

Ice-O-Matic®

Technical Manual



B, EC and ECP Series

Electro-Mechanical Cubers

Including Under Counter Models

**Also Covers Electro-Mechanical C Series
Machines Manufactured After 1988**

Table Of Contents

General Information

How To Use this Manual	A-1
Model and Serial Number Format	A-2
Electrical & Mechanical Specifications	A-3
Installation Guidelines	A-8
Electrical and Plumbing Requirements	A-9
Remote Condenser Installation	A-10
How The Machine Works	A-11

Scheduled Maintenance

Maintenance Procedure	B-1
Cleaning and Sanitizing Instructions	B-1
Winterizing Procedure	B-2

Troubleshooting Trees

How To Use The Troubleshooting Trees	C-1
Troubleshooting Trees Table Of Contents	C-2

Water System

Water Distribution and Components	D-1
UC20/EUC200 Bin Removal	D-2

Refrigeration System

Refrigeration Cycle and Components	E-1
Harvest Cycle	E-6
Remote System	E-6
Pump Down System	E-8

Electrical System

Control Circuit	F-1
Compressor and Start Components	F-2
Untimed Freeze	F-3
Timed Freeze	F-4
Harvest Cycle	F-5
Pump Down System	F-10
Wiring Diagram	F-11

Index	F-32
-------	------

How To Use This Manual

Ice-O-Matic provides this manual as an aid to the service technician in installation, operation, and maintenance of the electro-mechanical C, EC and ECP series cube ice machines. If used properly this manual can also help the service technician troubleshoot and diagnose most of the problems that may occur with the machine.

The first two sections of this manual provide general and maintenance information. The remainder of the manual beginning with section C provides troubleshooting and service information. Section C contains flow charts called troubleshooting trees. Page C-1 provides instructions on using the troubleshooting trees. Each troubleshooting tree is named to describe a particular problem with the operation of the machine. When following the troubleshooting trees the service technician will be led through questions and checks and end up at a probable solution. When using the troubleshooting trees it is important that the service technician understand the operation and adjustments of the components being checked and the component suspected of being defective. A detailed description of the operation and adjustments of the components as well as other service information is laid out in the pages that follow section C.

Each section, after section C, focuses on a particular system in the ice machine; water distribution system, refrigeration system and electrical system. It is important that these sections be used together with the Troubleshooting Trees in section C.

Most aspects of the C, EC and ECP series cube ice machines are covered in this manual, however, should you encounter any conditions not addressed herein, please contact the Technical Service Department for assistance. You may also write the Ice-O-Matic Technical Service Department:

Ice-O-Matic
11100 East 45th Av.
Denver, CO 80239
Attn: Service Department

Phone: 1-800 423-3367
1-888 FIX-4-ICE (349-4423) AFTER HOURS EMERGENCY
(303) 371-3737
Fax: (303) 371-4153

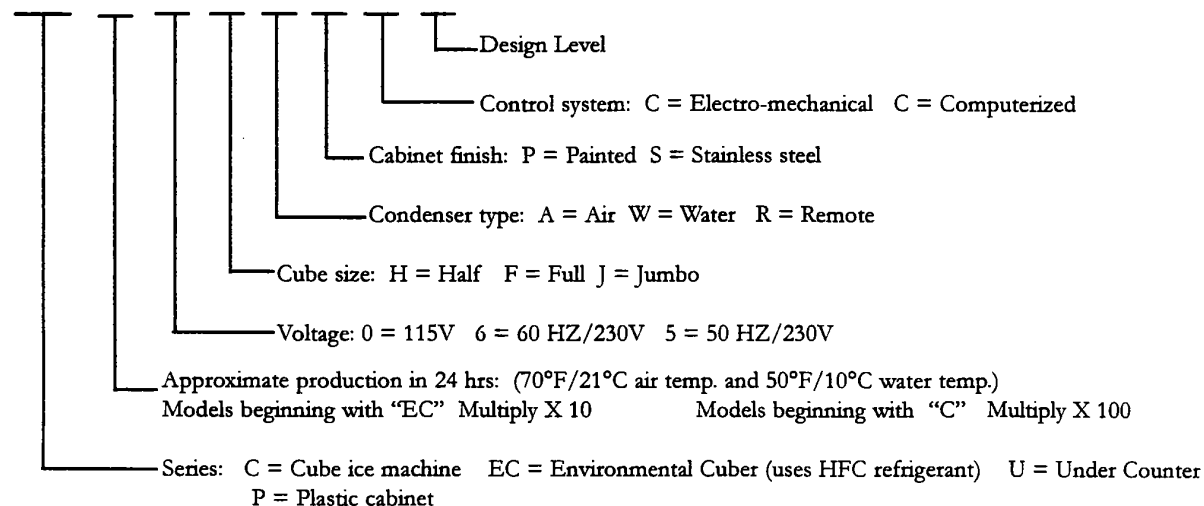
Any service communication must include:

- Model Number
- Serial Number
- A detailed explanation of the problem

Model and Serial Number Format

Model Numbers

EC 40 0 H A P B 1



Serial Number Date Code

First letter in the serial number indicates the month and decade of manufacture.

First digit in the serial number indicates the year of manufacture.

Example: A 5 was manufactured January 1985. M 5 will be manufactured in January 1995.

1980-1989, 2000 - 2009	MONTH	1990-1999
A	JANUARY	M
B	FEBRUARY	N
C	MARCH	P
D	APRIL	Q
E	MAY	R
F	JUNE	S
G	JULY	T
H	AUGUST	U
I	SEPTEMBER	V
J	OCTOBER	W
K	NOVEMBER	Y
L	DECEMBER	Z

Note: O and X have been eliminated.

EC and ECP Series / General Information

Electrical and Mechanical Specifications

"C" Series / 60 Cycle Machines

Model Number	Ice Production. per 24 hrs. @ 90°F (32°C) Air 70°F (21°C) Water		Compressor		Voltage Characteristics	No. of Wires (incl grd.)	Minimum Circuit Ampacity	Max Fuse Size	**Refrigerant		
	Lbs	Kg	H.P.	*RLA					Type	Oz.	Grams
UC-20#-A-P-B	170 Lbs	77 Kg	1/3	6.5	115/60/1	3	9.3	15	R-12	14oz	397g
UC-20#-W-P-B	200 Lbs	91 Kg	1/3	6.5	115/60/1	3	8.7	15	R-12	13oz	369g
C-20#-A-P-B	170 Lbs	77 Kg	1/3	6.2	115/60/1	3	11.3	15	R-12	18oz	510g
C-20#-W-P-B	200 Lbs	91 Kg	1/3	6.1	115/60/1	3	10.6	15	R-12	12oz	340g
C-30#-A-P-B	235 Lbs	113 Kg	1/2	9.8	115/60/1	3	13.3	20	R-502	26oz	742g
C-30#-W-P-B	281 Lbs	138 Kg	1/2	9.1	115/60/1	3	11.8	20	R-502	16oz	454g
C-40#-A-P-B	313 Lbs	142 Kg	1/2		115/60/1	3	18.2	20	R-12	23oz	652g
C-40#-W-P-B	345 Lbs	156 Kg	1/2		115/60/1	3	17.4	20	R-12	18oz	510g
C-40#-R-P-B	290 Lbs	132 Kg	1/2		115/60/1	3	15.1	20	R-12	144oz	4082g
C-40#-A-P-B1	313 Lbs	142 Kg	1/2	10.6	115/60/1	3	14.6	20	R-502	32oz	907g
C40#-W-P-B1	345 Lbs	156 Kg	1/2	10	115/60/1	3	13.0	20	R-502	16oz	454g
C-50#-A-P-B	435 Lbs	197 Kg	3/4	10	115/60/1	3	14.6	20	R-502	32oz	907g
C-50#-W-P-B	503 Lbs	228 Kg	3/4	10.6	115/60/1	3	13.0	20	R-502	16oz	454g
C-50#-R-P-B	430 Lbs	195 Kg	3/4	12	115/60/1	3	18.8	20	R-502	160oz	4536g
C-66#-A-P-B	477 Lbs	216 Kg	1-1/4	4.8	208-230/60/1	3	14.6	20	R-502	32oz	907g
C-66#-W-P-B	556 Lbs	252 Kg	1-1/4	4.9	208-230/60/1	3	13.0	20	R-502	18oz	510g
C-66#-R-P-B	489 Lbs	222 Kg	1-1/4	7	208-230/60/1	3	18.8	20	R-502	160oz	4536g
C-106#-A-P-B	758 Lbs	344 Kg	1-3/4	9.5	208-230/60/1	3	14.6	20	R-22	60oz	1701g
C-106#-W-P-B	880 Lbs	399 Kg	1-3/4	9.4	208-230/60/1	3	13.0	20	R-22	34oz	964g
C-106#-R-P-B	750 Lbs	340 Kg	1-3/4	9.4	208-230/60/1	3	18.8	20	R-22	240oz	6804g
C-107#-A-P-B	758 Lbs	344 Kg	1-3/4	9	208-230/60/1	4	12.3	20	R-22	60oz	1701g
C-107#-W-P-B	880 Lbs	399 Kg	1-3/4	9	208-230/60/1	4	11.7	20	R-22	34oz	964g
C-107#-R-P-B	750 Lbs	340 Kg	1-3/4	9	208-230/60/1	4	13.4	20	R-22	240oz	6804g

= H (Half cube) or F (Full cube)

* Rated Load Amps

** Use refrigerant charge specified on Serial Plate when charging system.

Electrical and Mechanical Specifications

*EC*Series / 60 Cycle Machines

Model Number	Ice Production. per 24 hrs. @ 90°F (32°C) Air 70°F (21°C) Water		Compressor		Voltage Characteristics	No. of Wires (incl grd.)	Minimum Circuit Ampacity	Max Fuse Size	**Refrigerant		
	Lbs	Kg	H.P./	*RLA					Type	Oz.	Grams
			BTUH								
EUC-200#-A-P-B	148 Lbs	66 Kg	1/3	7.2	115/60/1	3	10.1	15	R-134a	15oz	426g
EUC-200#-W-P-B	175 Lbs	79 Kg	1/3	6.7	115/60/1	3	8.9	15	R-134a	10oz	284g
EUC-206#-A-P-B	154 Lbs	70 Kg	1/3	3.1	208-230/60/1	3	4.6	15	R-134a	14oz	397g
EUC-206#-W-P-B	***	***	1/3	***	208-230/60/1	3	***	15	R-134a	***	***
EC-300#-A-P-B	244 Lbs	111 Kg	1/2	14.4	115/60/1	3	19.7	20	R-404a	21oz	596g
EC-300#-W-P-B	298 Lbs	135 Kg	1/2	9.8	115/60/1	3	12.8	20	R-404a	14oz	397g
EC-400#-A-P-B	345 Lbs	157 Kg	1/2	11.1	115/60/1	3	15.6	20	R-404a	32oz	908g
EC-400#-W-P-B	449 Lbs	204 Kg	1/2	10.3	115/60/1	3	13.4	20	R-404a	14oz	397g
EC-406#-A-P-B	326 Lbs	149 Kg	1/2	5.9	208-230/60/1	3	9.0	15	R-404a	32	908g
EC-406#-W-P-B	***	***	1/2	***	208-230/60/1	3	***	15	R-404a	***	***
EC-500#-A-P-B	451 Lbs	205 Kg	1/2	12.3	115/60/1	3	17.7	20	R-404a	32oz	908g
EC-500#-W-P-B	498 Lbs	226 Kg	1/2	10.5	115/60/1	3	13.7	20	R-404a	15oz	426g
EC-500#-R-P-B	438 Lbs	199 Kg	1/2	12.3	115/60/1	3	17.5	20	R-404a	160oz	4536g
EC-606#-A-P-B	460 Lbs	215 Kg	3/4	7.5	208-230/60/1	3	10.7	15	R-404a	32oz	908g
EC-606#-W-P-B	550 Lbs	250 Kg	3/4	5.6	208-230/60/1	3	7.5	15	R-404a	18oz	510g
EC-606#-R-P-B	489 Lbs	220 Kg	3/4	7.4	208-230/60/1	3	11.5	15	R-404a	160oz	4536g
EC-806#-A-P-B1	618 Lbs	280 Kg	10080	7.9	208-230/60/1	3	11.2	20	R-404a	34oz	964g
EC-806#-R-P-B1	705 Lbs	320 Kg	10080	8.2	208-230/60/1	3	12.4	20	R-404a	160oz	4536g
EC-806#-A-P-B2	698 Lbs	317 Kg	10080	9.2	208-230/60/1	3	12.8	20	R-404a	41oz	1162g
EC-806#-W-P-B2	840 Lbs	382 Kg	10080	7.4	208-230/60/1	3	9.8	20	R-404a	29oz	822g
EC-806#-R-P-B 2	762 Lbs	346 Kg	12000	8.1	208-230/60/1	3	12.3	20	R-404a	240oz	6804g
EC-806#-A-P-B1	618 Lbs	280 Kg	10080	7.9	208-230/60/1	3	11.2	20	R-404a	34oz	964g
EC-806#-R-P-B1	705 Lbs	320 Kg	10080	8.2	208-230/60/1	3	12.4	20	R-404a	160oz	4536g
EC-806#-A-P-B2	698 Lbs	317 Kg	10080	9.2	208-230/60/1	3	12.8	20	R-404a	41oz	1162g
EC-806#-W-P-B2	840 Lbs	382 Kg	10080	7.4	208-230/60/1	3	9.8	20	R-404a	29oz	822g
EC-806#-R-P-B 2	762 Lbs	346 Kg	12000	8.1	208-230/60/1	3	12.3	20	R-404a	240oz	6804g

= H (Half cube) or F (Full cube)

* Rated Load Amps

** Use refrigerant charge specified on Serial Plate when charging system.

*** Machine not available at time of printing.

EC and ECP Series / General Information

Electrical and Mechanical Specifications

"EC" Series / 60 Cycle Machines

Model Number	Ice Production. per 24 hrs. @		Compressor		Voltage Characteristics	No. of Wires (incl grd.)	Minimum Circuit Ampacity	Max Fuse Size	**Refrigerant		
	70°F (21°C) Air		H.P./	*RLA					Type	Oz.	Grams
	Lbs	Kg	BTUH								
EC-1006#-A-P-B1	811 Lbs	369 Kg	12000	9.0	208-230/60/1	3	13	20	R-404a	50oz	1418g
EC-1006#-W-P-B1	941 Lbs	428 Kg	12000	6.8	208-230/60/1	3	9.0	20	R-404a	32oz	907g
EC-1006#-R-P-B1	905 Lbs	411Kg	14100	9.3	208-230/60/1	3	13.8	20	R-404a	240oz	6804g
EC-1007#-A-P-B1	***	***	***	***	208-230/60/3	4	***	***	R-404a	***	***
EC-1007#-W-P-B1	***	***	***	***	208-230/60/3	4	***	***	R-404a	***	***
EC-1007#-R-P-B1	***	***	***	***	208-230/60/3	4	***	***	R-404a	***	***
EC-1406#-A-P-B1	1100 Lbs	499 Kg	1-1/4	11	208-230/60/1	3	16.2	20	R-404a	108oz	3062g
EC-1406#-W-P-B1	1050 Lbs	477 Kg	1-1/4	9.3	208-230/60/1	3	12.5	20	R-404a	28oz	794g
EC-1406#-R-P-B1	1050 Lbs	477 Kg	1-1/4	11.7	208-230/60/1	3	17.3	30	R-404a	240oz	6804g
EC-1406#-A-P-B2	1122 Lbs	510 Kg	20000	13.8	208-230/60/1	3	19.6	30	R-404a	108oz	3062g
EC-1406#-W-P-B2	1187 Lbs	540 Kg	20000	11.7	208-230/60/1	3	15.6	20	R-404a	28oz	794g
EC-1406#-R-P-B2	1134 Lbs	515 Kg	20000	16.5	208-230/60/1	3	23.3	25	R-404a	240oz	6804g
EC-1407#-A-P-B1	990 Lbs	449 Kg	1-3/4	9.7	208-230/60/3	4	14.7	25	R-404a	108oz	3062g
EC-1407#-W-P-B1	1093 Lbs	496 Kg	1-3/4	7.1	208-230/60/3	4	9.8	20	R-404a	28oz	794g
EC-1407#-R-P-B1	956 Lbs	434 Kg	1-3/4	9.1	208-230/60/3	4	14.0	25	R-404a	240oz	6804g
EC-1407#-A-P-B2	***	***	***	***	208-230/60/3	4	***	***	R-404a	***	***
EC-1407#-W-P-B2	***	***	***	***	208-230/60/3	4	***	***	R-404a	***	***
EC-1407#-R-P-B2	***	***	***	***	208-230/60/3	4	***	***	R-404a	***	***
EC-1806#-W-P-B1	1650 Lbs	757 Kg	1-3/4	16.2	208-230/60/1	3	21.2	30	R-404a	42oz	1191g
EC-1806#-R-P-B1	1575 Lbs	694 Kg	1-3/4	18.1	208-230/60/1	3	25.2	30	R-404a	400oz	11340g
EC-1806#-W-P-B2	1461 Lbs				208-230/60/1	3			R-404a		
EC-1806#-R-P-B2	1468 Lbs				208-230/60/1	3			R-404a		
EC-1807#-W-P-B1	1650 Lbs	757 Kg	1-3/4	8.3	208-230/60/3	4	11.3	20	R-404a	42oz	1191g
EC-1807#-R-P-B1	1575 Lbs	694 Kg	1-3/4	10.2	208-230/60/3	4	15.4	25	R-404a	400oz	11340g
EC-2106#-W-P-B1	1855 Lbs	843 Kg	26500	22.1	208-230/60/1	3	28.5	30	R-404a	50 oz	1418g
EC-2106#-R-P-B1	1723 Lbs	783 Kg	26500	31.0	208-230/60/1	3	43.1	50	R-404a	400oz	11340g
EC-2107#-W-P-B1	1853 Lbs		26000	10.4	208-230/60/3	4	13.9	20	R-404a	50oz	1418g
EC-2107#-R-P-B1	1737 Lbs		26000	14.4	208-230/60/3	4	22.3	25	R-404a	400oz	11340g

= H (Half cube) or F (Full cube)

* Rated Load Amps

** Use refrigerant charge specified on Serial Plate when charging system.

*** Machine not available at time of printing.

Electrical and Mechanical Specifications

*ECP*Series / 60 Cycle Machines

Model Number	Ice Production. per 24 hrs. @ 90°F (32°C) Air 70°F (21°C) Water		Compressor.		Voltage Characteristics	No. of Wires (incl grd.)	Minimum Circuit Ampacity	Max Fuse Size	**Refrigerant		
	Lbs	Kg	H.P.	*RLA					Type	Oz.	Grams
ECP-400#-A-P-B	***	***	***	***	115/60/1	3	***	***	***	***	***
ECP-400#-W-P-B	***	***	***	***	115/60/1	3	***	***	***	***	***
ECP-500#-A-P-B	396 Lbs	180 Kg	1/2	12.9	115/60/1	3	18.9	20	R-404a	36oz	1020g
ECP-500#-W-P-B	420 Lbs	190 Kg	1/2	11.2	115/60/1	3	14.8	15	R-404a	19oz	539g
ECP-556#-A-P-B	414 Lbs	188 Kg	1/2	7.5	208-230/60/1	3	10.8	15	R-404a	36oz	1020g
ECP-556#-W-P-B	229 Lbs	226 Kg	1/2	5.5	208-230/60/1	3	7.3	15	R-404a	19oz	539g

= H (Half cube) or F (Full cube)

* Rated Load Amps

** Use refrigerant charge specified on Serial Plate when charging system.

*** Machine not available at time of printing.

EC and ECP Series / General Information

Electrical and Mechanical Specifications

"C" Series / 50 Cycle Machines

Model Number	Ice Production. per 24 hrs. @ 90°F (32°C) Air 70°F (21°C) Water		Compressor		Voltage Characteristics	No. of Wires (incl grd.)	Minimum Circuit Ampacity	Fuse Size	**Refrigerant		
	Lbs	Kg	H.P.	*RLA					Type	Oz.	Grams
UC-25#-A-P-B	126 Lbs	57 Kg	1/3		230/50/1	3	7.0	15	R-12	14oz	426g
UC-25#-W-P-B	159 Lbs	72 Kg	1/3		230/50/1	3	6.7	15	R-12	10oz	284g
C-25#-A-P-B	126 Lbs	57 Kg	1/3	5.1	230/50/1	3	11.3	15	R-12	18oz	510g
C-25#-W-P-B	159 Lbs	72 Kg	1/3	5.1	230/50/1	3	10.6	15	R-12	12oz	340g
C-35#-A-P-B	227 Lbs	103 Kg	1/2	4.3	230/50/1	3	6.1	20	R-502	26oz	742g
C-35#-W-P-B	259 Lbs	126 Kg	1/2	3.1	230/50/1	3	4.6	20	R-502	16oz	457g
C-45#-A-P-B1	324 Lbs	147 Kg	3/4	6.4	230/50/1	3	9.1	15	R-502	32oz	907g
C45#-W-P-B1	377 Lbs	171 Kg	3/4	4.2	230/50/1	3	6.0	15	R-502	18oz	510g
C-65#-A-P-B	456 Lbs	207 Kg	3/4	6.6	230/50/1	3	9.1	20	R-502	32oz	907g
C-65#-W-P-B	544 Lbs	247 Kg	3/4	4.4	230/50/1	3	6.0	20	R-502	18oz	510g
C-65#-R-P-B	485 Lbs	220 Kg	3/4	4.7	230/50/1	3	8.9	20	R-502	160oz	4536g
C-105#-A-P-B	751 Lbs	341 Kg	2-1/2	12.7	230/50/1	3	17	30	R-22	60oz	1701g
C-105#-W-P-B	873 Lbs	396 Kg	2-1/2	12.6	230/50/1	3	17	30	R-22	34oz	964g
C-105#-R-P-B	745 Lbs	338 Kg	2-1/2	12.6	230/50/1	3	17.7	30	R-22	240oz	6804g

= H (Half cube) or F (Full cube)

* Rated Load Amps

** Use refrigerant charge specified on Serial Plate when charging system.

Electrical and Mechanical Specifications

"EC" series / 50 Cycle Machines

Model Number	Ice Production. per 24 hrs. @ 90°F (32°C) Air 70°F (21°C) Water		Compressor.		Voltage Characteristics	No. of Wires (incl grd.)	Circuit Ampacity	Max Fuse Size	**Refrigerant		
	Lbs	Kg	H.P.	*RLA					Type	Oz.	Grams
EC-205#-A-P-B	160 Lbs	72 Kg	1/3	3.9	230/50/1	3	5.6	15	R-134a	14oz	397g
EC-205#-W-P-B	195 Lbs	88 Kg	1/3	3.9	230/50/1	3	5.3	15	R-134a	12oz	312g
EC-305#-A-P-B	265 Lbs	120 Kg	1/2	9.0	230/50/1	3	12.4	15	R-404a	26oz	738g
EC-305#-W-P-B	291 Lbs	132 Kg	1/2	6.4	230/50/1	3	8.5	15	R-404a	14oz	397g
EC-405#-A-P-B	369 Lbs	168 Kg	3/4	9.2	230/50/1	3	12.8	15	R-404a	32oz	908g
EC-405#-W-P-B	470 Lbs	213 Kg	3/4	7.5	230/50/1	3	10.1	15	R-404a	16oz	454g
EC-605#-A-P-B	432 Lbs	196 Kg	1	5.1	230/50/1	3	7.9	20	R-404a	32oz	908g
EC-605#-W-P-B	514 Lbs	233 Kg	1	4.1	230/50/1	3	5.9	20	R-404a	14oz	397g
EC-605#-R-P-B	480 Lbs	217 Kg	1	5.6	230/50/1	3	9.4	20	R-404a	160oz	4536g
EC-805#-A-P-B	***	***	***	***	230/50/1	3	***	***	R-404a	***	***
EC-805#-W-P-B	***	***	***	***	230/50/1	3	***	***	R-404a	***	***
EC-805#-R-P-B	***	***	***	***	230/50/1	3	***	***	R-404a	***	***
EC-1005#-A-P-B	***	***	***	***	230/50/1	3	***	***	R-404a	***	***
EC-1005#-W-P-B	***	***	***	***	230/50/1	3	***	***	R-404a	***	***
EC-1005#-R-P-B	***	***	***	***	230/50/1	3	***	***	R-404a	***	***
EC-1405#-A-P-B	902 Lbs	410 Kg		14.5	230/50/1	3	20.8	25	R-404a	108oz	3062g
EC-1405#-W-P-B	1107 Lbs	503 Kg		11.6	230/50/1	3	15.4	20	R-404a	28oz	794g
EC-1405#-R-P-B	1002 Lbs	455 Kg		12.4	230/50/1	3	18.1	30	R-404a	240oz	6804g
EC-1805#-W-P-B	1744 Lbs	792 Kg	3-1/4	14.3	230/50/1	3	18.8	30	R-404a	42oz	1191g
EC-1805#-R-P-B	1438 Lbs	653 Kg	3-1/4	20.2	230/50/1	3	27.9	50	R-404a	400oz	11340g

= H (Half cube) or F (Full cube)

* Rated Load Amps

** Use refrigerant charge specified on Serial Plate when charging system.

*** Machine not available at time of printing.

EC and ECP Series / General Information

Installation Guidelines

For proper operation of the ICE-O-MATIC ice machine the following installation guidelines must be followed. Failure to do so may result in loss of production capacity, premature part failures, and may void all warranty. Installation should be performed by a qualified service technician.

Ambient Operating Temperatures

Minimum operating temperature: 50° F (10° C)

Maximum operating temperature: 100° F (38° C)

Clearance Requirements

Self contained air cooled machines must have a minimum of 6" (15 cm) of clearance at the rear and at the sides of the machine that allow air circulation.

Incoming Water Supply

Minimum water temperature: 40° F (4.5° C)

Maximum water temperature: 100° F (38° C)

Minimum water pressure: 20 psi (1.4 bar)

Maximum water pressure: 60 psi (4.1 bar)

Note: If water pressure exceeds 60 psi (4.1 bar) a water pressure regulator must be installed.

Water Filtration

It is recommended that a water filter system be installed with all ice machines. See filter manufacturer's instructions for proper installation of the filter system.

Plumbing

Install incoming water supply and drain lines according to national and local code requirements. See Plumbing Diagram on page A9 for line sizing.

- When installing a water cooled machine it is not necessary to filter condenser water.
- Run all drain lines separately.
- Insure that an open or trapped drain is available within 10 ft (3 m) of ice machine.
- Connect a separate condenser drain line (water cooled models only) to the 3/8 O.D. copper tube at rear of machine.
- Connect a separate, well-pitched overflow/purge drain line to the fitting at rear of machine.
- Overflow/purge drain must be vented.
- Connect a separate bin drain line to the 3/4" FPT fitting at rear of cabinet or bin.

Electrical Specifications and Connections

All electrical requirements must meet national and local codes.

Machine must be installed on a separate circuit.

See serial plate, located on back of the machine.

See page A5-A6 for location of electrical connections.

Stacking

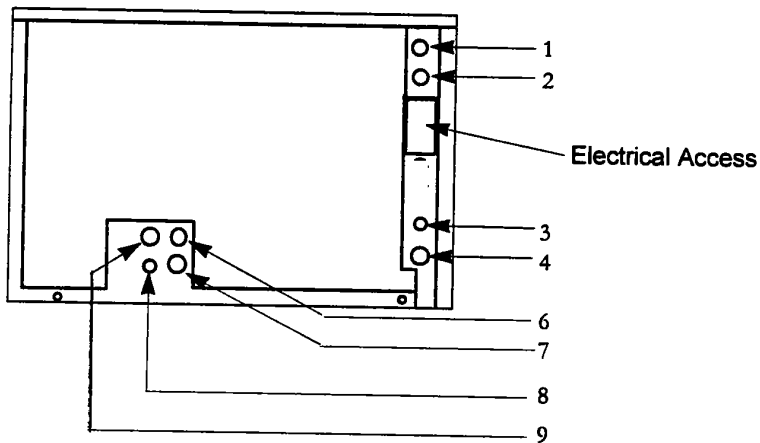
If machines are to be stacked refer to instructions in stacking kit.

Electrical and Plumbing Requirements

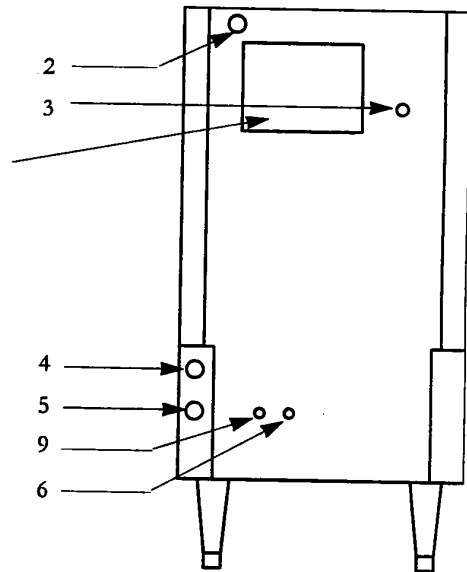
Electrical and Plumbing Sizing

- 1 Electrical Inlet: 7/8" knock-out for remote or ECP water cooled
- 2 Electrical Inlet: 7/8" in knock-out
- 3 Water inlet fitting: 3/8" FPT
- 4 Purge drain: 3/4" FPT (some models may use 9/16" I.D. plastic tubing)
- 5 Bin drain fitting: 3/4" FPT
- 6 Water cooled condenser drain fitting: 1/2" FPT
- 7 Remote condenser discharge line fitting: 1/2" quick-connect
- 8 Remote condenser liquid line fitting: 3/8" quick-connect
- 9 Water cooled condenser inlet fitting: 1800 Series 1/2" FPT All other models 3/8" FPT

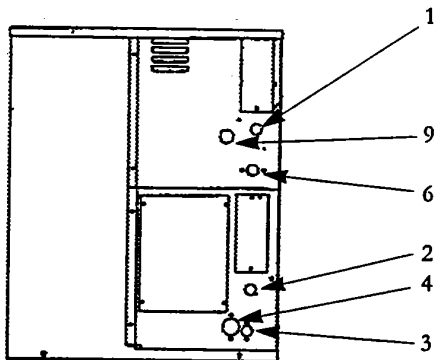
C and EC Models
(Except Under Counter)



Under Counter Models



ECP Models



EC and ECP Series / General Information

Remote Condenser Installation

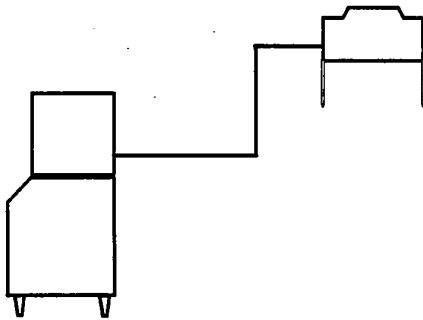
For proper operation of the ICE-O-MATIC ice machine the following installation guidelines must be followed. Failure to do so may result in loss of production capacity, premature part failures, and may void all warranty.

Installation Guidelines

- Ambient operating temperatures: -20° F (-28° C) to 110° F (43° C)
- Maximum refrigerant line length: 40 ft. (12.2 m)
- Maximum vertical rise: 15ft. (4.6 m)
- Minimum condenser height: C66/65, EC606/605 and ECP606, condensers must not be installed more than 6' (1.83 meters) below the refrigerant line quick connects at rear of ice machine. No part of the refrigerant lines, between the machine and condenser, should fall below this point. Condensers for all other machines addressed in this manual must be installed above quick connect fittings at rear of machine.

When installing the condenser above the machine:

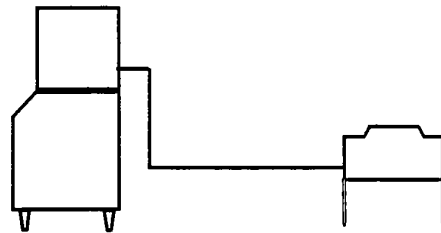
DO Slope refrigerant lines downward toward compressor.



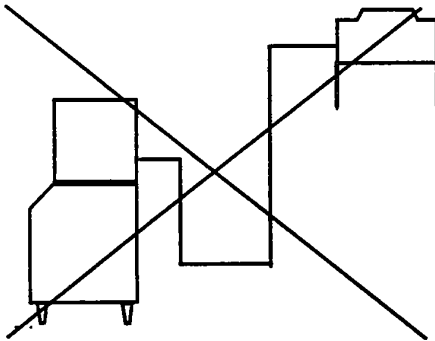
When installing condenser below the ice machine (C66/65 and EC606/605 and ECP606 ONLY):

DO Add 3 lbs (85 grams) of refrigerant to system.

DO Slope refrigerant lines downward toward condenser

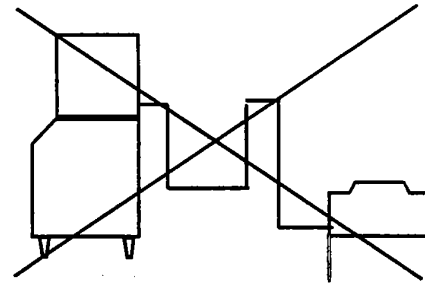


DO NOT Install any part of the refrigerant lines below the quick connect fittings at rear of machine.



DO NOT Install the condenser lower than 6' (1.83 meters) below the quick connect fittings at rear of machine.

DO NOT Create oil traps in refrigerant lines by sloping lines downward then rising upward.



Connecting Precharged Line Sets

Before connecting line set fittings to the machine and condenser lubricate threads and o-rings with refrigerant oil. Leak check connections after connecting.

Note: The tubing sets are charged with a vapor holding charge only.

General Operation

A general description of how the C, EC and ECP series cubers work is given below. The remainder of the manual provides more detail about the operation and troubleshooting of these machines.

With the ICE/OFF/WASH switch in the ICE position, the compressor, water pump, and condenser fan motor (air cooled machines only) will energize starting the freeze cycle.

During the freeze cycle water is circulated over the evaporator(s) where the ice cubes are formed. When the suction pressure has pulled down to the proper cut-in pressure of the timer initiate (pressure control), the contacts close energizing the time delay module (timer). See page F3 for the proper timer initiate setting. At this time the cubes will be close to completion. The remaining portion of the freeze cycle is determined by the timer setting. The timer is pre-set at the factory to achieve the proper ice bridge thickness but may need to be adjusted upon initial start-up, see page F4.

Once the amount of time on the time delay module has past, the machine enters harvest. Power is now supplied to the water purge valve, hot gas valve(s), and the harvest assist motor(s). The water purge valve opens, and allows the water pump to purge the water remaining in the water trough, removing all impurities and sediment. This allows the machine to make clear ice cubes and keep mineral build-up at a minimum. The hot gas solenoid(s) opens allowing hot gas to go directly to the evaporator(s), heating the evaporator(s) and breaking the bond between the evaporator and the slab of ice.

The harvest assist motor, which is also energized during harvest, turns a slip clutch which pushes a probe against the back of the ice slab. There is one harvest assist assembly for each evaporator. Once the evaporator has reached approximately 40°F (4.5°C) in temperature, the slip clutch overcomes the bonding of the ice to the evaporator and pushes the slab of ice off the evaporator and into the bin. The clutch also actuates a switch that rides on the outer edge of the clutch. When the clutch makes one complete revolution the switch is tripped and the machine enters the next freeze cycle. If the machine has dual evaporators both switches must trip before the machine enters freeze.

When the ice drops into a full bin during harvest the splash curtain(s) is held open, tripping a bin switch, and the machine will shut off. When the ice is removed from the bin the splash curtain will close and the machine will come back on. Under Counter models use a thermostatic bin control instead of a switch.

Notes

Maintenance

Danger!

Electrical shock and/or injury from moving parts inside this machine can cause serious injury. Disconnect electrical supply to machine prior to performing any adjustments or repairs.

Warning!

Failure to perform the required maintenance at the frequency specified will void warranty coverage in the event of a related failure.

To insure economical, trouble free operation of the machine, the following maintenance is required every 3 months.

Maintenance Procedure

1. Clean the ice-making section per instructions below. Cleaning should be performed a minimum of every 6 months. Local water conditions may require that cleaning be performed more often.
2. Check ice bridge thickness. See page F4. for proper thickness and adjustment procedure.
3. Check water level in trough. See page D1. for proper level and adjustment.
4. Clean the condenser (air cooled machines) to insure unobstructed air flow.
5. Check for leaks of any kind; water, refrigerant, oil, etc.
6. Check the bin switch for proper adjustment, see bin switch adjustment on page F9.
7. Check the cam switch Setting, see page F8.
8. Check water regulating valve (water cooled machines) for proper adjustment by measuring water temperature, see page E3.
9. Check to see that the T.X.V. bulb is securely fastened.
10. Check all electrical connections.
11. Oil fan motor if motor has oil fitting (self contained air cooled).

Cleaning and Sanitizing

Harvest problems may occur if the following procedures are not performed every six months.

1. Remove ice machine front panel.
2. Make sure all ice is off evaporator. If ice is being made, initiate harvest or wait for cycle completion, then turn machine "OFF" at the ICE/OFF/ WASH switch.
3. Remove or melt all ice from the bin.
4. Add recommended amount of approved ice machine cleaner to water trough according to label instructions on container.
5. Initiate the wash cycle at the ICE/OFF/WASH switch by moving switch to the "WASH" position. Allow the cleaner to circulate for approximately 15 minutes to remove mineral deposits.
6. Depress the purge switch and hold until cleaner has been flushed down the drain and diluted by fresh incoming water.

EC and ECP Series / Scheduled Maintenance

7. Terminate the wash cycle by moving the ICE/OFF/WASH switch to the "OFF" position. Remove the splash curtain and inspect the evaporator and water spillway to assure all mineral residue has been removed.
8. If necessary, wipe evaporator, spillway and other water transport surfaces with a clean, soft cloth to remove remaining residue. If necessary, remove the water distribution tube, disassemble and clean with a bottle brush, see page D-2. Reassemble all parts and repeat steps 4 through 7 as required to remove residue.
9. Turn off machine water supply and clean water trough thoroughly to remove all scale or slime build-up. If necessary, remove trough to reach all splash area and float.
10. Prepare 1-1/2 to 2 gallons (5.7 to 7.5 liters) of approved (EPA/FDA) sodium hypochloride food equipment sanitizer to form a solution with 100 ppm free chlorine yield minimum.
11. Add enough sanitizing solution to fill the water trough to overflowing and move the ICE/OFF/WASH switch to the "WASH" position and allow circulation to occur for 10 minutes and inspect all disassembled fittings for leaks. During this time, wipe down all other ice machine splash zones, plus the interior surfaces of the bin, deflector and door with the remaining sanitizing solution. Inspect to insure that all functional parts, fasteners, thermostat bulbs (if used), etc. are in place.
12. Depress the purge switch and hold until sanitizer has been flushed down the drain. Turn on the machine water supply and continue to purge the diluted sanitizing solution for another 1-2 minutes.
13. Move the ICE/OFF/WASH switch to the "ICE" position and replace the front panel.
14. Discard the first two ice harvests.

Winterizing

Important

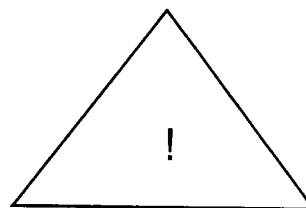
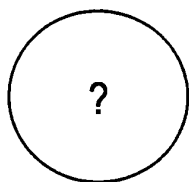
Whenever the ice machine is taken out of operation during the winter months, the procedure below must be performed. Failure to do so may cause serious damage and will void all warranties.

1. Shut water off to the machine.
2. Turn the ICE/OFF/WASH Switch to the off position.
3. Make sure all ice is off evaporator. If ice is being made, initiate harvest or wait for cycle completion, then turn machine "OFF" at the ICE/OFF/ WASH switch.
4. Disconnect the tubing between the pump discharge and the water distributor manifold.
5. Drain the water system completely. Do not replace the tubes.
6. On water cooled machines, hold water regulating valve open by prying upward on the spring with a screwdriver while using compressed air to blow all the water out of the condenser.
7. Wipe out the storage bin.

How To Use The Troubleshooting Trees

The troubleshooting trees were developed to be used in conjunction with the service information in the sections that follow. If used together as intended, these two part of the manual will allow the ice machine service technician to quickly diagnose many of the problems encountered with ice machines. When used as designed, the troubleshooting trees can lead you from a general symptom to the most likely component to suspect as the cause of the problem. The trees are not designed to be "parts changer guides; please do not use them as such! Components returned to the factory for warranty are tested by the factory and will not be covered under the warranty policy if they are not defective. Please refer to page A-1 for instructions on using the entire manual.

The trees are made of three types of boxes:



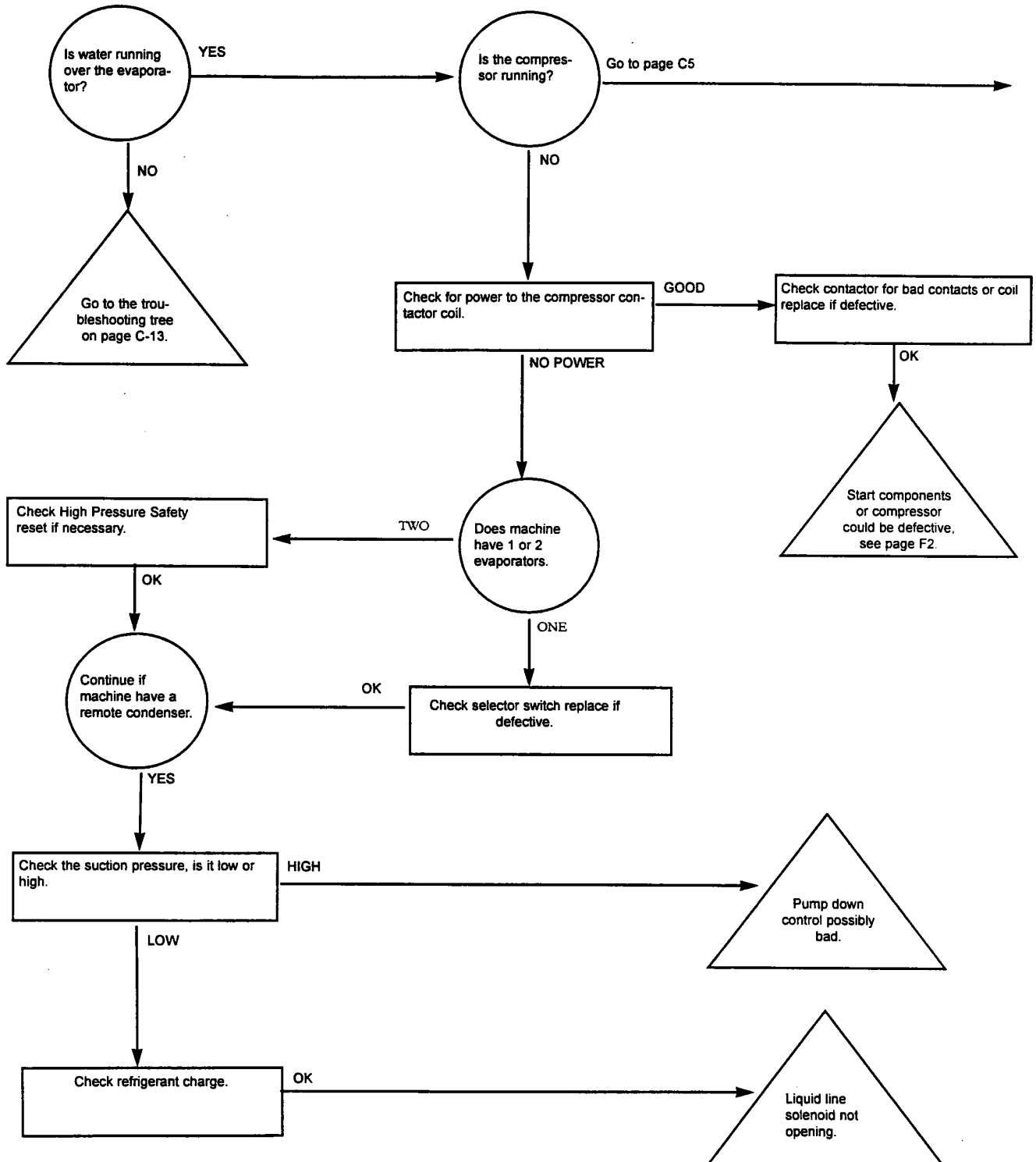
QUESTION boxes ask a yes/no question and the answer will lead to either another question box, a check box, or a solution box.

CHECK boxes will suggest a point to check for proper operation, and will often refer you to a page in the service information sections of this manual. The result of the check may lead to another box, or a solution box.

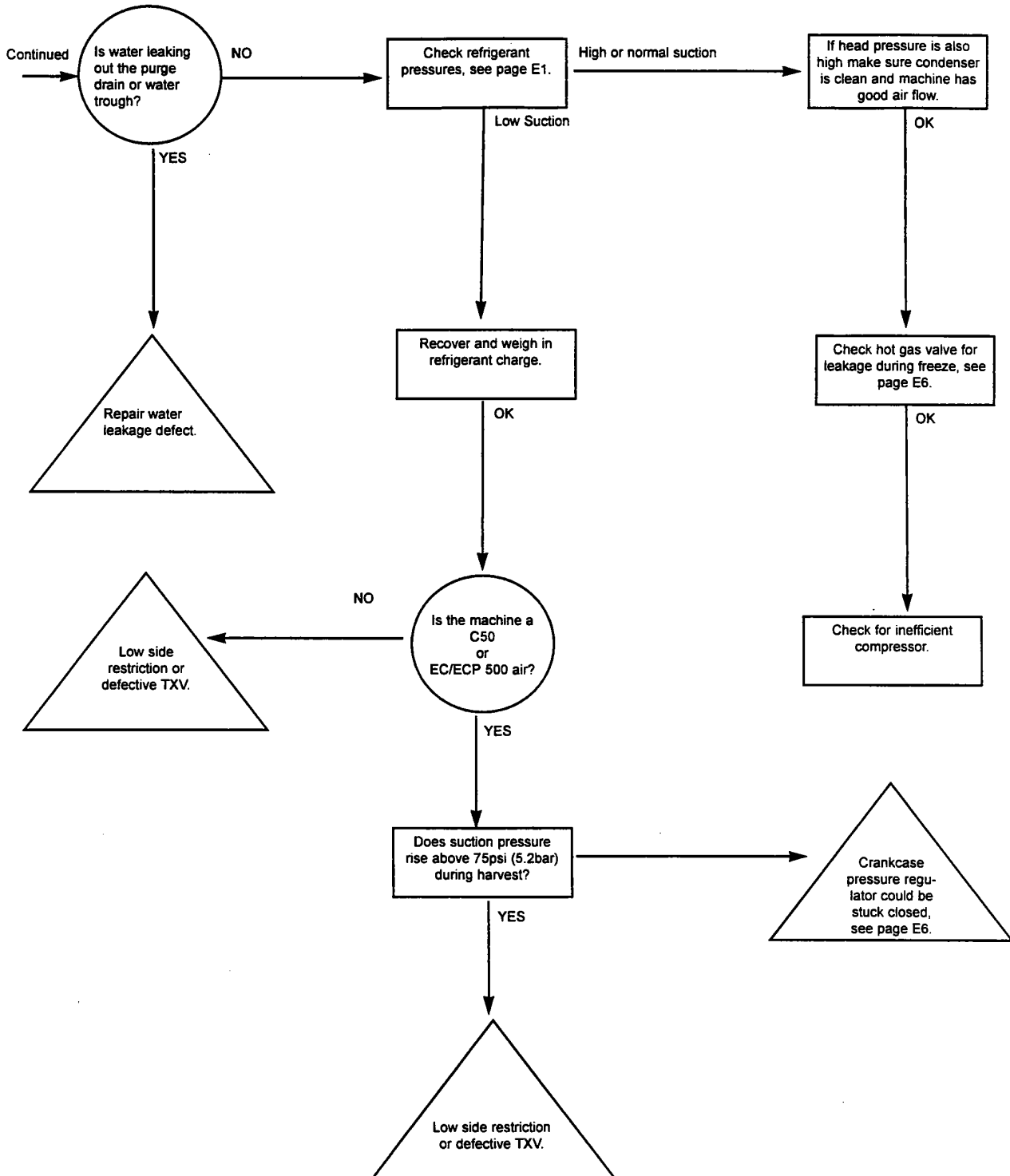
SOLUTION boxes suggest the most likely component to cause the malfunction described in the heading of the tree. When reaching a solution box, **Do Not** immediately assume the component is defective. The final step is to verify that the component is indeed defective, by using the service information in the sections that follow.

To use the troubleshooting trees, first find the page with the heading describing the type of problem occurring. Begin at the top of the page and follow the tree, step-by-step. When a check box is reached, it may be necessary to refer to another section in the manual. Once a solution box is reached, refer to the appropriate section to verify that the component in the solution box is, indeed, the problem. Adjust, repair or replace the component as necessary.

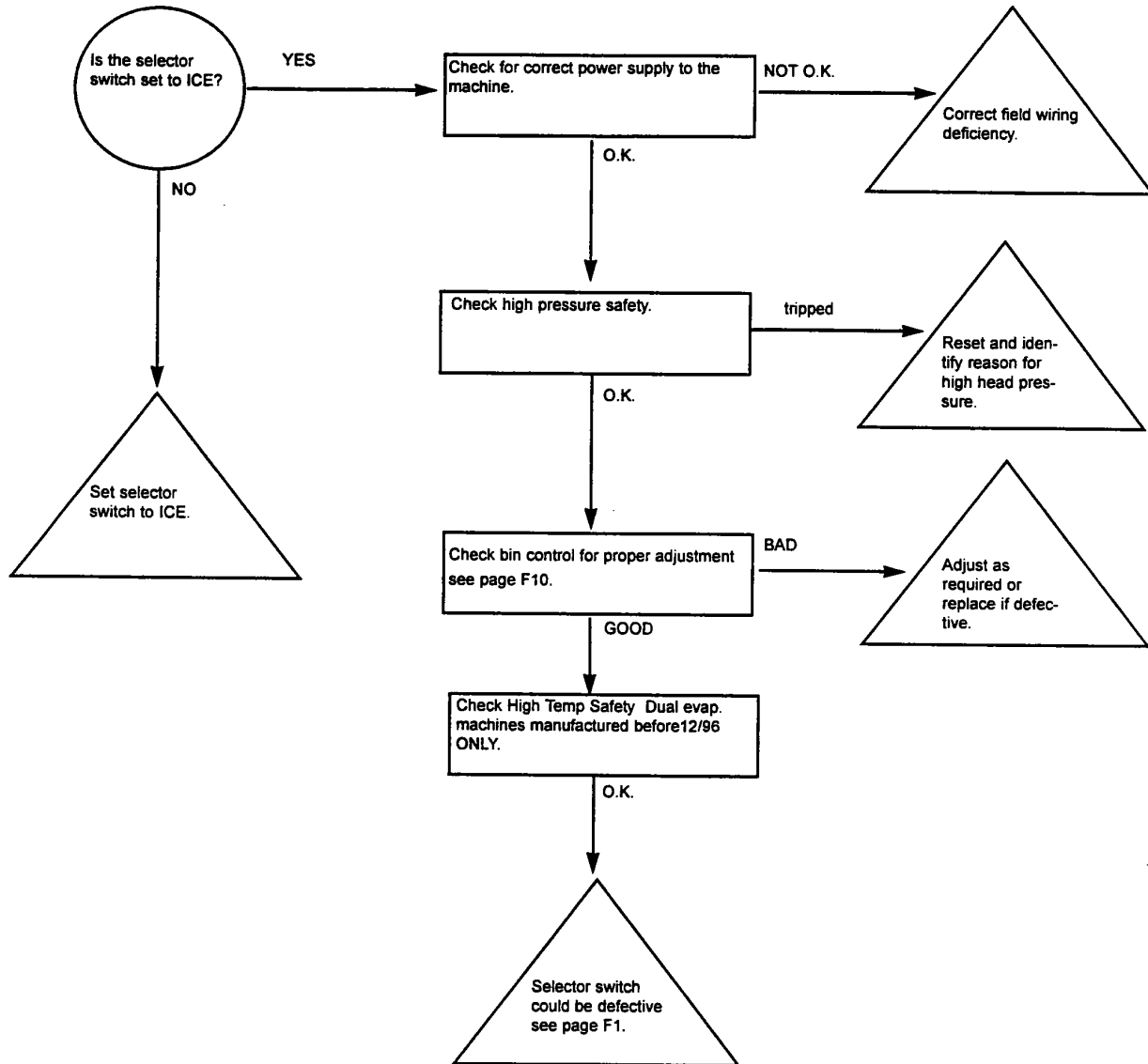
Machine Runs, Does Not Make Ice



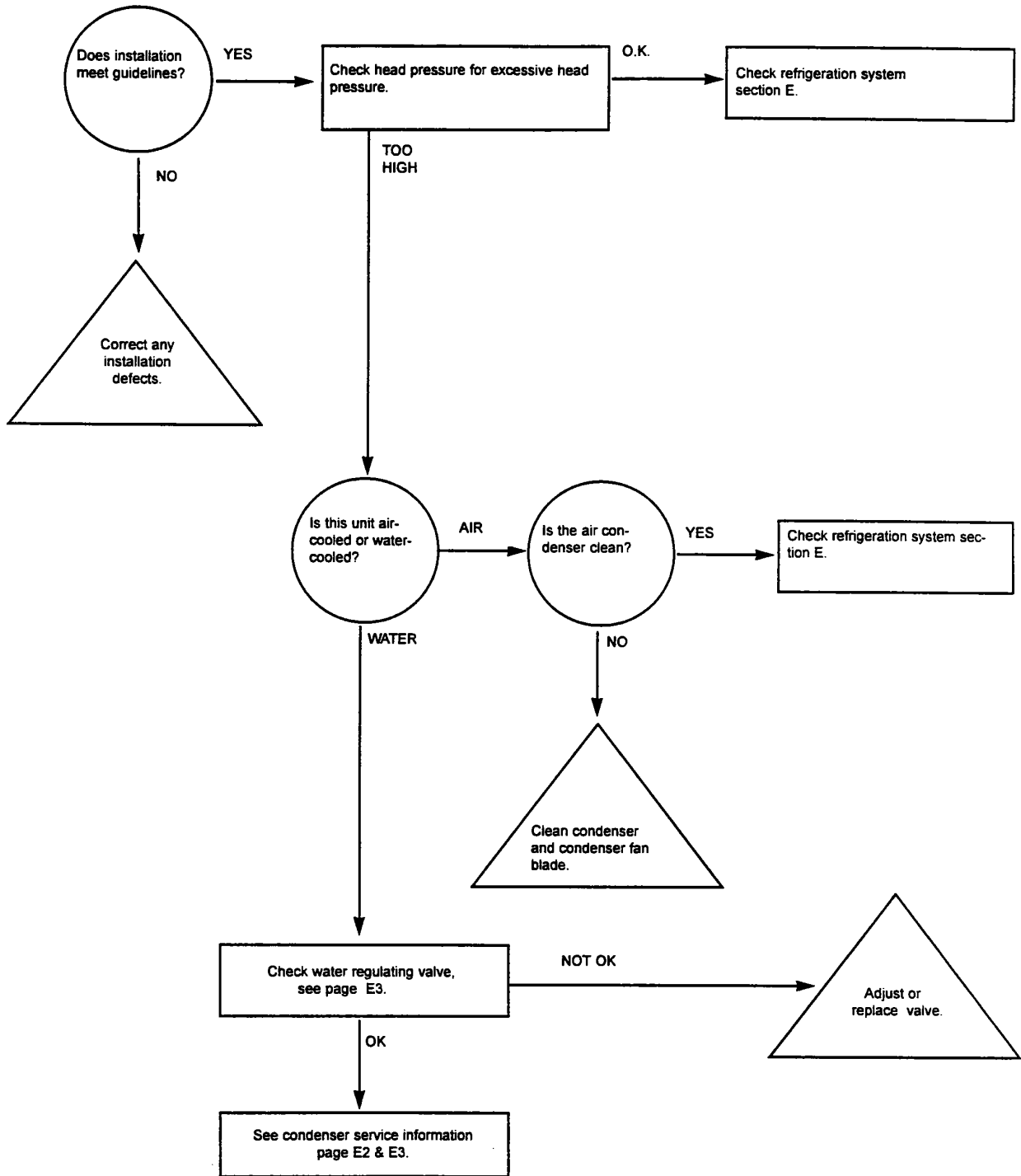
Machine Runs, Does Not Make Ice (continued)



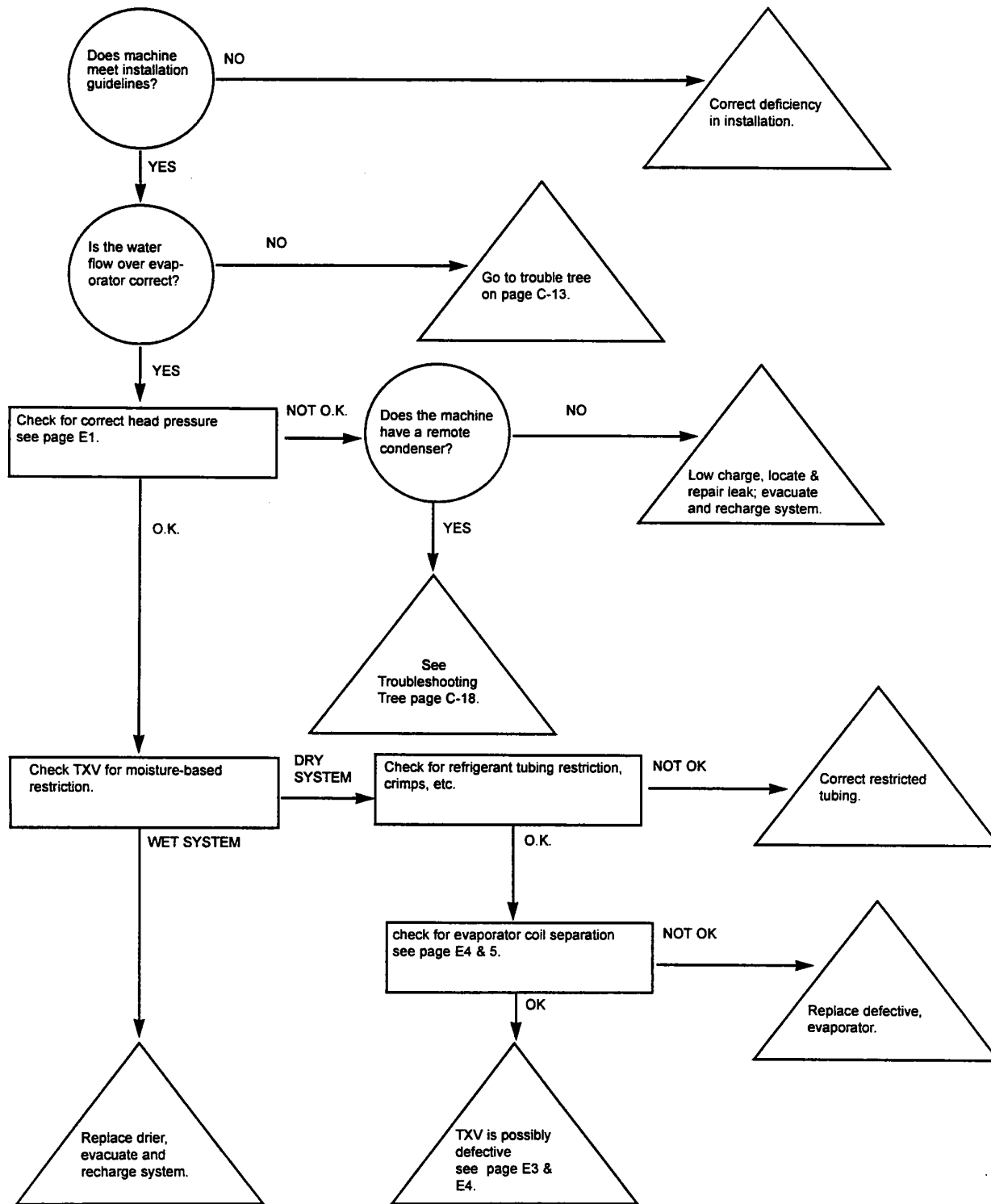
Machine Does Not Run



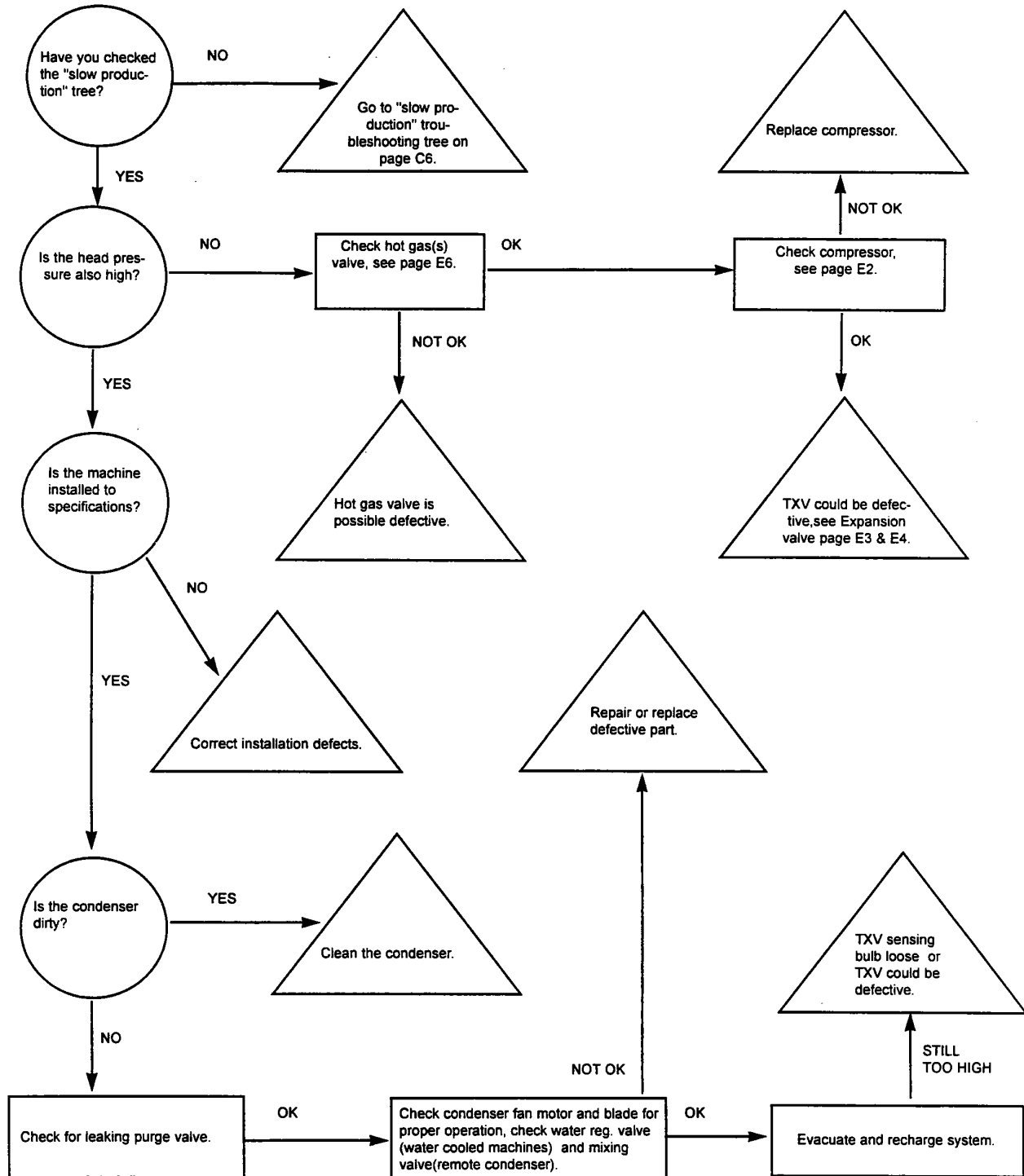
Slow Production (Cube Formation Good)



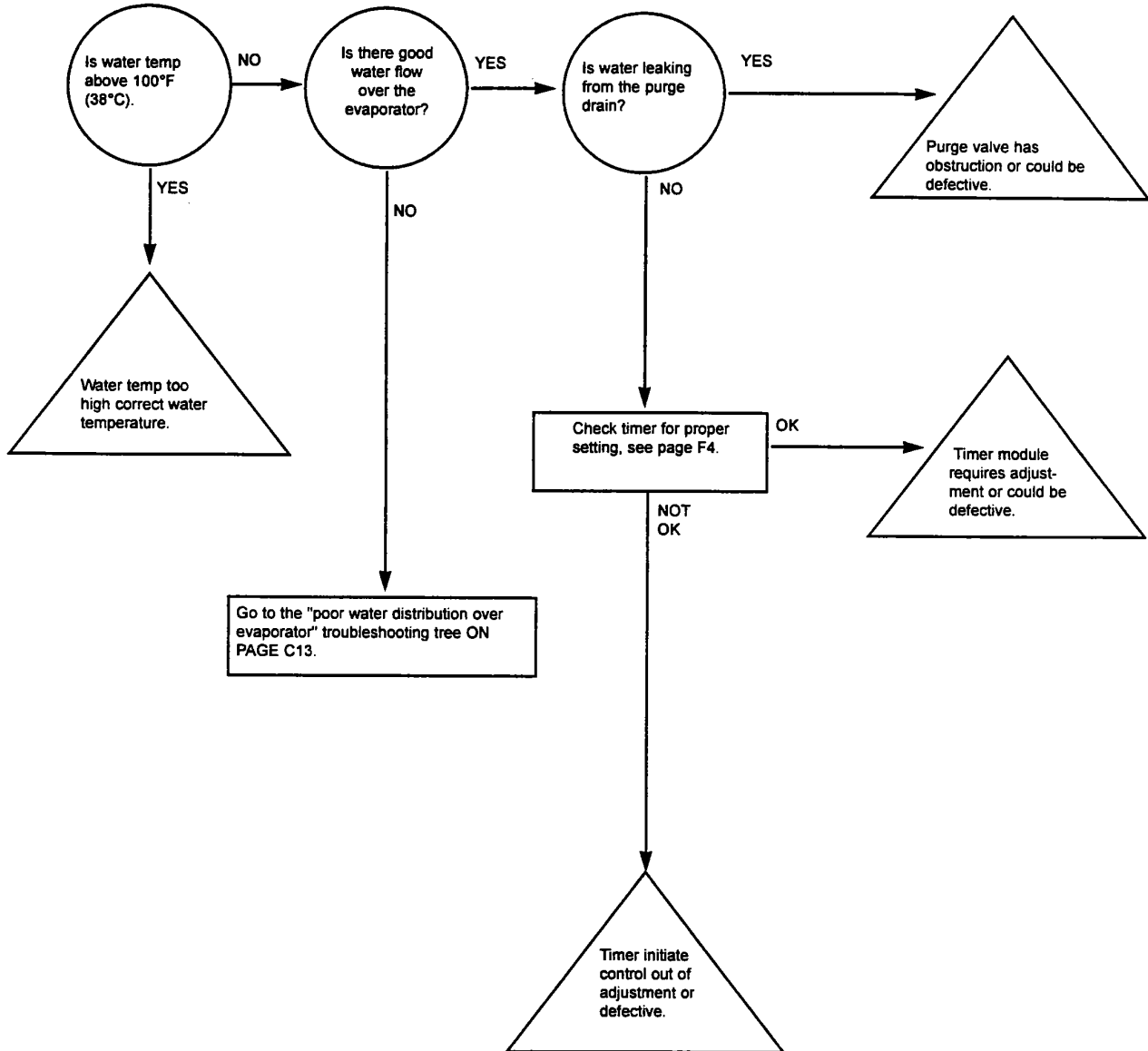
Low Suction Pressure



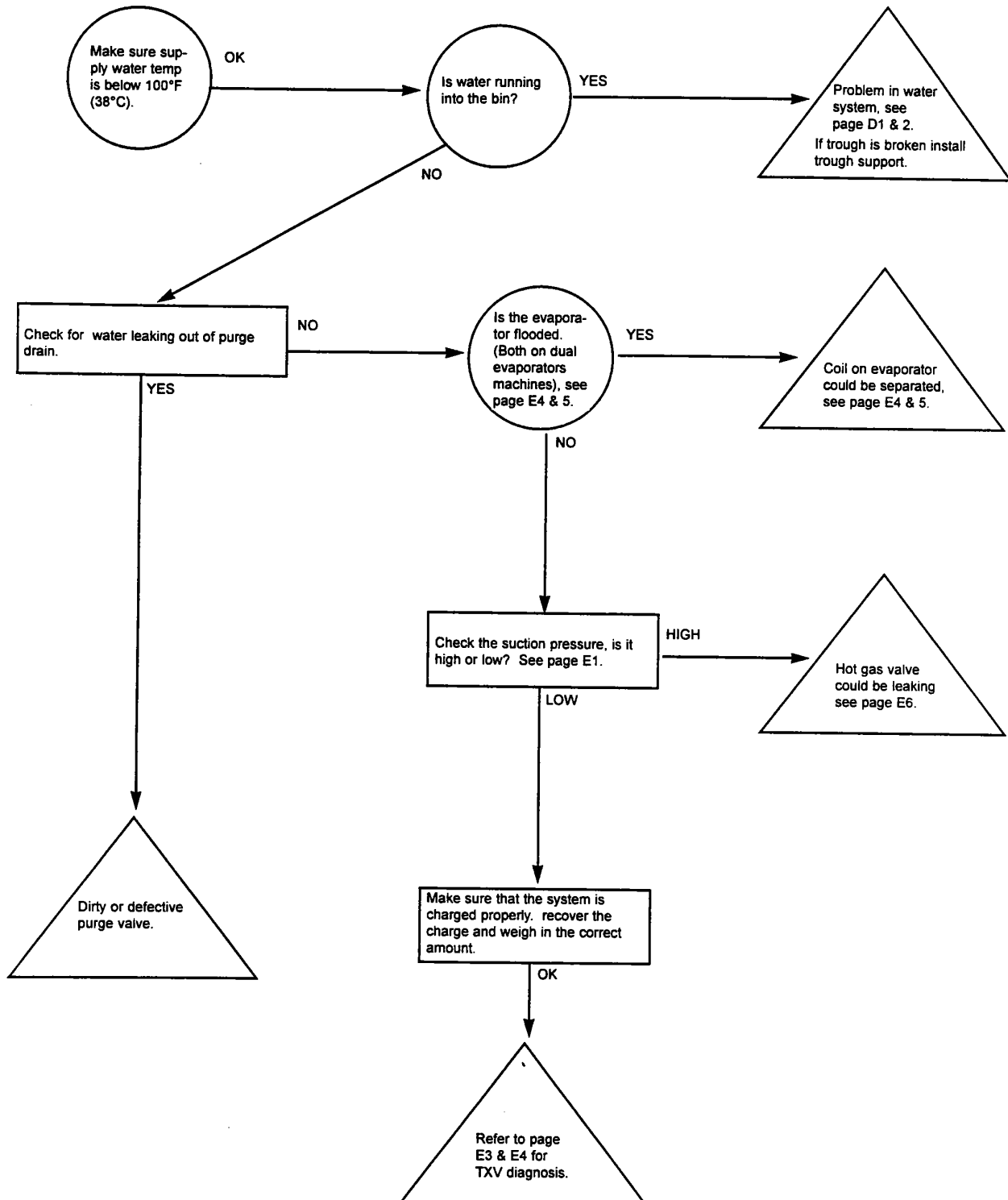
High Suction Pressure



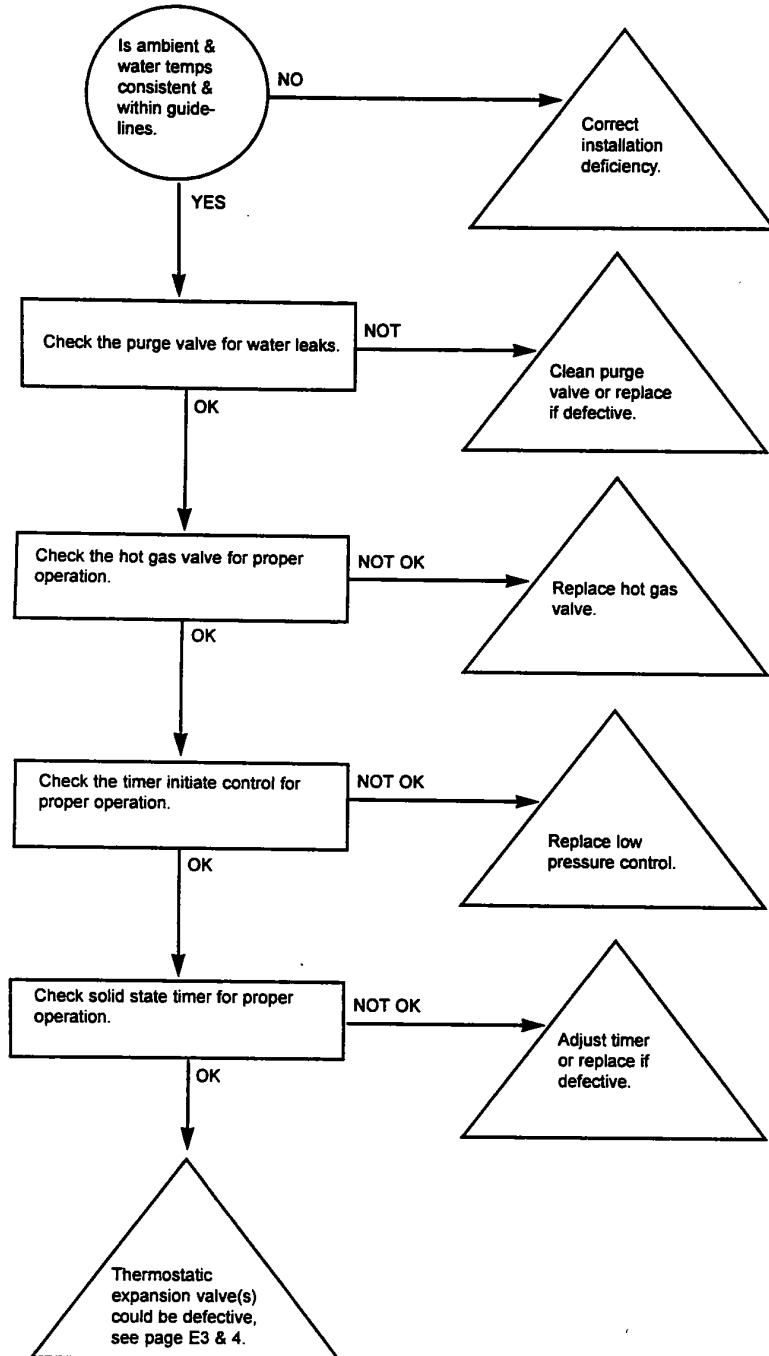
Cubes are Hollow



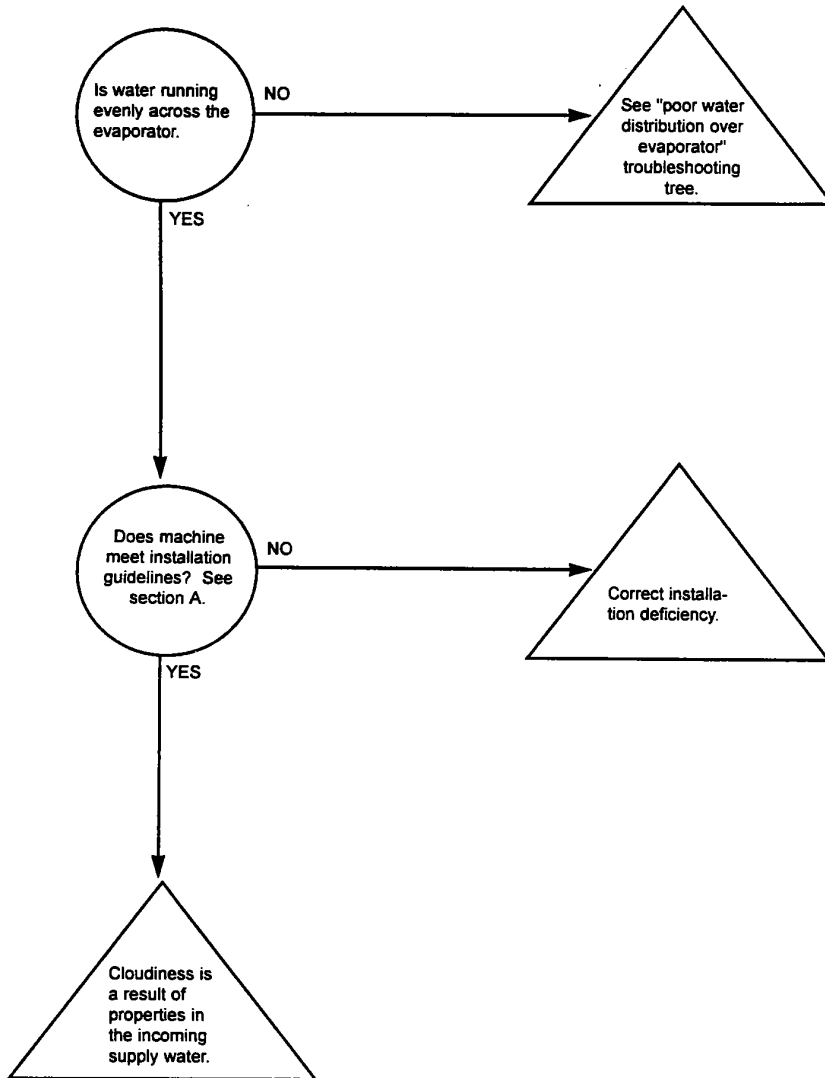
Uneven Bridge Thickness



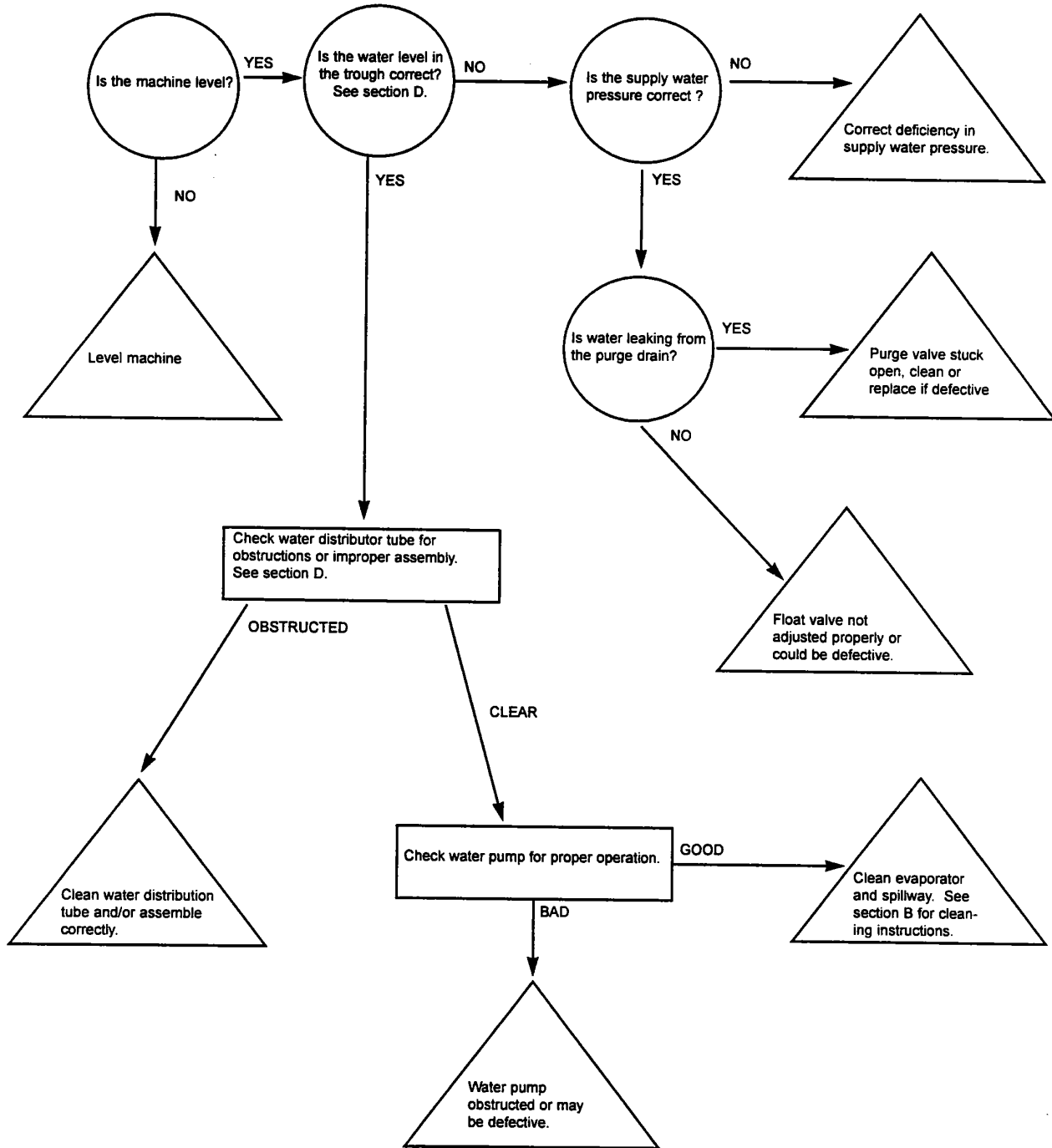
Ice Bridge Thickness Varies Cycle to Cycle



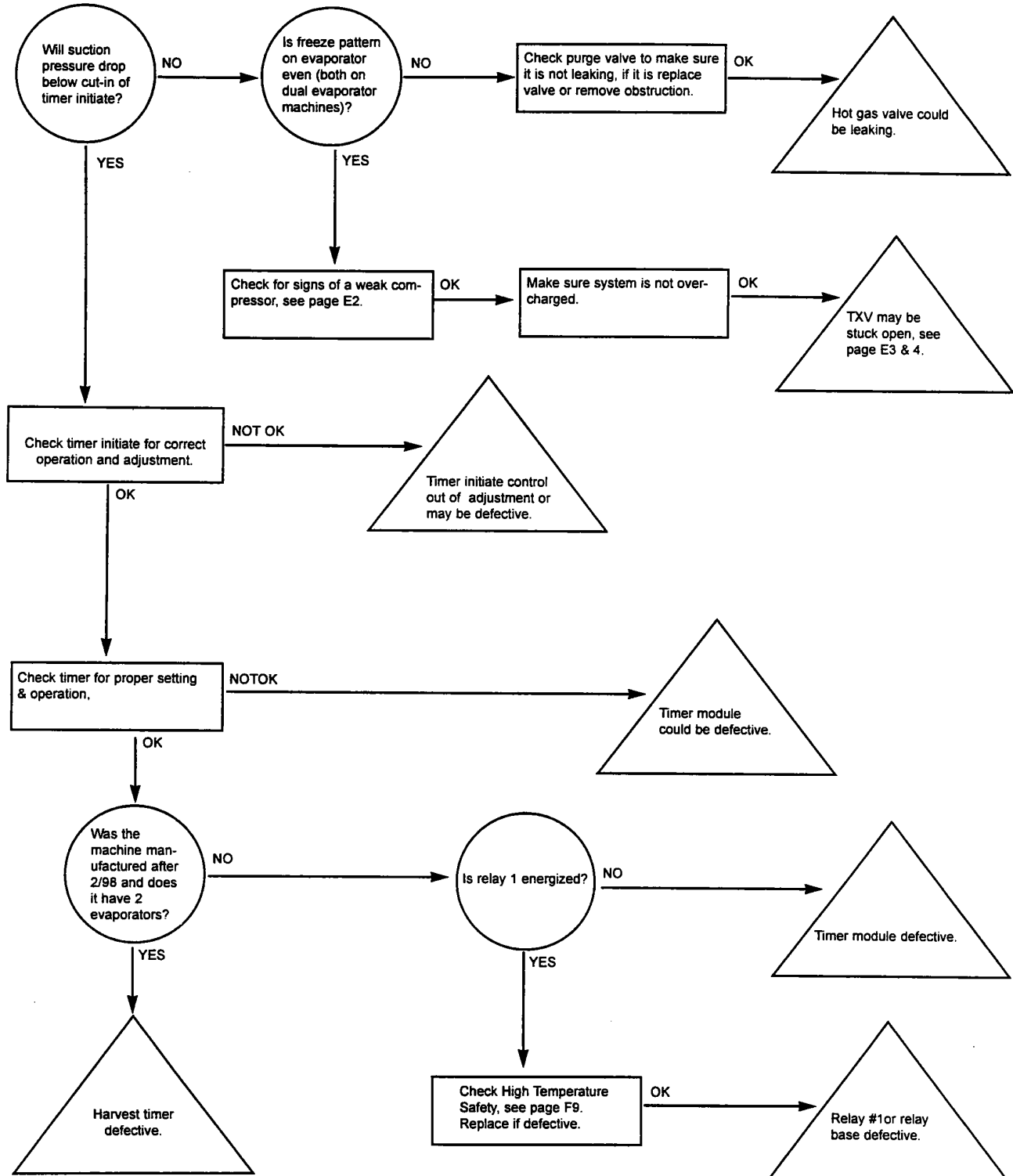
Machine Produces Cloudy Ice



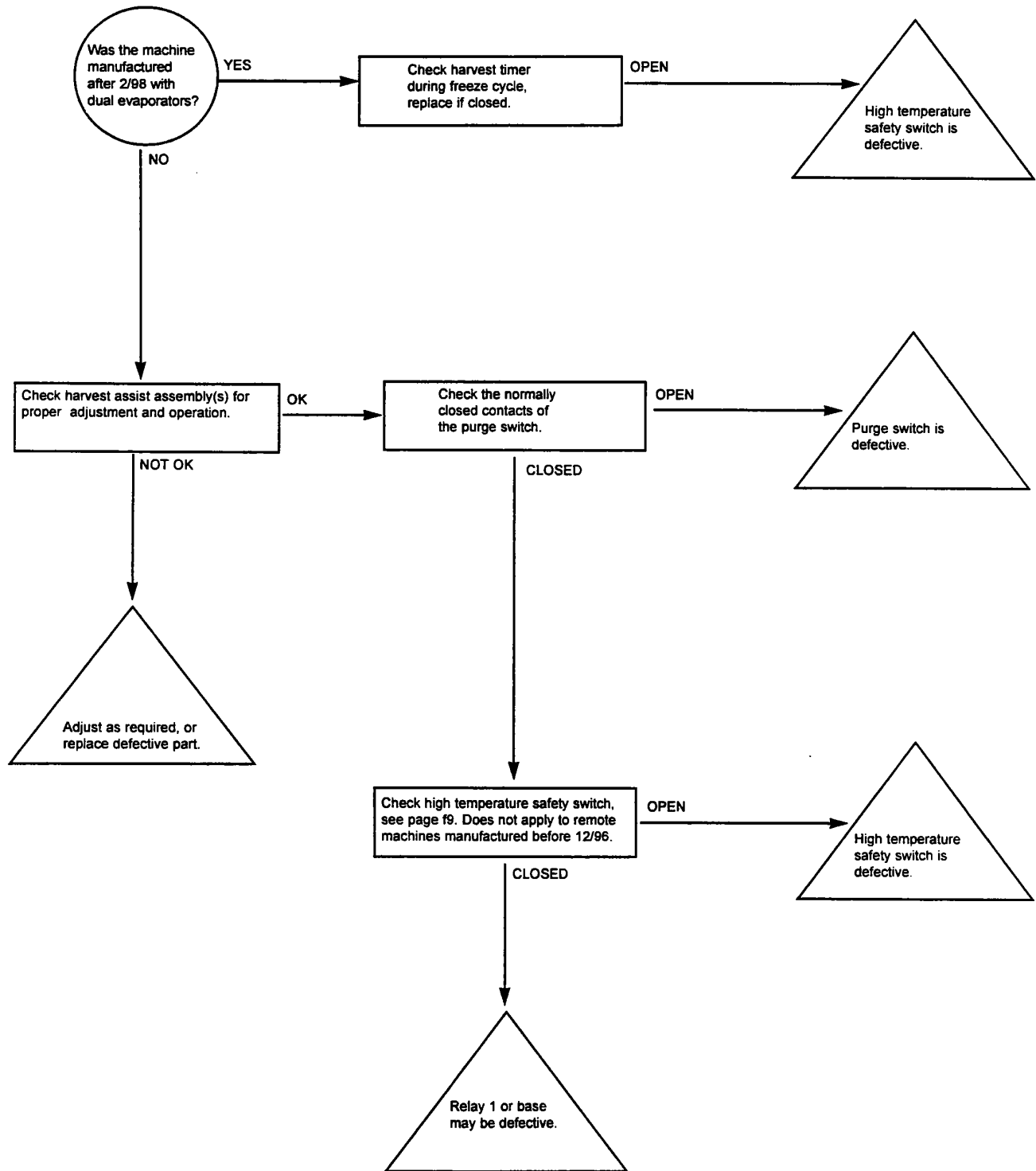
Poor Water Distribution over the Evaporator



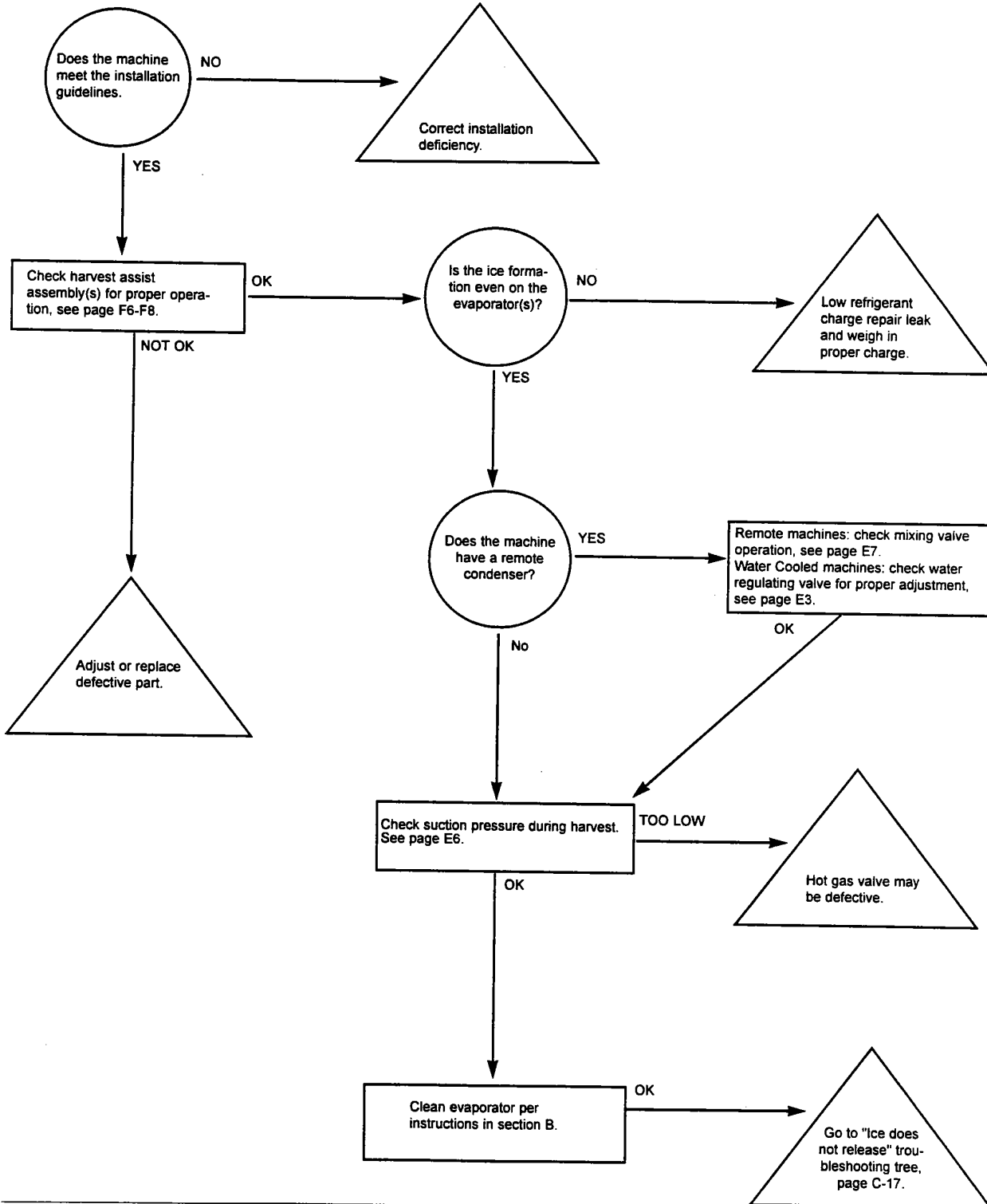
Machine Does Not Enter Harvest



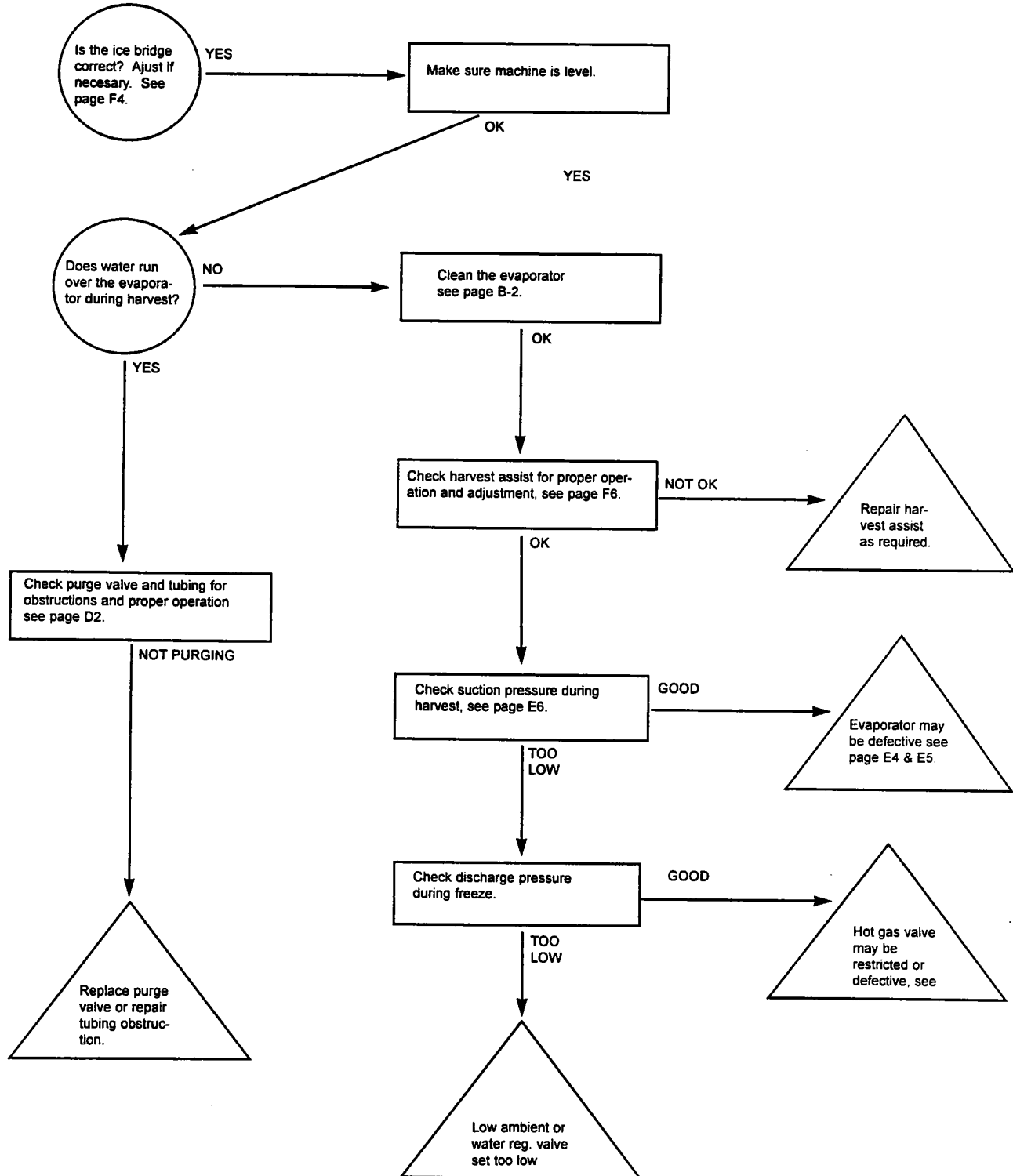
Machines Enters Harvest, Then Returns to Freeze Prematurely



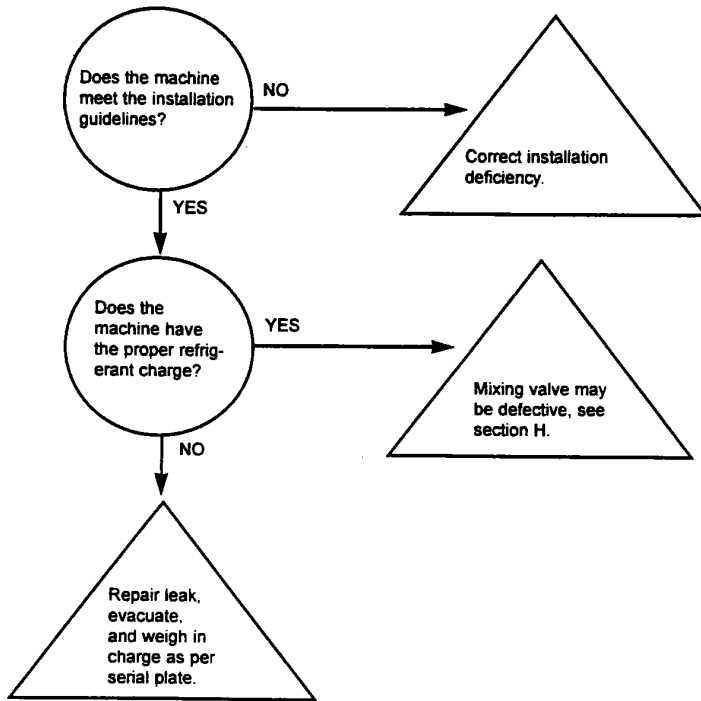
Length of Harvest Excessive

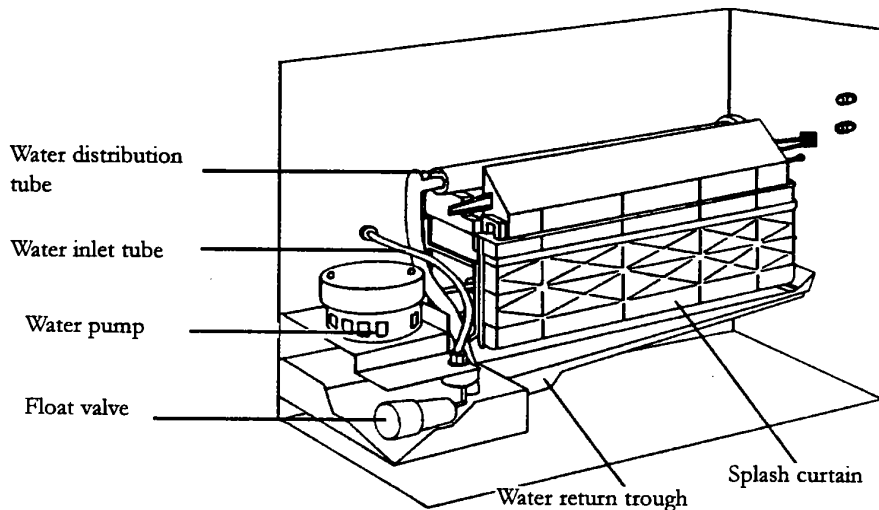


Ice Does Not Release From Evaporator



Hot Evaporator, Low Suction and Discharge Pressures (Remote Only)





C/EC Series Machine Shown

Water Distribution and Components

Water enters the machine through the **float valve** located in the **water trough**. The water trough holds water used for ice making. The float valve is used to maintain the proper water level in the water trough. During the freeze cycle water is continuously circulated over the evaporator by the **water pump**. When the machine enters harvest the **purge valve** opens and mineral laden water is pumped out of the water trough to the drain.

Note: The water trough requires a support bracket to prevent breakage of the water trough. Brackets can be ordered for older machines that were manufactured without them.

Float Valve

The water level can be adjusted by carefully bending the arm of the float. The water level should be 1/2" (1.3 cm) above the top of the water pump impeller housing during the freeze cycle.

On Under Counter models the float can be accessed by removing the top of the machine and the access panel, which is visible when the top is removed. Adjust the float by carefully bending the water tube located between the float valve and back panel. The water level should be 1/2" (1.3cm) below the top of the trough during the freeze cycle.

If the float valve does not allow water into the trough or water flow is slow, the float valve may be restricted. Remove and disassemble the float valve and clean the orifice. If water flow is still slow check the water pressure to be sure it is at least 20psi (1.4 bar).

If the float valve does not stop the water flow make sure the water pressure to the machine does not exceed 60 psi (4.1 bar). Install a water pressure regulator if pressure is too high. If the water pressure is not the problem, the float seal or the entire float valve assembly should be replaced.

Water Distribution and Components

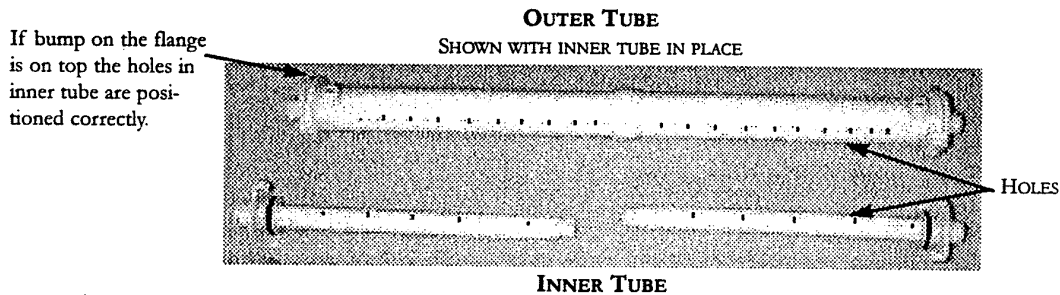
Water enters the machine through the **float valve** located in the **water trough**. The water trough holds water used for ice making. The float valve is used to maintain the proper water level in the water trough. During the freeze cycle water is continuously circulated over the evaporator by the **water pump**. When the machine enters harvest the **purge valve** opens and mineral laden water is pumped out of the water trough to the drain.

Note: The water trough requires a support bracket to prevent breakage of the water trough. Brackets can be ordered for older machines that were manufactured without them.

Float Valve

The water level can be adjusted by carefully bending the arm of the float. The water level should be 1/2" (1.3 cm) above the top of the water pump impeller housing during the freeze cycle.

On Under Counter models the float can be accessed by removing the top of the machine and the access panel, which is visible when the top is removed. Adjust the float by carefully bending the water tube located between the float valve and back panel. The water level should be 1/2" (1.3cm) below the top of the trough during the freeze cycle.



Important!

For proper water flow over the evaporator the holes on the inner tube must be facing upward.

Splash Curtain

A splash curtain covers the evaporator (except undercounter models) to prevent water from splashing into the bin. The splash curtain is also used to actuate the bin switch. When the bin becomes full of ice, the splash curtain is held open when the ice drops off the evaporator. The actuator tab of the splash curtain releases pressure on the bin switch and the machine shuts off. See bin control on page F9. On single evaporator machines, if a splash curtain is removed or opened during the freeze cycle the machine will continue to run until the ice drops from the evaporator. On dual evaporator machines manufactured before March 1998, if a splash curtain is removed or opened during the untimed portion of the freeze cycle the machine will shut off. If the machine is in the timed portion of the freeze cycle the machine will continue to run until harvest has ended. On dual evaporator models beginning March 1998, if a splash curtain is removed or opened during any portion of the freeze cycle the machine will shut off. If a curtain is removed or opened during the harvest cycle the machine will continue running until harvest has ended.

The splash curtain can be removed by swinging the bottom of the curtain away from the evaporator. Lift the right side of the curtain up and out of the hinge pin slot. To reinstall the curtain, position the left side pin into the slot first. On C/EC models position the curtain behind the actuator arm of the bin switch. On ECP Models the bin switch actuator rod must first be removed from the curtain. Swing the curtain away from the evaporator, push up on the center of the rod to bow it slightly while pulling upwards where it connects to the curtain. If the rod was removed and installed properly it will still be connected to the bin switch in the control box. If the rod comes disconnected from the bin switch remove the control box cover and reattach it around the actuator arm of the bin switch. Reconnect the bin switch actuator rod by swinging the curtain away from the evaporator, push up on the center of the rod bowing it slightly, while pushing the end of the rod into the slot in the curtain.

Note: There is no splash curtain used on the Under Counter Models. An adjustable thermostatic bin control is used rather than a bin switch. See page F9 for adjustment procedure.

Purge

When the machine enters the harvest cycle the water pump continues to run and the purge valve opens. This allows mineral laden water to be pumped from the trough to the drain. This helps keep the water system clean. On dual evaporator models beginning March 1998, the water pump and purge valve remain energized during the entire harvest cycle. All other machines, the water pump and purge valve de-energize once water is flushed from the trough. The length of time that the water pump and purge valve remain energized is controlled by the cam switch, see page F6.

Note: The purge valve must be completely closed during the freeze cycle. If water leaks through the purge valve during freeze the freeze time will be extended and poor ice formation will result.

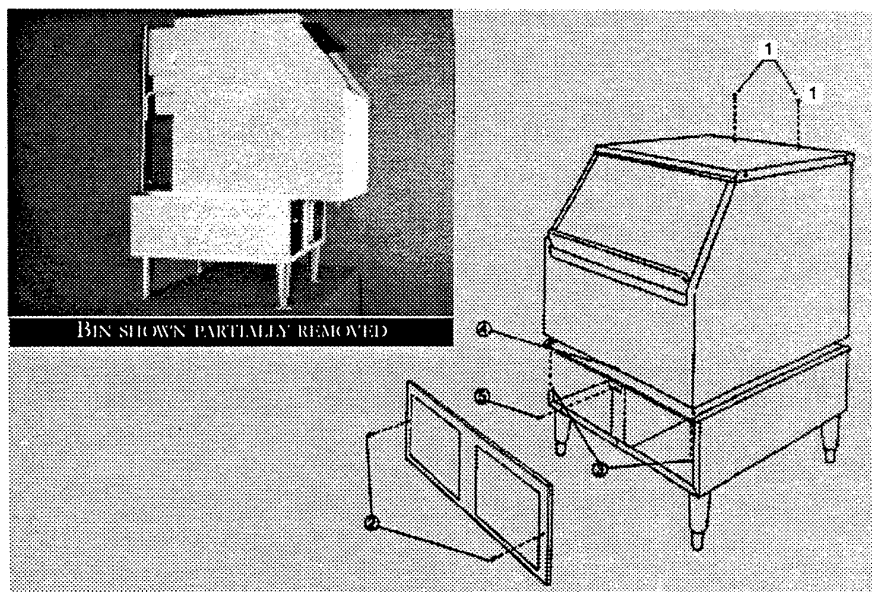
The purge valve can also be energized manually by pushing the purge switch. The purge switch is used when cleaning the water system to flush cleaning solution down the drain. See page B1 for cleaning instructions.

UC20/EUC200 - Bin Removal

The bin can be removed on under counter models to access many of the components.

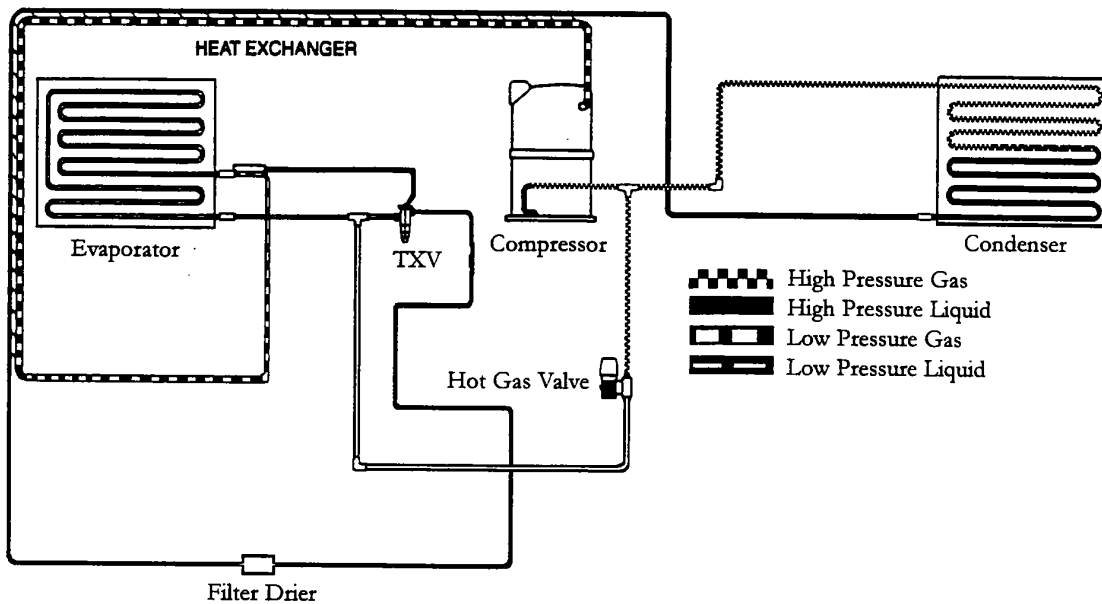
Procedure

1. Remove the 2 phillips head screws from rear of top panel.
2. Remove the louvered panel below the bin.
3. Remove 2 screws, from front corners of bin.
4. Remove 1 screw from center of front edge of bin.
5. Remove drain tube from underneath bin. This step is not necessary on machines manufactured before 5/88.



Notes

Refrigeration System / EC and ECP Series



Refrigeration Cycle and Components

Before diagnosing the refrigeration system, it is very important that refrigerant charge be correct. Whenever the refrigeration system has been opened, the filter-drier must be replaced and the proper refrigerant charge must be weighed in. See refrigerant charge information on page A3 through A8.

Refrigerant Pressures

At the beginning of the freeze cycle the suction pressures are as indicated in the chart below. The pressure at the beginning of freeze may be up to 10 p.s.i. (.7 bar) less than those stated, depending on operating conditions. Pressures less than this may indicate an under charge. With proper ice bridge thickness, the suction pressure at the end of the freeze cycle is also indicated in the chart below. This pressure may also vary with operating conditions. The head pressure on water cooled units should be adjusted to the pressures shown in the chart. Discharge pressure on air cooled units will vary with ambient conditions but will typically run higher than water cooled units. Remote condensers located in ambient temperatures below 70°F (21°C) will typically run a lower head pressure. See Mixing Valve later in this section.

Model Number	Refrigerant Type	Approx. Suction Pressure		Approximate Head Pressure
		Begin Freeze	End Freeze	
EUC200/EC206	R-134a	30 PSI (2.1 bar)	10 PSI (.7 bar)	125 PSI (8.6 bar)
UC20, C20, C40	R-12	30 PSI (2.1bar)	10 PSI (.7 bar)	125 PSI (8.6 bar)
C40B1	R-502	50 PSI (3.4 bar)	34 PSI (2.3)	225 PSI (15.5 bar)
C30,C50,C66	R-502	50 PSI (3.4 bar)	26 PSI (1.8 bar)	225 PSI (15.5 bar)
All R404a machines	R-404a	55 PSI (3.8 bar)	28 PSI (2 bar)	250 PSI (17.2 bar)
C106	R-22	50 PSI (3.4 bar)	24 PSI (1.7 bar)	225 PSI (15.5 bar)

Note: The above information also applies to the 50Hz versions of the machines listed.

Refrigeration System / EC and ECP Series

Refrigerant is pumped throughout the refrigeration system by a hermetic **compressor**. Refrigerant, in its gas state, is pumped from the compressor to the **condenser**. Heat is removed from the refrigerant either by forced air movement through the condenser or by a heat exchanger (water cooled condenser) that transfers heat from the refrigerant to water. The refrigerant changes to a liquid when cooled.

The refrigerant in a liquid state passes through a **filter drier**. The filter drier traps small amounts of moisture and foreign particles from the system.

Important!

The filter drier must be replaced whenever the refrigeration system is opened or if the refrigerant charge has been completely lost.

Compressor

The compressor runs during the entire cycle.

If the valves in the compressor are damaged the compressor will be unable to pump refrigerant efficiently. Damaged valves may be the symptom of another problem in the refrigeration system such as liquid refrigerant returning to the compressor or high head pressure. When a compressor is replaced it is important that the refrigeration charge be weighed in and the system be checked for proper operation to prevent a repeat failure

An inefficient compressor will usually have a higher than normal suction pressure at the end of the cycle. The freeze cycle will be longer than normal and/or the harvest cycle may be excessively long. To check the compressor, check the compressor amperage draw five minutes into the freeze cycle. If the amp draw is less than 70% of rated full load amps the compressor may be inefficient. These symptoms may also be caused by other problems, therefore, it is important to use the troubleshooting trees when diagnosing a problem. See Electrical System for more information on the compressor and compressor start components.

Air Cooled Condenser (Self Contained)

To properly cool the condenser there must be adequate air flow around the machine. The ambient air temperature should not exceed 100°F (38°C). See Installation Guidelines on page A9. The condenser coil and fan blades must be kept clean. The condenser can be cleaned with compressed air or by using a brush. If a brush is used, brush in the direction of the fins taking care not to bend the fins. If condenser fins are bent this will also restrict air flow through the condenser and the fins will need to be straightened with a fin comb.

All Models except Under Counter and ECP: The condenser is located in back of the cabinet. On 30" (76cm) wide machines air is pulled through the condenser, by a single fan motor and discharged through the right side panel. Some models may have a top discharge. On 48" (122cm) wide machines air is pulled through the condenser by two fan motors and discharged through both side panels.

Under Counter Models: The condenser is located in front of the machine below the bin. Air is pulled through front louvered panel and through the condenser by a single fan motor. Air is discharged through the left side of the front louvered panel.

ECP Models: The condenser is located on the left side of the machine. Air is pulled into the cabinet through the back panel and pushed through the condenser. A single fan motor is used.

Important!

Do not block air flow as it will cause premature failure of the machine and will void the warranty.

If any of the above problems exist, the head pressure will be excessively high, slow production will result, the compressor may overheat and will eventually be damaged.

Note: On C40 models (R-12 only) a **fan control** is used to maintain the head pressure between 100 psi (7 bar) and 125 psi (8.6 bar) during low ambient conditions.

Water Cooled Condenser

If the machine has been installed properly, the water flow through the condenser will be in a direction opposite the refrigerant flow. The water condenser must have a minimum of 20 psi (1.4 bar) of water pressure to the condenser. The water temperature must not exceed 100°F (38°C). A water regulating valve is used to control the flow of water into the condenser. In areas that have poor water quality the condenser may eventually become coated with mineral deposits. This will decrease the efficiency of the condenser resulting in high head pressure. Water cooled condensers replaced because of failure due to excessive mineral build up will not be covered under warranty.

Water Regulating Valve

The water regulating valve controls the head pressure by regulating the amount of water flow through the condenser. The bellows of the regulating valve are connected to the high side of the system. As the head pressure rises, the bellows expand increasing the water flow through the condenser. The rate of water flow can be changed by adjusting the spring pressure screw at the top of the valve. The valve should be adjusted to maintain a head pressure of 250 psi (18.3 bar) on R404a machines. R-502 and R-22 machines should maintain a head pressure of 225 psi (15.5 bar). R-12 and R-134a machines should maintain a head pressure of 125 psi (8.6 bar). The valve can also be checked for proper adjustment by checking the water exiting the condenser, it should be between 100°F (38°C) and 110°F (43°C). When the machine is off, the water regulating valve will close completely stopping the flow of water through the condenser. If the water flow does not stop when the machine is off the valve should be replaced.

Air Cooled Condenser (Remote)

See pages E6 and E7.

High Pressure Safety

If the head pressure becomes too high the high pressure safety will open and the machine will shut off. The high pressure safety opens at 250 psi (17.25 bar) on R-12 and R-134a machines, 400 psi (27.5 bar) on R-502 and R-22 machines and 450 psi (31 bar) on R-404a machines. Note: The high pressure safety is used on all water cooled and remote machines and some self-contained air cooled machines.

Thermostatic Expansion Valve

The thermostatic expansion valve meters the flow of refrigerant into the evaporator changing its state from a high pressure liquid to a low pressure liquid. This drop in pressure causes the refrigerant to cool. The cooled refrigerant absorbs heat from the water circulating over the evaporator. As the evaporator fills with liquid refrigerant the evaporator becomes colder.

The flow of refrigerant into the evaporator is controlled by the temperature at the outlet of the evaporator. The expansion valve bulb, which is mounted to the top of the suction line, senses the evaporator outlet temperature causing the valve to open or close. As ice forms on the evaporator the temperature drops and the flow of refrigerant into the evaporator decreases. This causes the suction pressure to drop.

Thermostatic Expansion Valve Diagnosis

The evaporator should become completely flooded (filled with liquid refrigerant) during the freeze cycle. A completely flooded evaporator will have a uniform freeze pattern (ice formation across the evaporator). A starved evaporator (not enough liquid refrigerant) will have poor or no ice formation at the top of the evaporator, and the tubes(s) exiting the evaporator will not frost. All tubes should be frosted within approximately 5 minutes from the start of the freeze cycle. An expansion valve that is restricted or not opening properly will starve the evaporator causing the suction pressure to be lower than normal. A low refrigerant charge will also starve the evaporator and cause low suction and head pressures. If not sure of the amount of charge in the system the refrigerant should be recovered and the correct charge weighed in before a defective valve can be diagnosed. If the evaporator is starved but the suction pressure is higher than normal the TXV is not the problem, refer to the troubleshooting trees in section C.

Refrigeration System / EC and ECP Series

Thermostatic Expansion Valve Diagnosis, continued

Symptom	Problem	Remedy
Single Evaporator Machine 1. Evaporator flooded but suction pressure not dropping. Compressor has been checked and appears to be good. Suction line at compressor may be colder then normal.	a. TXV sensing bulb not making good contact with suction line or uninsulated. b. TXV sensing bulb in wrong location. c. System overcharged. d. TXV stuck open.	Remedy a. Clean suction line and clamp bulb securely. Insulated bulb. b. Relocate sensing bulb to top of suction line. c. Recover refrigerant and weigh in correct charge.
2. Evaporator starved, no frost on line(s) exiting evaporator. Suction pressure is low. See Evap. diagram on page E5.	a. Machine is low charged. b. TXV restricted or sticking closed	d. Replace TXV. a. Recover refrigerant and weigh in proper charge. b. Relace TXV and filter drier. Once valve has been removed check valve for
Dual Evaporator Machine 1. Both Evaporators flooded, suction pressure dropping slower than normal. Compressor has been checked and appears to be good. Suction line at compressor may be colder then normal.	a. A TXV sensing bulb is not making good contact with suction line or is uninsulated. b. A TXV sensing bulb in wrong location. c. System overcharged. d. A TXV is stuck open.	moisture. a. Clean suction line and clamp bulb securely. Insulated bulb. b. Relocate bulb to top of suction line. c. Recover refrigerant and weigh in correct charge. d. Replace TXV.
2. One Evaporator starved and one is properly flooded Suction pressure lower than normal.	a. TXV restricted or sticking closed.	a. Replace both TXV's.

If the TXV sticks open or if the sensing bulb is not making good contact with the suction line, the flow of refrigerant into the evaporator will be too great and liquid refrigerant will flood the compressor. The suction pressure will remain higher then normal and the machine will remain in an extended freeze cycle. Ice will build evenly but will become very thick.

A dual evaporator machine will have one TXV for each evaporator. If one TXV sticks open and the other is operating normally, the suction pressure will be higher than normal and both evaporators will build thick ice. It is recommended that both valves be replaced if one sticks open.

If one TXV is sticks closed and one is operating normally the suction pressure will be normal or low but the evaporator with the defective valve will be starved (thick ice at the bottom and thick ice at the top).

Important!

Use only Ice-O-Matic O.E.M replacement expansion valve. Warranty will be void if an expansion valve other then the correct Ice-O-Matic replacement is used.

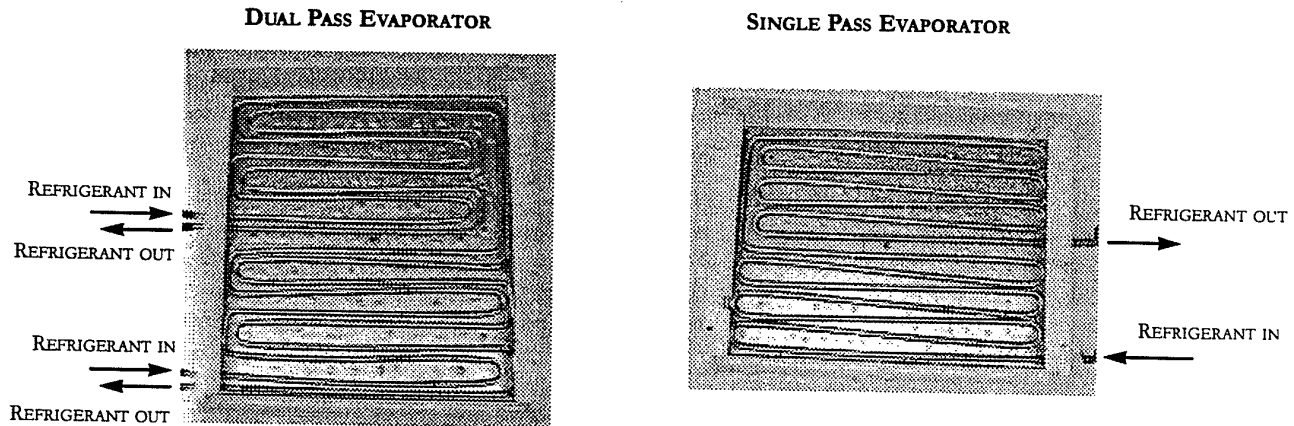
Evaporator

As water is circulated over the front of the evaporator, liquid refrigerant is circulated through the tubing attached to the back of the evaporator. As the liquid refrigerant in the tubing vaporizes it absorbs heat from the water, causing it to freeze. The evaporator should be completely flooded throughout most of the freeze cycle. A flooded evaporator will build ice evenly across the evaporator. The top row will usually be slightly thinner then the rest of the evaporator. A starved evaporator will have thick ice at the top and thin ice at the bottom. Most problems with ice formation or harvesting are not related to a defective evaporator, use the Troubleshooting Trees in section C for additional help in diagnosis.

Note: The C105/106, C185/186 and EC1805/1806 will have a slight variance in ice thickness from top to bottom.

Refrigeration System / EC and ECP Series

Refrigerant enters the evaporator through the top tube and exits through the bottom tube. On models C105/106, C185/186 and EC1805/1806 the refrigerant line at the outlet of the TXV splits into two feeder tubes. This split occurs at the distributor which is a fitting that is soldered to the TXV. One feeder tube from the distributor feeds the top of the evaporator, the other tube feeds the bottom of the evaporator. The evaporator tubes run parallel, in opposite directions, along the back of the evaporator creating a dual pass. See diagram below.



If the evaporator is flooded but is not building ice evenly it is possible that the evaporator has coil separation. Evaporator coil separation is the separation of the refrigerant tubing from the back of the evaporator plate. This is very rare but occurs from time to time. Usually, all of the following symptoms will be present.

1. Low suction pressure.
2. Ice not releasing from the evaporator during harvest.
3. Hollow cubes or uneven ice bridge on some areas of the evaporator.

If coil separation is suspected let the machine run in freeze until the timer has energized. Now check the evaporator for areas where cubes are less developed than the cubes in other areas. If the cubes are all the same size, coil separation is not the problem. If there are areas other than the top row with less developed cubes, check the refrigerant lines at the inlet(s) and outlet(s) of the evaporator, if both lines are frosted the coil is separated. To confirm coil separation remove and check the back of the evaporator. If the coil is separated the evaporator must be replaced. If the outlet(s) of the evaporator is not frosted the problem is not with coil separation (refer to the troubleshooting trees, section C).

Note Permanent discoloration on the evaporator plating is normal and will cause no problems with harvesting the ice or with sanitary conditions. Before condemning the evaporator for plating problems be certain it is not just discoloration. Good evaporators will not be covered under warranty.

Note: If the spillway (white plastic evaporator top) becomes damaged it can be replaced. It is not necessary to replace the entire evaporator.

As the liquid refrigerant leaves the evaporator it changes to a low pressure gas before returning to the compressor.

Important!

Liquid refrigerant must not return to the compressor, compressor damage will result. Frost on the suction line at the inlet of the compressor indicates liquid returning to the compressor. Check for frost at the end of the freeze cycle. If liquid is returning to the compressor the problem must be located and corrected. See Refrigerant Charge, Thermostatic Expansion Valve and Evaporator.

Harvest Cycle

Once the freeze cycle is complete the machine enters the harvest cycle. The **hot gas valve(s)** opens allowing hot discharge gas to enter the evaporator. Some models use a **crankcase pressure regulator** to control suction pressure at the compressor during harvest.

Hot Gas Valve

When the machine enters harvest the hot gas valve coil(s) is energized and the hot gas valve opens. Discharge gas is pumped through the hot gas valve directly into the evaporator(s). Dual evaporator units beginning March 1998 have one hot gas valve for each evaporator. Dual evaporator unit before March 1998 use only one hot gas valve. The evaporator temperature will reach approximately 40°F (4.5°C). The suction pressure during harvest should reach a minimum of 40 psi (2.8 bar) on R-12 and R-134a units and 70 psi (4.8 bar) on R-502, R-22 and R-404a units. The head pressure will drop during harvest.

If a hot gas valve does not open completely during harvest there will not be enough hot gas in the evaporator to defrost the ice. This can be checked by watching the suction pressure during harvest. If there is not enough hot gas entering the evaporator the suction pressure will be lower than the pressures stated above. It is important that the machine has the proper refrigerant charge, a normal head pressure during freeze and the compressor is working properly when making this check. Use the Troubleshooting Trees in section C if not sure.

If the hot gas valve leaks during the freeze cycle ice will not form on the top of the evaporator and the suction pressure will be higher than normal. To check the hot gas valve to see if it is leaking, let the machine run in the freeze cycle for approximately 5 minutes, now feel the difference in temperature between the inlet and outlet of the valve. A definite temperature difference should be felt. If so the problem is not the hot gas valve. If the lines are the same temperature and the suction pressure is higher than normal, the hot gas valve is leaking and should be replaced.

Crankcase Pressure Regulator (EC500/ECP550/556 Models Only)

The crankcase pressure regulator prevents the suction pressure at the compressor from exceeding 75 psi (5.2 bar). The pressure regulator is in the suction line between evaporator and compressor.

A spring at the top of the valve keeps a downward force on the seat inside the valve body allowing refrigerant to pass through the valve. When the suction pressure at the outlet of the valve becomes greater than 75 psi (5.2 bar), the seat is forced upwards against the spring causing the seat to partially restrict the flow of refrigerant. This reduces the refrigerant pressure leaving the valve and entering the compressor. This reduction in suction pressure keeps the compressor from operating under an excessive load.

During the freeze cycle the suction pressure is normally below 75 psi (5.2 bar), therefore the crankcase pressure regulator is wide open and there is no pressure drop through the valve. During harvest however, the suction pressure normally exceeds 75 p.s.i. (5.2 bar). During this time the valve regulates the pressure entering the compressor keeping it at 75 psi (5.2 bar).

If the crankcase pressure regulator fails in the closed position the suction pressure will be lower than normal or will run in a vacuum. To determine the difference between a crankcase pressure regulator stuck closed and a restriction at the TXV, allow the machine to enter harvest, if the suction pressure at the compressor rises during harvest the crankcase pressure regulator is not the problem. If the crankcase pressure regulator fails in the open position the suction pressure at the compressor will rise above 75 psi (5.2 bar).

Remote System

Machines that use remote condensers have several components that are not used in self contained machines. A **Mixing Valve** controls the head pressure when the ambient temperature at the condenser drops below 70° F (21° C). When the bin fills with ice or is turned off at the selector switch, the machine will pump all the refrigerant into the receiver before shutting off.

Refrigeration System / EC and ECP Series

Remote Condenser

Important!

For proper operation the remote condenser must be installed properly. Improper installation will void the warranty. See remote install guidelines on page A10.

The location of the remote condenser should be such that the ambient air temperature does not exceed 110°F (43°C). If ambient temperature exceeds 110°F (43°C) ice production will decrease until ambient temperature decreases. Air is pulled upward through the condenser from the bottom by the fan motor.

The condenser coil and fan blades must be kept clean. The condenser can be cleaned with compressed air or by using a brush. If a brush is used, brush in the direction of the fins taking care not to bend the fins. If condenser fins are bent this will also restrict air flow through the condenser and the fins will need to be straightened with a fin comb.

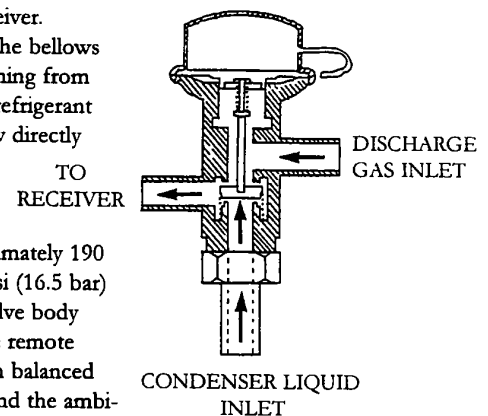
If the air flow is restricted or the condenser is dirty the head pressure will be excessively high, slow production will result and the compressor may overheat and eventually become damaged. Problems related to dirty condenser or poor air flow will not be covered under warranty.

Note: The condenser fan motor runs continuously, it will shut off only when the ice machine is off.

Mixing Valve

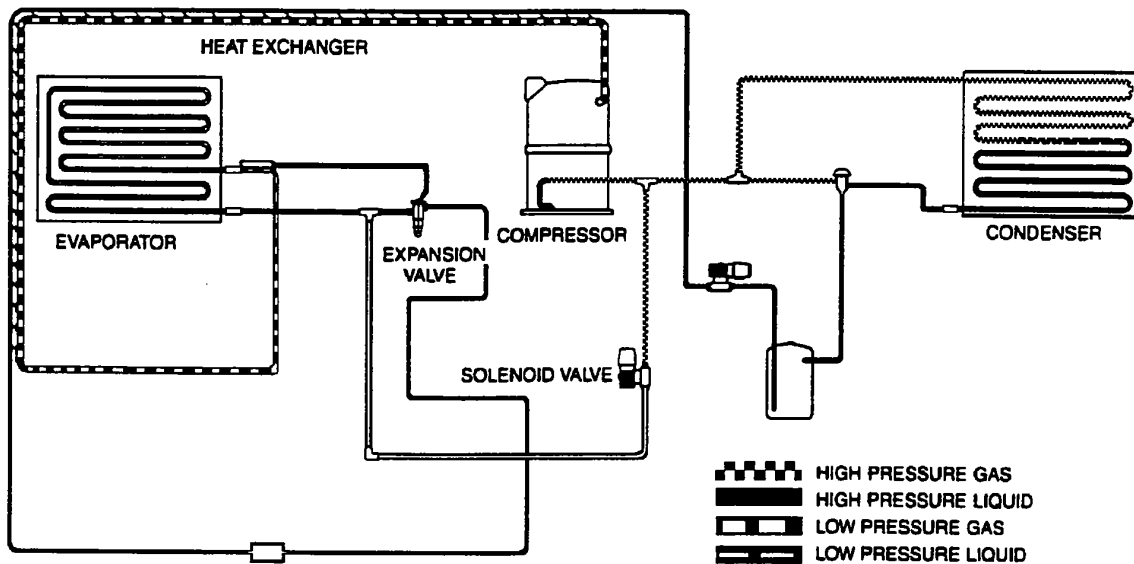
When the temperature at the condenser is above 70°F (21°C), the refrigerant flow from the compressor is directed by the mixing valve through the condenser and into the receiver.

When the temperature at the condenser drops below 70°F (21°C), the pressure in the bellows of the mixing valve becomes greater than the pressure of the liquid refrigerant coming from the condenser. This change allows the valve to partially restrict the flow of liquid refrigerant leaving the condenser. This allows discharge gas to by-pass the condenser and flow directly into the receiver, mixing with the liquid refrigerant from the condenser. The amount of discharge gas that by-passes the condenser increases as the ambient temperature at the condenser decreases. During low ambient conditions the action of the mixing valve allows the head pressure to be maintained at approximately 190 psi (13.1 bar) on R-502. R-404a machines maintain a head pressure of either 240 psi (16.5 bar) or 190 psi (13.1 bar) depending on the model or date of manufacture, check the valve body for the setting. R-22 machines maintain a head pressure of 180 psi (12.4 bar). The remote system depends on an adequate refrigerant charge in order for the system to remain balanced during ambient temperature changes. If the refrigeration system is undercharged and the ambient temperature is below 70°F (21°C) the mixing valve will not work properly. The mixing valve will allow too much refrigerant to bypass the condenser.



Problem	Possible Cause	Remedy
1. Head pressure low/liquid line between valve and receiver cold. Ambient condenser temp. below 70°F (21°C).	a. Valve defective, not allowing discharge gas into receiver.	a. Replace valve.
2. Head pressure low /liquid line between valve and receiver hot.	a. System low charged. b. Valve defective, not allowing enough sub-cooled liquid into receiver.	a. Find and repair leak if present. Recover refrigerant and weigh in proper charge. b. Replace valve.
3. Head pressure high/liquid line returning from condenser is cool. Ambient condenser temperature above 70°F (21°C).	a. Valve defective, not allowing refrigerant to circulate through condenser.	a. Replace valve.

Refrigeration System / EC and ECP Series



Pump Down System (Remote Only)

The pump down system prevents liquid refrigerant from migrating to the evaporator and compressor during the off cycle and prevents the compressor from slugging or starting under excessive load.

Liquid Line Solenoid

When a machine with a remote condenser shuts off, the **liquid line solenoid** valve is de-energized causing the valve to close. The valve is located at the outlet of the receiver. When the valve closes the flow of refrigerant leaving the receiver is completely restricted, see diagram above. The compressor pumps all of the refrigerant into the condenser and receiver.

As the system pumps down, the pressure on the low side of the system drops. When the suction pressure drops to 19 psi (1.3 bar) the **pump down control** opens and the machine shuts off. See page F10 for pump down control operation. Liquid refrigerant is stored in the condenser and receiver while the machine is off.

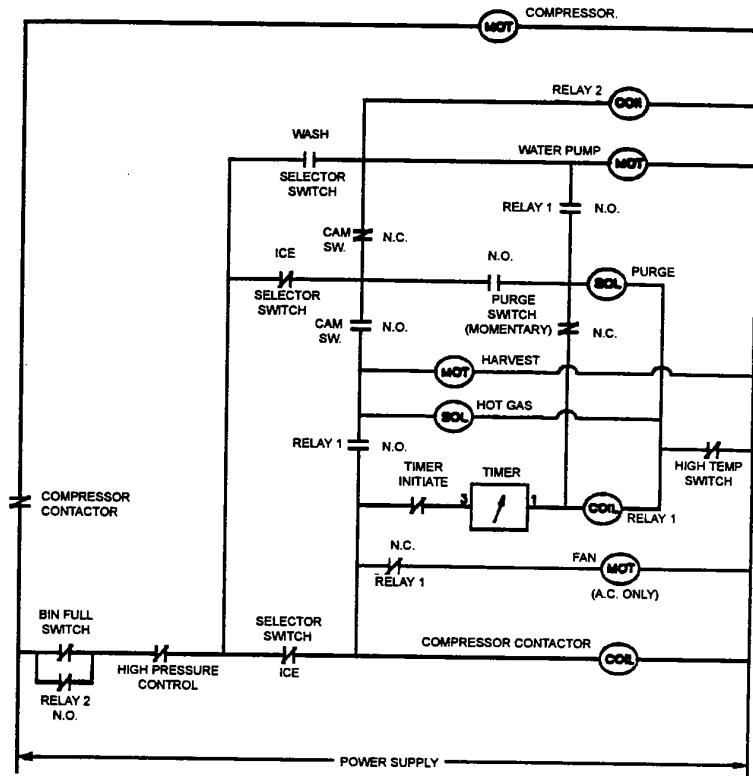
When the machine comes back on (the bin switch closes or the selector switch is turned to the ICE position), the liquid line solenoid valve opens and the refrigerant is released from the receiver. When the suction pressure rises to 45 psi (3.1) the pump down control closes and the machine comes back on.

If the machine will not pump down it may be because the valve is not closing all the way. A weak compressor will also prevent the machine from pumping down. Check for signs of a weak compressor before replacing the liquid line solenoid. Also before replacing valve disassemble valve and check for obstructions or other problems that may not allow it to seat.

Receiver

If the system has a remote condenser the refrigerant will enter a receiver before passing through the filter drier. The receiver holds reserve liquid refrigerant during the freeze cycle. The receiver also stores liquid refrigerant during the off cycle.

Single evaporator machine, shown in the Timed portion of the freeze cycle. Both 115V and 230V circuits apply.



Control Circuit

There are three basic control circuits described in this section; dual evaporator machines beginning March 1998 (serial no. P8 or after), dual evaporator machines before March 1998 (serial no. before P8) and single evaporator machines. Dual evaporator machines before March 1998 and single evaporator machines operate in much the same way except that dual evaporator machines use 2 harvest assist assemblies. Dual evaporator machines beginning March 1998 control the harvest cycle differently than other machines. It is important to know the type of machine you have and to use the information that applies.

Selector Switch

The selector switch is used to put the machine into the ICE making or WASH cycle or to turn the machine OFF. The WASH position allows only the water pump to run and is used during the cleaning process to pump cleaning solution throughout the water

system. When the selector switch is turned to the ICE position the machine begins the freeze cycle.

Contactors

When the selector switch is in the ICE position the contactor coil is energized. This energizes the compressor start components which start the compressor.

Purge Switch

The purge switch is a momentary switch used to manually energize the purge valve. It is used during the cleaning process to flush the cleaning solution from the water trough. The purge valve will remain open as long as the switch is depressed.

Dual evaporator models before March 1998 and all single evaporator models: The N.C. (normally closed) contacts of the purge switch also create a circuit to Relay 1. These contacts should remain closed unless the switch is depressed. If the switch is defective and the N.C. contacts are open when the machine enters harvest the machine will return to freeze when the timer initiate cuts-out.

Compressor and Start Components

The compressor should run during the entire cycle. If the machine is in the ICE position but the compressor is not running check the compressor contactor to see if it is engaged. If the contactor is not engaged the problem is not with the compressor or the starting components. If the contactor is engaged and there is correct voltage through the contactor there could be a problem with one of the starting components or the compressor.

It is recommended that start components be replaced when replacing a compressor.

Compressor Check

If the compressor uses an internal overload, be certain that the compressor has cooled and the overload has reset before diagnosing. If the compressor is cool and is still not running, check the windings by first removing the wires at the compressor terminals. With an ohm meter, check for continuity between all three terminals, if an open circuit exists between any of the terminals the compressor may need to be replaced. Check for continuity from each terminal to the compressor body, if continuity is found from any terminal to the compressor body, the compressor windings are shorted to ground and the compressor will need to be replaced. If the compressor appears to be good at this point, it is advisable to use a compressor analyzer to isolate the compressor from the start components while checking for a locked rotor. If an analyzer is not available, the compressor starting components must be checked, as described above.

If all starting components are good, check the amperage draw from the common terminal of the compressor, making sure proper voltage is supplied to the compressor and all wiring is properly connected. If the compressor does not start and there is excessive amperage draw, (see locked rotor amps on compressor) the compressor has a locked rotor and should be replaced.

Important!

Compressors returned to the factory for warranty are tested by the factory and will not be covered under the warranty policy if they are not defective.

Overload

If there is no amperage draw check the compressor overload. The compressor overload can be checked for continuity after removing it from the compressor and letting it cool to room temperature. If there is no continuity between the two terminals replace the overload. If the overload is suspected of opening prematurely it is best checked by replacing it with an overload which is "known to be good".

Capacitors

The Start Capacitor is an electrical storage device used to provide starting torque to the compressor. If a start capacitor is defective the compressor will not start properly.

The run capacitor is an electrical storage device used to improve running characteristics and efficiency of compressor. The Run Capacitor is not used on all models. If a run capacitor is defective the compressor will draw too much current while running.

Before checking a capacitor, it should be discharged by shorting across the terminals. If a run or start capacitor is cracked, leaking or bulging it should be replaced. If a capacitor is suspected of being defective it can easily be checked by replacing it with a capacitor of the correct size which is "known to be good", if the compressor starts and runs properly replace the original capacitor. A capacitor tester can also be used.

Start Relay

The start relay breaks the electrical circuit to the start windings when the compressor motor speed increases. If the relay is defective the compressor will not start or it will start but will run for a very short time.

A compressor relay can be checked by removing the relay and checking the relay contacts for damage and check for continuity across the closed relay points. Check the relay coil with an ohm meter. If no continuity is read, replace the relay.

Untimed Freeze Cycle

During the freeze cycle the compressor, water pump and condenser fan motor(s) (if used) are running. On remote machines the liquid line solenoid is also energized, see Refrigeration Section. As ice forms on the evaporator, the suction pressure drops. The machine is in the untimed portion of the freeze cycle and will remain in untimed freeze until the suction pressure drops low enough to close the **timer initiate**. See page E1 for operating pressures.

Dual evaporator machines manufactured before March, 1998 will energize the **freeze timer** through **relay 2** when the timer initiate closes. All other machines power goes directly to the freeze timer once the timer initiate closes.

Timer Initiate

The timer initiate is a low pressure control that cuts-in (closes) on pressure drop. When the Timer Initiate closes, the freeze timer is energized and the machine enters the timed portion of the freeze cycle. When the machine enters harvest and the suction pressure rises the control cuts-out (opens). The timer initiate should close and open at the pressure indicated in the chart

Model Number	Refrigerant Type	Timer Initiate Setting	
		Cut-in Pressure	Cut-out Pressure
UC20/C20/C40(R12)	R12	13 PSI	27 PSI
EUC200/206/EC200	R134a	15 PSI	29 PSI
C30/C50/C66/C136/C186	R502	30 PSI	48 PSI
C40B1(R502)	R502	37 PSI	55 PSI
C106	R22	26 PSI	44 PSI
EC300	R404A	30 PSI	48 PSI
EC400/EC406/ECP400	R404A	37 PSI	55 PSI
EC500/ECP550/556	R404A	32 PSI	50 PSI
EC606/EC1406/EC1806	R404A	32 PSI	50 PSI
EC806/EC1006	R404A	35 PSI	53 PSI

Note: The timer initiate is factory set and does not normally need to be adjusted. If the ice bridge thickness is incorrect the freeze timer should be adjusted rather than the timer initiate. See page F4 for freeze timer adjustment procedure. The timer initiate may need to be adjusted if excessive time (more than 5 minutes) is needed on the timer to achieve proper bridge thickness or if very little time (less than 1 minute) is needed on the timer to achieve proper bridge thickness. See below.

If the timer initiate is suspected of being out of adjustment or not operating properly, check the control as follows:

If the machine has two evaporators and was manufactured before March 1998 connect a suction gauge to the machine and turn the selector switch to the ICE position. Relay 2 should energize when the timer initiate cuts-in. Note the suction pressure at this time. Adjust the timer initiate if the cut-in point does not match the chart. See below if relay 2 does not energize. When the machine enters harvest the timer initiate should cut-out de-energizing the relay. The cut-out point can differ from the chart a few psi either direction without effecting the operation. The differential is not adjustable.

Single evaporator machines and dual evaporator machines beginning March, 1998 or if relay 2 does not energize, make the following check. Make sure the high temperature safety control is not open, see page F8. Turn machine OFF and disconnect incoming power by unplugging the machine or switching the circuit breaker OFF. Attach one lead of a voltmeter to terminal 1 and the other lead to terminal 2 of the timer initiate. Reconnect incoming power and turn the machine to the ICE position. Connect a suction gauge to the machine. The Volt Meter should read line voltage until the Timer Initiate cuts-in at which point it should read 0V. Note the suction pressure at this point. Adjust the timer initiate if necessary. Turning the adjusting screw C.C.W. lowers the cut-in and cut-out point. If the control cannot be adjusted to the correct pressure setting or in the cut-in point is erratic the control must be replaced. If the suction pressure is not dropping properly see the Troubleshooting Tree "Machine Does Not Enter Harvest" in section C.

EC and ECP Series / Electrical System

Relay 2

Dual evaporator models beginning March 1998: Relay 2 is used during the harvest cycle, see page F5.

Dual evaporator models before March 1998: The freeze timer is energized through relay 2. When the timer initiate closes relay 2 is energized sending power to the freeze timer. When energized, relay 2 also bypasses the bin controls so that if one or both bin controls open during timed freeze the machine will not shut off. Relay 2 will de-energize when the timer initiate opens during harvest.

All Single Evaporator Models: Relay 2 is used only to bypass the bin control during the freeze cycle and the first part of the harvest cycle. Relay 2 is energized through the normally closed contacts of the cam switch at the beginning of the freeze cycle. When energized Relay 2 will prevent the machine from shutting off if the bin switch opens. The relay will remain energized until the cam switch is lifted onto the high part of the cam during harvest. At this time the machine will shut off if the bin switch is open.

If relay 2 is suspected of being defective it can temporarily be interchanged with another relay, if the problem still exists check for voltage across the relay coil terminals of the relay socket. If line voltage exists and the relay does not energize, the socket is defective. If there is no voltage the problem is elsewhere.

Relay 2 is not used on under counter models.

Timed Freeze

When the freeze timer is energized, the machine is in the timed portion of the freeze cycle. The freeze timer will time out the remainder of the freeze cycle. Once the time has passed, the machine will enter the harvest cycle.

Freeze Timer

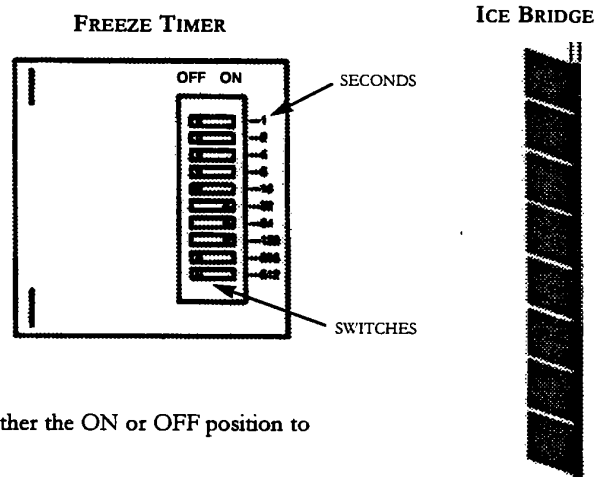
The freeze timer is an adjustable timer used to control the ice bridge thickness. The freeze timer is factory set but may need to be adjusted upon initial start-up of the machine. When time is added to the freeze timer the length of the freeze cycle is increased, therefore the ice bridge thickness is increased. When time is removed from the timer, the freeze cycle is shorted and the ice bridge thickness is decreased.

The freeze timer can be adjusted by sliding one or more switches to either the ON or OFF position to obtain the setting which will produce the proper ice bridge thickness.

Ice bridge thickness on C/UC/EC/EUC/ECP200/300 models should be 3/16" (5mm), all other models should have a bridge of 1/8" (3mm). If bridge is too thick remove enough time from timer to achieve proper thickness. If bridge is too thin add enough time to timer to achieve proper thickness.

Note: The freeze timer on ECP models is located on the circuit board. It operates and is adjusted as described above.

Check the freeze timer for proper operation as follows: If the machine has one evaporator, make sure that the high temperature safety is not open, see page F9. Turn the machine OFF and disconnect incoming power by unplugging the machine or switching the circuit breaker OFF. Attach one lead of a voltmeter to terminal 1 and the other lead to terminal 3 of the timer. Reconnect incoming power and turn the machine to the ICE position. The volt meter should read 0 volts until the timer initiate closes at which point the timer will energize and line voltage should be read. On dual evaporator machines before March 1998, relay 2 should energize when the timer initiate closes, if it does not check the timer initiate and relay 2, see pages F3 and F4. When the timer counts out the volt meter will again read 0 Volts. The time it takes the freeze timer to time out, once it has been energized, should match the timer adjustment. If it does not or if the timer never closes, the timer is defective.



Harvest Cycle

Dual evaporator models beginning March 1998: Once the freeze timer has counted out, power is sent through cam switch 1 and 2 to energize both harvest motors and relays 1 and 2. The relays supply power to the hot gas valves (one valve for each evaporator) and the purge valve. There is a 4 second delay before these components are energized. Each harvest motor turns a clutch assembly, the clutches should move enough to actuate both cam switches during the 4 second delay. Each harvest motor remains energized until it has turned the clutch one complete revolution. The cam switch then returns to the normal position and the motor is deenergized. Once both cam switches return to the normal position the machine returns to the freeze cycle. The purge valve and water pump remain energized throughout the entire harvest cycle.

Dual evaporator models before March 1998 and all single evaporator models: Once the freeze timer has counted out, power is sent to relay 1 and the machine enters the harvest cycle. Once in harvest, the purge valve, hot gas valve and harvest motor(s) are energized. The water pump continues to run during the first part of the harvest cycle so that mineral laden water remaining in the water trough can be pumped through the purge valve to the drain. The harvest motor turns the clutch assembly to actuate the cam switch. There is one harvest assist assembly (harvest motor, clutch, probe and cam switch) for each evaporator. The cam switch is in the normal position during freeze and at the beginning of harvest. Once the clutch turns far enough to actuate the cam switch the water pump and purge valve de-energize. The harvest motor continues to turn the clutch. When the the cam switch (both cam switches on dual evaporator machines) return to the normal position the machine returns to the freeze cycle.

On single evaporator machines, if the bin switch (thermostat on under counter models) is open when the cam switch is actuated by the high part of the cam, the machine will shut off. On dual evaporator machines, if the bin switch is open when the cam switches return to the normal position the machine shuts off. Remote units pump down before shutting off.

Relay 1

Dual evaporator models beginning March 1998: Relay 1 is controlled by the right side cam switch (cam switch 1) . When the time on the freeze timer passes, power is sent to relay 1 through cam switch 1. When relay 1 is energized contacts R-1A close to bypass the bin control and contacts R-1B close sending power to the hot gas valves and purge valve via the harvest delay timer. Relay 1 will deenergized once the clutch completes one revolution and cam switch 1 returns to the normal position.

The operation of relay 2 is identical to relay 1 except that it is controlled by the left side cam switch (cam switch 2). If one or both relays are energized power will be sent to the hot gas valves and purge valve via the harvest delay timer. Both relays must deenergize before the machine returns to the freeze cycle..

Dual evaporator models before March 1998 and all single evaporator models: When relay 1 is energized, contacts R-1B close sending power to the hot gas valve and harvest motor. Contacts R-1A close sending power to the purge valve. Contacts R-1A also send power to the coil of relay 1 to keep the relay energized when the timer initiates opens. On self contained air cooled models with one evaporator the N.C. contacts of R-1B keep the condenser fan motor energized during freeze, when the contacts open during harvest the condenser fan motor is de-energized.

If relay 1 is suspected of being defective, it can temporarily be interchanged with another relay, if the problem still exists check for voltage across the relay coil terminals of the relay socket. If line voltage exist and the relay does not energize, the socket is defective. If there is no voltage the problem is elsewhere.

Relay 2

Dual evaporator models beginning March 1998: The operation of relay 2 is identical to relay 1 except that it is controlled by the left side cam switch (cam switch 2).

Dual evaporator models before March 1998 and all single evaporator models: See page F4.

EC and ECP Series / Electrical System

Relay 3

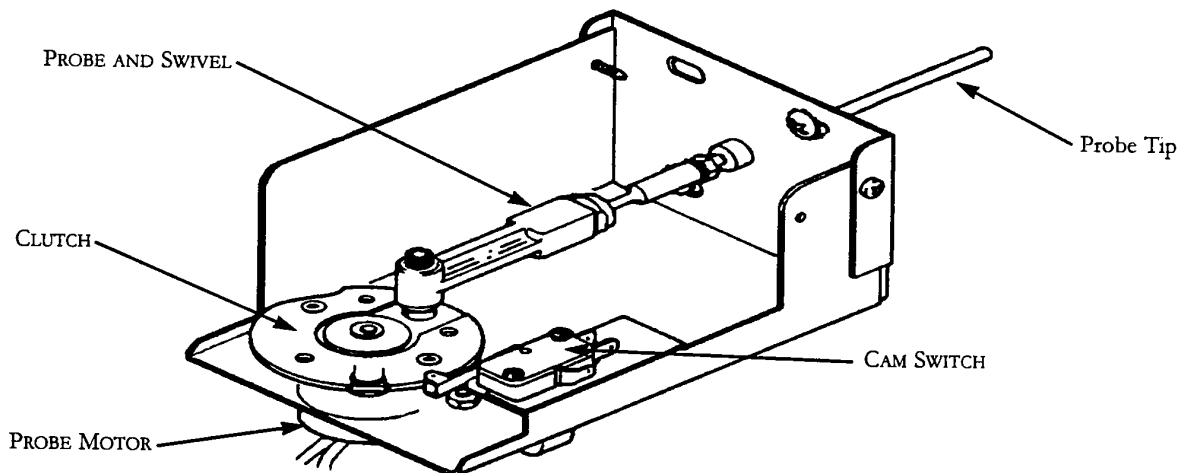
Dual evaporator models beginning March 1998: Not used on these machines.

Dual evaporator machines: Relay 3 is energized during harvest. When energized the N.C. contacts open to shut the condenser fan motors off on self contained air cooled machines. The N.O. contacts of relay 3 close during harvest to bypass the bin switches preventing the machine from shutting off during harvest if one or both bin switches open. When relay 3 de-energizes at the beginning of freeze, the N.O. contacts return to the open position and the machine will shut off if one or both bin switches are open.

Single evaporator remotes: Relay 3 remains energized until the machine is turned off or shuts down due to an open bin switch or an open high pressure safety. When the relay de-energizes, the N.O. contacts that power the condenser fan motor open, shutting the fan motor off. When the machine is reset or turned back on, relay 3 energizes and the N.O. contacts close to bypass the pump down control. This allows the compressor contactor to energize before the suction pressure is high enough to close the pump down control.

Harvest Timer

Dual evaporator models beginning March 1998 only: The harvest timer is a non adjustable timer that delays power to the hot gas valves and purge valve for 4 seconds. This delay allow time for the cam switches to actuate before the hot gas valves are energized. This prevents the machine from returning to freeze when the timer initiate opens on pressure rise.



Harvest Assist Assembly

There is one **harvest assist assembly** for each evaporator. The harvest assist assembly has two purposes; to assist in moving the ice off the evaporator and to control the length of harvest. When the machine enters harvest power is sent to a **harvest motor** which turns a slip **clutch**. A **probe** is attached to the clutch and is pushed against the back of the ice slab as the clutch turns. The clutch begins to slip when the probe applies approximately 8 oz of pressure against the ice slab. It takes approximately 1 minute for hot gas to heat the evaporator enough to loosen the ice from the evaporator plate. At this point the clutch pressure overcomes the capillary attraction of the ice to the evaporator plate and the ice begins to move off of the evaporator. As the ice is being pushed the clutch stops slipping and begins to turn, extending the probe enough to push the ice completely off the evaporator plate.

Once the ice has been moved off the evaporator plate, the harvest components must be de-energized as quickly as possible so another freeze cycle can begin. This is done with the **cam switch**. The actuator arm of the cam switch rides against the cam portion of the clutch which actuates the switch as the clutch turns. When the clutch makes one complete revolution and the cam switch drops to the low part of the cam and the machine returns to freeze. On dual evaporator machines the both clutches must make one revolution before the machine returns to freeze. When in freeze the probe is retracted and is no longer in the freeze area of the evaporator.

Harvest Motor

The harvest motor is energized at the beginning of harvest and on single evaporator units will remain energized until the machine returns to the freeze cycle. On dual evaporator machines, one harvest motor will usually de-energize while the machine is still in harvest and the other will remain energized until the machine returns to freeze.

A defective harvest motor will usually not run. The harvest motor runs in a Clockwise direction. It is possible for a defective motor to run backwards(C.C.W). If this happens the motor must be replaced. It is also possible for a defective motor to “bump” backwards immediately when entering harvest. This will cause the machine to return to freeze immediately after entering harvest. If the machine is in harvest only for a split second the harvest motor may be defective. Verify the motor is defective by watching the clutch closely when the machine enters harvest.

Clutch Assembly

The clutch assembly consists of a slip clutch and cam. A probe is attached to the clutch assembly and the harvest motor turns the clutch during harvest. As the harvest motor turns, the clutch will slip while the probe is pushed against the ice. The clutch will continue to slip as long as the pressure required to move the ice is greater than 8oz. Once the evaporator has heated enough to break the bond of ice to the evaporator, the pressure required to move the ice becomes less than 8oz. and the clutch begins to turn.

The clutch assembly is not adjustable. If the clutch tension is weak (less than 8 oz. of pressure), a slow harvest or excessive ice meltage during harvest will result. If the clutch pressure becomes too tight, the force of the probe against the back of the ice may cause the slab to break and the ice may not fall off the evaporator. There is no exact way to measure clutch tension. If the clutch tension is suspected of being too tight or too weak, turn the clutch by hand, the clutch should turn smoothly without “grabbing”. The clutch should be easy to turn by hand but should offer some resistance. If in doubt as to whether or not the clutch is defective, compare the tension with one that is known to be good.

There are 3 different clutch configurations, the indentation will vary in size depending on the model and the number of evaporator plates. For proper operation it is important that when replacing or removing a clutch assembly the correct replacement be installed.

Probe Tip and Swivel

The probe tip is attached to the clutch and makes contact with the back of ice slab during harvest. The swivel allows the probe tip to pivot as the clutch turns so that the probe is pushed straight through guide holes.

The tip of the probe should be flush with the back of the evaporator or recessed up to 1/16" (.16 cm). The probe tip must not extend into the freezing area of the evaporator during freeze.

The length of probe tip is adjustable by loosen the lock nut that tightens against the swivel and screwing probe tip in or out of swivel. Once the probe has been adjusted to proper length tighten the lock nut.

If the probe tip binds during operation it may cause the clutch to slip unnecessarily. This may occur if the harvest motor mounting bracket is not aligned properly or if the probe tip has a excessive build up of mineral deposits on it. Remove and clean the probe if necessary.

To check the probe tip for binding, remove the set screw holding the probe to the clutch and simulate the movement of the swivel and probe by moving the swivel in a circular motion around the outer portion of the clutch. The probe should slide in and out of the guides without resistance. The swivel should also move freely. If any resistance is felt the bracket should be adjusted. Loosen two screws holding harvest motor mounting bracket in place and reposition the bracket until the probe moves freely. This check should be made whenever the harvest assist assembly is removed for any reason.

EC and ECP Series / Electrical System

Cam Switch Operation

The cam switch is used to terminate the harvest cycle.

Dual evaporator models beginning March 1998: When the machine is in the freeze cycle, the actuator arm of both cam switches are in the low part of the cam. The harvest motor and cam switch on the right side are referred to as harvest motor 1 and cam switch 1. Harvest motor 2 and cam switch 2 are on the left side.

During the harvest cycle power is supplied to harvest motor 1 and the coil of relay 1 through the N.C. (normally closed) contacts of cam switch 1 (right side). Power is supplied to harvest motor 2 and the coil of relay 2 through the N.C. contacts of cam switch 2 (left side). As the probe motors turn, the clutch assemblies move lifting the cam switches out of the indentation and onto the high part of the cam. This actuates the cam switches. The harvest motors and relays are now energized through the N.O. (normally open) contacts (now closed) of each cam switch. When either clutch has made one revolution and the cam switch returns to the normal position, the harvest motor and relay controlled by that switch are deenergized. When both cam switches have returned to the normal position the machine returns to freeze.

Dual evaporator models before March 1998: When the machine is in the freeze cycle, the actuator arm of both cam switches are in the low part of the cam. The harvest motor and cam switch on the right side are referred to as harvest motor 1 and cam switch 1. Harvest motor 2 and cam switch 2 are on the left side.

During freeze power is supplied to water pump through the N.C. contacts of cam switch 1 (right side). When the machine enters harvest, power is supplied to the water pump and purge valve through the N.C. contacts of cam switch 1 and through the N.O. (closed during harvest) of relay 1. Power is supplied to relay 3, the hot gas valve and harvest motor 2 through the N.C. contacts of cam switch 2. The water pump, purge valve and relay 1 will remain energized until cam switch 1 is on the high part of the cam. Power to harvest motor 1 will be maintained through the N.O. contacts of cam switch 1 which are now closed. When cam switch 2 is lifted onto the high part of the cam, power is maintained to relay 3, the hot gas valve and harvest motor 2 through the N.O. contacts of cam switch 2 which are now closed. Once cam switch 2 falls back into the indentation the machine will return to freeze if cam switch 1 has already fallen into the indentation. If cam switch 1 is still on the high part of the cam the machine will remain in harvest until it returns to the low part of the cam.

Single evaporator models: The actuator arm of the cam switch rides on the edge of the clutch assembly and is actuated by the high and low part of the cam.

When the machine is in the freeze cycle the actuator arm of the cam switch is in the low part of the cam. During freeze power is supplied to the water pump and relay 2 through the N.C. contacts of the cam switch. When the machine enters harvest, power is supplied to the water pump and purge valve through the N.C. contacts of the cam switch and through the N.O. contacts of relay 1 (closed during harvest). The water pump, purge valve and relay 1 remain energized until the cam switch is lifted on to the high part of the cam. Relay 2 will also de-energize at this time allowing the machine to shut off if the bin switch opens.

When the clutch makes a complete revolution, the cam switch drops into the low part of the cam and the N.O. contacts return to the open position returning the machine to freeze.

Cam Switch Adjustment

Check the switch for proper adjustment by slowly turning the clutch by hand in a C.C.W. direction while listening for the switch contacts to change. The switch should "click" just before the roller reaches the high part of the cam. Now slowly turn the clutch in a C.W. direction and the switch should "click" just before the roller reaches the low part of the cam. Adjust the switch by loosening the mounting screws and moving the position of the switch.

Important!

If the cam switch is suspected of being defective it should be checked with an ohm meter. It should not be assumed that the switch is good because a "click" can be heard when moving the actuator arm.

High Temperature Safety

The high temperature safety is a thermal disc that protects the machine if the machine “sticks” in the harvest cycle. The high temperature safety is clamped to the suction line near the T.X.V. sensing bulb. It is a normally closed switch that opens when the suction line temperature reaches 120°F (48.8°C) and closes when the temperature drops to 80°F (26.6°C). If the high temperature safety opens during harvest the harvest components will de-energize.

If the high temperature safety is defective and fails during freeze, relay 1 (relay 1 and 2 on dual evaporator models beginning March 1998) will not energize and the machine will not enter harvest.

Service Tip

All model except dual evaporator models beginning March 1998: If the high temperature safety is suspected of being defective push the purge switch and listen for the purge valve to energize. If the purge valve does not energize it is probable that the H.T.S. is defective. Remove the H.T.S and check it with an ohm meter to verify that it is defective

Important!

Do not allow the machine to operate without the high temperature safety. Damage to the machine may result and the warranty will be void.

Bin Control Operation

The bin control is used to shut the machine off when the bin fills with ice. The bin control must be checked upon installation or initial start-up and when performing maintenance. Adjustments are not covered under warranty.

All Machines except Under Counter and ECP models: There is one bin switch for each evaporator. The bin switch is located behind the side panel and mounted to the side of the machine. The actuator arm of the bin switch protrudes through the side of the machine and comes in contact with the splash curtain. When the bin is full of ice the splash curtain is held open when ice drops off the evaporator. This releases the pressure of the bin switch actuator arm allowing the switch to open.

- Dual evaporator models beginning March 1998: If either bin switch opens during the the freeze cycle the machine will shut off. During harvest the bin switches are bypassed by relay 1 and 2 to prevwnt the machine from shutting off during the harvest cycle.
- Dual evaporator models before March 1998: If either bin switch opens during the untimed portion of the freeze cycle the machine will shut off. If the either bin switch opens during timed freeze or the first part of harvest, relays 2 and 3 bypass the bin switch and the machine will continue running. If either bin switch is open when the machine returns to the freeze cycle the machine will shut off.
- Single evaporator machines: If the bin switch opens during freeze or the first part of harvest, relay 2 bypasses the bin switch and the machine will continue running. If the bin switch is open during harvest when the cam switch is lifted onto the high part of the cam the machine will shut off. When the bin switch closes again the machine will restart.

ECP Series Machines: The bin switch is located in the control box and is actuated by a rod that attaches to the splash curtain. When the bin is full of ice the splash curtain is held open when ice drops off the evaporator. This releases the pressure against the bin switch actuator arm allowing the switch to open.

If the bin switch opens during freeze or the first part of harvest, relay 2 bypasses the bin switch and the machine will continue running. If the bin switch is open during harvest when the cam switch is lifted onto the high part of the cam the machine will shut off. When the bin switch closes again the machine will restart.

Under Counter Machines: A thermostatic bin control is used on under counter models. The bin thermostat is located in the control box with a capillary tube which is in a brass tube mounted to the water trough. When ice comes in contact with the capillary tube housing the bin thermostat opens and the machine shuts off.

EC and ECP Series / Electrical System

Bin Control Adjustment

All Models (except Under Counter models): Check the bin switch for proper adjustment by swinging the bottom of the evaporator away from the evaporator. Slowly bring the curtain towards the evaporator. The switch should close when the bottom edge of the curtain is even with the outer edge of the water trough. Adjust the switch by loosening the screws that hold the switch (ECP Series) or the switch mounting plate (B and EC Series) in place. Move the switch to the proper position and retighten the screws. Recheck the adjustment.

Under Counter Machines: Turn the machine to the Ice or Wash position. Hold ice against the brass tube mounted to the water trough making sure ice is touching at least 6" (15 cm) of the tube. The machine should shut off in approximately 1 minute and remain off for approximately 3 minutes. If a major adjustment is needed, turn the adjustment screw C.C.W. until it stops then turn it C.W. 1/8 turn. This should put the control close to the proper adjustment, recheck and make a minor adjustment if needed. If a minor adjustment is needed, turn the the adjustment screw C.W. (COLDER) to increase the time it takes for the machine to shut off and C.C.W. for a faster shut down.

Pump Down System (Remote Only)

If a remote machine is shut down either by the selector switch, bin control or high pressure safety, the **liquid line solenoid** is de-energized allowing the valve to close. This blocks the flow of refrigerant causing all the refrigerant to be pumped in to the condenser and receiver. This is done to prevent liquid refrigerant from migrating into the compressor during the off cycle, which could cause damage to the compressor upon start-up. Also see Pump Down System in the Refrigeration Section on page E8. As the refrigerant is pumped into the receiver the suction pressure begins to drop, once the suction pressure reaches approximately 17p.s.i. (1.7bar) the **pump down control** contacts open, de-energizing the compressor contactor.

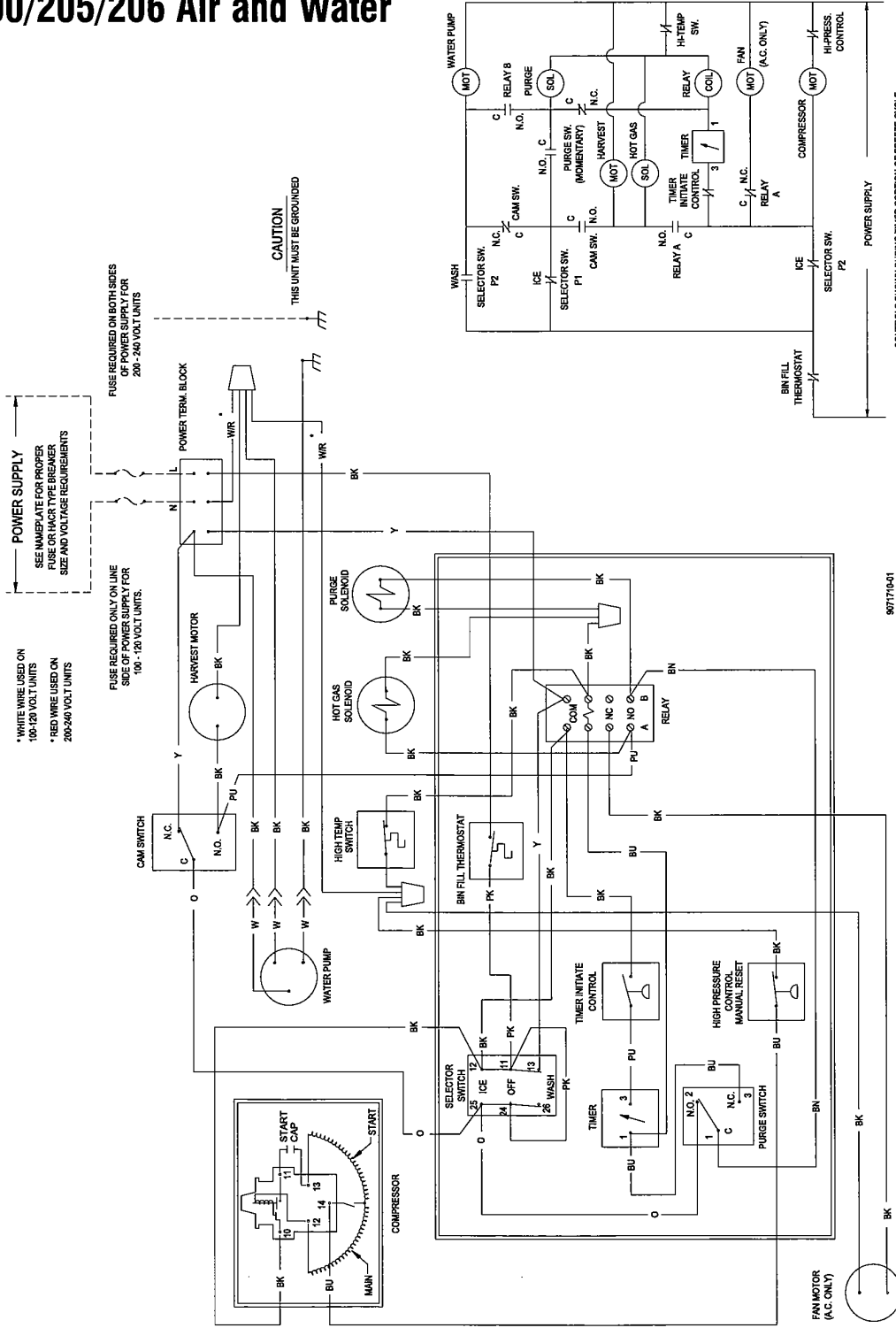
When the machine is turned back on, power is then supplied to the liquid line solenoid opening the valve and allowing the suction pressure to rise enough to close the pump down control contacts.

Pump Down Control

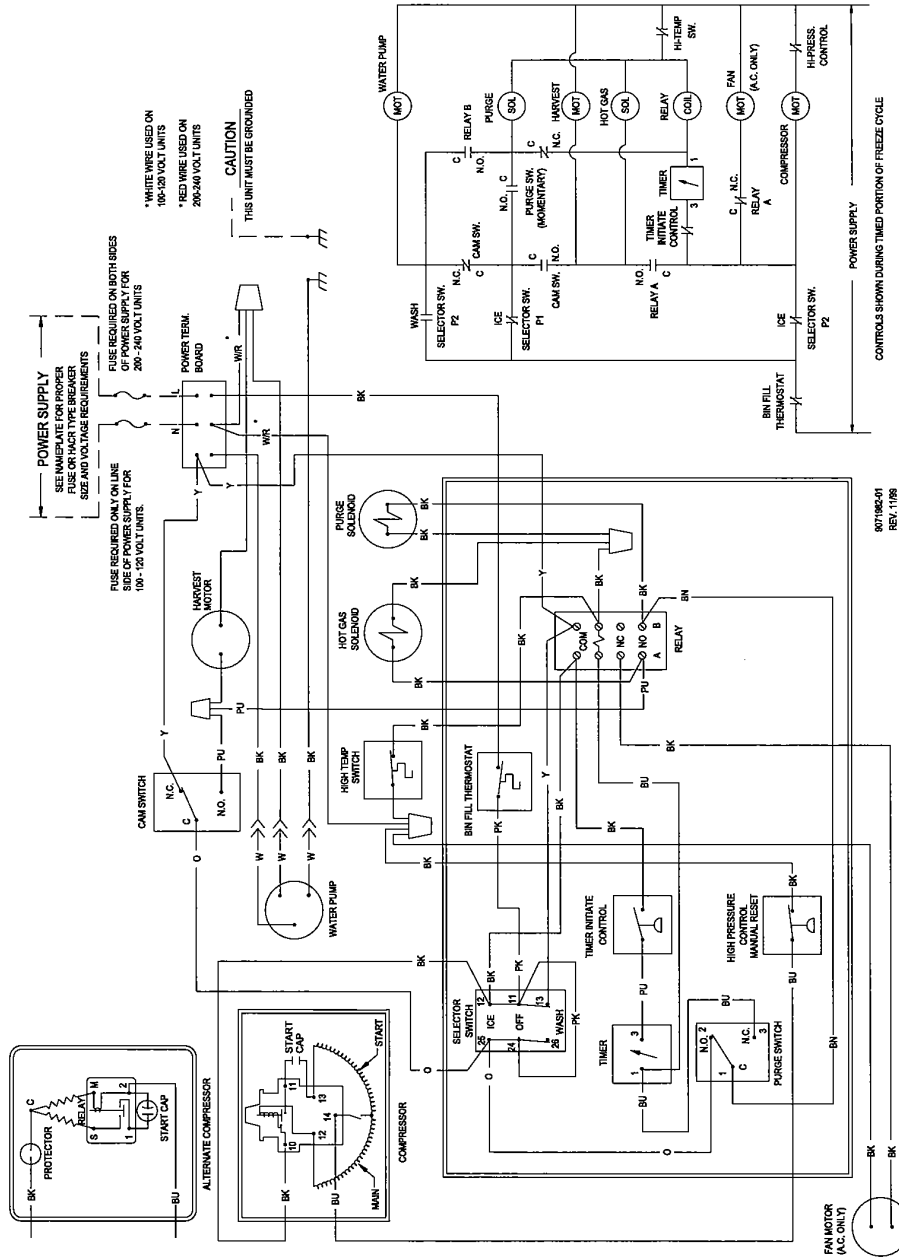
The Pump down control is a Low Pressure Control that shuts the machine off when the suction pressure drops during pump down.

The control is factory set to Cut-out (open) at 17psi (1.7bar) and Cut-in (close) at 45psi (3.1bar). The pump down control does not normally need to be adjusted, however adjustments may be made by turning the adjustment screw.

EUC200/205/206 Air and Water

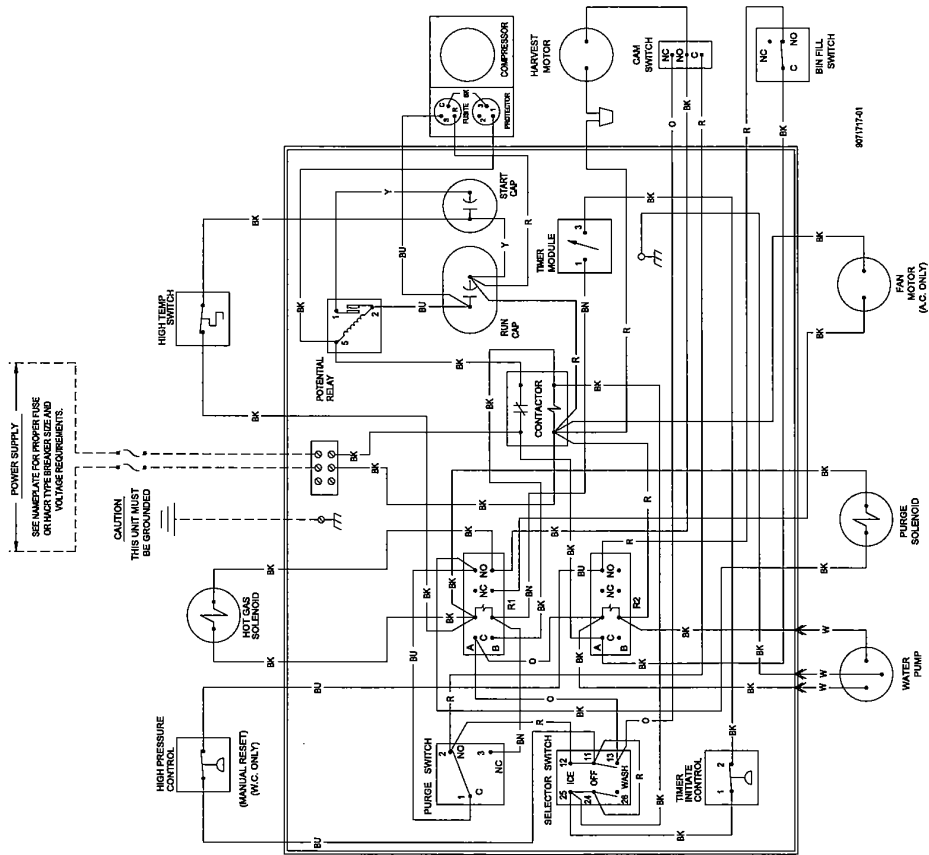
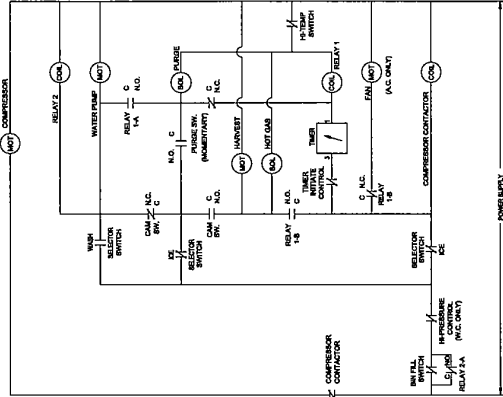


EUC150/200/205/206 "B3" Air & Water

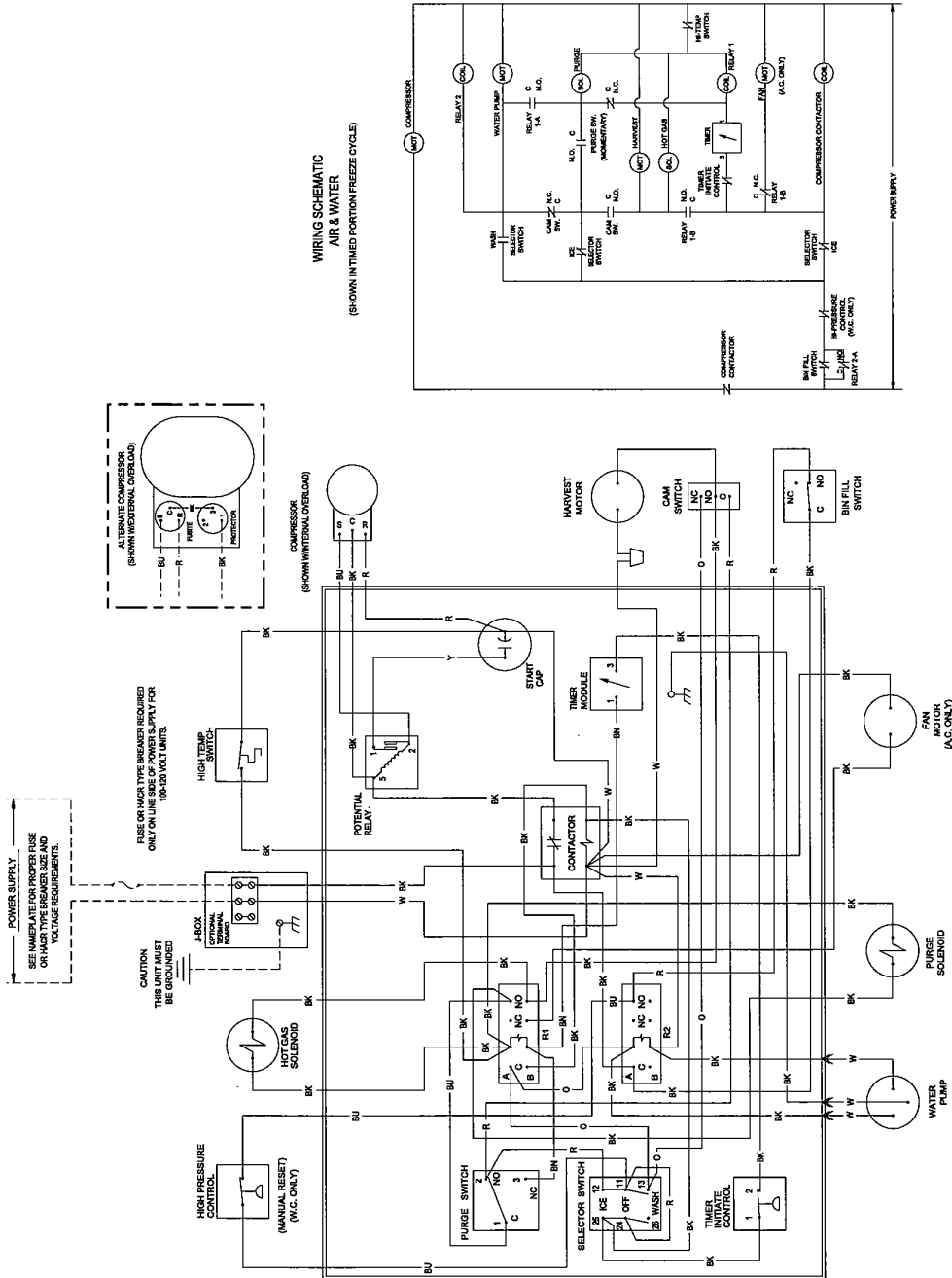


C35/45 Air and Water

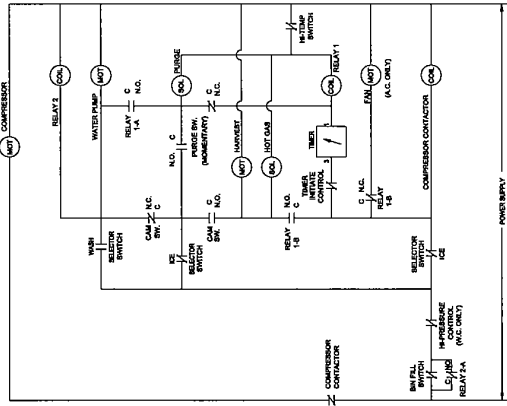
WIRING SCHEMATIC
AIR & WATER
(SHOWN IN TIMED PORTION FREEZE CYCLE)



EC300/400 Air and Water

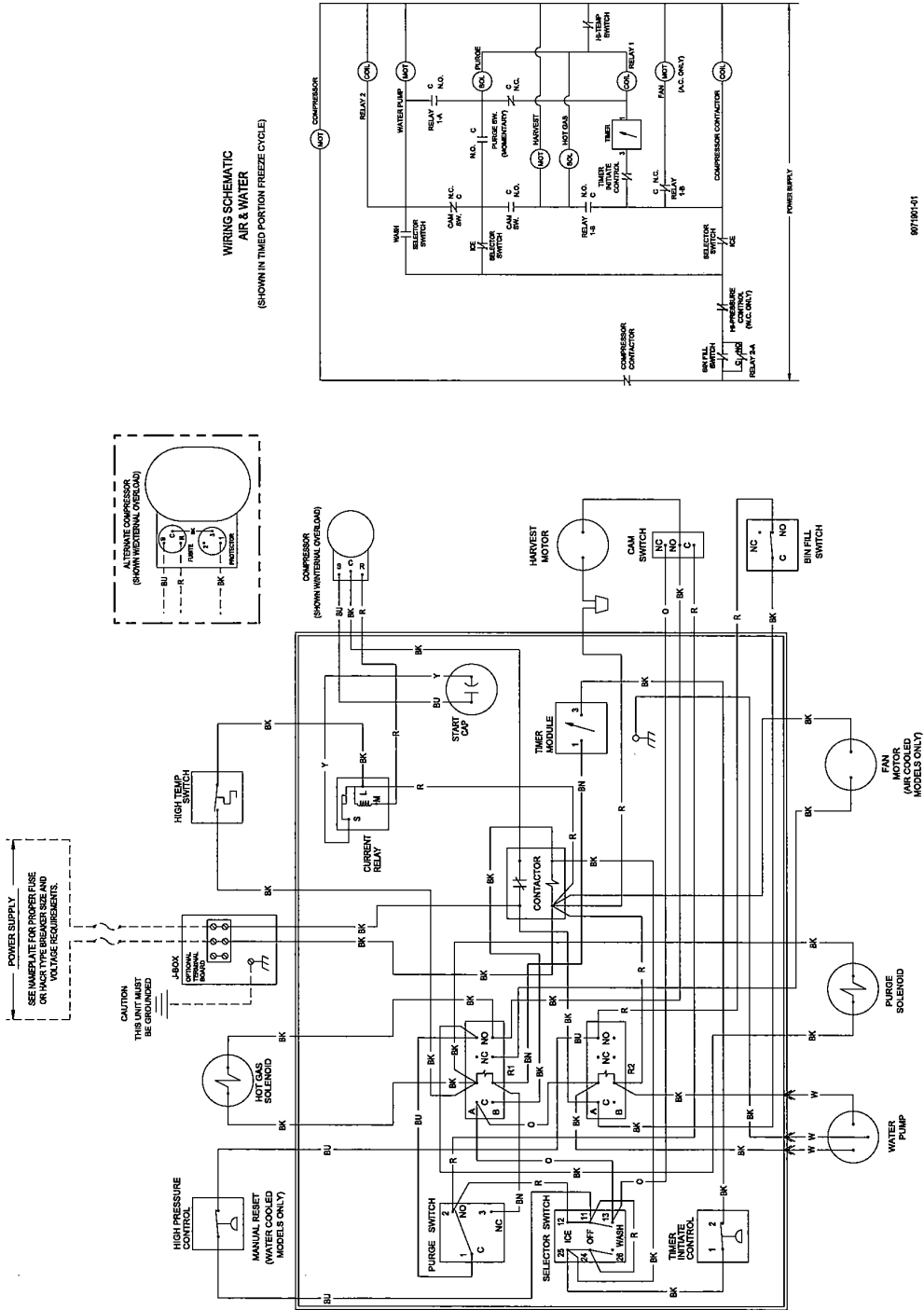


WIRING SCHEMATIC
AIR & WATER
(SHOWN IN TIMED PORTION FREEZE CYCLE)



9071902-01

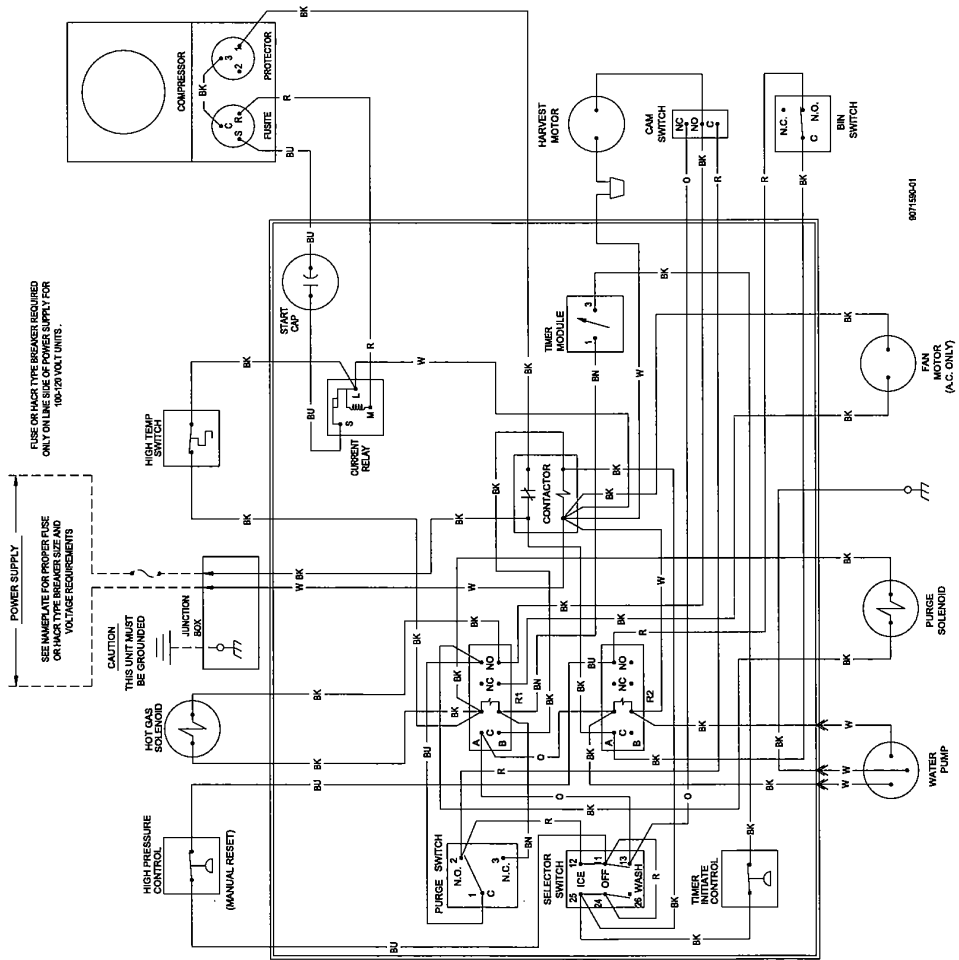
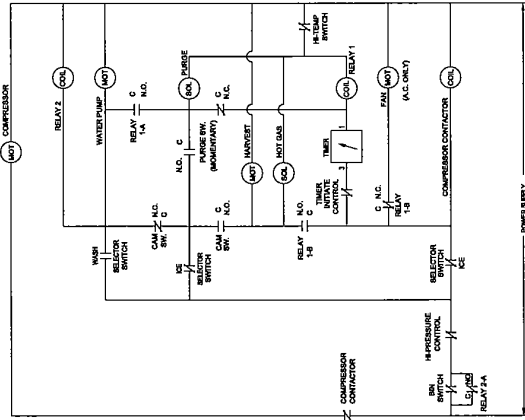
EC305/405/406 Air and Water



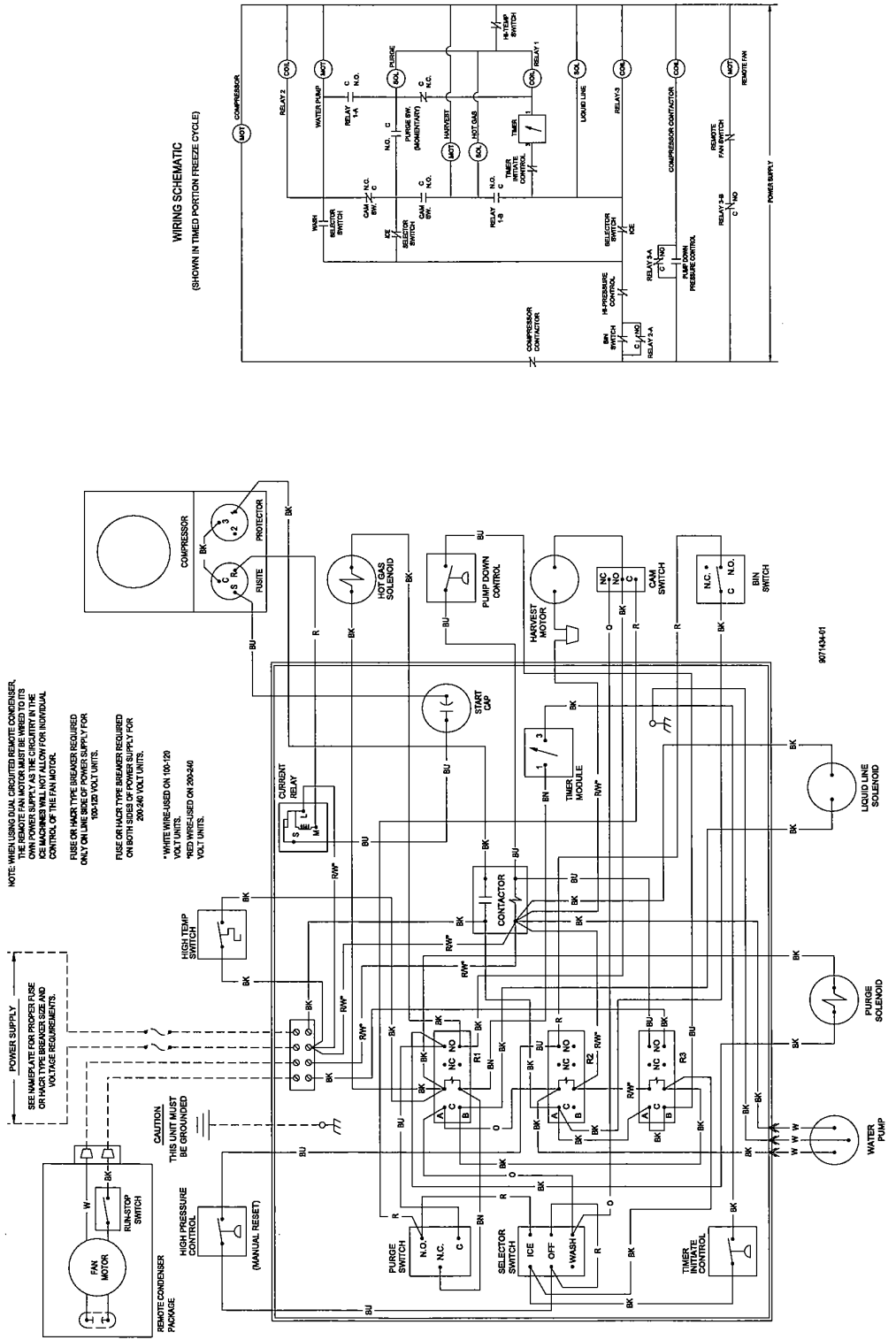
C40 Air and Water

**WIRING SCHEMATIC
AIR & WATER**

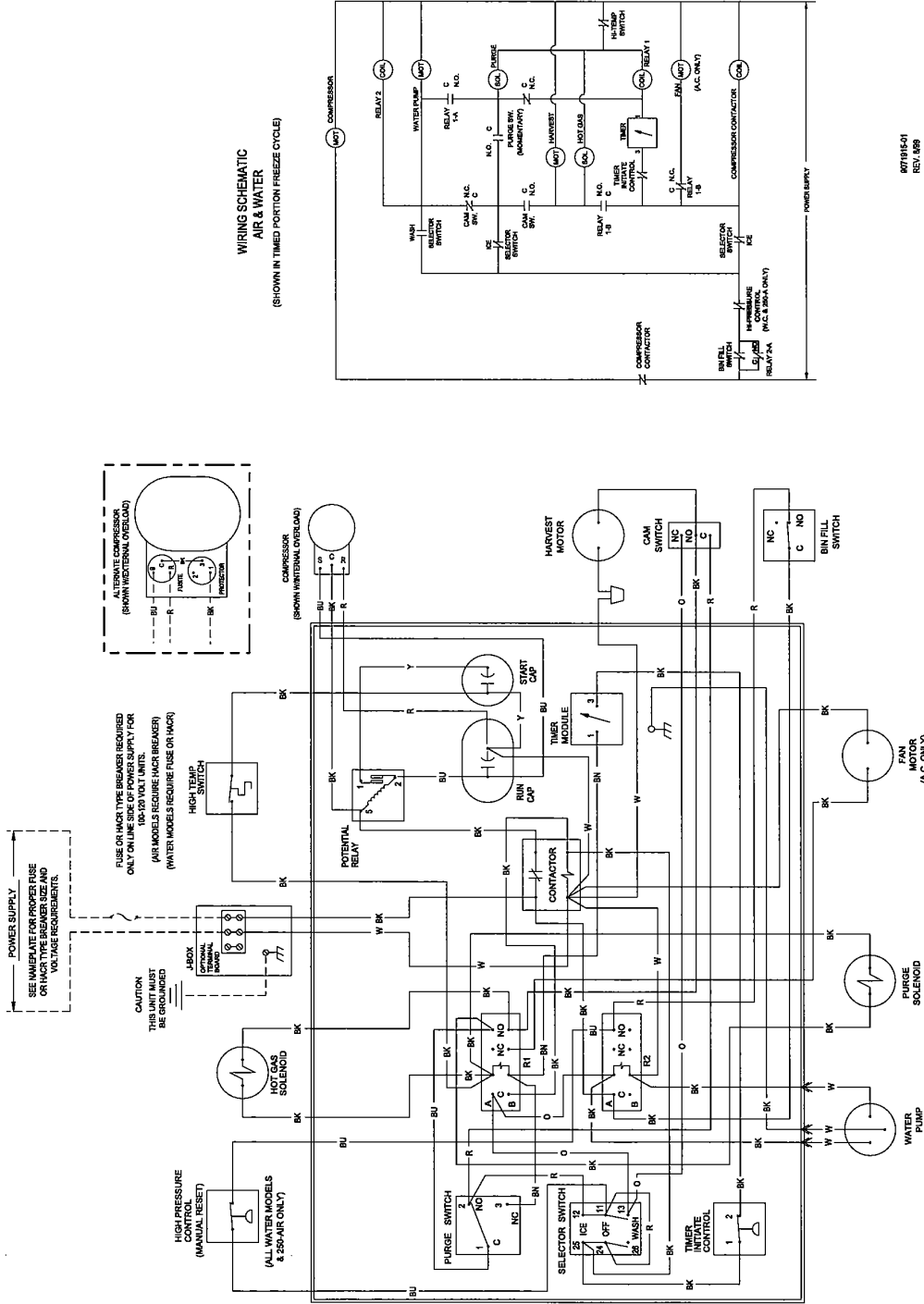
(SHOWN IN TIMED PORTION FREEZE CYCLE)



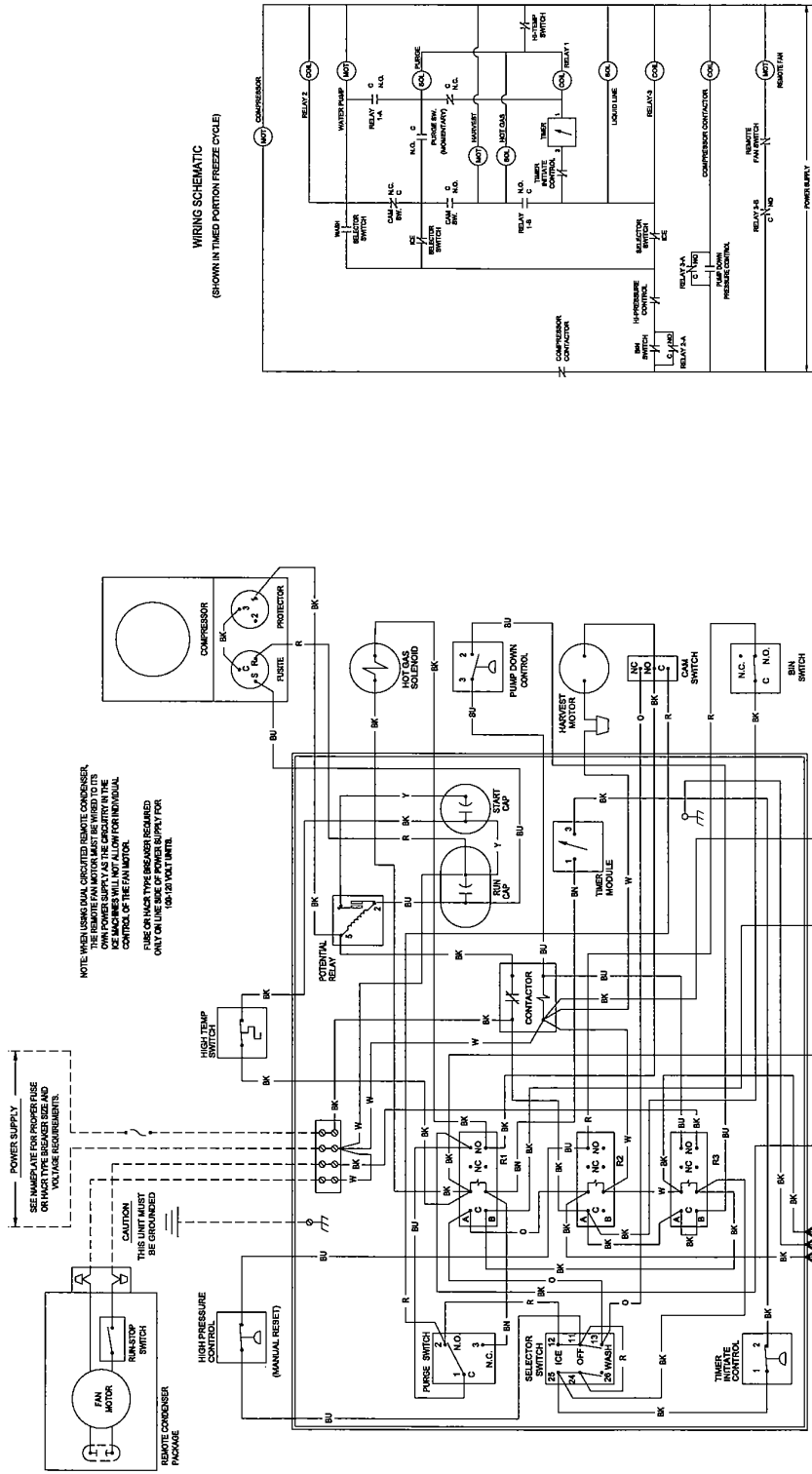
C40 Remote



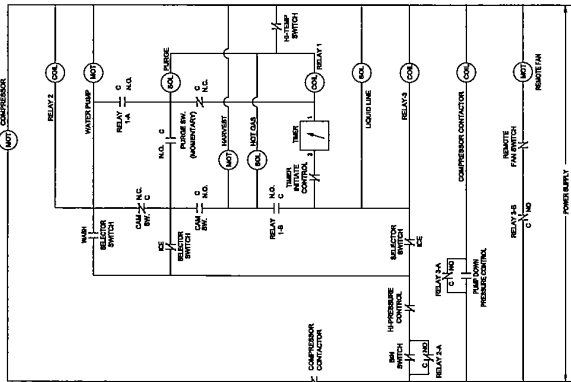
C50 and EC500 Air and Water



C50 Remote

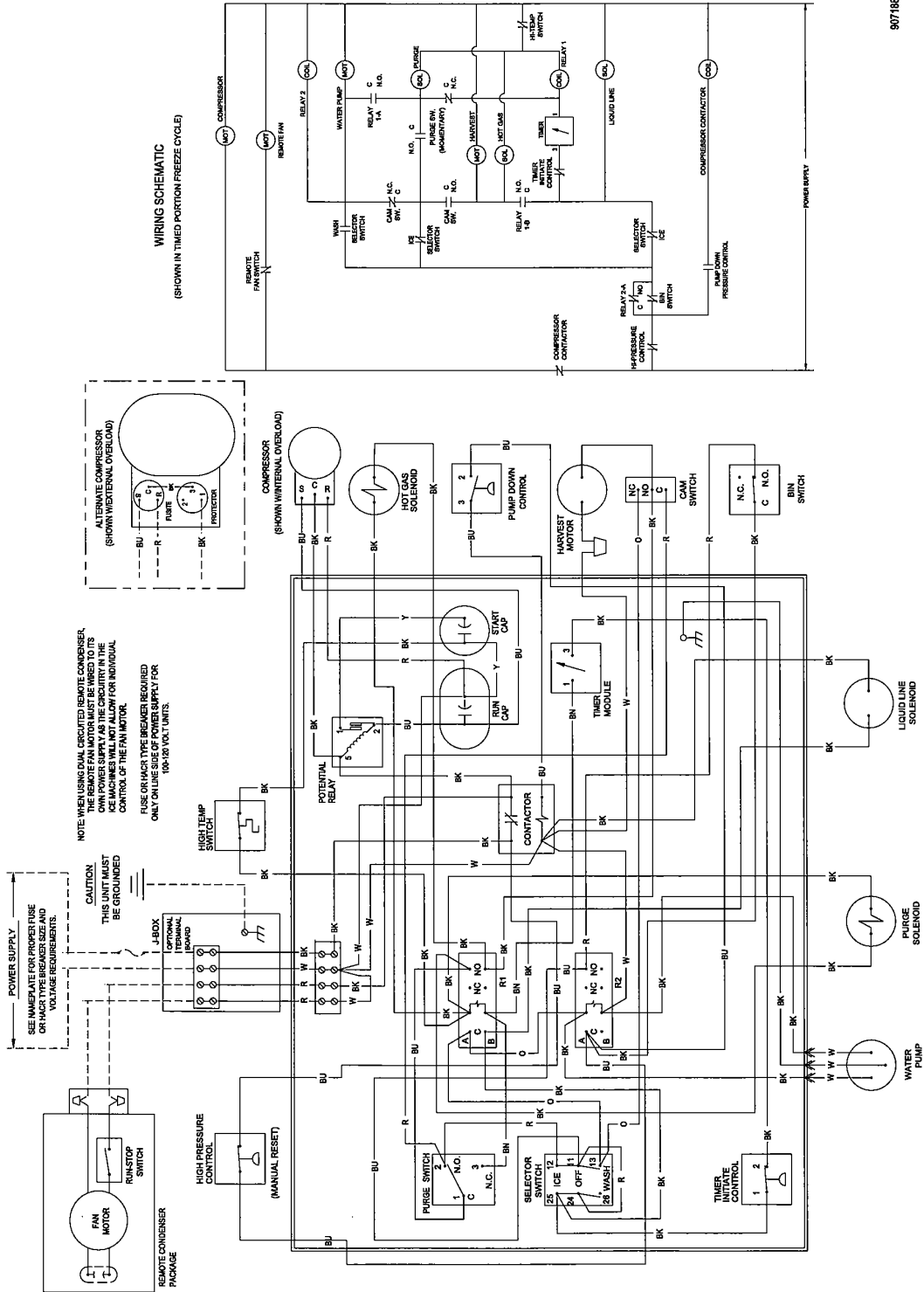


WIRING SCHEMATIC
(SHOWN IN TIMED PORTION FREEZE CYCLE)

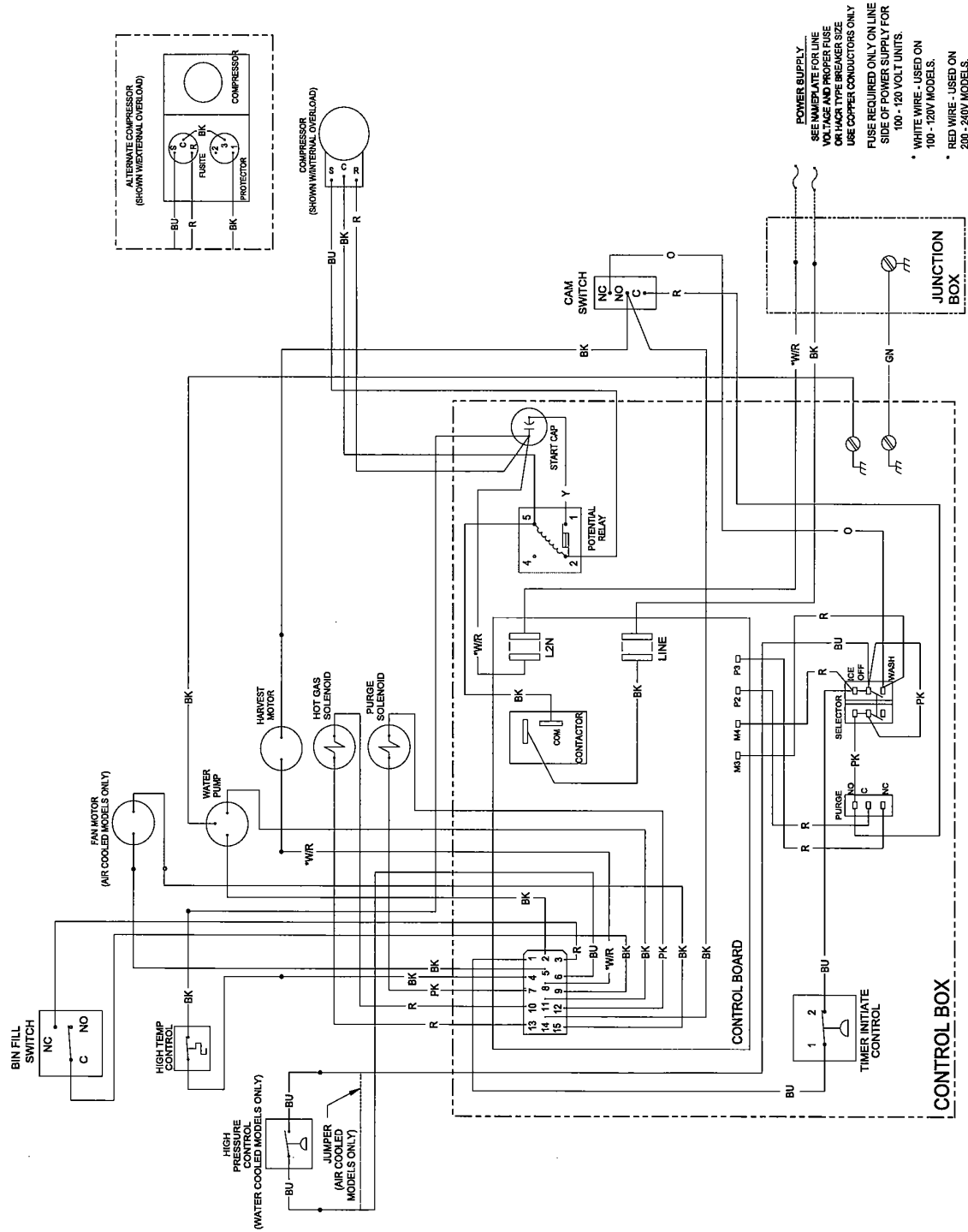


EC500 Remote

907188R-01



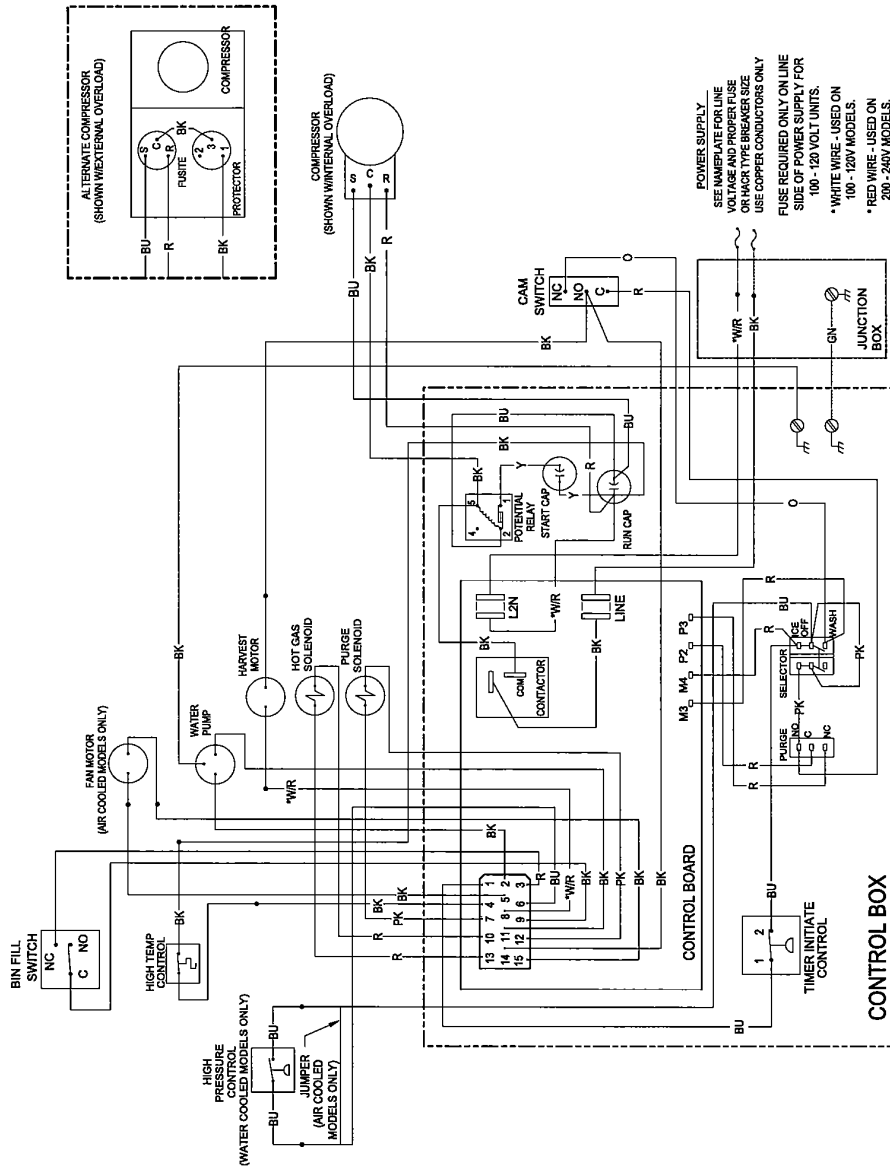
ECP400 Air and Water



8071945-01

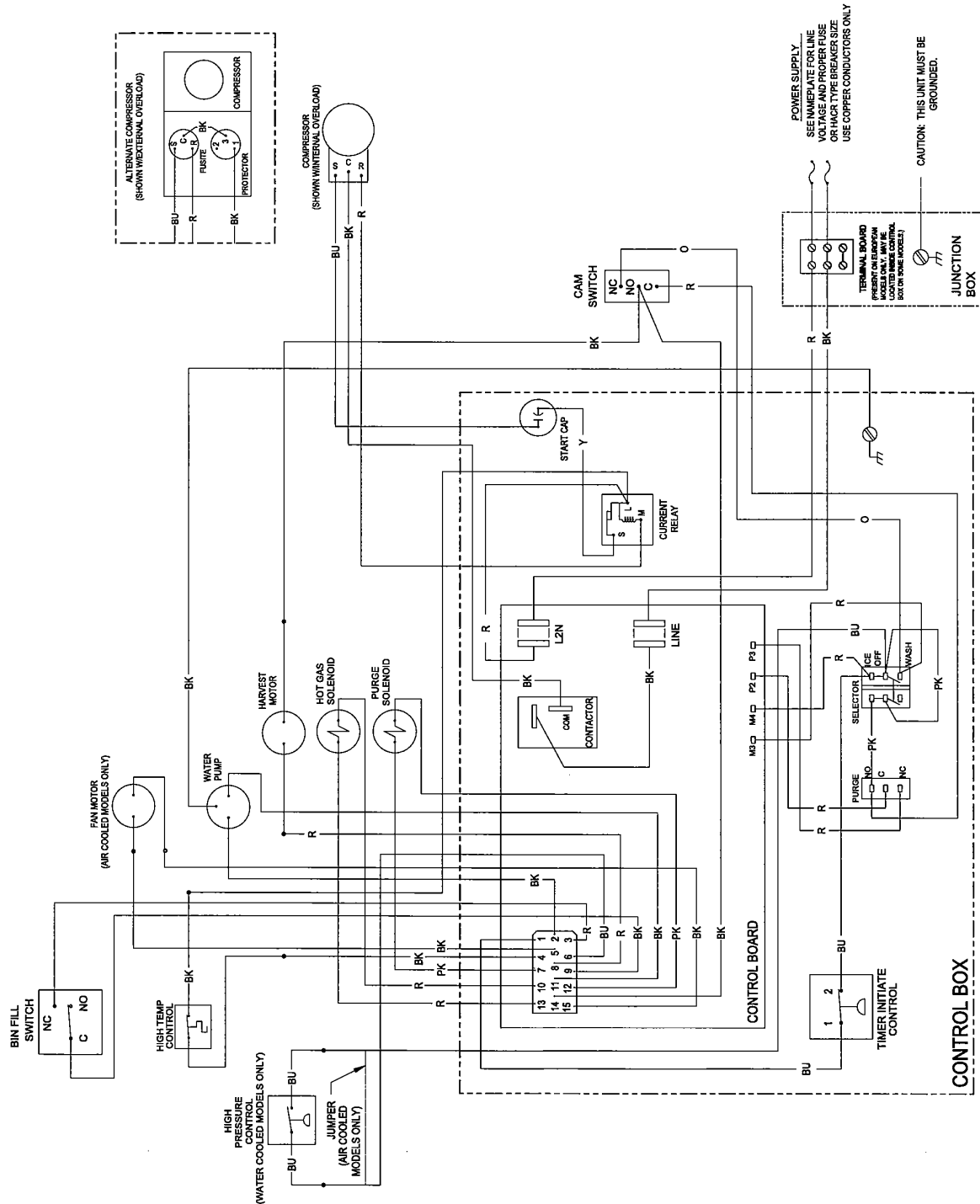
ECP500/556 Air and Water

8071844-01



ECP555A Air

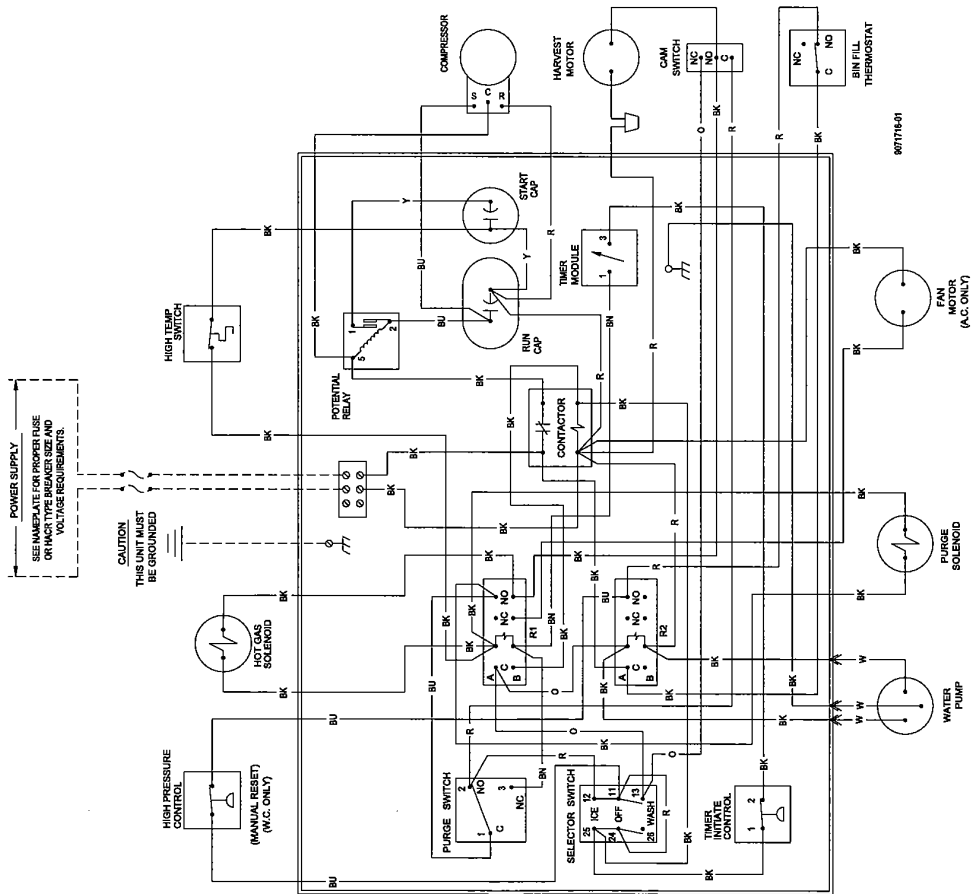
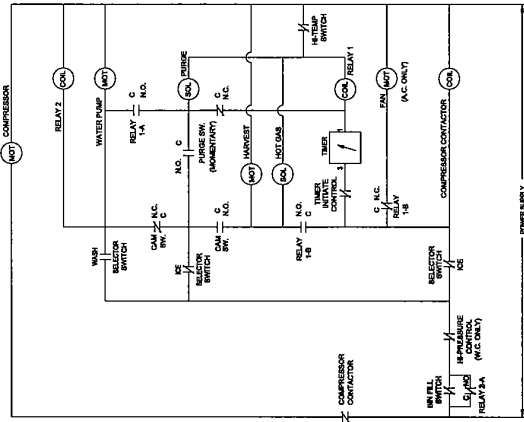
9871971-01



C65/66/105/106 Air and Water

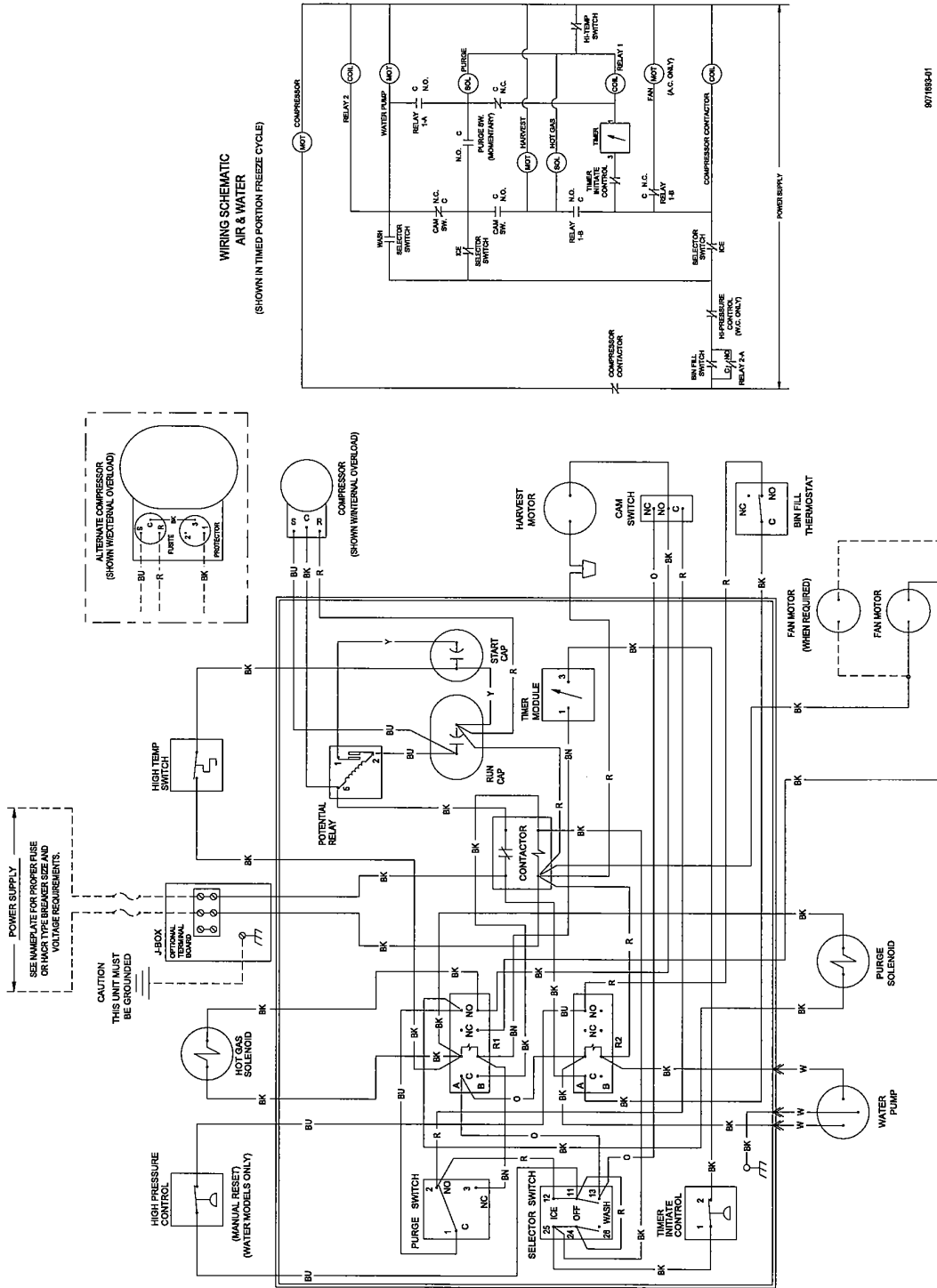
WIRING SCHEMATIC
AIR & WATER

(SHOWN IN TIMED PORTION FREEZE CYCLE)

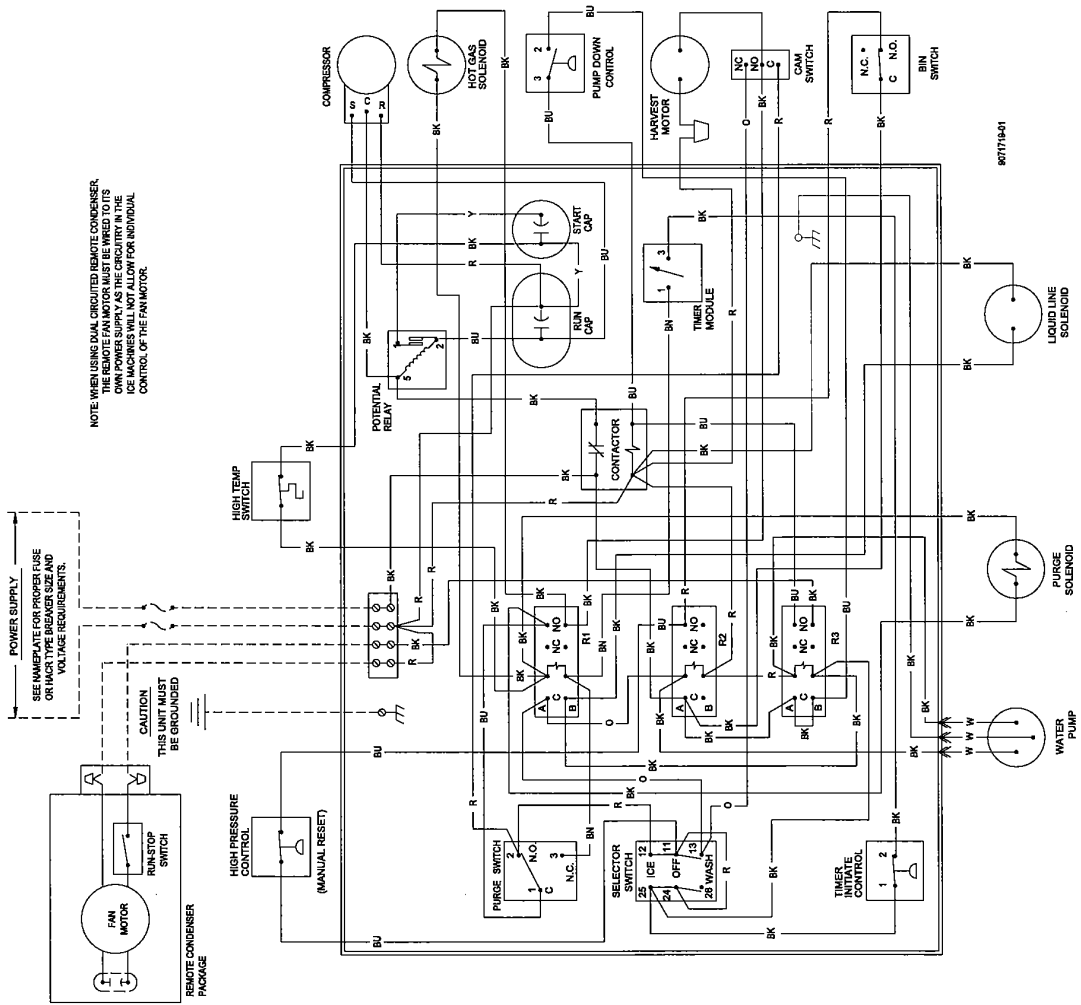


EC and ECP Series / Electrical System

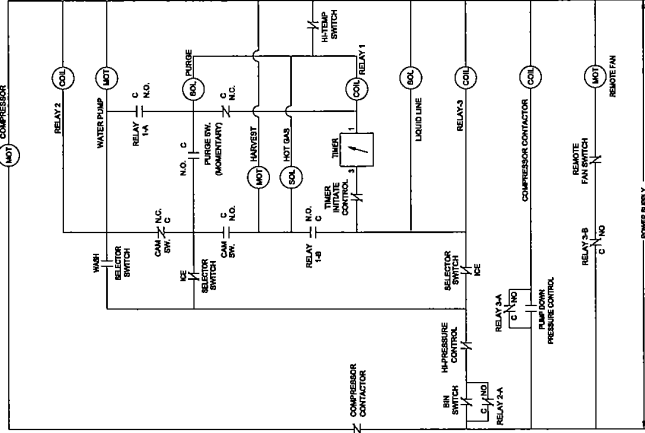
EC605/606/806/1006 Air and Water



C65/66/105/106 Remote

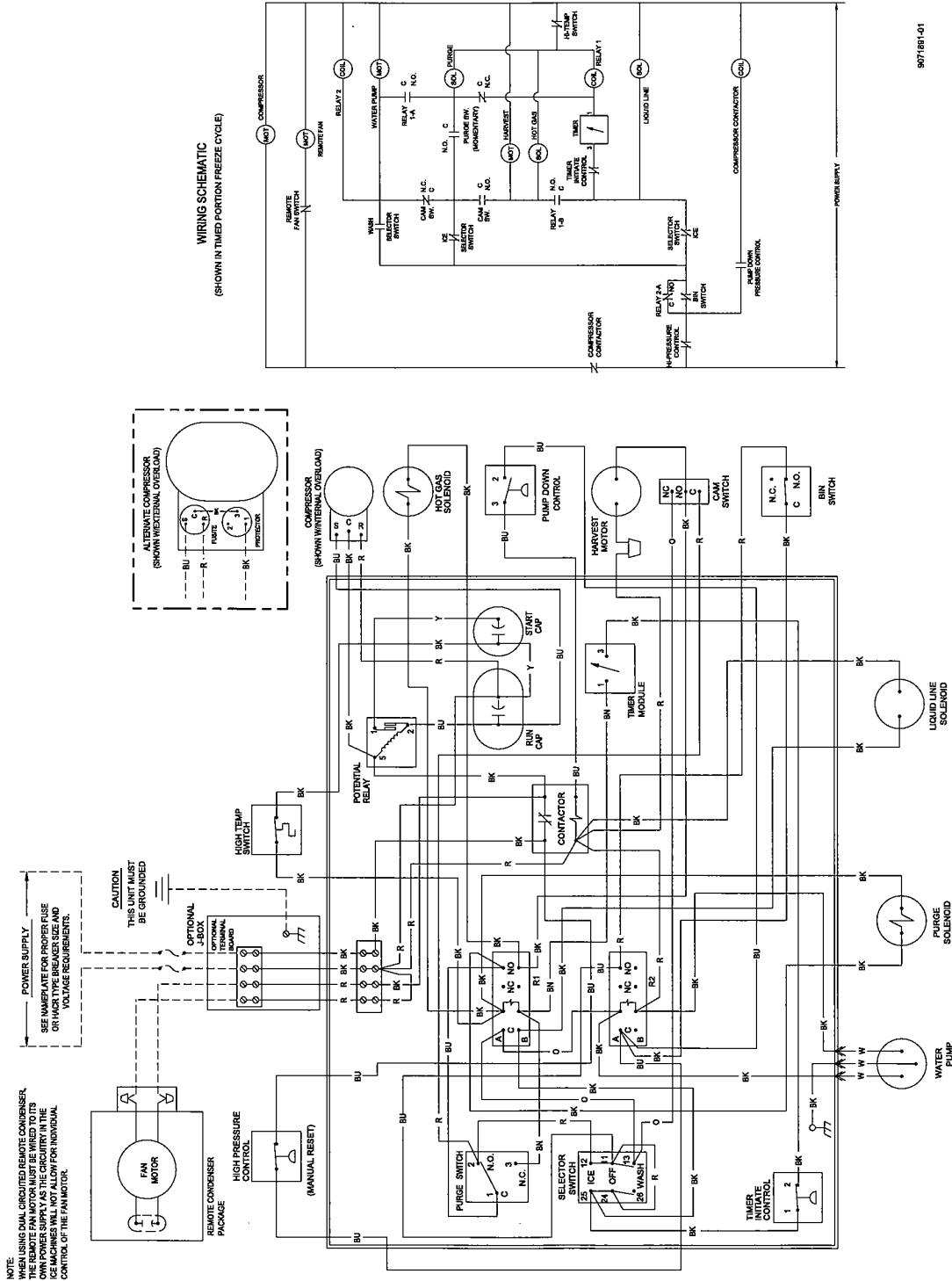


WIRING SCHEMATIC
(SHOWN IN TIMED PORTION FREEZE CYCLE)



EC and ECP Series / Electrical System

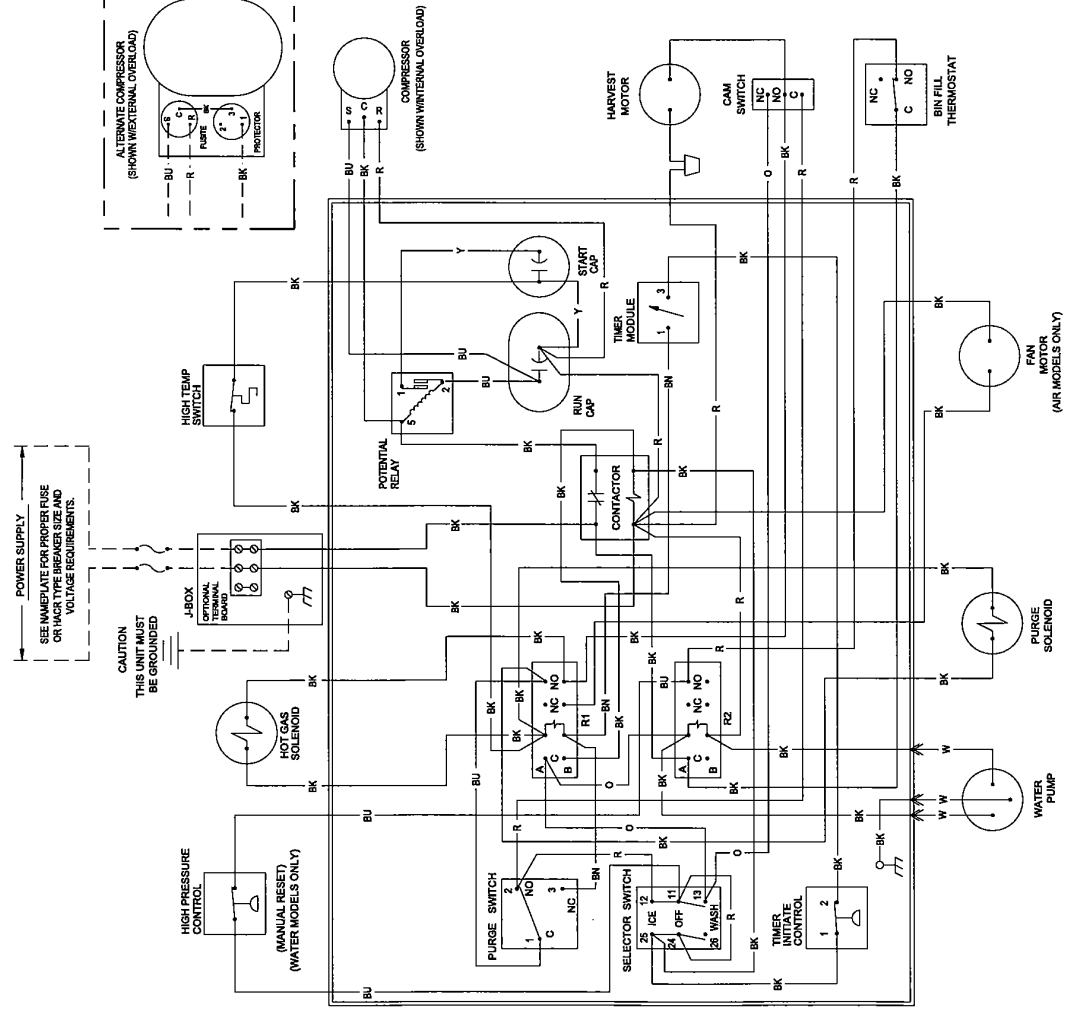
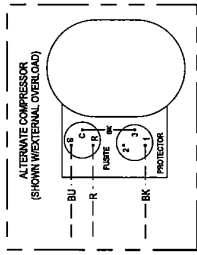
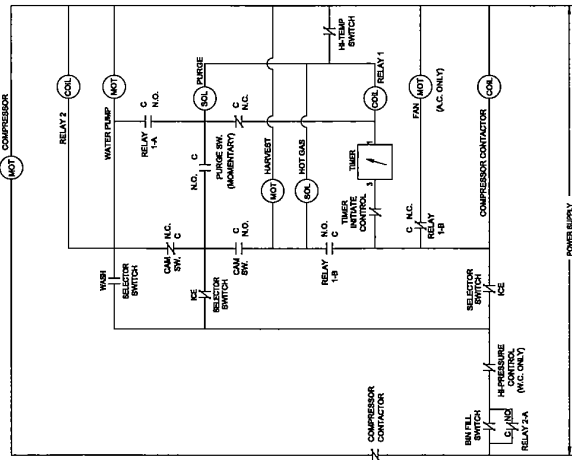
EC605/606/806/1006 Remote



C106 Air and Water

WIRING SCHEMATIC
AIR & WATER

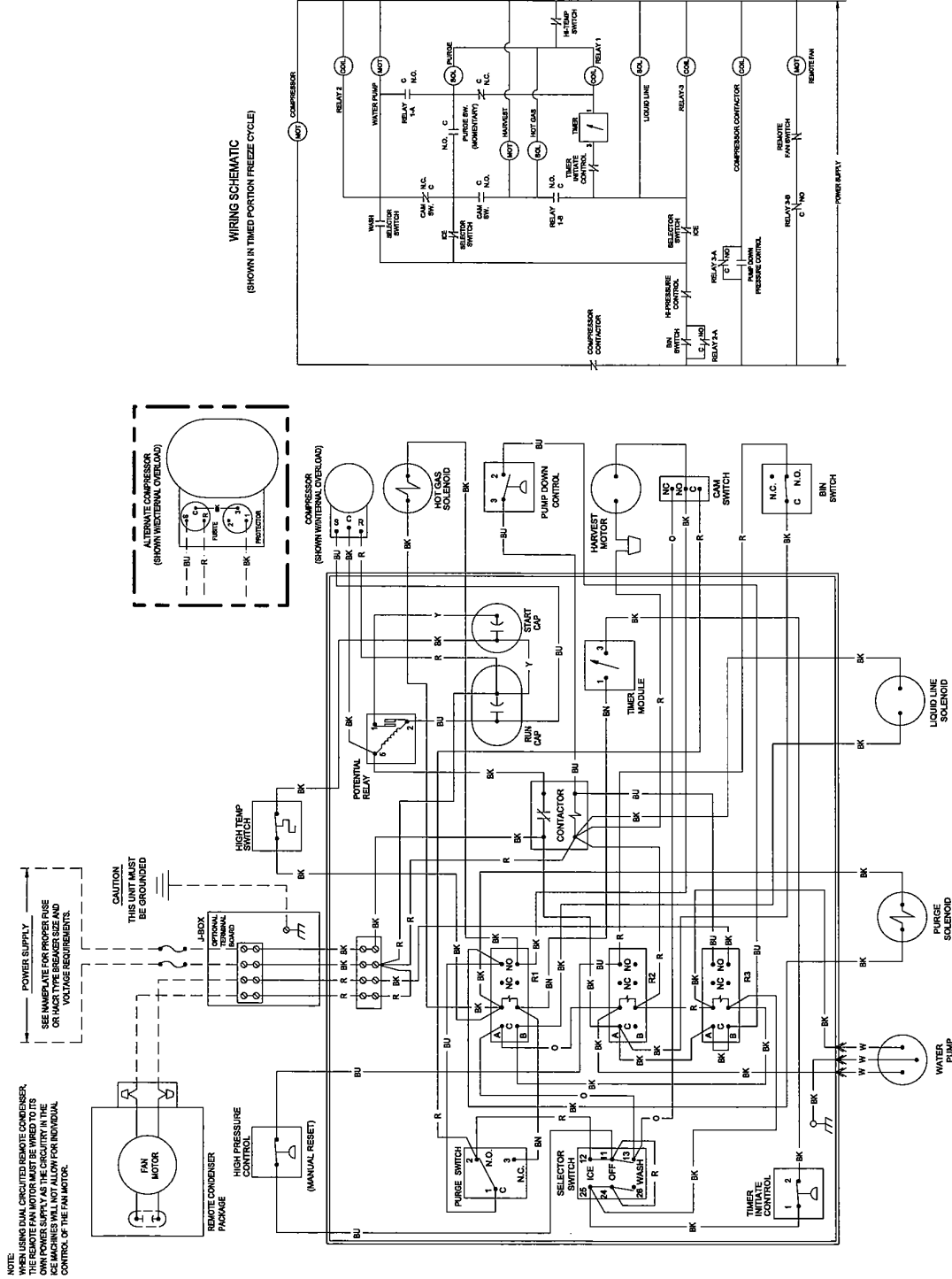
(SHOWN IN TIMED PORTION FREEZE CYCLE)



9071869-01

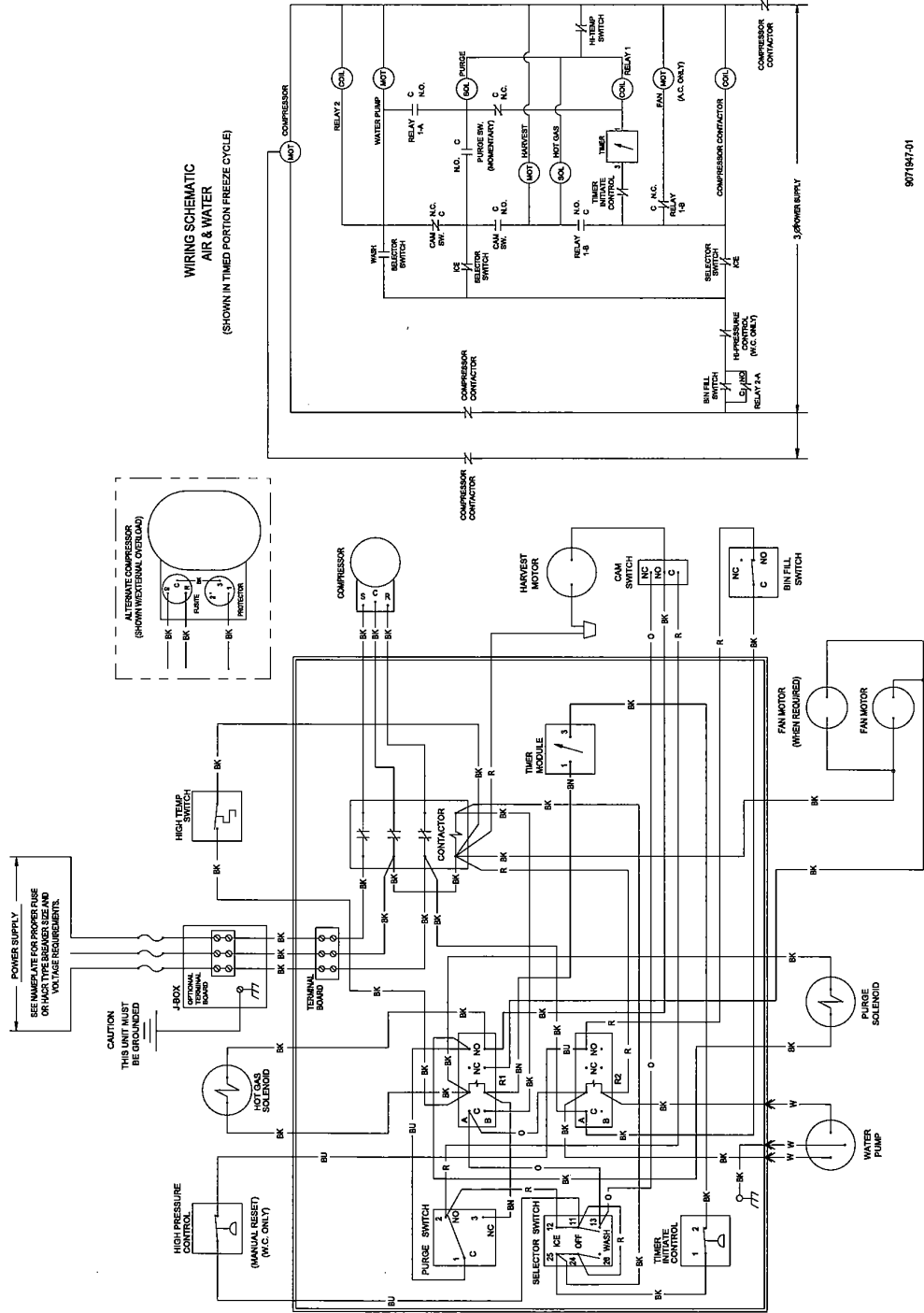
EC and ECP Series / Electrical System

C106 Remote



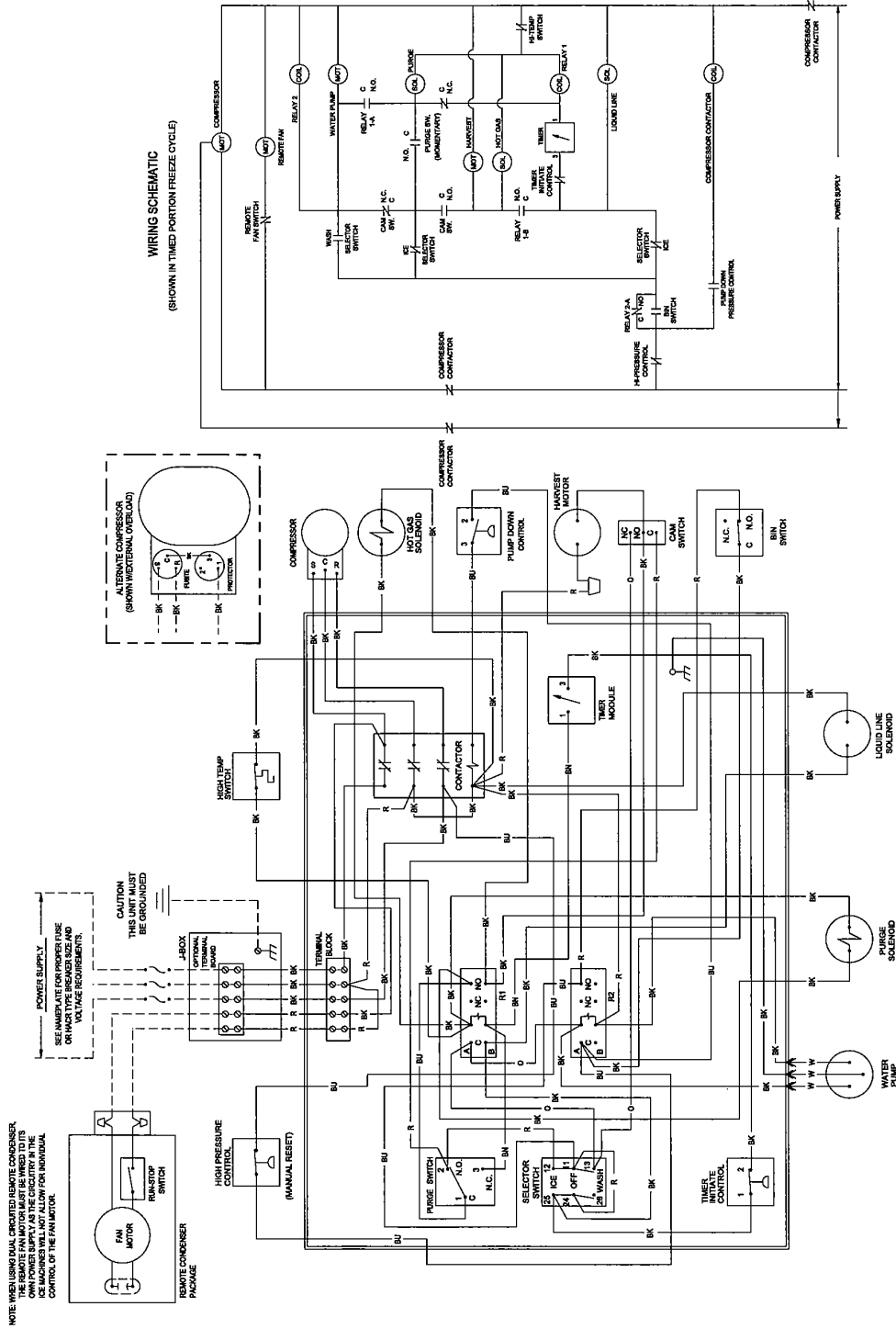
9071830-01

EC1007 Air and Water



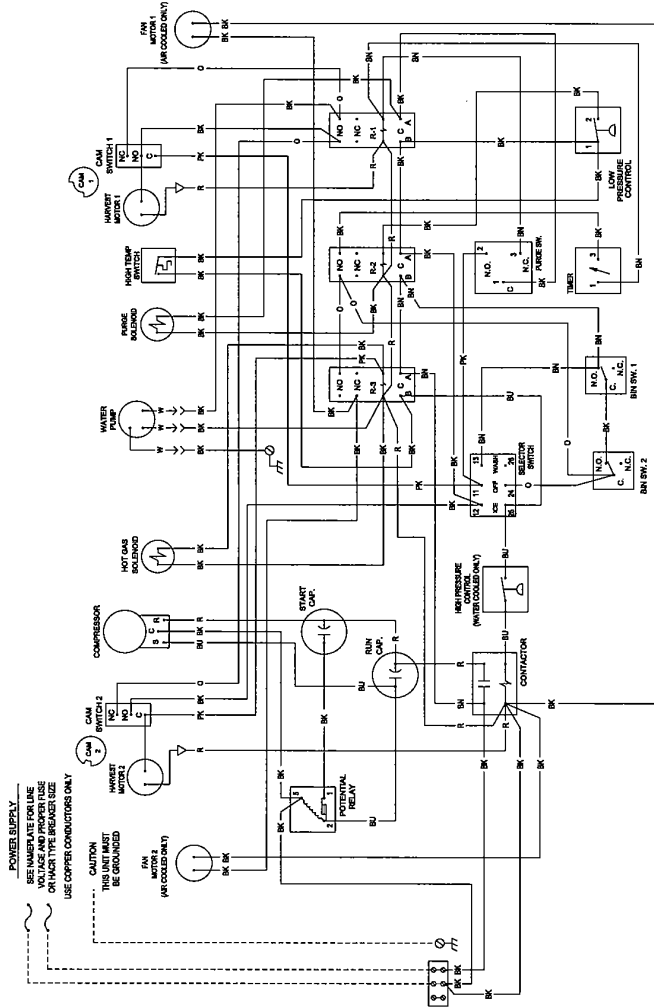
9071947-01

EC1007 Remote



9071968-01

C135/136/185/186 Air and Water



907181-01

POWER SUPPLY
SEE NAME PLATE FOR LINE
VOLTAGE AND PROPER FUSE
OR MOTOR TYPE BREAKER SIZE
USE COPPER CONDUCTORS ONLY

CAUTION
THIS UNIT MUST
BE GROUNDING

WATER MOTOR 1
(AIR COOLED ONLY)

WATER MOTOR 2
(AIR COOLED ONLY)

WATER PUMP

HOT GAS
SOLENOID

COMPRESSOR

CAM SWITCH 2

WATER MOTOR 1
(AIR COOLED ONLY)

WATER MOTOR 2
(AIR COOLED ONLY)

WATER PUMP

HOT GAS
SOLENOID

COMPRESSOR

CAM SWITCH 2

WATER MOTOR 1
(AIR COOLED ONLY)

WATER MOTOR 2
(AIR COOLED ONLY)

WATER PUMP

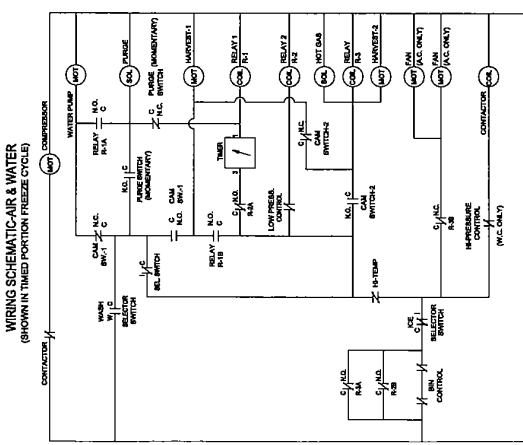
HOT GAS
SOLENOID

COMPRESSOR

CAM SWITCH 2

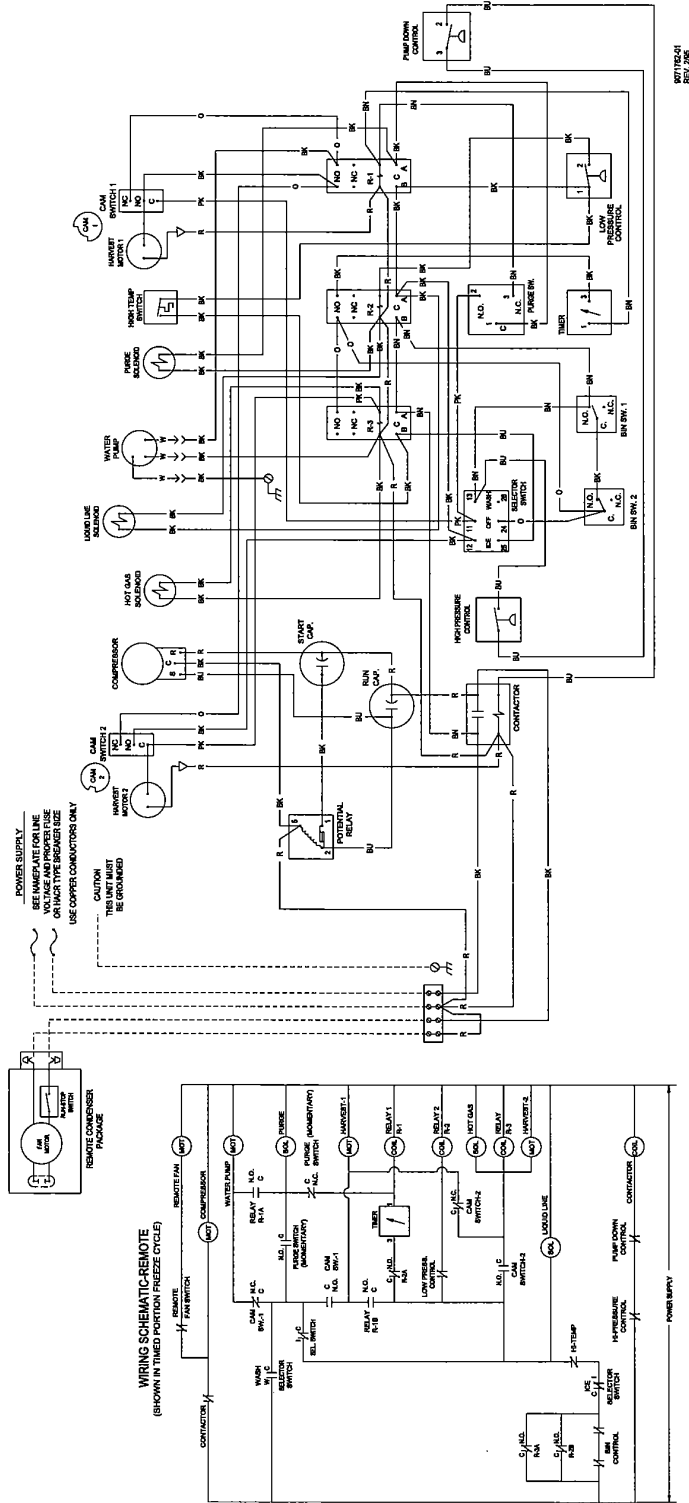
WATER MOTOR 1
(AIR COOLED ONLY)

WATER MOTOR 2
(AIR COOLED ONLY)

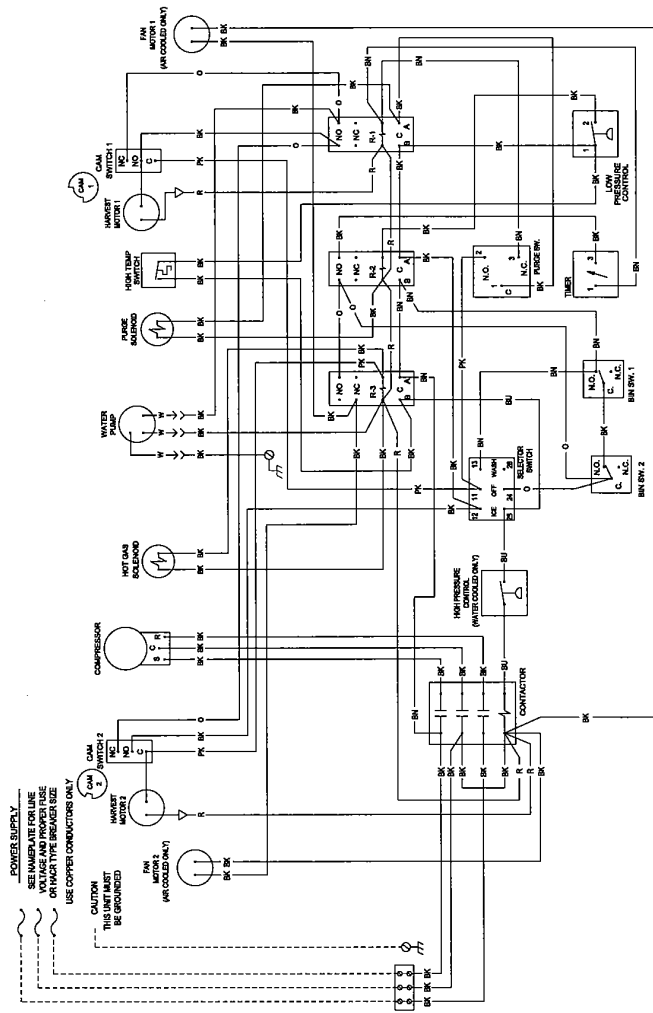


WIRING SCHEMATIC-AIR & WATER
(SHOWN IN TIMED PORTION FREEZE CYCLE)

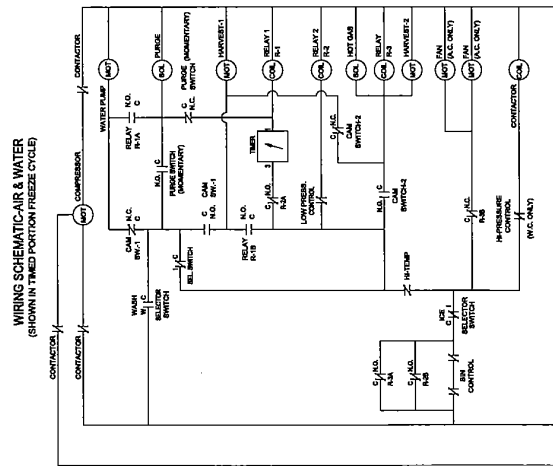
C135/136/185/186 Remote



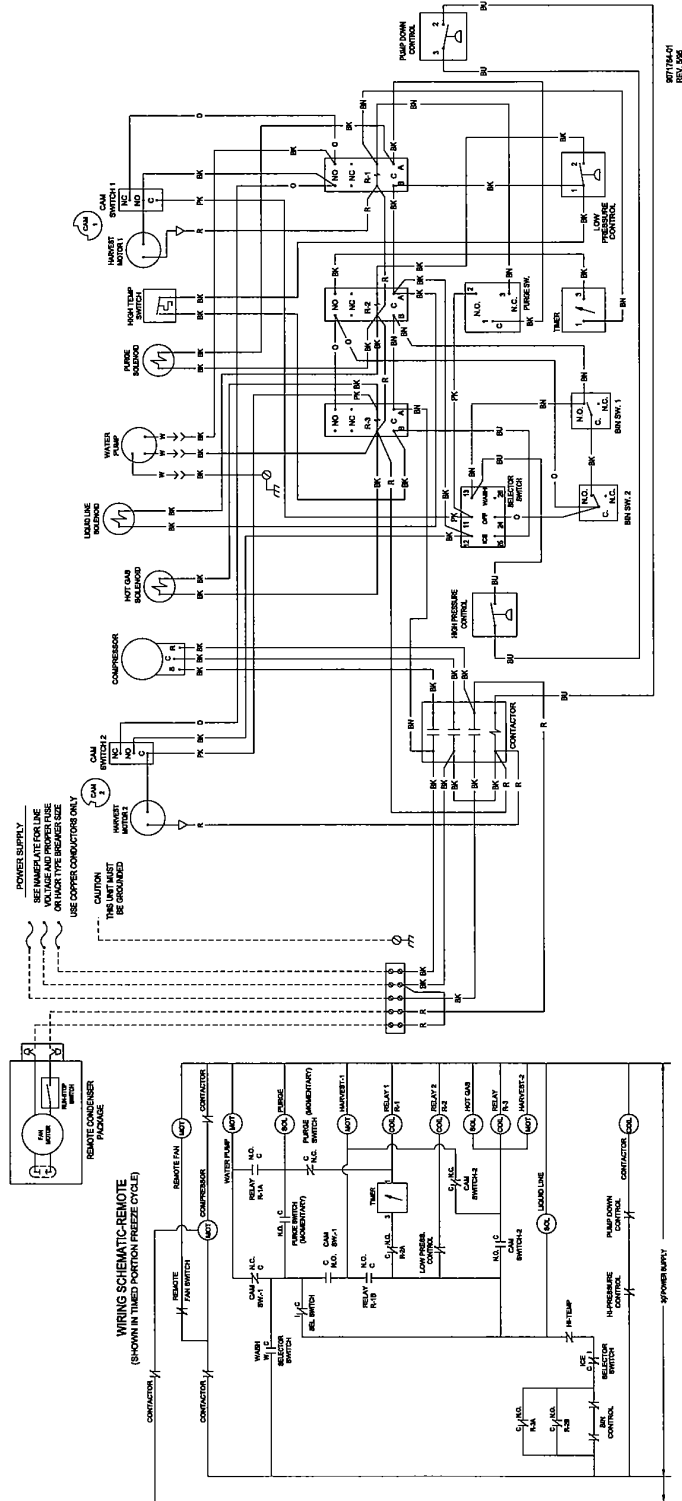
C137/187 Air and Water



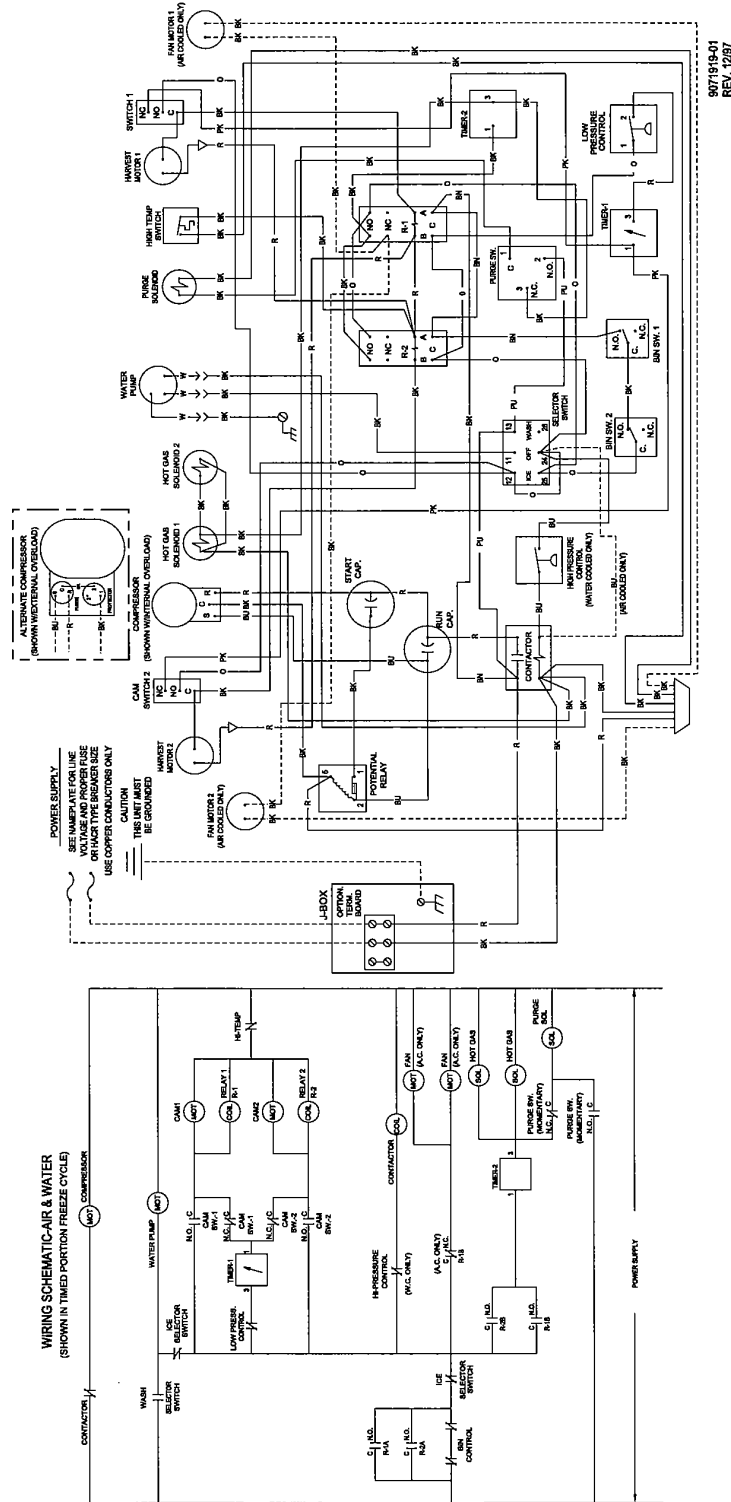
901763-01



C137/187 Remote

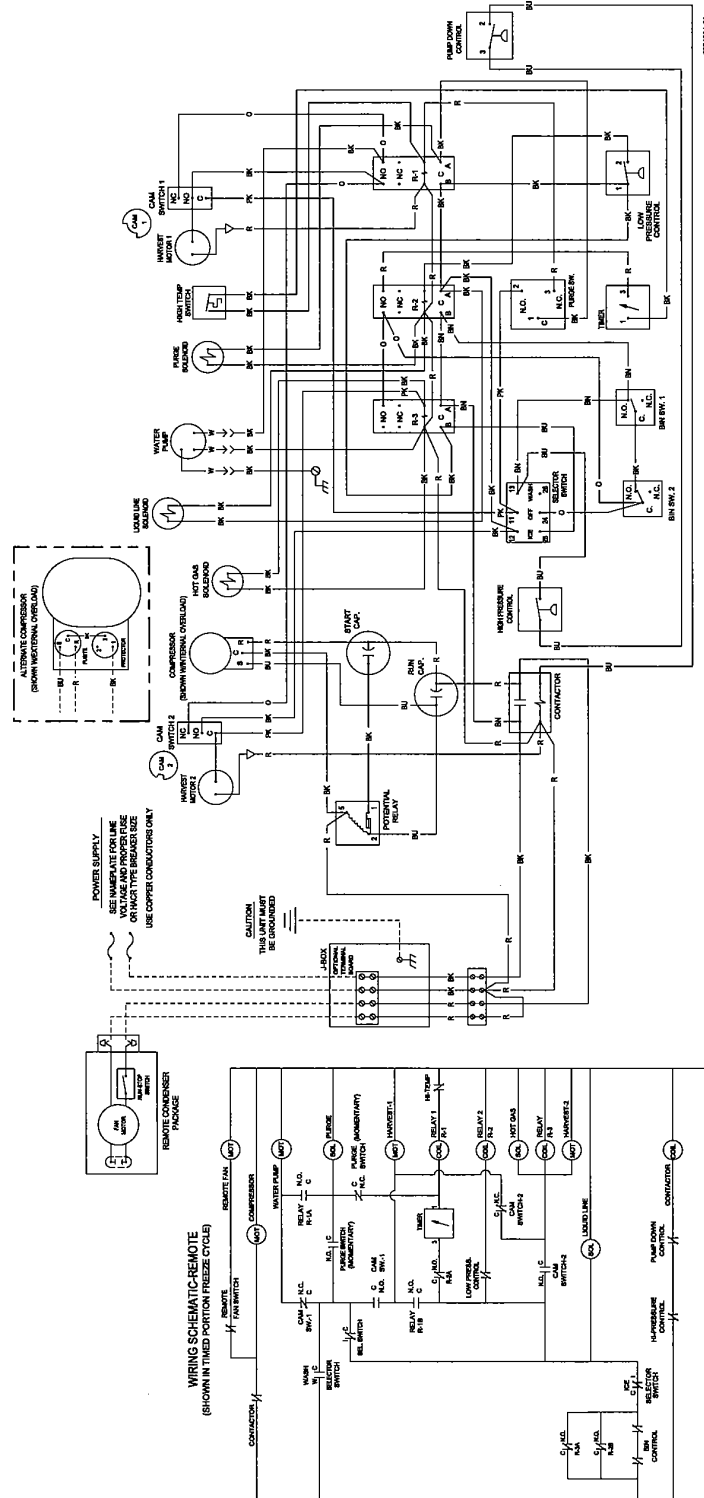


EC1405/1406/1805/1806 Air and Water B2

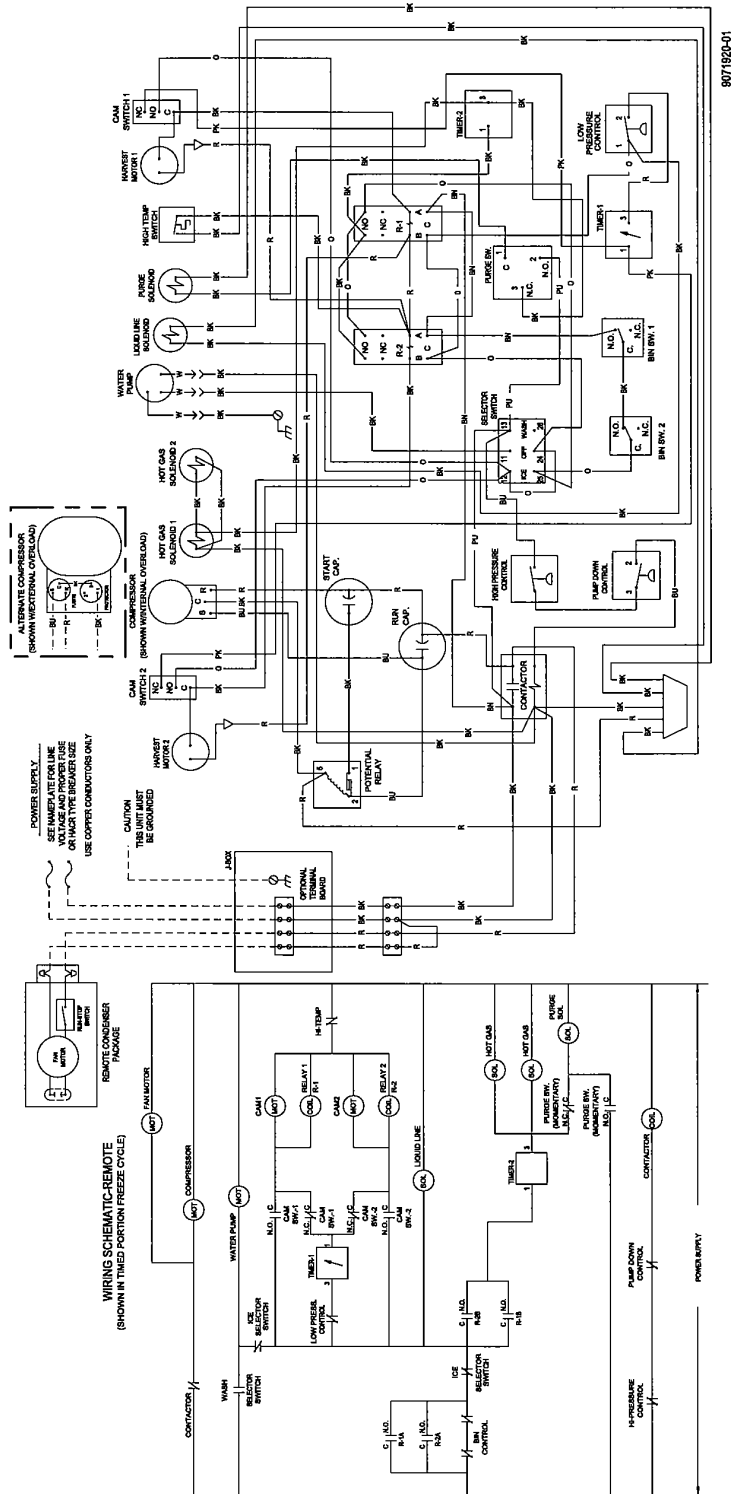


90719-01
REV. 12/87

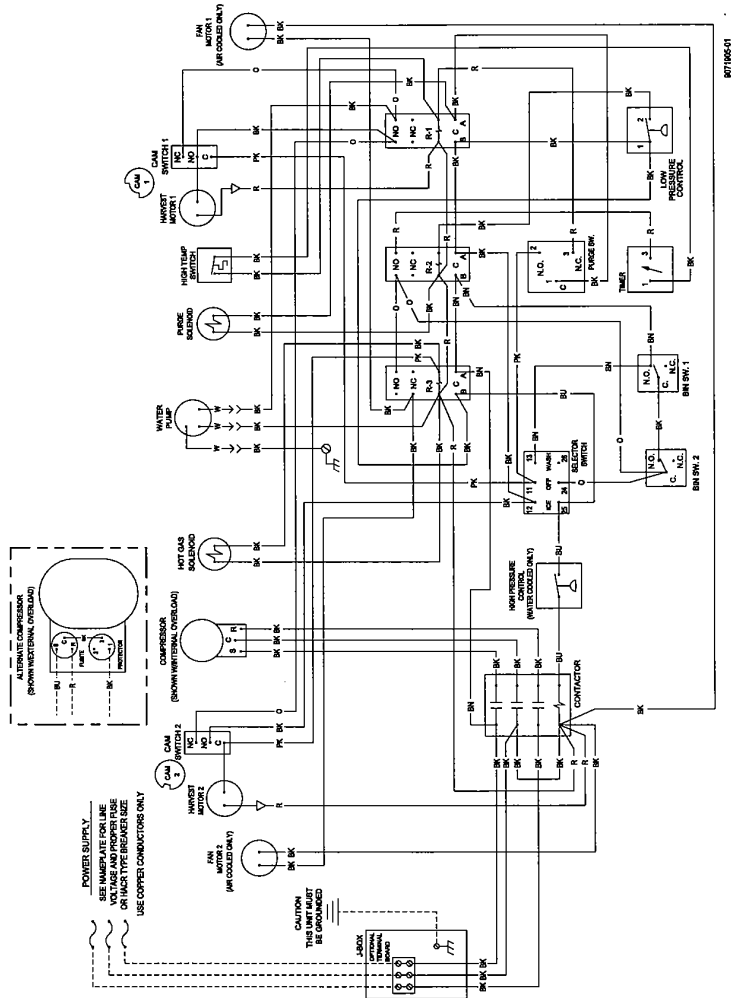
EC1405/1406/1805/1806 Remote B1



EC1405/1406/1805/1806 Remote B2

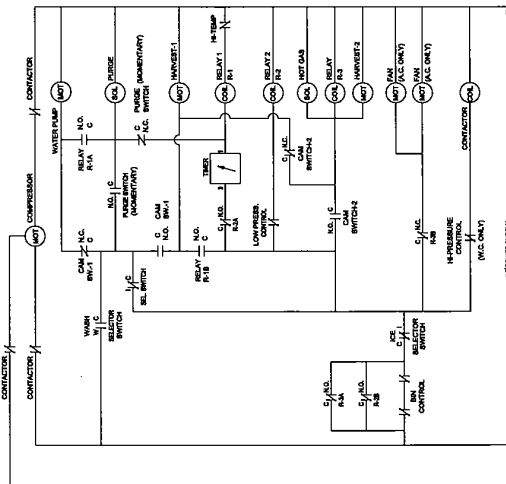


EC1407/1807 Air and Water B1

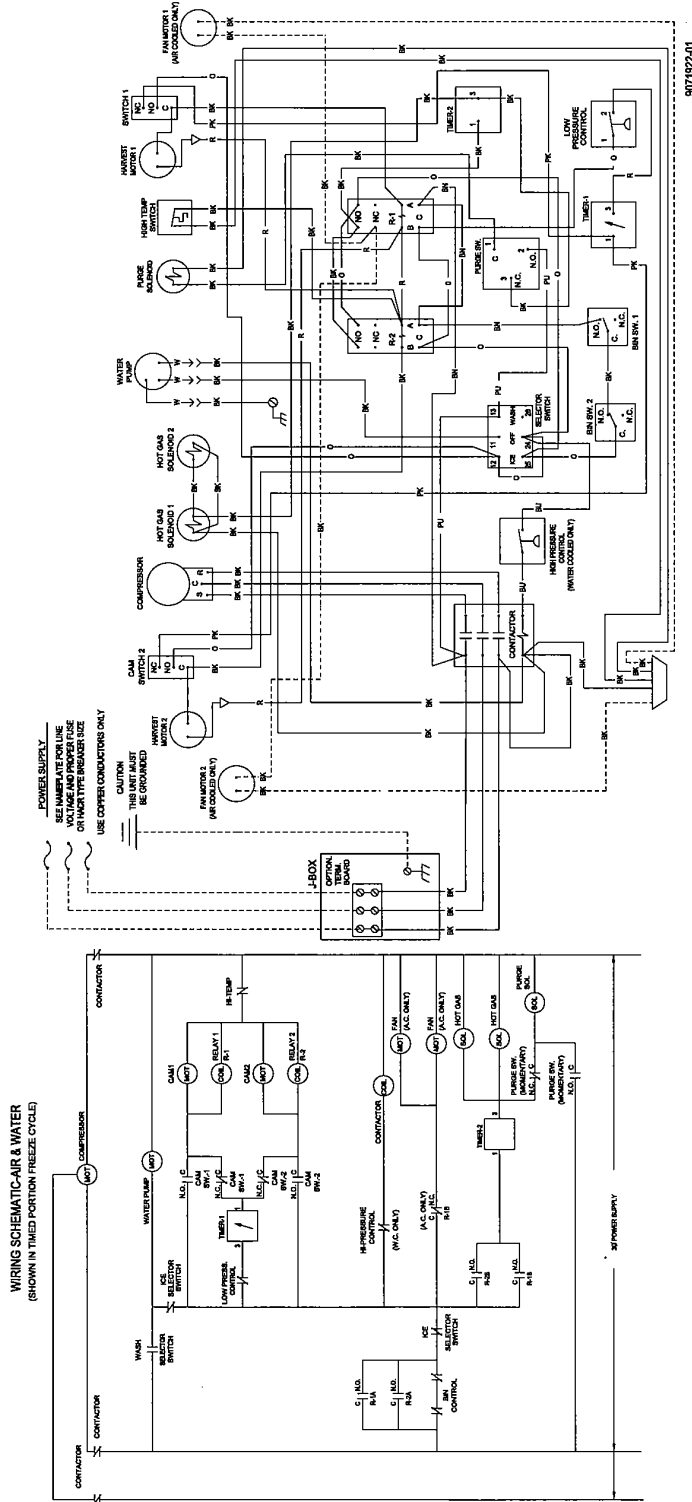


871106-01

WIRING SCHEMATIC AIR & WATER
(SHOWN IN TYPED PORTION FREEZE CYCLE)

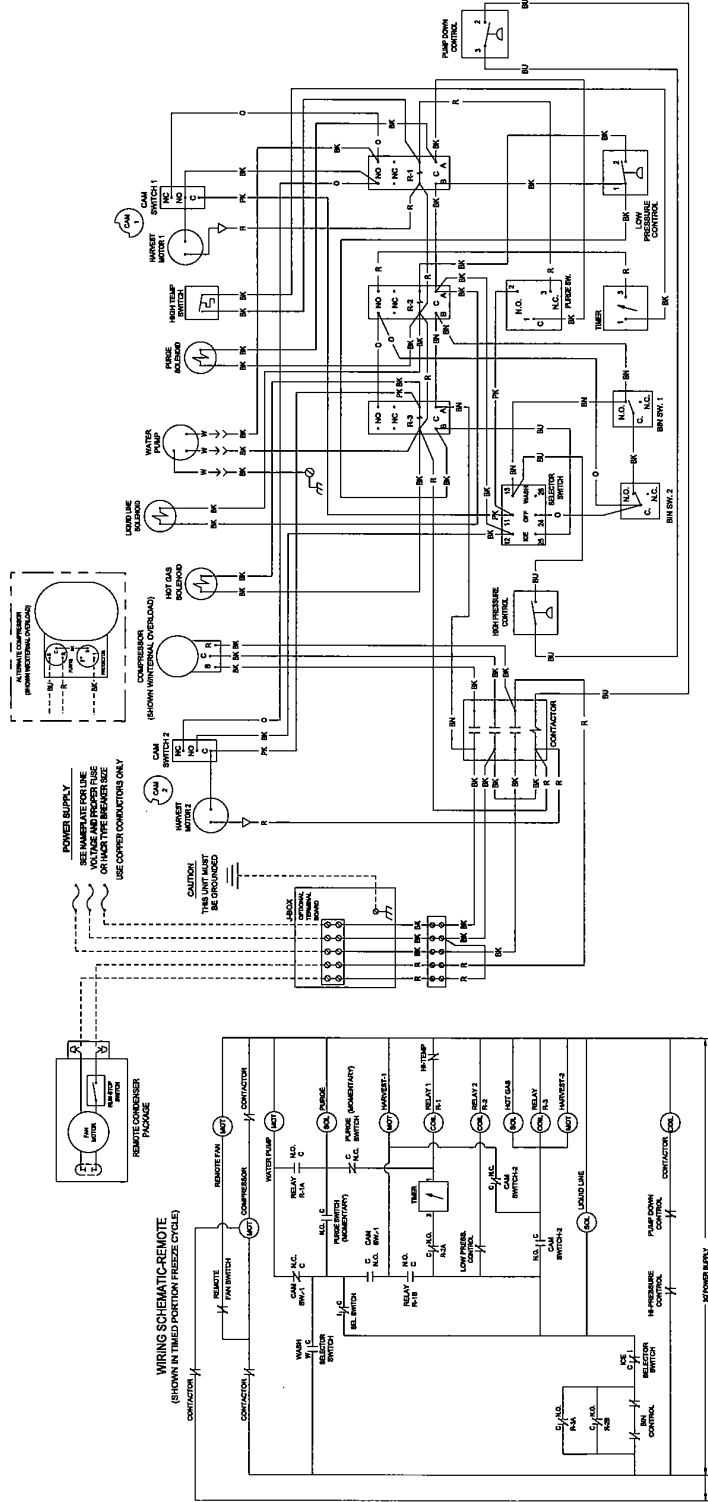


EC1407/1807 Air and Water B2

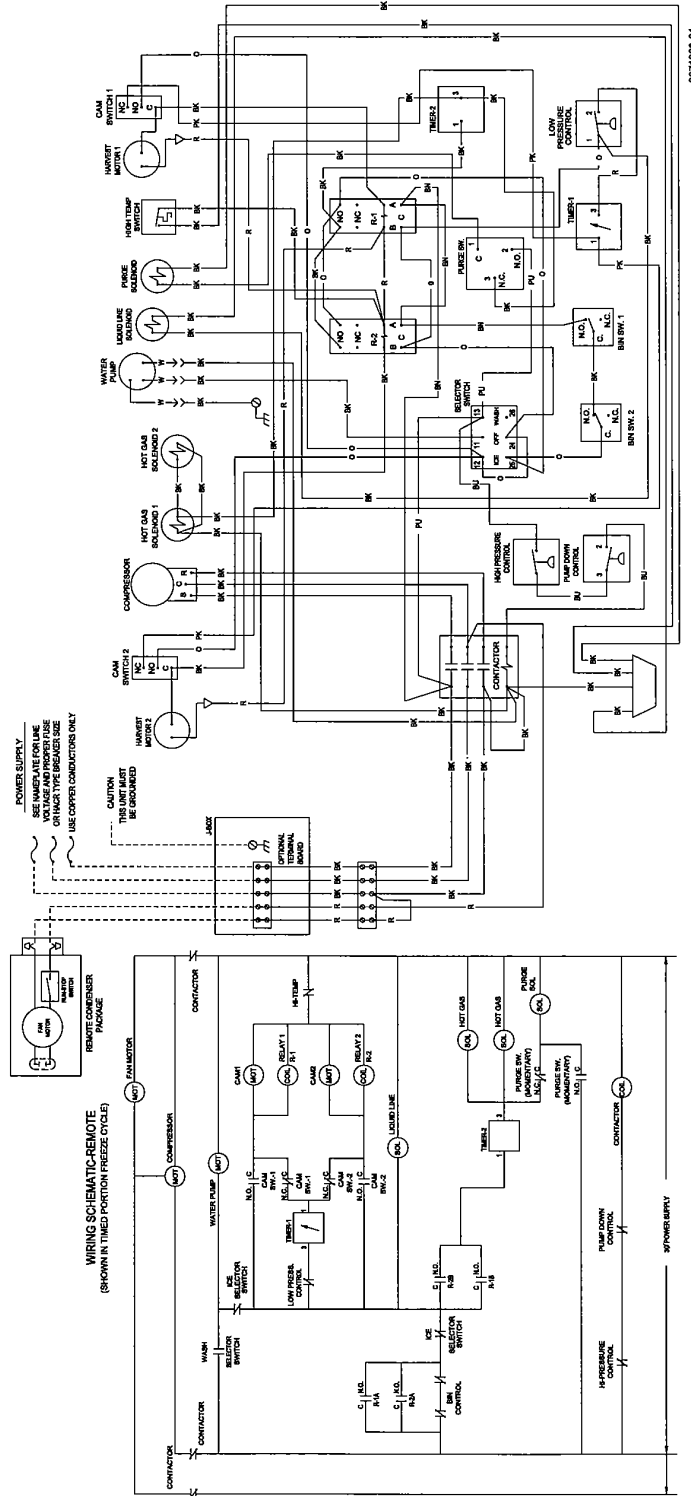


9071932-01

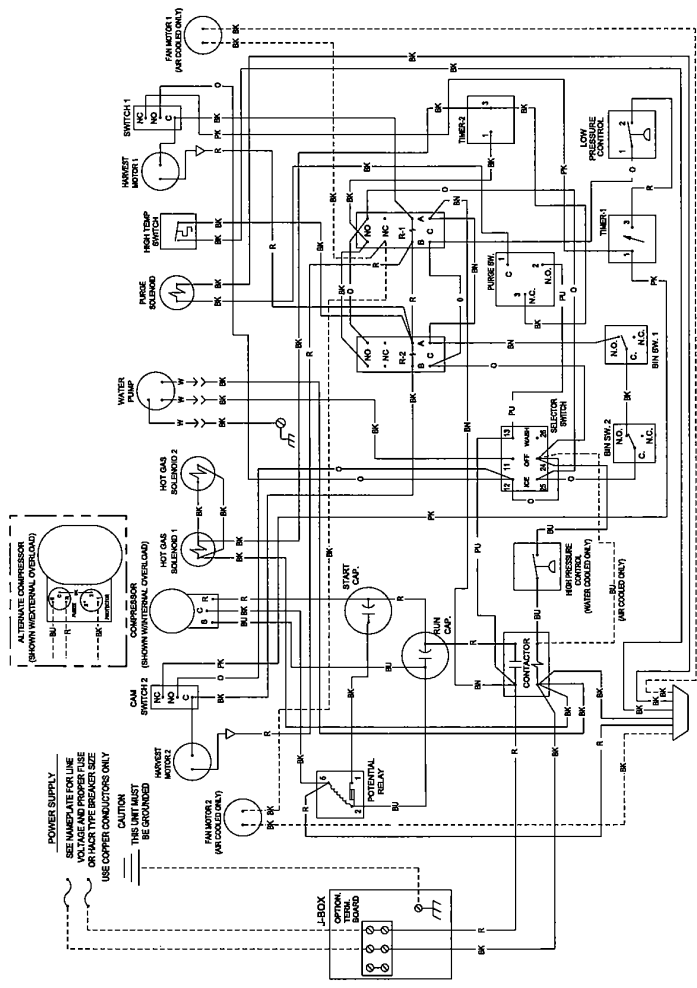
EC1407/1807 Remote B1



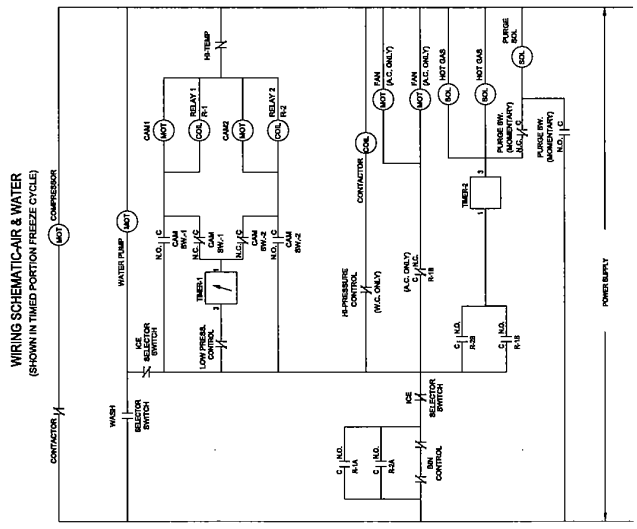
EC1407/1807 Remote B2



EC2106 Water

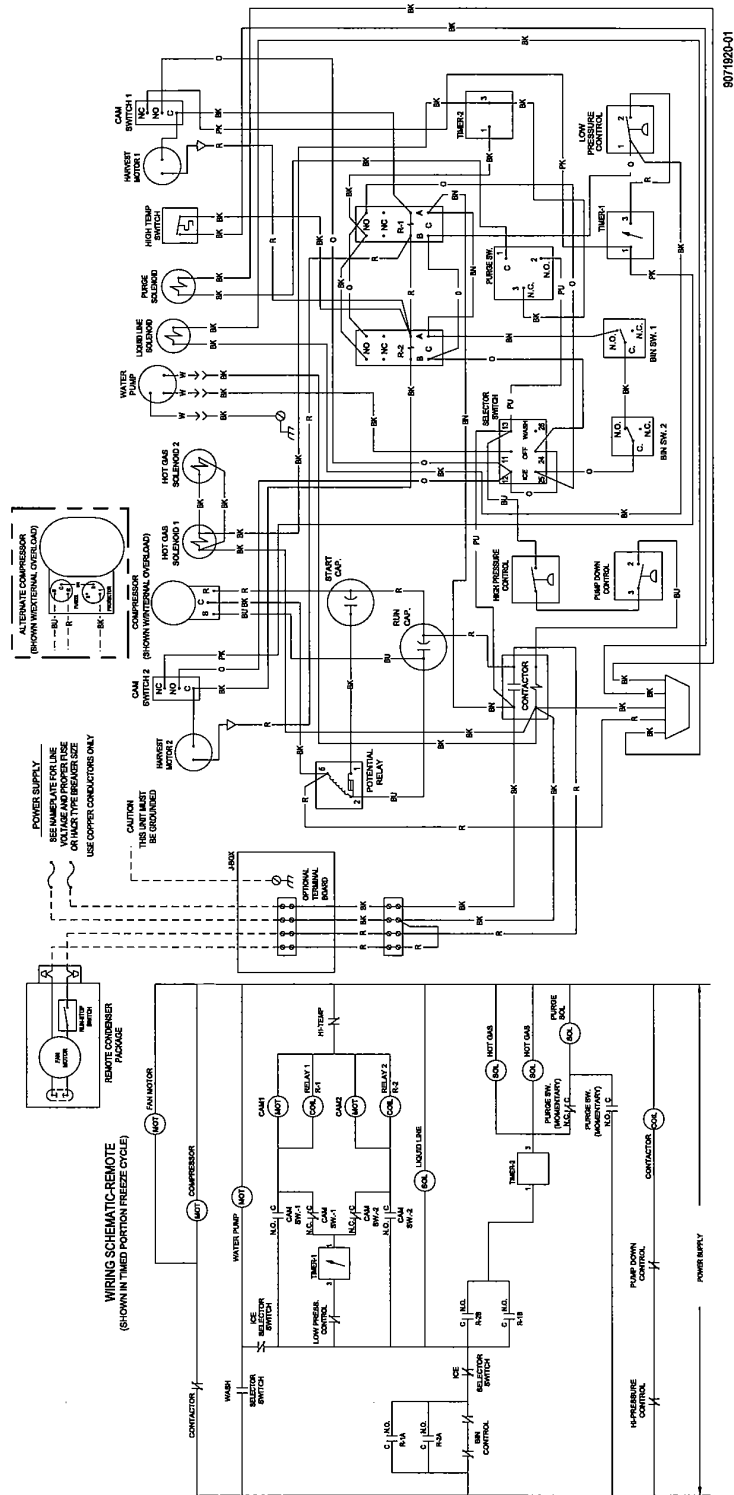


9071919-01
REV. 12/87



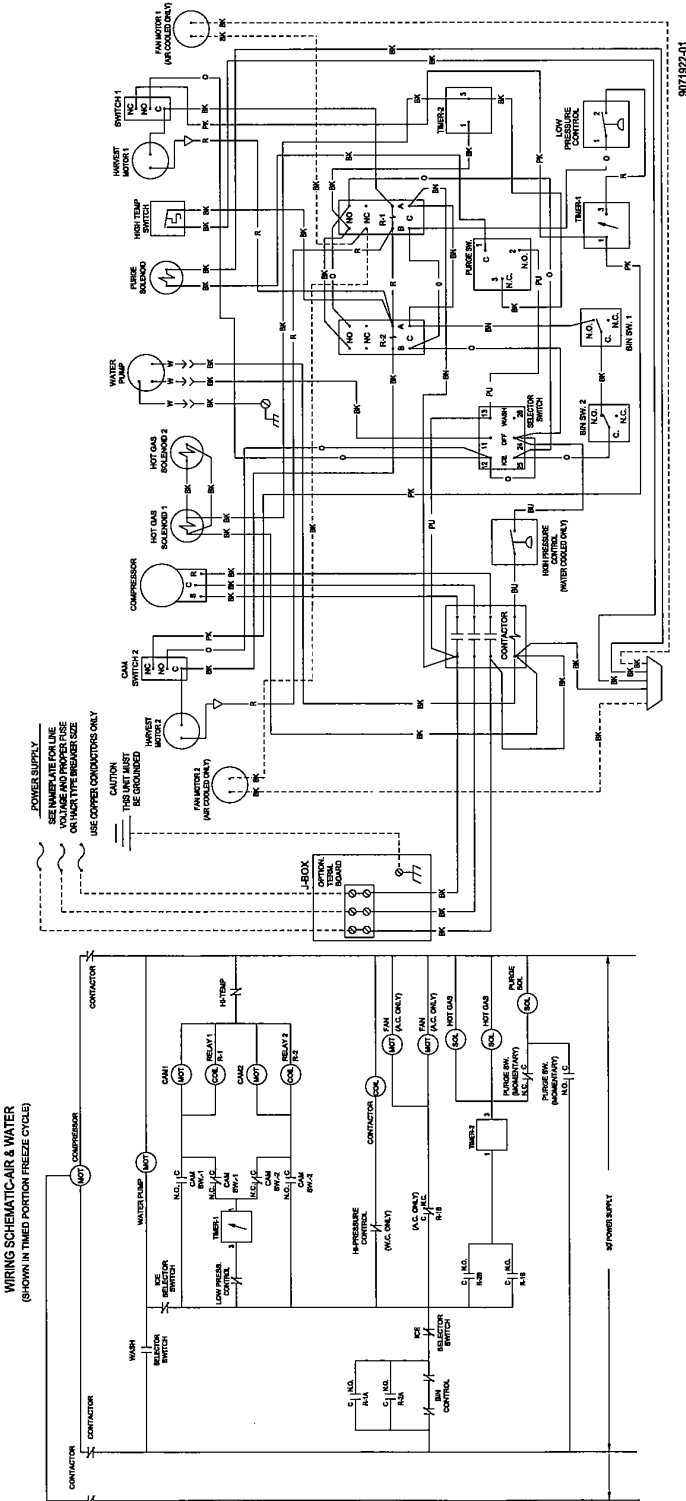
WIRING SCHEMATIC-AIR & WATER
(SHOWN IN TIMED PORTION FREEZE CYCLE)

EC2106 Remote



8071820-01

EC2107 Water



WIRING SCHEMATIC-AIR & WATER
(SHOWN IN TIMED PORTION FREEZE CYCLE)

9071822-01

Notes

General Information / Flake Ice Machines

A

Address	A1
Adjustments	A8
Ampacity (Machine)	A3A7

B

Bridge Thickness	F3-F4
Bin Control	F9
Bin Removal (under counter models)	D3

C

Cam Switch	F6, F8
Capacitor	F2
Cleaning	
evaporator	B1
condenser	B1, E2
Clearance	A8
Clutch Assembly	F6-F7
Compressor	E2, F2
horsepower	A3-A7
overload	F2
R.L.A.	A3-A7, E2
Condenser, <i>also see Remote</i>	E3
fan motor	E2
Contactors	F1
Crankcase pressure regulator	E6

D

Date Code	A2
Distribution tube	D2

E

Electrical	
connections	A9
specifications	A3-A7
Electrical System	F31-F32
Evaporator	E3-E5

F

Fan control	E2
Fan motor	F2
Remote	E7
Fax number	A1
Filter drier	E2
Float Valve	D1
Flow charts, <i>see troubleshooting trees</i>	C1
Freeze cycle	E1-E5, F3-F4
Freeze timer	F3-F4
Fuse Size	A3-A7

H

Harvest	
assist assembly	F6
cycle	E6, F5-F9
motor	F6
Hot Gas Valve	E6
High Pressure Safety	E3
High Temperature Safety	F8

I

Ice	
cycle	A11
production	A3-A7
thickness (bridge thickness)	F3-F4
Installation	A8-A10

L

Liquid Line Solenoid	E8, F10
Low Pressure Control	
<i>see Pump Down Control</i>	
<i>see Timer Initiate</i>	

M

Maintenance	B1-B2
Mixing Valve	E7
Model Number	A2

P

Flake Ice Machines / General Information

Phone Number (Ice-O-Matic)	A1	Stacking	A8
Plumbing Diagram	A9	T	
Pressure		Temperature	
control (safety)	E3	ambient	A8, E2, E7
head	E1-E3, E7	operating	E8
suction	E1, E6	water	E8, E3
water	A8	safety (high temp. safety)	F8
Purge		Thermostatic expansion valve	E3-E4
drain	A9	Timer	
length of	F8	freeze	F3-F4
switch	F1	initiate	F3
valve	D1, D3, F5	Troubleshooting trees	C3-C18
Pump Down Control.....	E8, F10	table of contents for	C2
Pump Down System.....	E8, F10	how to use	C1
Probe	F7	TXV	E3-E4
Probe Motor (harvest motor)	F5, F6		
		V	
R		Voltage characteristics	A3-A7
Receiver	E8, E10	W	
Refrigerant		Wash	F1
charge	A3-A7, E2	<i>also see cleaning</i>	
cycle	E1-E5	Water	
type	A3-A7, E1	distribution system	D1-D3
pressures	E1, E6	condenser	E3
Refrigeration System	E1-E8	conditions	B1, E3
Relay		cooled	E3
1	F5	distribution tube	D2
2	F4	pressure	A8
3	F5	pump	D1
start	F2	regulating valve	E3
Remote		trough	D1
condenser	E7	Winterizing	B2
installation	A10	Wiring Diagrams	F11-F31
system	E6-E8, F10		
S			
Sanitizing	B1		
Specifications	A3-A7		
Splash Curtain	D2		
Selector Switch	F1		
Serial Number	A2		
Start Relay	F2		
Start-Up Procedure, <i>see adjustments</i>	A8		

