37422	HFES 3 1/2RC	34415	61947	48181	HFES 4 1/2 XC

FACTORY WIRING — STANDARD UNIT COOLERS
Air, Hot Gas and Electric Defrost

The following 3 diagrams show the standard factory (internal) wiring for Air, Hot Gas and Electric Defrost

Air Defrost

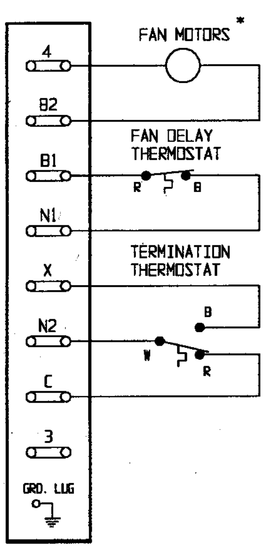
Diagram 1



Units may have more than one motor—multiple motors are wired in parallel.

Hot Gas Defrost

Diagram 2

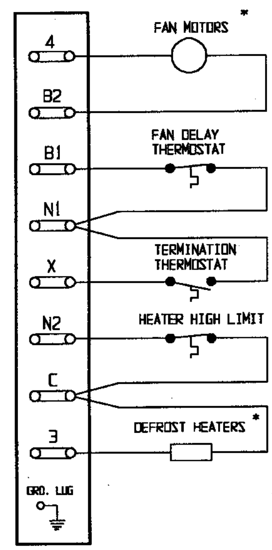


Units may have more than one motor—multiple motors are wired in parallel.

Note: Fan delay thermostat is on low temperature units only.

Electric Defrost

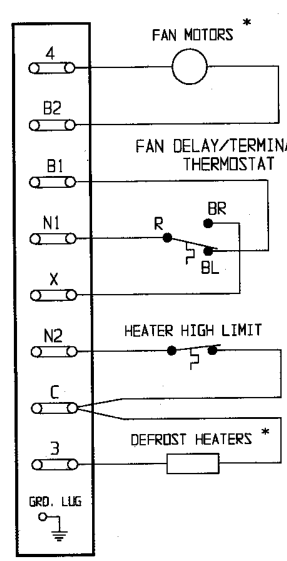
Diagram 3
(EFE Units)



Units may have more than one motor—multiple motors are wired in parallel and multiple heaters are wired in parallel.

Note: Fan delay thermostat is on low temperature units only.

Diagram 4
(SDE Units)



Units may have more than one motor—multiple motors are wired in parallel and multiple heaters are wired in parallel.

TYPICAL FIELD WIRING—SEQUENCE OF OPERATION
General Information

IMPORTANT: *All wiring must be done in accordance with applicable codes and local ordinances. Refer to the unit cooler nameplate to determine the required ampacities of motor and heater circuits.*

NOTE: The wiring diagrams on Pages 9 to 13 are shown to provide visual support for the field wiring considerations and sequence of operations discussed below. They are generic relative to the high-side, showing only the defrost timer. Refer to Page 8 for details of internal unit cooler wiring.

The basic sequence of operation for electric defrost is given on Page 11—all other electric defrost diagrams refer back to that sequence with the exceptions noted.

Wiring Legend

The following is a legend of the wiring symbols and designations used in diagrams 15 through 23.

☐	Field terminal block connection in Witt condensing unit.
°	Field terminal-block connection
— —	Field wiring
— —	Bold dashed wiring shows alternate methods of terminating defrost—pressure control in condensing unit or thermostat in unit cooler.
TC1	Room thermostat
LLS	Liquid line solenoid
PC	Pressure control
M2	Heater contactor
M3	Fan motor contactor
M4	Heater contactor
R1	Lockout relay
R2	Sequencing relay
R3	Sequencing relay

Air Defrost

SDA and EFA units will require the connection of power to the fan motor circuit.

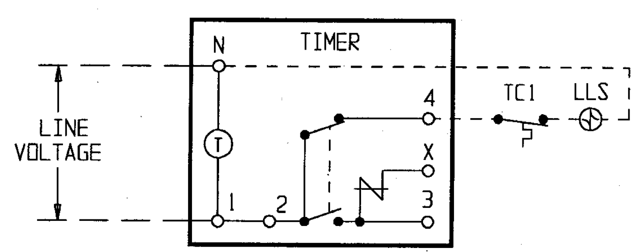
An air defrost system is wired so that the evaporator fans run continuously unless manually de-energized. Whenever the compressor stops, the room air (minimum +34 degrees) warms the coil to room temperature, melting the frost.

It is essential that the frost completely melts and drains each time the compressor cycles off. If it does not, a *partial air defrost* results, and the residual water and slush re-freeze into ice during the next run cycle. Ice removal usually requires manual defrost methods.

Adequate off-cycle (defrost) time is a function of system capacity. If the system is too small for the application, ice build-up will usually result. Use of an air defrost timer is sometimes successful on undersized systems in avoiding coil icing. A temporary loss of room temperature will occur during defrost.

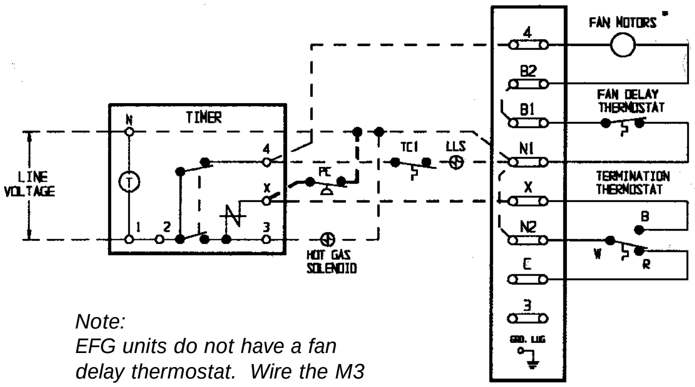
Optional timers are available to assist in air defrost application.

Wiring Diagram 4—Time Termination is done by setting the fail-safe dial of the timer to the desired defrost duration.



TYPICAL FIELD WIRING — SEQUENCE OF OPERATION
Hot Gas Defrost—Re-Evap Type

Wiring Diagram 5—115 volt or 208-230 volt units wired directly to timer.



Note:
EFG units do not have a fan delay thermostat. Wire the M3 holding coil directly to N1.

Normal Refrigeration—The liquid line solenoid valve (LLS) receives power from terminal #4 of the defrost timer through the room thermostat. The thermostat will close on rise of room temperature, energizing the LLS, allowing refrigerant flow to the unit cooler. Pressure will build up in the low-side and the low pressure control (not shown) will close, starting the compressor.

The room thermostat will open when it reaches its cut-out set point, breaking power to the LLS. The LLS will close, stopping refrigerant flow to the unit cooler. The system will pump down and the compressor will stop.

Defrost—The defrost timer will switch to the defrost position at the preset time. Timer contact to terminal #4 will open, breaking power to the LLS and the unit cooler fan motor(s). Timer contact to terminal #3 will close at the same time, supplying power to the hot gas solenoid valve (HGS), allowing hot gas to flow to the unit cooler. A normally open solenoid valve installed in the discharge line to the condenser (not shown) is typically wired in parallel with the HGS.

NOTE: Both temperature and pressure terminations are shown in the same wiring diagram for the sake of brevity—only one would actually be employed. The pressure control would be eliminated for temperature termination—the field wire from terminal "X" on the unit cooler to terminal "X" on the timer would be eliminated for pressure termination.

Temperature Termination—The Defrost Termination thermostat installed in the unit cooler will sense the completion of defrost and close its contact X-N2, supplying power to terminal "X" on the timer.

The termination solenoid in the timer will switch the timer back into the normal (refrigerating) position, opening the contact to timer terminal #3 (de-energizing the HGS); and closing the contact to terminal #4 (energizing the LLS and bringing power to one side of the unit cooler fan motors).

Pressure Termination—The pressure control (by others) will sense the completion of defrost (recommended set point is the refrigerant pressure equivalent to 45° F.) and close its contact, supplying power to terminal "X" on the timer. The balance of the termination sequence is identical to Temperature Termination above.

Systems with SDG Units will begin to refrigerate without the unit cooler fans running. This prevents water droplets and steam from blowing into the room. The fan delay thermostat installed in the unit cooler will sense when the coil re-freezes and will close contact B1-N1 energizing the fan motors. Thus normal refrigeration is resumed.

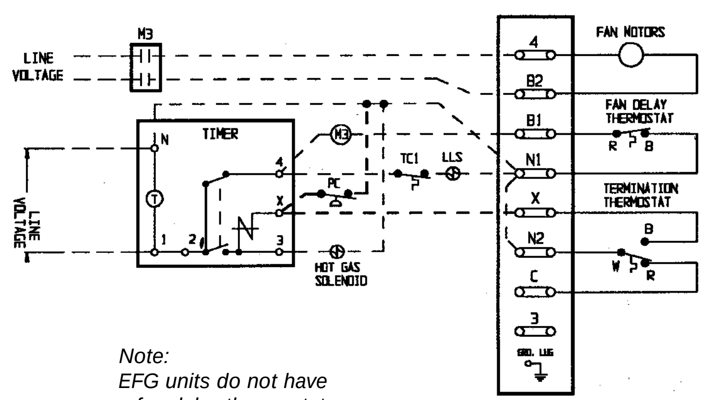
NOTE: SDG unit fans on systems operating above +20° evaporator temperature may experience excessive delay restarting after defrost. The fan delay thermostat may be de-activated as follows.

Move the B1 end of the B1-B2 jumper to N1 (Diagram 5).

Wire the M3 contactor holding coil to N1 & 4 (rather than B1 & 4 as shown in Diagram 6).

Systems with EFG units are not furnished with fan delay thermostats, so the fans start operating immediately upon termination.

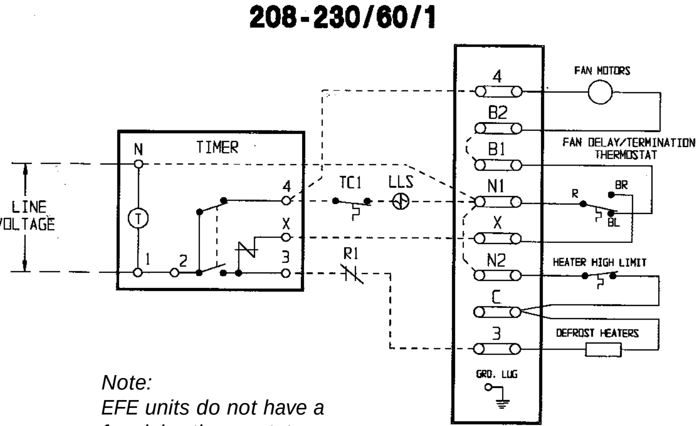
Wiring Diagram 6—Units Wired with Fan Contactor



Note:
EFG units do not have a fan delay thermostat. Wire the M3 holding coil directly to N1.

TYPICAL FIELD WIRING—SEQUENCE OF OPERATION
Electric Defrost—Single Unit Cooler Systems

Wiring Diagram 7—One 208-230 volt unit wired directly to timer.



Note:
EFE units do not have a fan delay thermostat. Wire a jumper from B2 to N1.

Normal Refrigeration —The liquid line solenoid valve (LLS) receives power from terminal #4 of the defrost timer through the room thermostat. The thermostat will close on rise of room temperature, energizing the LLS and allowing refrigerant flow to the unit cooler. Pressure will build up in the low-side and the low pressure control (not shown) will close, starting the compressor.

The room thermostat will open when it reaches its cut-out set point, breaking power to the LLS. The LLS will close, stopping refrigerant flow to the unit cooler. The system will pump down and the compressor will stop.

Defrost —The defrost timer will switch to the defrost position at the pre-set time. Timer contact to terminal #3 will close, supplying power to the normally closed Lock-Out Relay R-1. The holding coil of R1 (not shown) is to be wired in parallel with the compressor contactor holding coil. R-1 will thereby remain open as long as the compressor is running, preventing the heaters from operating at the same time as the compressor. This eliminates the need for oversized wiring to the condensing unit. R-1 can also represent a normally closed auxiliary contact in the compressor contactor.

Timer contact to terminal #4 will open at the same time, breaking power to the LLS and the unit cooler fan motors. Refrigerant flow to the unit cooler will stop. The compressor will continue to run until the system pumps down on the low pressure control, stopping the compressor. Relay R1 will close at that time, energizing the defrost heaters to defrost the coil.

Temperature Termination—The Defrost Termination thermostat installed in the unit cooler will sense the completion of defrost and close its contact N1-X, supplying power to terminal "X" on the timer. The termination solenoid in the timer will switch the timer back into the normal (refrigerating) position, opening the contact to terminal #3 (de-energizing the defrost heater); and closing the contact to terminal #4 (energizing the LLS and bringing power to terminal #4 of the unit cooler fan motors).

***Caution**: Coolers warmer than 32°F. are susceptible to partial air defrost resulting in ice build-up. Time termination may be required.*

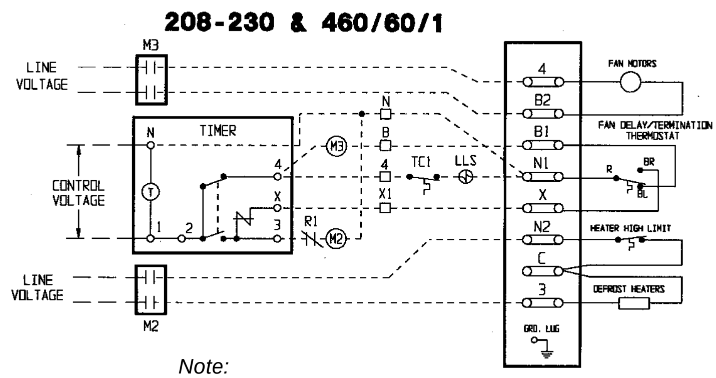
SDE Units will begin to refrigerate without the unit cooler fans running. This prevents water droplets and steam from blowing into the room. The fan delay thermostat will sense when the coil re-freezes and will close contact B1-N1, energizing the fan motors. Thus normal refrigeration is resumed.

NOTE: SDE unit fans on systems operating above +20° evaporator temperature may experience excessive delay restarting after defrost. The fan delay thermostat may be de-activated as follows:

Move the B1 end of the B1-B2 jumper to N1 (Diagram 7).

Wire the M3 contactor holding coil to N1 & 4 (rather than B1 & 4 as shown in Diagram 8).

Wiring Diagram 8—One 208-230 or 460 volt unit wired with fan motor and defrost heater contactors.



Note:
EFE units do not have a fan delay thermostat. Wire the M-3 holding coil directly to N1.

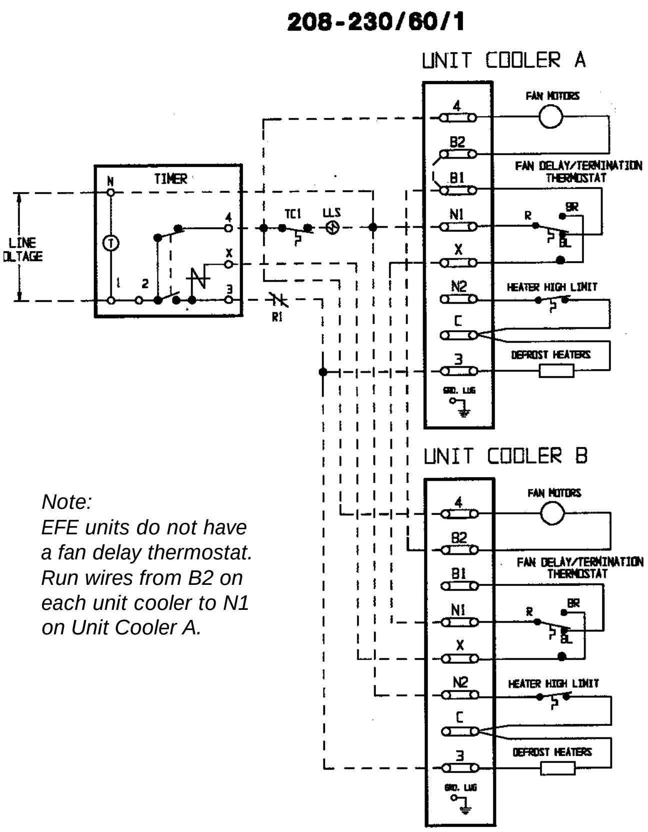
Identical to Diagram 7 except:

1. Terminal #4 on the defrost timer will supply power to the holding coil of motor contactor M3 instead of supplying power directly to the fan motors.
2. Terminal #3 on the timer will supply power to the holding coil of heater contactor M2 instead of supplying power directly to the defrost heater.

TYPICAL FIELD WIRING—SEQUENCE OF OPERATION
Electric Defrost—Dual Unit Cooler Systems

(Without Sequencing Relays

Wiring Diagram 9—Two 208-230 units wired directly to timer.



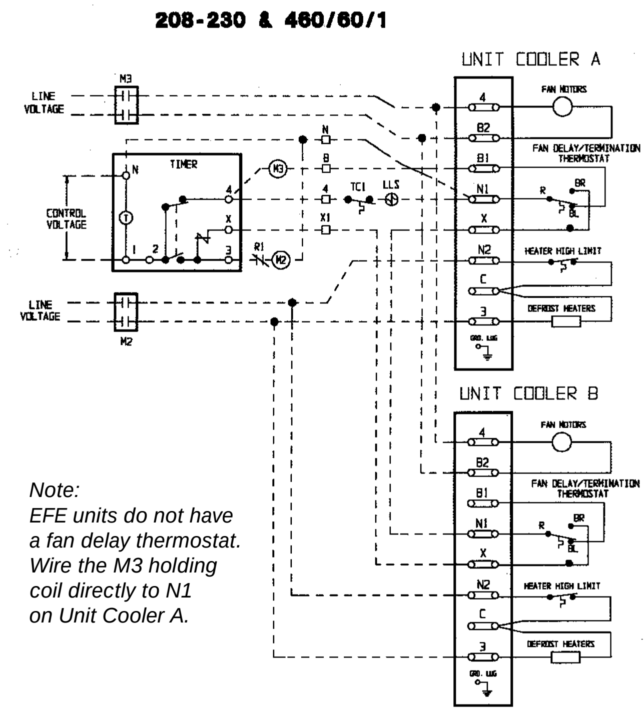
Note:
EFE units do not have a fan delay thermostat. Run wires from B2 on each unit cooler to N1 on Unit Cooler A.

Sequence of operation is the same as Wiring Diagram 7, except:

1. Defrost termination thermostat contacts N1-X are wired in series—both unit coolers must terminate to terminate the timer.

2. The fan delay thermostat in Unit B is not used—the fan delay function for both units is controlled by the fan delay on Unit A.

Wiring Diagram 10—Two 208-230 or 460 volt units wired with fan motor and defrost heater contactors.

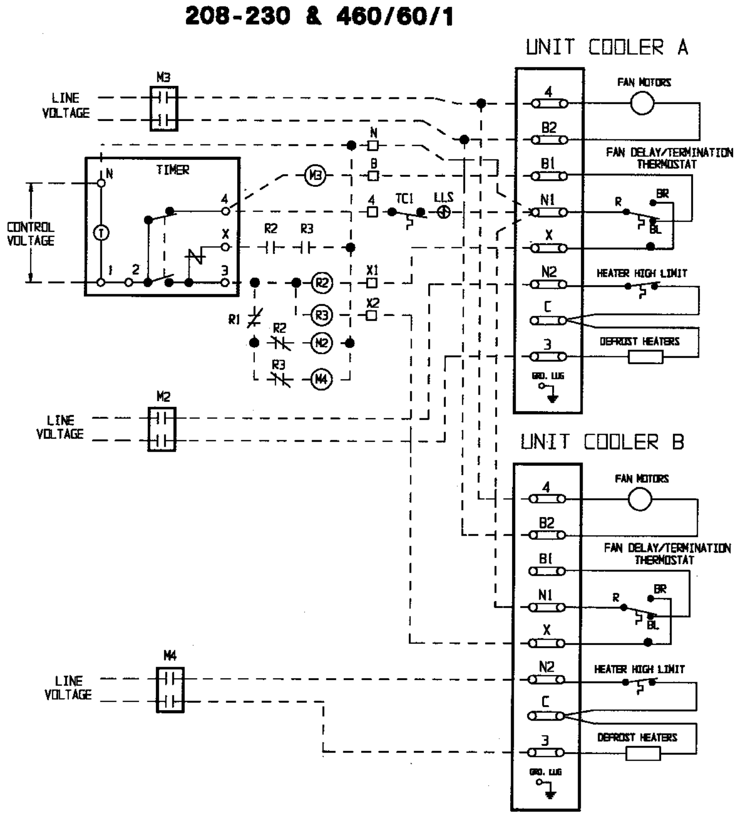


Note:
EFE units do not have a fan delay thermostat. Wire the M3 holding coil directly to N1 on Unit Cooler A.

Identical to Diagram 9 except that fan motor and defrost heater power is supplied through contactors M3 and M2 respectively.

TYPICAL FIELD WIRING—SEQUENCE OF OPERATION
Electric Defrost—Dual Unit Cooler Systems
(With Sequencing Relays)

Wiring Diagram 11—Two 208-230 or 460 volt units wired with fan motor and defrost heater contactors.



Identical to Wiring Diagram 10 except that termination is accomplished through sequencing relays R2 and R3.

The heaters of one unit can de-energize when the coil is clean while the other unit can continue defrost if required. This eliminated steaming of the unit that completed defrost first.

Note that separate heater contactors (M2 & M4) are required for each unit cooler.

Unit A will energize R2 when it terminates. R2 normally closed (N.C.) contact will open, de-energizing heater contactor M2. R2 normally open (N.O.) contact closes. The timer cannot terminate, however, until both (N.O.) R2 and R3 contacts close—they are wired in series to timer terminal "X".

Unit B continues defrost until termination temperature is reached. R3 will then energize—its (N.C.) contact opens (de-energizing M4) and its (N.O.) contact closes (bringing power to timer terminal "X") which terminates defrost.

Note:
Medium temperature units do not have a fan delay thermostat. Wire the M3 holding coil directly to N1 on Unit Cooler A.

START-UP PROCEDURE

System Check

Before starting the refrigeration system, check the following items:

1. Make sure the system is wired as shown in the diagrams in the Installation Section of this bulletin or the diagram in the unit.
2. Make sure all electrical connections are tight.
3. Make sure all piping is done as described in the Installation Section of this bulletin and in accordance with good piping practice.
4. Make sure all fan set screws are tight.
5. Make sure that the service valves on the compressor and receiver are open.
6. Make sure the unit is mounted securely and level. Pour water into the drain pan to make sure that the drain pan and drain line drain completely.
7. Make sure that the drain line is adequately heated on freezer applications.
8. Properly evacuate the system.
9. Follow proper procedures for handling and start-up of systems using polyester based lubricants.
10. Record the refrigerant type, system charge and oil type in the blanks provided on the unit nameplate.

Initial Start-up

Check the following items after initial unit start-up:

1. After the initial start-up, the fans on low temperature electric and hot gas defrost units will not start until the coil temperature pulls down to about 30°F. The fans may cycle several times until the room temperature is pulled down.
2. Check the system for proper refrigerant charge and oil level.
3. Make sure that the expansion valve superheat is set correctly. See the "Superheat Adjustment" section below.
4. Make sure the drain line heater is functioning properly.
5. During initial start-up it is not unusual to have very heavy frost loads. It may be necessary to manually initiate defrost cycles as needed until the moisture level in the room is reduced.
6. Observe the first defrost cycle on electric and hot gas defrost units to make sure that all system components are functioning properly. Check the amp draw of the defrost heaters on electric defrost units to make sure that they are working. Also make sure that the defrost cycle is terminated by the termination thermostat and not by the "fail-safe" on the timer.

Superheat Adjustment

The superheat must be adjusted properly for efficient unit cooler operation and to protect the compressor from floodback. The superheat should be set at 10°F to 12°F .

1. Allow the system to operate until the refrigerated space temperature has been reduced to the design temperature.
2. Connect an accurate low pressure gauge to the access fitting installed in the suction line at the unit cooler outlet.

   ***Caution**: The evaporator pressure reading must be taken at a point no more than five feet from the unit cooler. For this reason, it is not normally suitable to use the compressor suction service valve for this purpose.*

3. Tape the sensor from an electronic thermometer to the suction line as close to the expansion valve bulb as possible. Insulate the sensor.
4. Take evaporator pressure and temperature readings with the system operating. Determine the superheat using a Pressure-Temperature Saturation Table for the refrigerant being used. The following example will illustrate the procedure.

   Given:

   Measured pressure = 43 PSIG
   Measured temperature= 35° F

From a Saturation Table, the saturation temperature for R-22 at 43 PSIG is 20° F . Compare the saturated suction temperature from the table to the actual suction temperature on the thermometer. The difference is the superheat.

35° F - 20° F = 15° F superheat

A superheat of 15°F is too high so the valve must be opened up. See the expansion valve manufacturers recommendations for the adjustment procedure. Always wait for 20 to 30 minutes after adjustment for the system to stabilize. Take new readings and readjust the valve as required.

Defrost Controls

Electric Defrost Timer

The standard timer is an 8145-20 Paragon or equal. If a different timer is used, make sure that it has a "fail safe" feature. This is a setting on the timer that will terminate the defrost cycle after a set period of time, if the defrost thermostat fails to do so. This feature assures that the unit will not stay in defrost for an extended period of time. However, it is important that the "fail-safe" not be set for a time period that is too short. If this is done, the defrost may be terminated by the "fail-safe" and not by the termination thermostat. This can result in incomplete defrost cycles. For most applications, a "fail-safe" setting of 40 minutes should be used.

Normally two defrost periods per day are adequate but more may be required if humidity levels are high.

Defrost Termination/Fan Delay Thermostat Electric Defrost (SDE)

This is an SPDT fixed setting (thermal-disk type) thermostat. It is mounted to the coil endplate with two sheetmetal screws. It can be easily moved to other endplate locations to meet unusual frosting conditions. The thermostat closes from “Red” to “Brn” at 55°F on rise in temperature to provide termination. It closes from “Red” to “Blk” at 35°F on a fall in temperature to provide fan delay.

Defrost Termination Thermostat

This is a fixed setting (thermal-disk type) control.

Electric Defrost (EFE)—An SPST thermostat is used, closing on rise at 50° F. with a 20° differential. It is clipped to a return bend at the best average location. It can be readily moved to meet unusual frosting conditions.

Hot Gas Defrost (SDG & EFG)—An SPDT thermostat is used, closing on rise at 70° F. with a 10° differential. It is clipped to a return bend near the exit point of the defrosting refrigerant. The factory location should not have to be changed in the field.

Safety Thermostat

This is a fixed setting (thermal-disk style) thermostat that is furnished on all electric defrost units. It is an open-on-rise control set to open at 90° F. It provides additional protection against overheating the unit cooler and room should the primary termination fail.

Fan Delay Thermostat

This is a fixed setting (thermal-disk style) thermostat that is furnished on hot gas defrost SDG units.

It is a SPST open-on-rise thermostat which opens at +40° and closes at +30°,sensing return bend temperature near the beginning of a coil circuit.

Fan Delay—Medium Temperature

SDE & SDG unit fans on systems operating above -20° evaporator temperature may experience excessive delay restarting after defrost. The fan delay thermostat may be de-activated per the instructions on pages 10 and 11.

MAINTENANCE

General

Check unit at least once a month for proper defrosting. The amount and pattern of frosting can vary greatly. It is dependent on room temperature, product being stored, turnover of product, percentage of time door is open and the temperature and humidity conditions surrounding the room. It may be necessary to periodically change the number or duration of defrost cycles.

Cleaning

The unit should be shut down and cleaned per NSF regulations at least once every six months.

CAUTION*: Make sure all electrical power to the unit is turned off and locked out before proceeding.*

Clean the fins with an UL Sanitation approved cleaning agent. The drain pan and the end panels should then be opened and cleaned. The end panels may be removed and totally immersed in water for cleaning if so desired. The fan deck must be cleaned in place. The fan guards may be removed or cleaned in place. The fan blades can be cleaned when the fan guards are removed, but care must be taken not to bend the blades as this may cause an out-of-balance condition. All internal metal surfaces of the unit should also be cleaned.

Check-Up

All components should be checked at least every six months for proper operation as follows:

1. Tighten all electrical connections.
2. Tighten fan set screws.
3. Check the system refrigerant charge and oil level.
4. Make sure the defrost controls are functioning properly.
5. Check the drain pan and drain line for proper drainage.
6. Check the drain line heaters for proper operation.

Fan And Motor Replacement—Model SD

***WARNING**: Make sure all electrical power to unit is disconnected before replacing fans or motors.*

The fan and motor can be accessed for replacement thru the fan venturi.

1. Remove the fan guard by removing the four screws which hold it in place.
2. Remove the fan blade by loosening the set screw with an allen wrench.
3. Disconnect the motor by unplugging the motor wires from the wiring harness.
4. Remove the nuts from the studs on the shaft end of the motor.
5. Grasp the motor, slide it out of the mount, and remove it through the fan venturi.

To replace the motor, reverse the above steps. Make sure that all star washers are replaced to insure proper grounding of the motor to the unit.

Fan Delay Thermostat—Hot as Defrost (SDG)

This is an SPDT fixed setting (thermal-disk type) thermostat that is furnished on hot gas defrost units.

Fan Delay—Medium Temperature

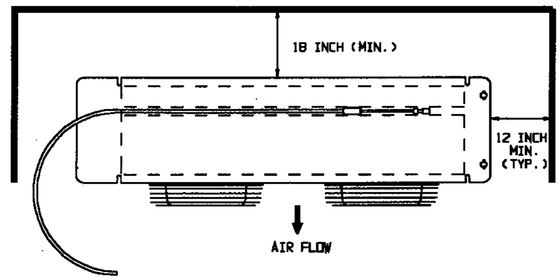
SDE & SDG unit fans on systems operating above +20° evaporator temperature may experience excessive delay restarting after defrost. The fan delay thermostat may be de-activated per the instructions on pages 10 and 11.

Fan And Motor Replacement—Model EF

***WARNING**: Make sure all electrical power to unit is disconnected before replacing fans or motors.*

1. Disconnect the drain line from the drain pan, remove the screws opposite the hinges and lower the drain pan.
2. Disconnect the motor by unplugging the motor wires from the wiring harness.
3. Remove the fan blade using an allen wrench.
4. Remove the 4 nuts from the shaft end of the motor.
5. Grasp the motor and slide it out of the mount and remove.

To replace the assembly, reverse the above steps.



Defrost Heater Replacement (EFE Units)

***WARNING**: Make sure all electrical power to unit is disconnected before replacing defrost heaters.*

1. Disconnect the drain line from the drain pan, remove the screws and lower the drain pan.
2. Unplug the heater wires from the wiring harness.
3. Model EF Low Velocity Units Only —Use pliers to remove the heater clips which hold the heaters in place.
4. Slide the heater out of the unit.

Reverse the above steps to reinstall the replacement heater.

Defrost Heater Replacement (SDE Units)

***WARNING**: Make sure all electrical power to unit is turned off.*

A. Insertion Heaters

1. Remove both unit end covers.
2. Disconnect heater leads from terminal block.
3. Straighten ends of heater.
4. Pull heater out of unit. Bend if necessary to avoid obstructions.
5. From TXV end of unit, insert heater leads into holes and push heater through coil.

   NOTE: Replacement heaters for 3-6 fan units are coiled for shipment. This allows heater to be installed even if end of unit is close to an obstruction. See Drawing 2.
6. Locate heater so that the ends extend 4.75 inches (over the rubber end seals) into the end compartment.
7. Connect leads to terminal blocks, bend heaters just enough at endplate so end cover can be installed and tie leads so they cannot contact hot parts of heaters.
8. Reinstall both end covers.

B. Bottom Heaters

1. Remove electrical end cover.
2. Disconnect heater leads from terminal block.
3. Use pliers to remove clips that hold the heater in place and remove the heater.
4. Pull heater out of unit. Bend if necessary to avoid obstructions.
5. Note bends in hold heater. This is done to insure NG contact between the heater and the drain pan.
6. If the new heater is coiled, straighten it by rolling it out on the floor.
7. Connect heater leads to terminal block.
8. Reinstall drain pan and cover.

TROUBLESHOOTING CHART

Symptoms	*Possible Causes*	*Corrective Action*
Fan(s) will not operate.	1. Main switch open. 2. Blown fuses. 3. Defective motor(s). 4. Defective fan delay thermostat (SD only) or defective timer. 5. Unit in defrost cycle. 6. Fan delay thermostat (SDG only) not sensing coil temperature. 7. Evaporator temperature approaching 30°F.	1. Close switch. 2. Replace fuses. Check for short circuits or overload conditions. 3. Replace motor(s). 4. Replace defective component. 5. Wait for completion of cycle. 6. Make sure t'stat is properly positioned so it senses the coil return bend temperature. 7. Eliminate for delay.
Room temperature too high.	1. Room thermostat set too high. 2. Superheat too high. 3. System low on refrigerant. 4. Coil iced-up.	1. Adjust thermostat. 2. Adjust thermal expansion valve. 3. Add refrigerant. 4. Manually defrost coil. Check defrost controls for malfunction.
Defrost heaters will not operate.	1. Main switch open. 2. Blown fuses. 3. Defective heater(s). 4. Defective timer.	1. Close switch. 2. Replace fuses. Check for short circuits or overload conditions. 3. Replace heater(s). 4. Replace timer.
Coil not clearing frost during defrost cycle.	1. Defective heater(s). 2. Not enough defrost cycles per day. 3. Defective defrost termination t'stat 4. Defrost termination thermostat not sensing coil area that is not clearing. 5. Fail-safe on timer set too short.	1. Replace heater(s). 2. Adjust timer for more defrost cycles. 3. Replace thermostat. 4. Relocate thermostat. 5. Lengthen fail-safe time setting- do not exceed 40 minutes.
Ice accumulating in drain pan.	1. Defective heater. 2. Unit not pitched properly. 3. Drain plugged. 4. Defective drain line heater.	1. Replace heater. 2. Check and adjust if necessary. 3. Clean drain. 4. Replace heater.
Units stays in prolonged defost cycle.	1. Defective timer or thermostat. 2. Defrost termination thermostat not sensing coil temperature. 3. Fail-safe on timer set too long.	1. Replace defective component. 2. Make sure t'stat is positioned to sense coil return bend temperature (EFE, EFG, SDG) or end plate temperature (SDE). 3. Shorten fail-safe setting.

MODEL SD REPLACEMENT PARTS

FAN MOTORS AND BLADES

Unit Model	*Motor Data*			
	Voltage	*HP*	*RPM*	*Part No.*
All Models	115V	1/20 SP	1550	8216072
	230V			8216071
	460V			8216034
	115V	1/20 PSC	1550	8216074
	230V	1/20 PSC	1550	8216073

Fan Data	
Part No.	*Bore*
8221153	5/16

ELECTRIC DEFROST MODELS

Unit Size or Model No.	*Heater Data*			*Part No.*
	Qty	*Watts*	*Volts*	
1-Fan	3	380	230	8215114
2-Fan		685	230	8215115
Except models listed below: 119H, 139H, 085M, 105M 124M, 065L, 089L, 120L		760	230	8215116
3-Fan		990	230	8215117
Except models listed below: 230H, 168M, 210M 135L, 180L		1150	230	8215118
4-Fan		1295	230	8215119
5-Fan		1600	230	8215120
6-Fan		1905	230	8215121
All SDE	Defrost Termination & Fan Delay T'stat			8219247
	Defrost Heater Safety			8219243
ALL SDG	Defrost Termination Thermostat			8219242
Low & Med. Temp. SDG	Fan Delay Thermostat, 1-3 Fans			8219240
	Fan Delay Thermostat, 4-6 Fans			8219246
Consult Factory for 460V Specifications				

DRAIN PANS †

Unit Size or Model No.	*Part No.*
1-Fan Units	8513872
2-Fan Units—	8513873
Except models listed below: 119H, 139H, 085M, 105M 124M, 065L, 089L, 120L	8513874
3-Fan Units—	8513875
Except models listed below: 230H, 168M, 210M 135L, 180L	8513876
4-Fan Units	8513877
5-Fan Units	8513878
6-Fan Units	8513879

† Air &electric defrost only—contact factory for hot gas pan part number.

FAN GUARDS

Blade Size	*Part No.*
12" Wire	8397040
12" Plastic	8397045

MOTOR MOUNT

Unit Size	*Part No.*
All Units	8397042

NUMBER OF FANS vs. MODEL NUMBER

1-Fan Units
SDA 054H-074H
SDA, SDE, SDG 038M-060M
SDE, SDG 036L-052L

2-Fan Units
SDA 090H-139H
SDA, SDE, SDG 080M-124M
SDE, SDG 055L-120L

3-Fan Units
SDA 171H-230H
SDA, SDE, SDG 125M-210M
SDE, SDG 110L-180L

4-Fan Units
SDA 270H
SDA, SDE, SDG 214M-254M
SDE, SDG 181L-215L

5-Fan Units
SDA 330H
SDA, SDE, SDG 255M-305M
SDE, SDG 220L-240L

6-Fan Units
SDA 410H
SDA, SDE, SDG 325M-350M
SDE 260L & 300L

MODEL EF REPLACEMENT PARTS

FAN MOTORS AND BLADES

Unit Model	*Motor Data*				*Fan Blade Data*	
	Voltage	*HP*	*RPM*	*Part No.*	*Part No.*	*Bore*
All Models	115V	1/20	1550	8216072	8221007	5/16"
	208-230V	1/20	1550	8216071		
	460V	1/20	1550	8216034		
	115	1/20 PSC	1550	8216074		
	208-230V			8216073	8221005+	5/16"

+EFA, EFE and EFG Model 075 only

ELECTRIC DEFROST MODELS

Unit Cooler Size	*Heater Data*			*Part Number*
	Quantity	*Watts*	*Volts*	
1-Fan Units	2	545	230	8215015
2-Fan Units		545		8215016
3-Fan Units		1305		8215018
4-Fan Units		1305		8215018
5-Fan Units		2180		8215112
6-Fan Units		2725		8215113
All	Defrost Termination Thermostat			8219241
EFE	Defrost Heater Safety			8219243
All EFG	Defrost Termination Thermostat			8219242

NUMBER OF FANS vs. MODEL NUMBER

1-Fan Units
EFA, EFE, EFG 050

2-Fan Units
EFA, EFE, EFG 075-100

3-Fan Units
EFA, EFE, EFG 130-160

4-Fan Units
EFA, EFE, EFG 190-220

5-Fan Units
EFA, EFE, EFG 270

6-Fan Units
EFA, EFE, EFG 340

DRAIN PANS

Unit Size	*Part No.*
1 Fan Units	8512851
2 Fan Units	8512852
3 Fan Units	8512853
4 Fan Units	8512854
5 Fan Units	8512855
6 Fan Units	8512856

FAN GUARDS

Blade Size	*Part No.*
10"	8397002

SERVICE NOTES