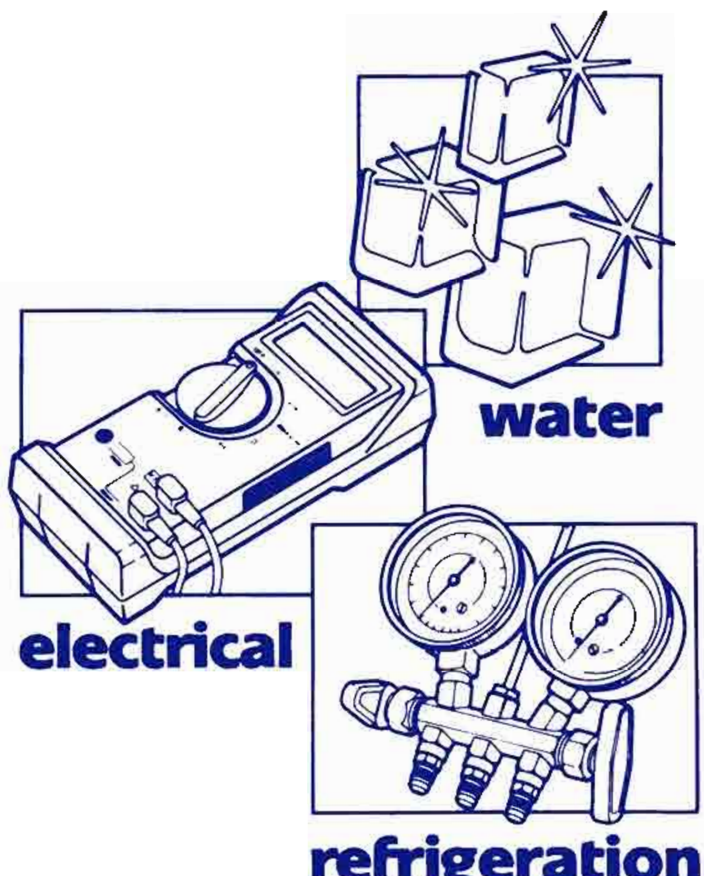
Manitowoc® SERVICE TECHNICIAN'S HANDBOOK

E and G MODEL ICE MACHINES



P/N 83-5164-9

TABLE OF CONTENTS

(Continued on next page)

Table of Contents (continued)

ICE MACHINE WARRANTY INFORMATION

IMPORTANT

Read this section very carefully for warranty explanation. (Refer to Warranty Bond for complete details.)

OWNER WARRANTY REGISTRATION CARD

Warranty coverage begins the day the ice machine is installed.

IMPORTANT

To validate the installation date, the OWNER WARRANTY REGISTRATION CARD must be mailed in.

If the card was not returned, Manitowoc will use the date of sale to the Manitowoc Distributor as the first day of warranty coverage for your new ice machine.

About Your Warranty

For a detailed explanation of the warranty, we have compiled a list of the most commonly asked questions regarding warranty coverage.

Contact your local Manitowoc representative or our Wisconsin factory for further warranty information.

WARRANTY COVERAGE

(Effective for Ice Machines Installed after January 1, 1991)

Parts

1. The ice machine is warranted against defects in materials and workmanship under normal use and service for three (3) years from the date of the original installation. It is important to send in the warranty registration card so Manitowoc can begin your warranty on the installation date.

2. An additional two (2) years (five (5) years total) warranty is provided on evaporator and compressor from the date of original installation.

Labor

1. Labor to repair or replace defective components is warranted for three (3) years from the date of original installation.
2. An additional two (2) years (five (5) years total) labor warranty is provided on the evaporator from the date of original installation.

Exclusions from Warranty Coverage

The following items are not included in the warranty coverage of the ice machine.

1. Normal maintenance, adjustments and cleaning as outlined in the Use and Care Guide.
2. Repairs due to unauthorized modifications to the ice machine or the use of nonapproved parts without written approval from Manitowoc Ice, Inc.
3. Damage from improper installation as outlined in the Installation Instructions; improper electrical supply, water supply or drainage; flood; storms; or other acts of God.
4. **Premium labor rates due to holidays, overtime, etc. Travel time, flat rate service call charges, mileage and miscellaneous tools and material charges not listed on the payment schedule are excluded as well as additional labor charges resulting from inaccessibility of the ice machine.**
5. Parts or assemblies subjected to misuse, abuse, neglect or accidents.
6. When the ice machine has been installed, cleaned and/or maintained inconsistent with the technical instructions provided in the Owner/Operator Use and Care Guide and the Installation Manual.

Authorized Warranty Service

To comply with the provisions of the warranty, a refrigeration service company qualified and authorized by a Manitowoc distributor or a Contracted Service Representative must perform the warranty repair.

COMPONENT FUNCTION, SPECIFICATIONS AND CHECK PROCEDURES

OPERATIONAL CHECKS

All Manitowoc ice machines are factory operated and adjusted before shipment; normally no adjustments are necessary for new installations.

FLOAT VALVE

Function
Maintains correct water level in water trough.

Check Procedure
1. Set ICE/OFF/WATER PUMP switch at OFF.

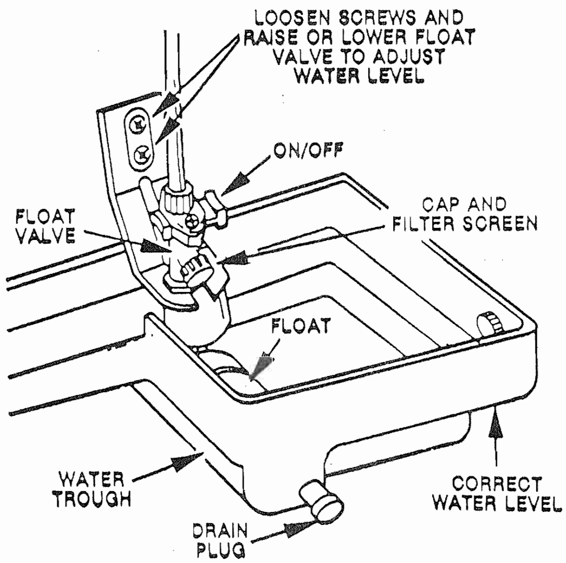


FIGURE 1. FLOAT VALVE CHECK

2. Remove drain plug from trough and allow water to drain. See Figure 1.
3. Reinstall drain plug on trough and allow trough to refill to proper level.

   The float valve is factory set to maintain correct water level. If adjustment is necessary, proceed as follows:
   a. Loosen two screws on float valve bracket.
   b. Raise or lower float valve assembly, then tighten screws.
   c. If further adjustment is necessary, carefully bend float arm to achieve correct level.
   d. If float valve cannot be adjusted to maintain correct water level in trough, disassemble and clean before replacement.

SINGLE EVAPORATOR BIN SWITCH

Function

Bin switch operation is controlled by movement of the water curtain. It resets ice machine to the freeze cycle by momentarily interrupting power to the transformer board as ice falls from the evaporator. On the G-600 and G-800 the bin switch also energizes the 7-second delay timer on self-contained ice machines to shut the machine off when the bin is full.

Specifications

Single pole/single throw, normally closed.

Check Procedure

1. Pull water curtain away from evaporator until ice machine shuts off, Figure 2. (Remote machines, wait for ice machine to pump down.)

2. Slowly return curtain to evaporator. Ice machine should restart as bottom edge of water curtain passes just inside edge of water trough. (Remote machines, bin switch energizes Liquid Line Solenoid.)

3. If bin switch adjustment is necessary, adjust as follows:
   a. Set ICE/OFF/WATER PUMP switch at OFF.
   b. Slowly pull bottom of water curtain away from evaporator until bin switch clicks, then slowly return curtain toward evaporator.
   c. If bin switch clicks before water curtain reaches water trough, lengthen the bin switch activating pin.
   d. If bin switch clicks when curtain is too far toward evaporator, shorten the bin switch activating pin.
   e. Set ICE/OFF/WATER PUMP switch at ICE after adjustment is complete.

4. Bin switch pin adjustment (see Figure 2):
   a. Loosen brass nut.
   b. Turn end of pin closest to water curtain counterclockwise to lengthen, clockwise to shorten.
   c. Tighten brass nut after adjustment and repeat Check Procedure.

5. If bin switch does not operate properly after adjustment, check bin switch with Ohmmeter and/or voltmeter while depressing and releasing activating pin. If bin switch does not open and close properly, replace switch.

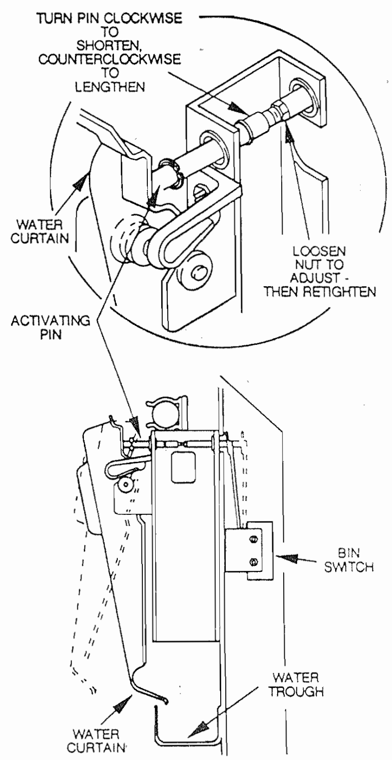


FIGURE 2. BIN SWITCH ACTIVATING PIN ADJUSTMENT

DUAL EVAPORATOR G1200 - G1700 SERIES BIN SWITCHES

Function

1. The front evaporator or rear evaporator bin switch is controlled by movement of the corresponding water curtain.
2. The front bin switch movement energizes relay A and the rear bin switch movement energizes relay B during the harvest cycle.
3. Either bin switch may be held open to shut the ice machine off when the bin is full of ice.

Specifications

Single pole, double throw.

Bin Switch Setting (Figure 3)

1. During freeze cycle, pull water curtain away from evaporator until ice machine shuts off.

NOTE

On remote models the ice machine may run 20 to 30 seconds before shutting off.

2. Slowly return curtain to evaporator. Ice machine should restart as bottom edge of water curtain passes just inside edge of water trough.

The bin switch is factory set and should not require adjustment. If bin switch adjustment is necessary, adjust as follows:

1. Set ICE/OFF/WATER PUMP switch at OFF.
2. Slowly pull bottom of water curtain away from evaporator, then slowly return curtain toward evaporator.
3. Loosen appropriate locking screw.
4. If bin switch clicks before water curtain reaches water trough, move lever toward water curtain.
5. If bin switch clicks too far into water trough, move lever away from water curtain.
6. Tighten locking screw.
7. Set ICE/OFF/WATER PUMP switch at ICE after adjustment is complete.

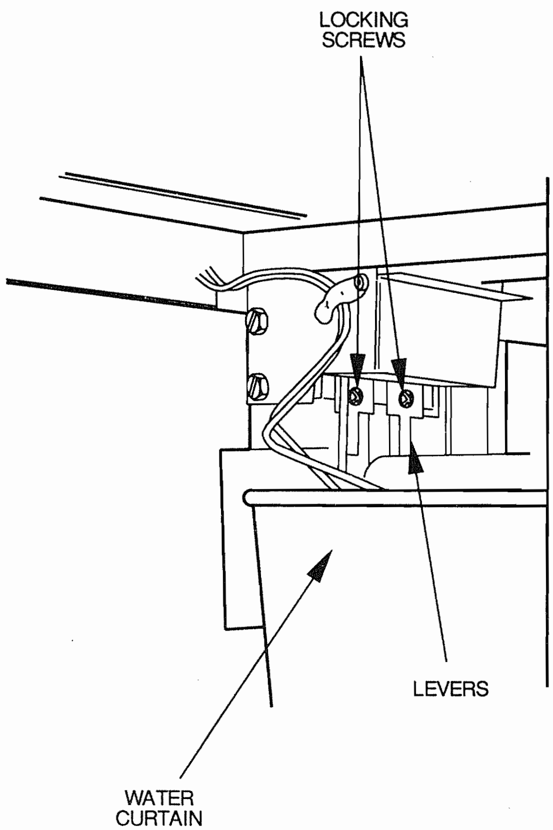


FIGURE 3. BIN SWITCH CHECK

Bin Switch Replacement

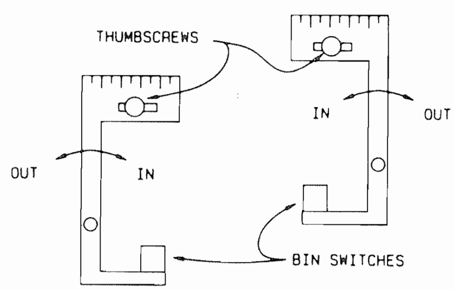
If the bin switch does not operate properly after adjustment, check bin switch with Ohmmeter and/or voltmeter while depressing and releasing bin switch. If bin switch does not open and close properly, replace switch.

BIN SWITCH OPERATION E1100 SERIES

The ice maker should only operate when bottoms of water curtains are inside water trough ensuring all recirculating water will be retained. Check by operating ice machine in the freezing mode. Pull curtains away from evaporators stopping the ice machine. Slowly return curtains to their normal positions. The ice machine should start only after curtains have passed over water trough.

ADJUSTMENT PROCEDURE

1. Disconnect all electrical supplies to ice machine (on water-cooled units, the high pressure reset control must be closed).
2. Connect battery operated test light (or ohmmeter) to terminal #12 on board with #3 relay and to terminal #35 of small terminal board.
3. Loosen thumbscrew on rear switch bracket, move bracket inward until light comes on. Note graduation mark at thumbscrew. Move bracket inward 1-1/2 to 2 graduations and tighten thumbscrew. (Use threaded hole which best accommodates bracket position.)
4. Adjust front switch in identical manner except move test light lead from terminal #12 to terminal #3 of sensor transformer board.



ICE THICKNESS PROBE

Function

Maintain correct ice thickness.

Check Procedure

Verify that wire connections are clean and tight. Inspect bridge connecting the cubes. The ice thickness probe is factory set to maintain 1/8-inch ice thickness. If adjustment is necessary, proceed as follows:

1. Turn adjustment screw (Figure 4) on ice thickness probe clockwise to increase ice thickness, counterclockwise to decrease ice thickness.

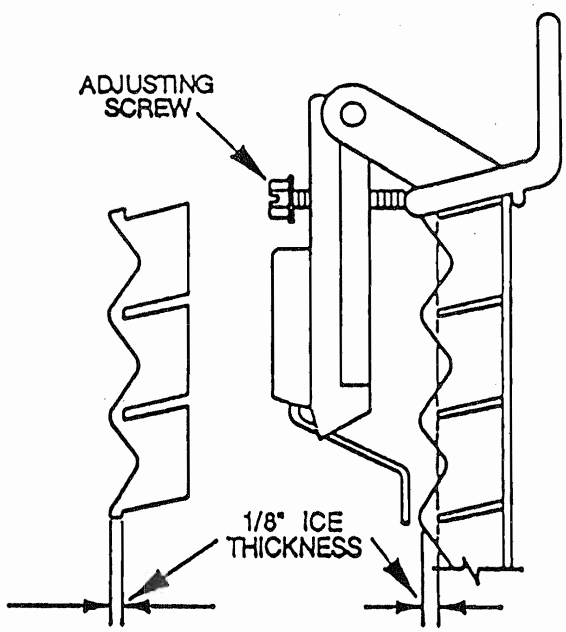


FIGURE 4. ICE THICKNESS CHECK

> **NOTE**
>
> Do not turn more than 1/4 turn at a time. Check ice at least two harvest cycles after initial adjustment before adjusting again (if necessary).

2. Ensure ice thickness probe wires and bracket do not restrict movement of probe.

3. If probe does not maintain correct ice thickness, refer to diagnosing Electronic Control Circuitry.

HEADMASTER CONTROL VALVE FAILURE CHART

Possible Problem	Probable Cause	Corrective Measures
Valve not maintaining pressures	Non-approved valve	Install O.E.M. Headmaster Control valve
A. Discharge pressure extremely high B. Liquid line entering receiver feels hot	Valve stuck in bypass	Replace valve
A. Discharge pressure low B. Liquid line entering receiver extremely cold	Valve not bypassing	Replace valve
A. Discharge pressure low B. Liquid line entering receiver is warm-to-hot	Ice machine low on charge	Refer to determining if low on charge procedures listed on Page 11

HEADMASTER CONTROL VALVE (Remote Machines)

Manitowoc remote systems require headmaster control valves with special settings. Replace defective headmaster control valves **only** with "original" Manitowoc replacement parts.

OPERATION

The R-12 headmaster control valve has a non-adjustable setting of 125 psig (± 5), while the R502 valve is set for 185 psig (± 10). At ambient temperatures of 70°F or above, refrigerant flows through the valve from the condenser to the receiver inlet. At temperatures below 70°F, the head pressure control dome's nitrogen charge closes the condenser port and opens the bypass port from the compressor discharge line. In this modulating mode, the valve maintains minimum head pressure by building up liquid in the condenser and bypassing discharge gas directly to the receiver.

DIAGNOSING HEADMASTER VALVE

1. Determine air temperature entering remote condenser.
2. Determine if head pressure is high or low in relationship to outside temperature (refer to a Operation Pressure Chart for the model of ice machine you are working on). If air temperature is below approximately 70°F, the head pressure should be modulating around 185 psig (R502) and 125 psig (R12).
3. Determine the temperature of the liquid line entering the receiver by feeling with hand. This line is normally "body" temperature (warm).
4. Using the symptoms gathered in Steps 3 and 4, refer to Failure Chart on Page 9.

NOTE

An ice machine with a failed headmaster that will not bypass will function properly with condenser air temperatures of approximately 70°F or above. When temperature drops below approximately 70°F, the headmaster fails to bypass and the ice machine malfunctions.

Use the following procedure if you suspect the ice machine is low on charge:

1. Add refrigerant in 2 lb. increments, but do not exceed 6 lbs.
2. If the ice machine was low on charge, the headmaster function and discharge pressure will return to normal after the charge is added. Do not leave the ice machine run; to assure operation in all ambient conditions, the ice machine must be evacuated and recharged with proper nameplate charge.
3. If the ice machine does not start to operate properly after adding charge, replace the headmaster.

FAN CYCLE CONTROL
(Self-Contained Air-Cooled Models)

Function

Cycles fan motor on and off to maintain proper operating discharge pressure.

The fan cycle control is normally closed and opens on a drop in discharge pressure.

R-12

Specifications
Cut-out — 100 P.S.I.G.
Cut-in — 140 P.S.I.G.

R-502

Specifications
Cut-out — 175 P.S.I.G.
Cut-in — 225 P.S.I.G.

Check Procedures

1. Verify fan motor windings are not open or grounded and fan spins freely.
2. Connect manifold gauges to ice machine.
3. Hook voltmeter in parallel (across) to the fan cycle control, leaving wires attached.
4. Pressure above listed specification — read 0 volts and fan should be running.

   Pressure below listed specification — read line voltage and fan should be off.

HARVEST PRESSURE LIMITER CONTROL

Function

1. Safety control which cycles the ice machine out of a harvest cycle and returns it to a freeze cycle if suction pressure becomes excessive.

2. The H.P.L. safety control is normally closed and *opens* on a rise in *suction* pressure.

SPECIFICATIONS

	E400	E1100	G400	G600 G800	G1200 G1700
CUT-OUT	85 ± 5	80 ± 5	120 ± 5	110 ± 5	
CUT-IN	50 ± 5	40 ± 5	85 ± 5	85 ± 7	

Pressures listed P.S.I.G.

Check Procedure

1. Connect a voltmeter in parallel (across) the H.P.L. safety control.

2. Connect manifold gauges.

3. Set toggle switch to OFF position.

4. Pressures:
   a. When suction pressure rises above listed specification, the H.P.L. safety control must open. The voltmeter must read "line voltage".

   b. When the suction pressure drops below listed specification, the H.P.L. safety control must close. The voltmeter must read "0" volts.

> **NOTE**
>
> The ice machine will not cycle from freeze mode to harvest mode when the H.P.L. safety control is open.

5. Replace the H.P.L. safety control if it does not open or close properly or does not maintain proper settings.

LOW PRESSURE CUT-OUT CONTROL (Remote Machines)

Function

A drop in suction pressure opens the low pressure cut-out control.

E1100, G600, G800, G1200, G1700

Energizes and de-energizes the contactor to start and stop the ice machine.

E400

Starts and stops the compressor and remote condenser fan motor.

G400

Energizes and de-energizes the compressor relay to start and stop the ice machine.

R-12

Specifications

Cut-out – 2 P.S.I.G. ± 5.
Cut-in – 27 P.S.I.G. ± 5.

R-502

Specifications

Cut-out – 15 P.S.I.G. ± 3.
Cut-in – 40 P.S.I.G. ± 3.

Check Procedure

1. Connect manifold gauges.
2. Connect a voltmeter in parallel (across) wires leaving the cut-out control.
3. Set toggle switch to OFF position.
4. The liquid line solenoid valve will de-energize and the suction pressure will begin to decrease. The low pressure cut-out control will open at listed specification. The voltage across the L.P. cut-out control will be "line voltage".
5. Set toggle switch to ICE position. The liquid line solenoid valve will energize and the suction pressure will rise. The low pressure cut-out control will close at listed specification and the compressor and remote fan motor will start.
6. Voltage across the low pressure cut-out must be "0" volts with the compressor running.
7. Replace the low pressure cut-out control if it does not open and close properly or does not maintain proper settings.

HIGH PRESSURE CUT-OUT CONTROL – H.P.C.O.

Function

Safety control which turns the ice machine off if subjected to excessive high-side pressure. The H.P.C.O. control is a normally closed control and opens on a rise in pressure.

R-12

Specifications
Cut-out – 275 P.S.I.G. ± 5.
Cut-in – manual reset
(below 175 P.S.I.G. to reset).

R-502

Specifications
Cut-out – 440 P.S.I.G. ± 10.
Cut-in – manual reset
(below 300 P.S.I.G. to reset).

Check Procedure

1. Set ICE/OFF/WATER PUMP switch at OFF and reset H.P.C.O. (if tripped).
2. Hook voltmeter in parallel (across) to the H.P.C.O. leaving wires attached.
3. Connect manifold gauges.
4. Procedures:
   a. Water-Cooled Machines – Close the water service valve to the water condenser inlet. See Typical Installation illustration.
   b. Remote Machines – Disconnect fan motor.
5. Set ICE/OFF/WATER PUMP switch to ICE.

   No water or air flowing through the condenser will cause the H.P.C.O. control to turn the ice machine off because of excessive high pressure. Watch the high-pressure gauge and record the pressure at which the cut-out takes place.

Replace the H.P.C.O. control if:

1. The control will not reset.

> **NOTE**
>
> High-side pressure must be below listed specifications before resetting.

2. The control does not open at the specified cut-out point.

INSTALLATION: WIRING CONNECTIONS

The installation of an ice machine requires proper electrical connections to operate internal components properly. The following shows only proper wiring connections. Instructions supplied with the ice machine always take precedent over these instructions.

These diagrams **are not** intended to show wire routing, wiring sizing, disconnects, etc. All electrical connections and routing must conform to local and national electric codes.

A separate power supply is not needed for remote condenser fan operation. The remote condenser is normally wired through the ice machine circuitry. An approved dual unit condenser is wired separately – continuous run.

All electrical connections must conform to local and national codes.

DIAGRAM	1	208-230 Volt 1 ph 60 HZ self-contained
	2	208-230 Volt 3 ph 60 HZ self-contained
	3	208-230 Volt 1 ph 60 HZ remote
	4	208-230 Volt 3 ph 60 HZ remote
	5	208-230 Volt 1 and 3 ph 60 HZ remote with 115V dual condenser

DIAGRAM 1
208-230 Volt 1 pH 60 HZ Self-Contained

This diagram not intended to show proper wire routing, wire sizing, disconnects, etc. **only** the proper wire connections.

All electrical connections and routing must conform to local and national codes.

NOTE

L2 connection on 115V is N.

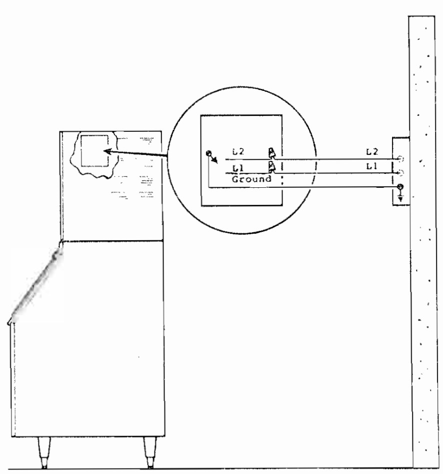


DIAGRAM 2
208-230 Volt 3 pH 60 HZ Self-Contained

This diagram not intended to show proper wire routing, wire sizing, disconnects, etc. **only** the proper wire connections.

All electrical connections and routing must conform to local and national codes.

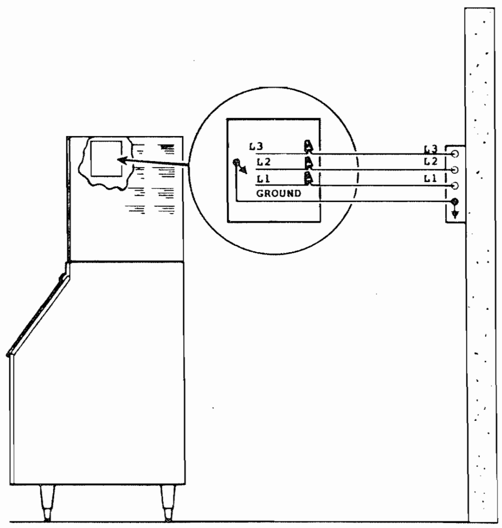


DIAGRAM 3
208-230 Volt 1 pH 60 HZ Remote

This diagram not intended to show proper wire routing, wire sizing, disconnects, etc. **only** the proper wire connections.

All electrical connections and routing must conform to local and national codes.

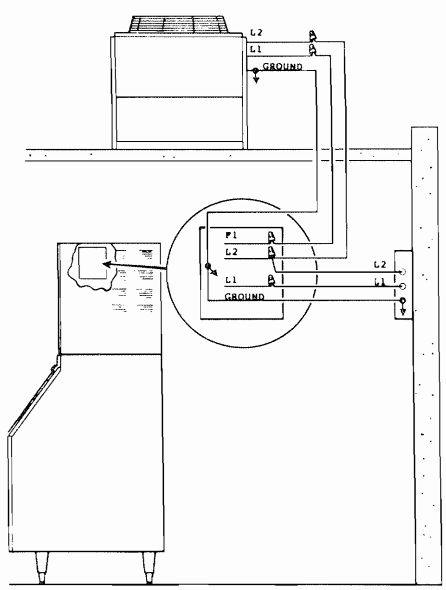


DIAGRAM 4
208-230 Volt 3 pH 60 HZ Remote

This diagram not intended to show proper wire routing, wire sizing, disconnects, etc. **only** the proper wire connections.

All electrical connections and routing must conform to local and national codes.

> **NOTE**
> L2 from the condenser must connect to L3 at the ice machine on 3 ph remote installations.

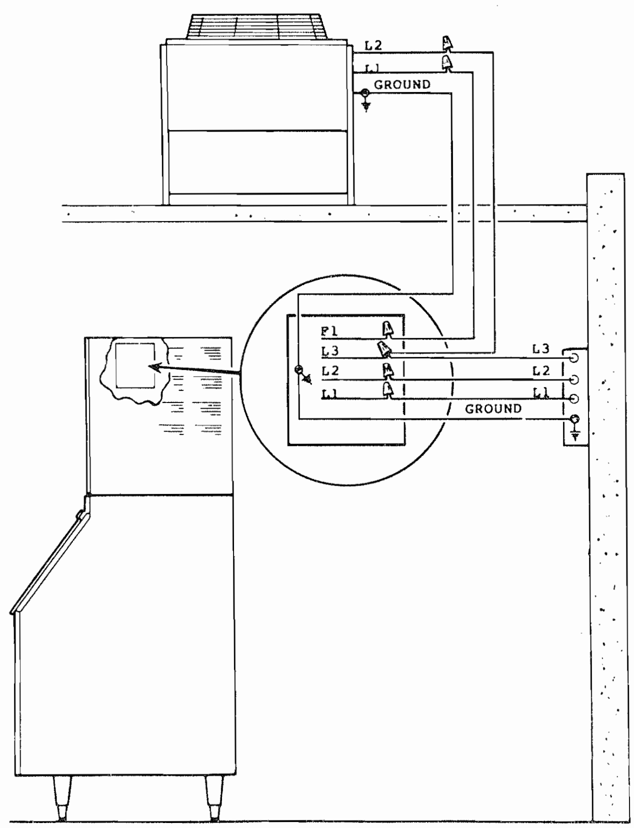
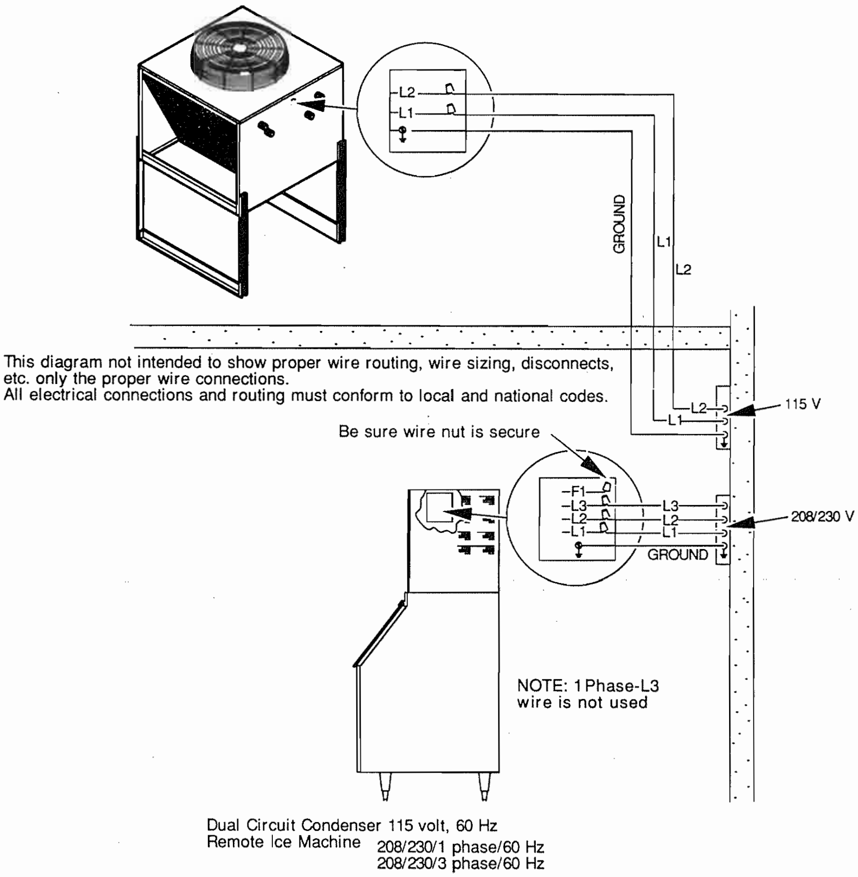


DIAGRAM 5
208-230 Volt 1 and 3 pH 60 HZ Remote
(With 115V Dual Condenser)

Motor: 2.8 amps. Electrical power for the dual-circuit remote condenser must be supplied from a separate electrical power source, not from the ice machine.



SPECIFICATIONS: REMOTE REFRIGERATION LINE SETS

Precharged Line Sets
The use of precharged refrigeration line sets is recommended. The benefits are prevention of air, moisture, and other contaminants being introduced into the refrigeration system at time of installation. Precharged line sets also eliminate the cost of recharging the system.

Lengthening or Reducing Line Set Lengths
To prevent loss of refrigerant in the ice machine or condenser, do the following prior to connecting lines: The quick connect fittings on the line sets are equipped with Schrader valves ... use these to remove vapor charge from the line set. Lengthen or shorten the lines while applying good refrigeration practices and insulate new tubing. Do not change the tube sizes. Evacuate the lines and place a vapor charge of approximately 5 oz. in each line. Leak check all joints and then proceed with connection to the ice maker and condenser.

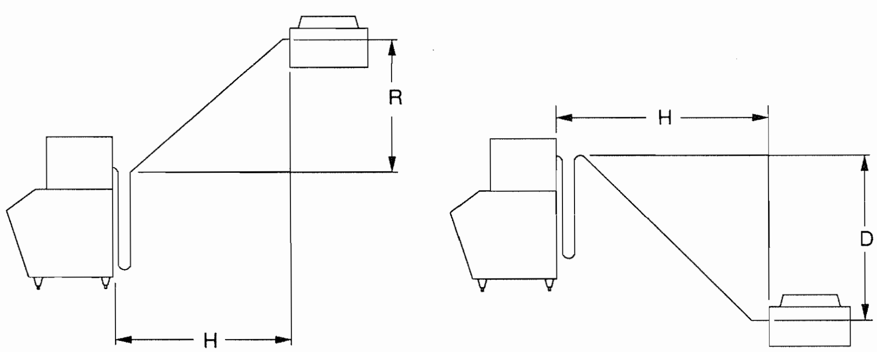
Field Constructed Line Sets
Refrigerant lines constructed in the field are made with refrigeration grade (hard or soft) copper tubing only. Both discharge and liquid lines are to be insulated. The use of quick connect fittings is recommended and stub kits are available through the Manitowoc Parts Department. The line set, when completed, is then evacuated and a vapor holding charge of approximately 5 oz. of the proper refrigerant is added to each line. Leak check all joints and then proceed with connections to the ice maker and condenser.

Line Set Sizing Chart		
Series Ice Machine	Discharge	Liquid
All E Series, G400, G600, G800	1/2"	3/8"
G1200, G1700	5/8"	3/8"

Routing of Line Sets
The following practices must be followed when routing refrigerant lines to insure the proper performance and service accessibility to the ice machine.

1. Make service loop in line sets as shown, permitting easy access to ice machine for cleaning and service. Hard draw copper should not be used at this location. If ice maker is moved frequently, use flexible line sections. Flexible line sections are available through Manitowoc's Parts Department.
2. This section of lines should always slope upward toward the condenser or downward when condenser is below ice maker. Never form a trap in the discharge line, refrigerant should always be free to drain toward the ice maker or condenser. The trap formed by the service loop is part of the ice maker's design.
3. Refrigerant lines located outdoors should be kept as short as possible. Also form tubes to prevent discharge line traps.

Select the proper length precharged line set. Excessive tubing must be cut out of the system. Do not coil up excess tubing!



CAUTION
Never form traps!

REMOTE CONDENSER MAXIMUM LOCATION DISTANCES

General
Remote condenser installations consist of vertical and horizontal line set distances to the condenser that, when combined, must fit within approved guidelines. These guidelines, drawings and calculation methods must be followed to verify a proper remote condenser installation.

Physical Line Set Length: 100 Ft. Maximum.
The ice machine compressor must have proper oil return. The receiver capacity is only designed to hold the nameplate charge. This is sufficient to operate the ice machine in ambient temperatures of -20°F to +120°F with line set lengths up to 100 ft.

Line Set Rise: 35 ft. Maximum
Line Set Drop: 15 ft. Maximum

A line set rise, drop, or horizontal distance greater than the maximun allowed exceeds the compressor start-up and pumping design limits and also results in poor oil return to the compressor.

Calculated Line Set Distance: 150 Ft. Maximum.
To eliminate the combination of rises, drops, and horizontal runs exceeding the compressor start-up and pumping limits, one of the following calculations must be made:

1. Rise(s) With Horizontal Run
   Multiply rise (R) by 1.7, add horizontal (H) distance. Do not exceed 150 ft. maximum calculated distance.

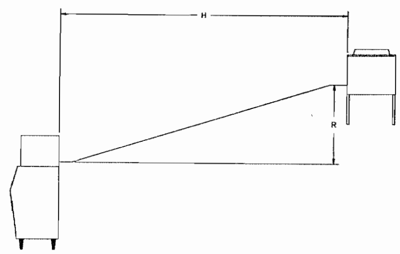
2. Drop(s) With Horizontal Run
   Multiply drop (D) by 6.6, add horizontal (H) distance. Do not exeed 150 ft. maximum calculated distance.
3. Rise and Drop With Horizontal Run
   (Multiply rise (R) by 1.7) add
   (Multiply drop (D) by 6.6) add
   horizontal (H) distance. Do not exceed 150 ft. maximum calculated distance.

IMPORTANT
After a rise is followed by a drop, another rise cannot occur
- OR -
After a drop is followed by a rise, another drop cannot occur

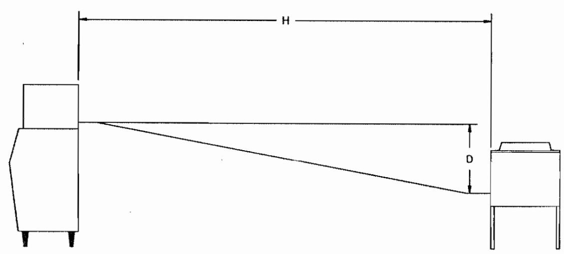
Warranty Note
The sixty (60) month compressor warranty, including the thirty-six (36) month labor replacement warranty, shall not apply when the remote ice machine is not installed within the remote specifications, or the refrigeration system is modified with a condenser, heat reclaim device, or parts and assemblies other than those manufactured by Manitowoc Ice, Inc., unless Manitowoc Ice, Inc. approves these modifications for specific locations in writing. The foregoing warranty shall not apply to any ice machine that has been installed and/or maintained inconsistent with the technical instructions provided by Manitowoc Ice, Inc.

CALCULATING MAXIMUM LINE SET DISTANCES

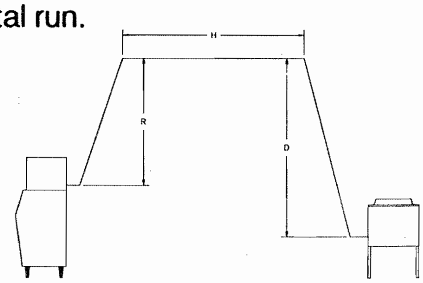
1. Rise(s) with horizontal runs.



2. Drop(s) with horizontal runs.



3. Rise and Drop with horizontal run.



Rise (35 ft.) ______ x 1.7 = ______

Drop (15 ft.) ______ x 6.6 = ______

Horizontal (100 ft.) = ______

Calculated Total (150 ft.) = ______

Numbers in parentheses are maximum distances.
R (rise), H (horizontal), and D (drop) are measured in feet.

ICE MACHINE HEAT REJECTION

Ice machines, like other refrigeration equipment, reject heat through the condenser. It is helpful to know the amount of heat rejected to accurately size air conditioning equipment when self-contained air-cooled ice machines are installed in air conditioned environments. **This heat rejection information is also necessary to evaluate the benefits of using water-cooled or remote condensers to reduce air conditioning loads.** The amount of heat added to an air conditioned environment by an ice machine using a water-cooled or remote condenser is negligible. Knowing the amount of heat rejected is also important when sizing a cooling tower for a water-cooled condenser unit.

	Heat Rejected (BTU's/Hr)	
Model Series	**Air Conditioning**	**Peak**
A100	2,500	3,100
E400	6,800	9,400
E1100	18,000	27,000
E/H200	4,300	5,500
G150	3,800	4,700
G200	4,500	5,700
G400	7,000	9,600
G600	10,400	14,400
G800	13,200	20,700
G1200	20,000	31,700
G1700*	25,000	40,500

*Self-contained air-cooled is not available.

Water-Cooled Models (Cooling Tower Applications)

A water-cooling tower installation does not require modification to the ice machine; the water regulator valve for the condenser continues to control the refrigeration discharge pressure. It is necessary to know the amount of heat rejection and the pressure drop through the condenser and water valve (inlet and outlet of the ice machine) to apply these types of systems to the ice machine.

- Water entering the condenser must not exceed 90°F.
- Water flow through the condenser must not exceed 5 GPM.
- Allow for a pressure drop of 7 psi between the condenser water inlet and outlet of the ice machine.
- Condenser water exiting temperature must not exceed 110°F.

REFRIGERANT CHARGE

Important: Refer to machine serial tag to verify system charge.

A-100 Series			
Air-Cooled		10 oz.	R-12
Water-Cooled		8 oz.	R-12
A-200 Series			
Air-Cooled		21 oz.	R-12
Water-Cooled		10 oz.	R-12
A-400 Series			
Air-Cooled		28 oz.	R-12
Water-Cooled		15 oz.	R-12
A-600 Series			
Air-Cooled		42 oz.	R-12
Water-Cooled		41 oz.	R-12
A-1100 Series			
Air-Cooled		65 oz.	R-12
Water-Cooled		45 oz.	R-12
Remote Air		16 lb.	R-12
A-2200 Series			
Air-Cooled		65 oz.	R-12
Water-Cooled		45 oz.	R-12
Remote Air		16 lb.	R-12
C-200 Series			
Air-Cooled		22 oz.	R-12
Water-Cooled		9 oz.	R-12
C-400 Series			
Air-Cooled		22 oz.	R-12
Water-Cooled		15 oz.	R-12
C-600 Series			
Air-Cooled		42 oz.	R-12
Water-Cooled		30 oz.	R-12
Remote Air		16 lb.	R-12
C-1100 Series			
Air-Cooled		65 oz.[3]	R-12
Water-Cooled	55 oz.[2]	45 oz.[3]	R-12
Remote Air		16 lb.	R-12
E-200 Series			
Air-cooled	24 oz.[4]	22 oz.[5]	R-12
Water-Cooled	16 oz.[4]	9 oz.[5]	R-12
E-400 Series			
Air-Cooled		22 oz.	R-12
Water-Cooled		15 oz.	R-12
Remote Air[1]		16 lb.	R-12

E-600 Series			
Air-Cooled		32 oz.	R-12
Water-Cooled		32 oz.	R-12
Remote Air		16 lb.	R-12
E-1100 Series			
Air-Cooled	55 oz.[2]	48 oz.[3]	R-12
Water-Cooled	50 oz.[2]	38 oz.[3]	R-12
Remote Air[1]		16 lb.	R-12
G150 Series			
Air-Cooled		13 oz.	R-502
Water-Cooled		8 oz.	R-502
G-200 Series			
Air-Cooled		20 oz.	R-502
Water-Cooled		12 oz.	R-502
G-400 Series			
Air-Cooled		22 oz.	R-502
Water-Cooled		24 oz.	R-502
Remote Air		16 lb.	R-502
G-600 Series			
Air-Cooled	34 oz.[2]	34 oz.[3]	R-502
Water-Cooled	30 oz.[2]	28 oz.[3]	R-502
Remote Air[1]		16 lb.	R-502
G-800 Series			
Air-Cooled	46 oz.[2]	42 oz.[3]	R-502
Water-Cooled	38 oz.[2]	38 oz.[3]	R-502
Remote Air[1]		16 lb.	R-502
G-1200 Series			
Air-Cooled		56 oz.	R-502
Water-Cooled		38 oz.	R-502
Remote Air[1]		18 lb.	R-502
G-1700 Series			
Water-Cooled	62 oz.[2]	50 oz.[3]	R-502
Remote Air[1]		22 lb.	R-502
H-200 Series			
Air-Cooled		24 oz.	R-12
Water-Cooled		18 oz.	R-12

[1] Remote air charge is total charge including lines and Manitowoc Condenser.
[2] With accumulator.
[3] Without accumulator.
[4] 1/2HP Compressor
[5] 1/3HP Compressor

NOTES

INTERIOR CLEANING

For efficient operation, clean and sanitize ice machine every six months.

> **IMPORTANT**
>
> Do not use hot water. If ice machine requires cleaning and sanitizing more frequently, consult a qualified service company to test the water quality and recommend appropriate water treatment.

Before cleaning, check water dump valve for proper operation. Deposits may accumulate in the valve causing leakage or restriction of water flow.

Removal of Parts for Cleaning

1. Loosen two screws holding front panel in place and remove front panel.
2. Set ICE/OFF/WATER PUMP switch at OFF after ice falls from evaporator at completion of Harvest cycle, or set switch at off and allow ice to melt off evaporator.

> **CAUTION**
>
> Never use any type of object to force ice from evaporator as damage may result.

3. Turn off water to the ice machine at water service valve.

> **WARNING**
>
> Disconnect electric power to ice machine at the electric switch box before proceeding.

4. Stacked ice machines:
   a. Remove top panel.
   b. Lift ice chute up and out of ice machine.
5. Remove all ice from bin.
6. Remove water curtain.
7. Remove drain plug from water trough and allow water to drain into bin.

Remove Water Pump (Figure 5)

1. Disconnect water pump power cord.

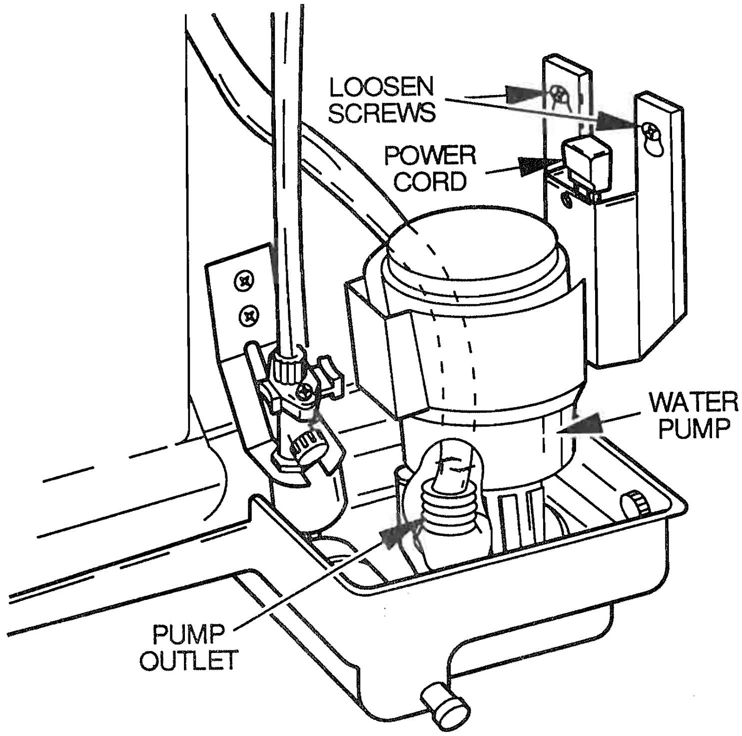


FIGURE 5. WATER PUMP REMOVAL (G200 MODELS SHOWN)

2. Disconnect hose or tee from pump outlet.
3. Loosen two screws holding pump mounting bracket to bulkhead.
4. Lift pump and bracket assembly off screws.

Remove Float Valve (Figure 6)

1. Turn valve splash shield clockwise a full turn or two, then pull the valve forward off the mounting bracket.
2. Disconnect the water inlet tube from the float valve at the compression fitting.
3. Remove filter screen and cap.

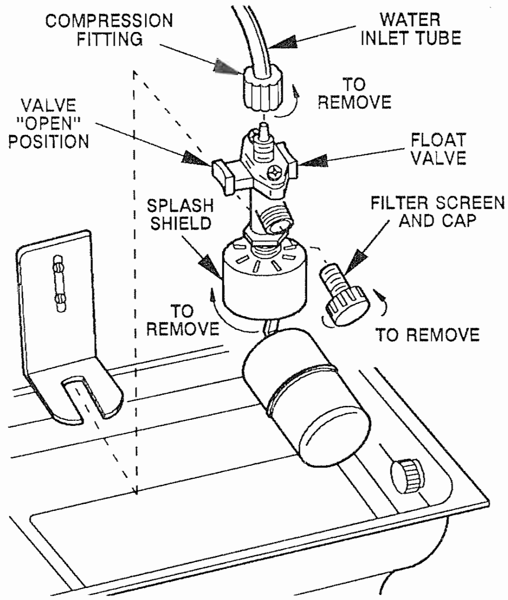


FIGURE 6. FLOAT VALVE REMOVAL

Remove Distribution Tube (Figure 7)

1. Remove distribution tube from the two spring clips holding it in place.
2. Disconnect the hose from the distribution tube and from the "T".

> **NOTE**
>
> To reinstall distribution tube, align locating pin on top extrusion with hole in distribution tube.

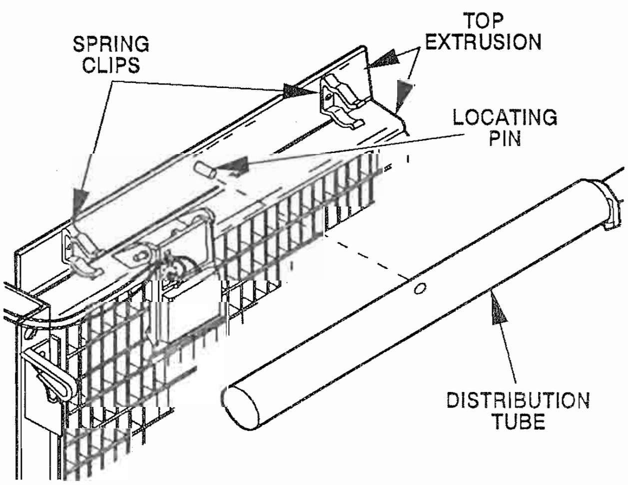


FIGURE 7. DISTRIBUTION TUBE REMOVAL

Disassemble Distribution Tube (Figure 8)

> **NOTE**
>
> Disassembly of the distribution tube is not usually necessary as normal cleaning of the ice machine will clean the tube. The distribution tube should only be disassembled if, after normal cleaning procedures, there is inadequate water flow from the distribution tube. (Ensure that any other water problems are eliminated beforehand.)

1. Heat rubber end plugs on distribution tube in warm water to soften them.
2. Remove end plugs and inner distribution tube.
3. Reheat rubber plugs in warm water after cleaning is complete and reassemble distribution tube.

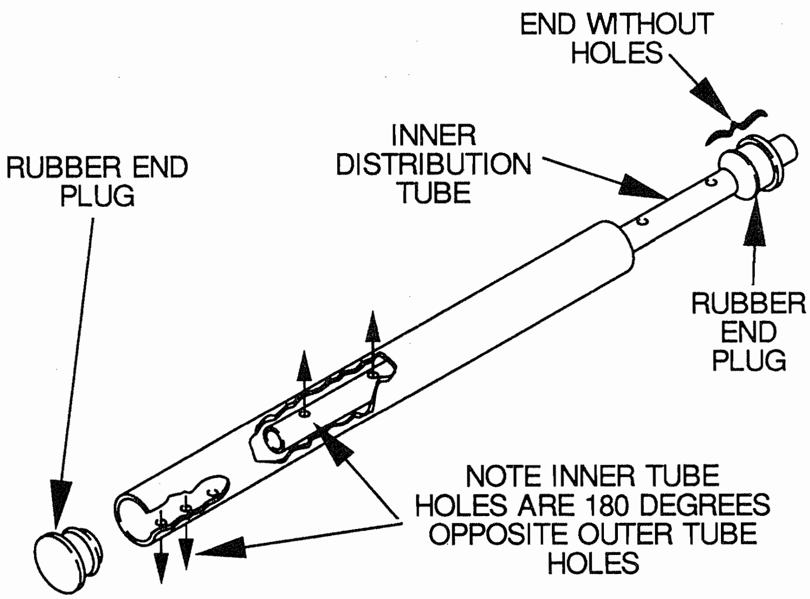


FIGURE 8. DISTRIBUTION TUBE DISASSEMBLY

> **NOTE**
>
> Position the holes in the inner and outer tubes 180° opposite each other when reassembling. The end of the inner distribution tube without holes must extend from the outer tube when reassembled to allow for attachment of the water line from the pump.

Remove Ice Thickness Probe (Figure 9)

> **WARNING**
>
> Disconnect electric power to ice machine at the electric service switch box before proceeding.

1. Disconnect wire leads from inside electrical control box.
2. Compress side of probe at top near hinge pin and disengage it from the bracket.

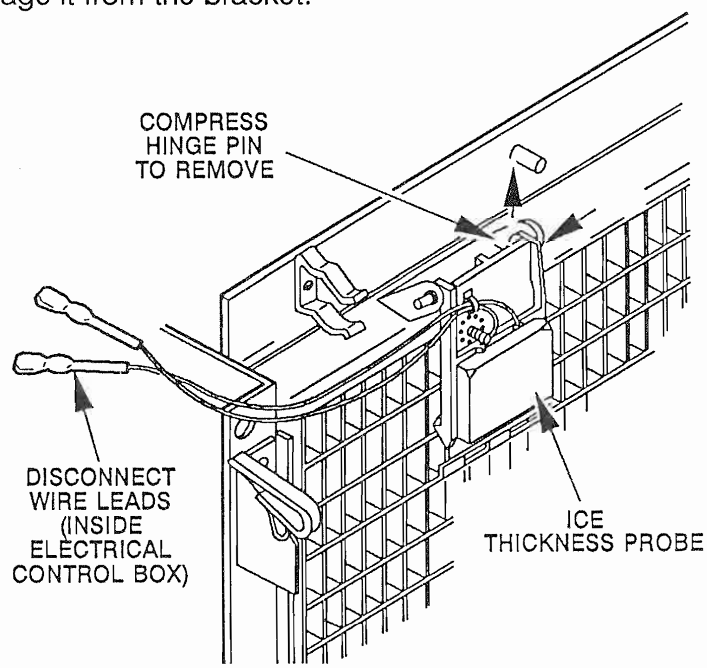


FIGURE 9. ICE THICKNESS PROBE REMOVAL

Remove Water Trough (Figure 10)

1. Remove thumb screws. Support trough while removing thumb screws.
2. Lower right side of trough into bin while disengaging left side of trough from holding pegs and remove trough from ice machine.

> **NOTE**
>
> Stacked ice machines: Remove trough from top ice machine by lifting up on front right side of trough, then pull out to disengage trough from pegs on left side of cabinet.

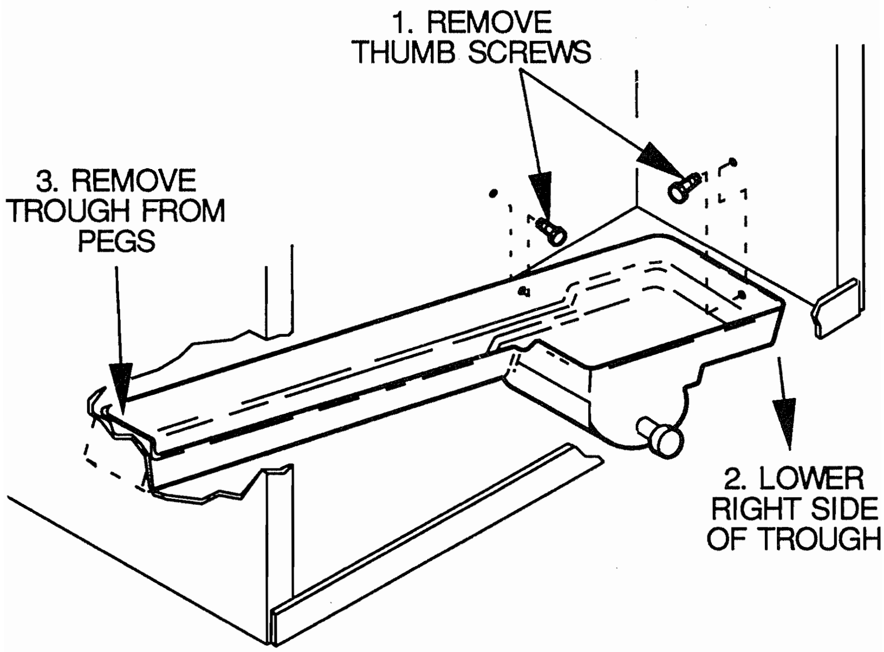


FIGURE 10. WATER TROUGH REMOVAL (G200 MODELS SHOWN)

Cleaning Procedures

Ice Machine Cleaner is for removal of lime scale or other mineral deposits. It is not used for removal of algae or slime. Refer to Sanitizing for removal of algae and slime.

CAUTION

Use only Manitowoc Ice Machine Cleaner, Part No. 94-0546-3, in recommended concentration as this is compatible with materials used in the manufacture of Manitowoc Ice Machines.

1. Soak parts in a solution of no more than 16 ounces of cleaner to one gallon of warm water. Use a brush **(DO NOT USE A WIRE BRUSH)** or a sponge to clean the parts, taking care not to damage them.

CAUTION

Do not immerse the water pump motor in the cleaning solution. Also, use care when cleaning the ice bridge thickness probe so as not to move the adjustment screw.

2. Use the cleaning solution and a brush or sponge to remove scale build-up from the top, sides and bottom extrusions, the inside of the ice machine panels, and the entire inside of the ice bin.

   A dirty top extrusion, Figure 7, could result in uneven water flow over the evaporator. Ensure all scale and dirt are removed.

3. Thoroughly rinse with clean water all parts and surfaces washed with the cleaning solution.

> **NOTE**
> Incomplete rinsing of the ice bridge thickness probe could leave residue which could cause the ice machine to go into premature harvest. For best results, brush or wipe off while rinsing and then wipe dry.

4. Reinstall all parts removed for cleaning except front panel and top chute (if stacked).

Clean the Evaporator Surface

> **NOTE**
> Failure to clean other parts prior to evaporator may result in poor cleaning of the evaporator surface.

1. Turn on water to ice machine at water service valve and ensure float valve is open, Figure 6.
2. Allow trough to fill to proper operating level.
3. Set ICE/OFF/WATER PUMP switch at WATER PUMP.
4. Add cleaner to water trough and allow solution to circulate a maximum of 10 minutes.

AMOUNT OF CLEANER	SERIES
2 oz.	100, 150, 200, 400, 600
3 oz.	800
4 oz.	1100, 1200, 1700

> **NOTE**
> Use a soft brush on excessively dirty evaporator to help remove deposits. Ensure connecting holes in back corners of cube molds are open.

5. Set ICE/OFF/WATER PUMP switch at OFF.
6. Shut off water at float valve. See Figure 6.
7. Drain water trough by removing drain plug.
8. Thoroughly rinse trough with clean water, then reinstall drain plug.
9. Turn on water at float valve.
10. Set ICE/OFF/WATER PUMP switch at WATER PUMP and allow water trough to fill to proper operating level.
11. Sanitize ice machine after cleaning.
12. Perform Operational Checks.

SANITIZING

Sanitizer is used for removal of algae and slime, AND AFTER USE OF MANITOWOC ICE MACHINE CLEANER. It is not used for removal of lime scale or other mineral deposits.

1. Loosen two screws holding front panel in place and remove front panel.
2. Set ICE/OFF/WATER PUMP switch at OFF after ice falls from evaporator at completion of Harvest cycle or set switch at OFF and allow ice to melt off evaporator.

CAUTION

Never use any type of object to force ice from evaporator as damage may result.

3. Stacked ice machines: Remove ice chute as described under Removal of Parts for Cleaning, step 4.
4. Remove water curtain.
5. Remove all ice from bin.
6. Set ICE/OFF/WATER PUMP switch at WATER PUMP.
7. Add one ounce of sanitizer to water trough and allow solution to circulate a minimum of one minute.
8. Drain solution from trough by removing drain plug.
9. Thoroughly rinse trough with clean water; then reinstall drain plug.

10. Wash all surfaces requiring sanitizing (ice machine and bin) with a solution of one ounce of sanitizer to up to four gallons of water.
11. Thoroughly rinse all sanitized surfaces with clean water.
12. Set ICE/OFF/WATER PUMP switch at ICE.
13. Perform Operational Checks. Discard first batch of ice.

CHECKING AND CLEANING THE WATER DUMP VALVE

> **NOTE**
> This covers the Alco plastic body water dump valve only.

Although cleaning the dump valve is considered maintenance, we recommend you use qualified maintenance personnel or service company to perform the following procedures.

Operation Check

1. Remove top and right side panel.
2. Set ICE/OFF/WATER PUMP switch at ICE.
3. Check clear plastic outlet drain hose of dump valve, Figure 11, for leakage while the ice machine is in the freeze mode.
4. If the dump valve is leaking, remove, disassemble and clean.

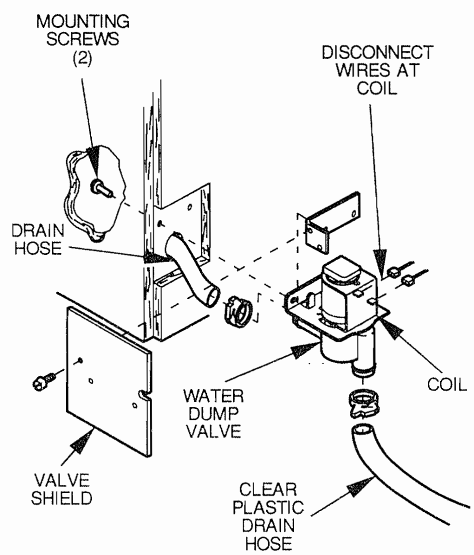


FIGURE 11. WATER DUMP VALVE REMOVAL

Remove Water Dump Valve (Figure 11)

> **WARNING**
> Disconnect electric power to the ice machine at the electric service switch box.

> **NOTE**
> Water dump valve can be cleaned without removing.

1. Drain water trough by removing drain plug.
2. Remove water dump valve shield from water dump valve mounting bracket.
3. Disconnect wires from dump valve coil.
4. Remove two screws securing dump valve and mounting bracket.
5. Remove tubing from dump valve by twisting off hose clamps.

Disassemble Water Dump Valve (Figure 12)

1. Lift cap and slide coil retainer cap from top of coil.

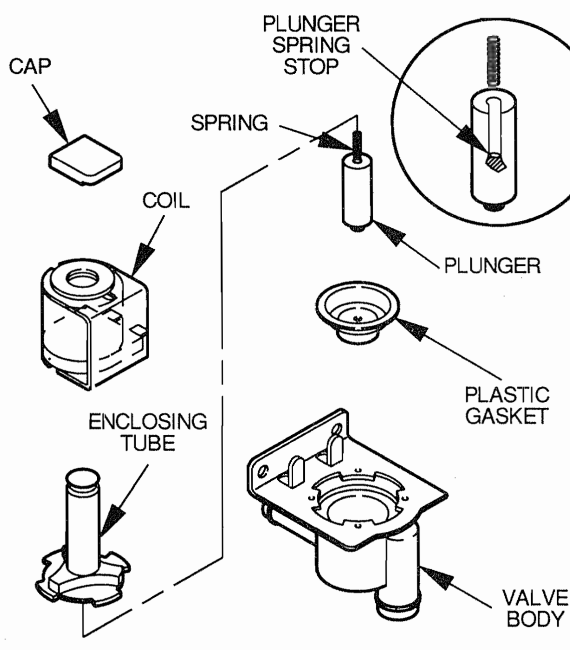


FIGURE 12. WATER DUMP VALVE DISASSEMBLY

2. Lift coil assembly off valve body. Note position of coil assembly on valve before removing. When reassembling valve, ensure coil is in same position.

3. Press down on plastic nut and rotate nut 1/4 turn and remove nut and enclosing tube from dump valve.
4. Remove enclosing tube, plunger and plastic gasket from valve body.

> **NOTE**
>
> It is not necessary to remove spring from plunger when cleaning. If spring is removed, insert *flared* end of spring into slotted opening in top of plunger until spring comes in contact with plunger spring stop. Use care not to stretch or damage spring in plunger when cleaning.

Cleaning Water Dump Valve

Replace excessively dirty or worn water dump valve components. Contact your Manitowoc Dealer.

1. Soak components in cleaning solution (refer to Cleaning Procedures). Remove heavy scale deposits with a stiff-bristle brush. Use a small bottle brush to clean inside the enclosure tube. Wipe off rubber gasket with soft cloth.

> **CAUTION**
>
> Do not soak coil assembly.

2. Thoroughly rinse components with clean water.
3. Thoroughly dry plunger and inside of enclosure tube.
4. Reassemble water dump valve and reinstall in ice machine.

WATER FILTRATION

Manitowoc recommends the use of water filtration on the water supply to the ice machine. Filtration reduces mineral build-up on the ice making surfaces of the ice machine which can slow the ice making process, reduce ice production, increase energy consumption and increase cleaning frequency. Filtration also improves ice quality. If the local water supply has high turbidity (dirty water), a prefilter is also recommended.

Consult your local dealer or distributor for information on Manitowoc's full line of Tri-Liminator filtration systems.

To ensure maximum filtration efficiency, replace the primary filter cartridge every six months. The filter gauge will indicate if replacement is necessary prior to six months usage (below 20 psig).

Tri-Liminator systems which include a prefilter should not require primary filter replacement prior to six months' usage. If replacement is indicated, first replace the prefilter.

Replacement Procedure (Figure 13)

1. Turn off water supply using the inlet shut-off valve.
2. Depress pressure release button to relieve pressure.
3. Unscrew housing from cap (see illustration).
4. Remove used cartridge from housing and discard.

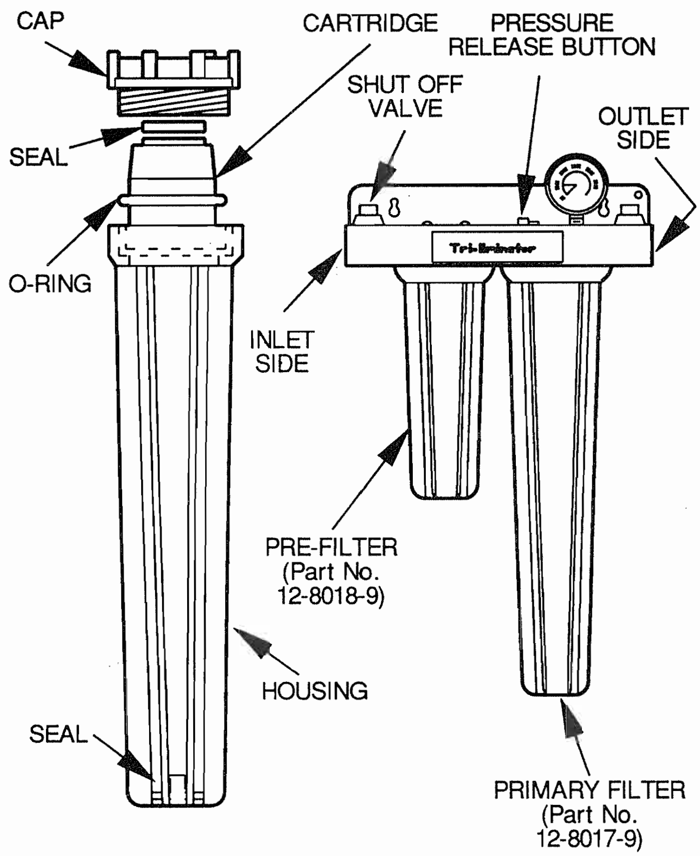


FIGURE 13. WATER FILTRATION

5. Remove O-ring from groove in the housing and wipe groove and O-ring clean. Relubricate O-ring with a coating of clean petroleum jelly (Vaseline). Place O-ring back in groove and, with two fingers, press it down into the groove.

NOTE

This is important to insure proper filter seal. Make sure O-ring is seated level in the groove.

6. Insert a new cartridge into the housing making sure that it slips down over the housing standpipe.
7. Screw the housing onto the cap and **hand tighten. Do not over-tighten or use spanner wrench.**
8. Repeat steps 3 through 7 for each filter housing.
9. Turn on the water supply to allow housing (and filter) to slowly fill with water.
10. Depress the pressure release button to release trapped air from housing. Check for leaks.

REMOVAL FROM SERVICE/WINTERIZATION

You must take special precautions if the ice machine is to be removed from service from extended periods or exposed to ambient temperatures at 32°F or below.

> **CAUTION**
>
> If water is allowed to remain in the machine in freezing, ambient temperatures, it could freeze, resulting in severe damage to some components. A failure of this nature is not covered by warranty.

Self-Contained Air-Cooled Machines

1. Disconnect electric power at circuit breaker or electric service switch.
2. Turn off water going to ice machine.
3. Remove drain plug from water trough.
4. Disconnect drain line and incoming ice making water line at rear of ice machine.
5. Blow compressed air in both incoming water opening and drain opening in rear of machine until water is no longer coming out of float valve and drain.
6. Ensure that no water is trapped in any of the machine's water lines, drain lines, distribution tubes, etc.
7. If machine is outside, cover machine to prevent exposure to elements.

Water-Cooled Machines

1. Perform all procedures listed under "Self-Contained Air-Cooled Machines".

2. Disconnect incoming water line and drain line from water-cooled condenser.
3. Pry open water regulating valve by inserting large standard screwdriver between bottom spring coils of valve. Pry spring upward to open valve, Figure 14.
4. Hold valve open and blow compressed air through condenser until no water remains.

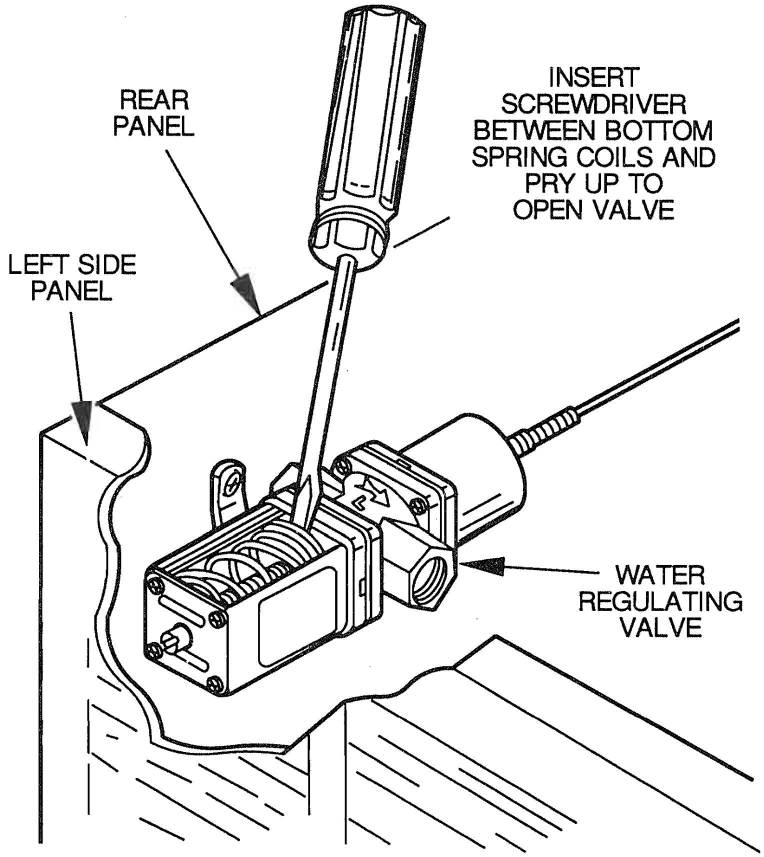


FIGURE 14. MANUALLY OPEN WATER REGULATING VALVE

Remote Machines

1. Frontseat receiver service valve, then pump down ice machine. (Hang a tag on toggle switch as a reminder to open receiver service valve on start-up.)
2. Perform all procedures listed under "Self-Contained Air-Cooled Machines".

> **NOTE**
>
> Before putting a remote machine back into operation after winterization, backseat the receiver service valve.

REFRIGERANT RECOVERY EVACUATION AND RECHARGING E and G MODEL ICE MACHINES

REMOVAL OF REFRIGERANT

Do not purge refrigerant to the atmosphere. Capture refrigerant using recovery equipment by following specific manufacturer's recommendations.

> **IMPORTANT**
>
> Manitowoc Ice, Inc. assumes no responsibility for the use of contaminated refrigerant. Damage resulting from the use of contaminated recycled refrigerant is solely the responsibility of the servicing company.

RECOVERY/EVACUATION AND CHARGING OF SELF-CONTAINED SYSTEMS

REFRIGERANT RECOVERY/EVACUATION

(Refer to illustration - SELF-CONTAINED EVACUATION CONNECTIONS)

> **IMPORTANT**
>
> Replace the liquid line drier before evacuating and recharging. Use only Manitowoc (O.E.M.) liquid line filter drier to prevent voiding warranty.

Refrigerant Recovery/Evacuation of self-contained equipment requires connections at 2 points as follows:

1. Suction side of compressor through suction service valve.
2. Discharge side of compressor through discharge service valve.

Procedures for Self-Contained Recovery/Evacuation

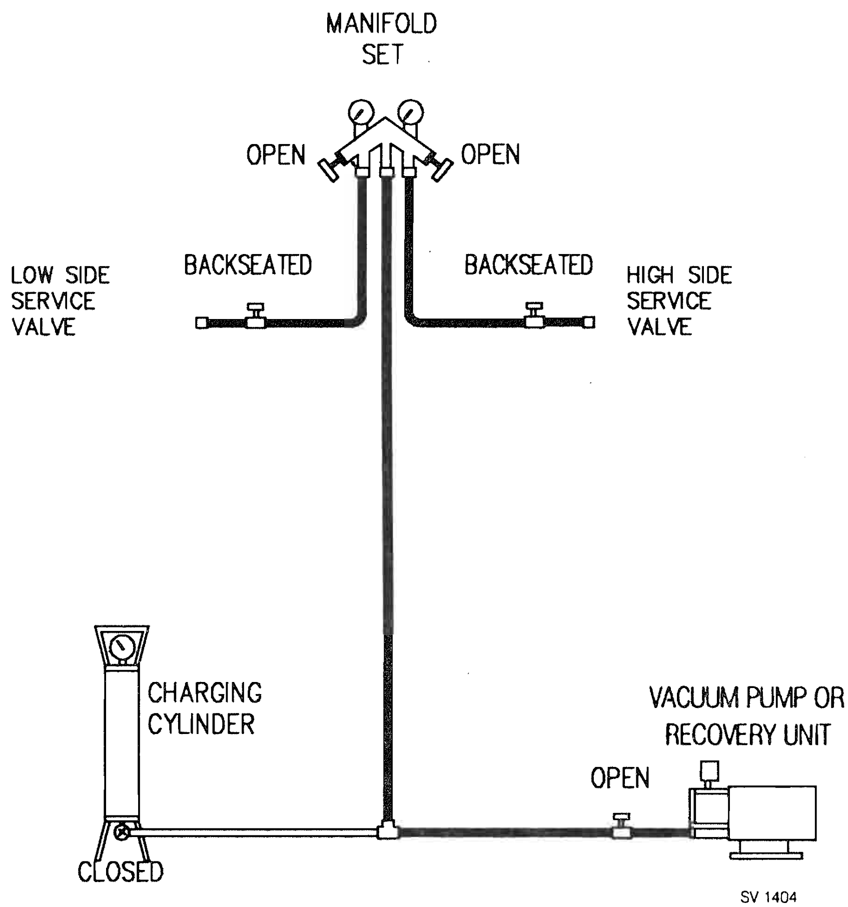
1. Place toggle switch to "OFF" position.
2. Install manifold gauges, charging cylinder/scale, and recovery unit or 2 stage vacuum pump per illustration.
3. Open (backseat) high and low side ice machine service valves, and open high and low side on manifold gauges.

4. Recovery: Operate recovery unit per manufacturer's instructions.

   Evacuation prior to recharging: Pull system down to 250 microns. Allow pump to run for 1/2 hour after reaching 250 microns. Turn off vacuum pump after 1/2 hour and ensure pressures do not rise. (Standing vacuum leak check).

> **NOTE**
>
> Recheck for leaks with a halide or electronic leak detector after charging ice machine.

5. Charge the ice machine per the Self-Contained Charging Procedures.



SELF-CONTAINED RECOVERY/EVACUATION CONNECTIONS

SELF-CONTAINED CHARGING PROCEDURES

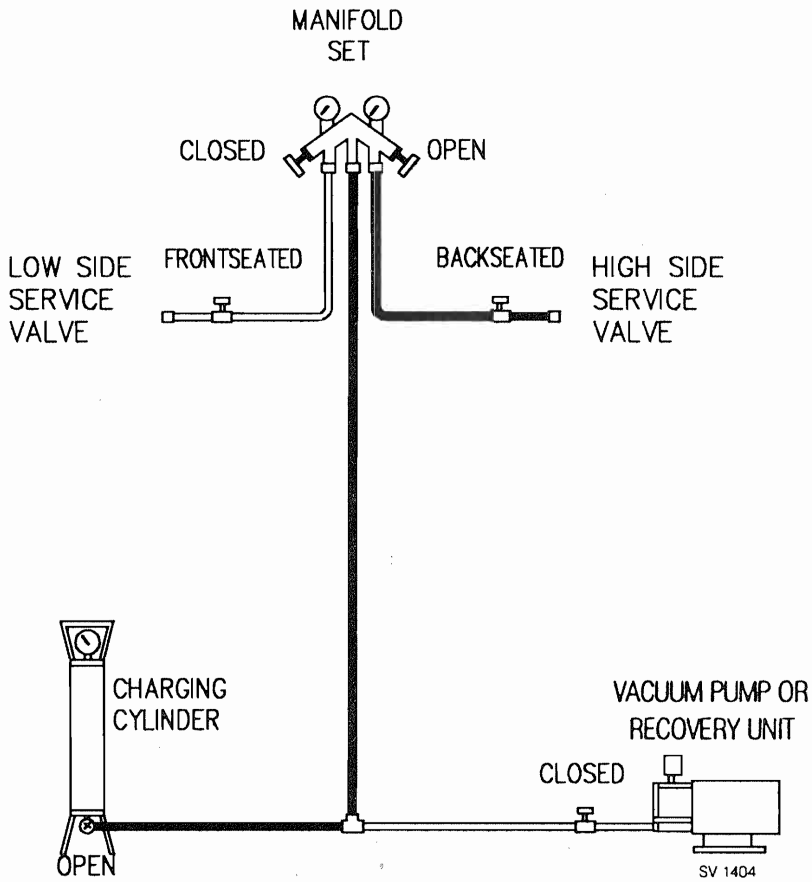
(Refer to illustration - SELF-CONTAINED CHARGING CONNECTIONS)

> **IMPORTANT**
>
> The charge is critical on all Manitowoc Series ice machines; therefore, use weight or charging cylinder to determine proper charge.

1. Ensure toggle switch is in "OFF" position.
2. Close vacuum pump valve, low side service valve, and low side valve on manifold gauge.
3. Open high side manifold gauge valve, backseat high side service valve.
4. Open charging cylinder and add measured nameplate charge through discharge service valve.
5. Allow system to "settle" for 2 or 3 minutes after charging.
6. Place ice machine toggle switch in "ICE" position, close high side on manifold gauge set, and add remaining vapor charge through suction service valve (if necessary).
7. Ensure all vapor in charging hoses is drawn into the ice machine before disconnecting manifold gauges per the following procedures:

> **NOTE**
>
> Manifold gauges must be properly removed to ensure no refrigerant contamination or loss occurs.

a. Run ice machine in freeze cycle.
b. Close high side service valve at ice machine.
c. Open low side service valve at ice machine.
d. Open both high and low side valves on manifold gauge set. Refrigerant in lines will be pulled into the low side of system. Allow pressures to equalize with ice machine still in freeze cycle.
e. Close low side service valve at ice machine.
f. Remove hoses from ice machine and install caps.



SELF-CONTAINED CHARGING CONNECTIONS

SV 1404

RECOVERY/EVACUATION AND CHARGING OF REMOTE SYSTEMS

EVACUATION

(Refer to illustration - 4 POINT EVACUATION CONNECTIONS)

Recovery/Evacuation of remote systems requires connections at **4-points** for complete system evacuation as follows:

1. Suction side of compressor through suction service valve.
2. Discharge side of compressor through discharge service valve.
3. Receiver outlet service valve (Evacuates area between head pressure control valve and pump-down solenoid.)
4. Access (Schraeder) valve on discharge line quick connect fitting on outside of compressor/evaporator compartment. This connection is necessary to evacuate the condenser. Without this connection, the magnetic check valve would close upon the pressure drop produced by evacuation prohibiting complete condenser evacuation.

> **NOTE**
>
> Manitowoc recommends using an access valve core removal and installation tool on the discharge line quick connect fitting. The tool permits removal of the access valve core for faster evacuation and charging without removing the manifold gauge hose.

REMOTE SYSTEM REFRIGERANT RECOVERY/EVACUATION PROCEDURES:

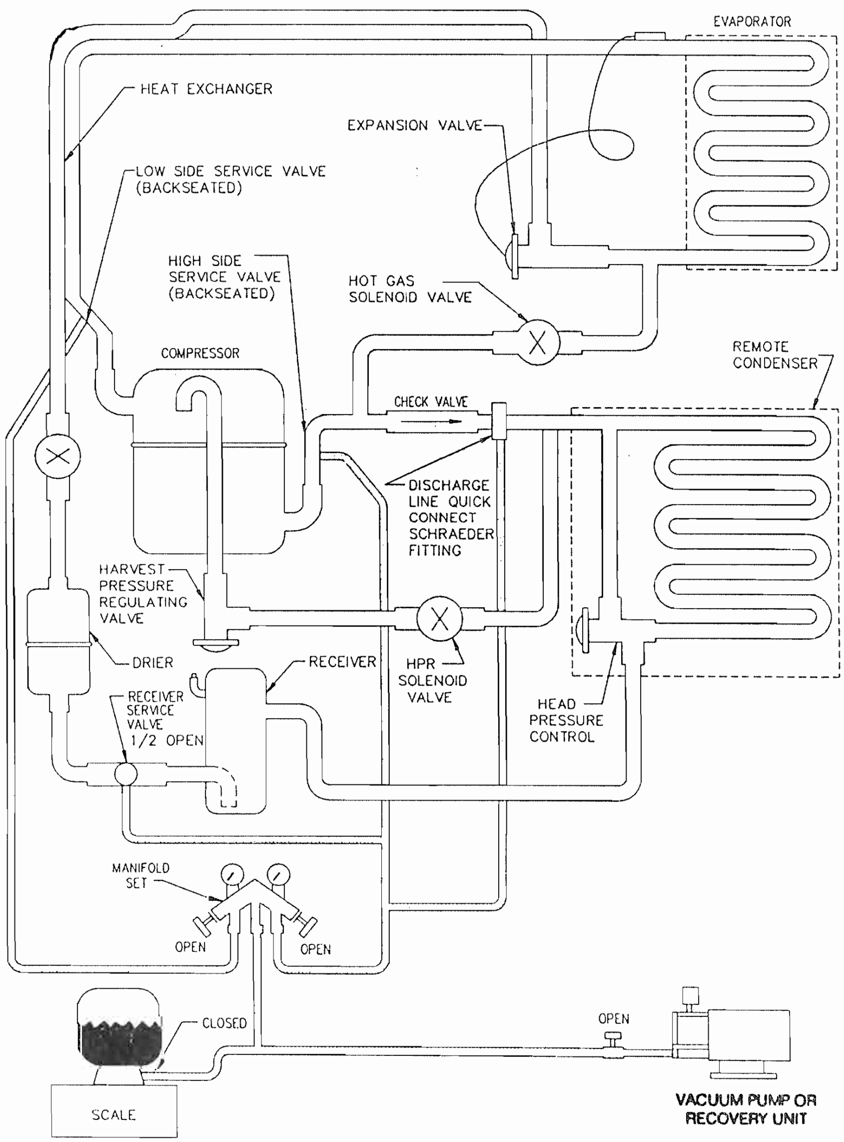
1. Place toggle switch in "OFF" position.
2. Install manifold gauges, scale, and recovery unit or 2-stage vacuum pump per illustration, 4-Point Evacuation Connections.
3. Open (backseat) high and low side ice machine service valves, position receiver service valve 1/2 open, and open high and low side on manifold gauge set.

4. Recovery: Operate recovery unit per manufacturer's instructions.

   Evacuation prior to recharging: Pull system down to 250 microns. Allow to run for 1 hour after reaching 250 microns. Turn off vacuum pump, ensure pressures do not rise (standing vacuum leak-check).

> **NOTE**
>
> Recheck for leaks with a halide or electronic leak detector after charging ice machine.

5. Charge the ice machine per the following charging procedures.



REMOTE RECOVERY/EVACUATION CONNECTIONS

REMOTE CHARGING PROCEDURES

(Refer to illustration - REMOTE CHARGING CONNECTIONS)

1. Ensure toggle switch is in the "OFF" position.

2. Close vacuum pump valve, frontseat (close) low side and high side service valves, close low side valve on manifold gauge set.

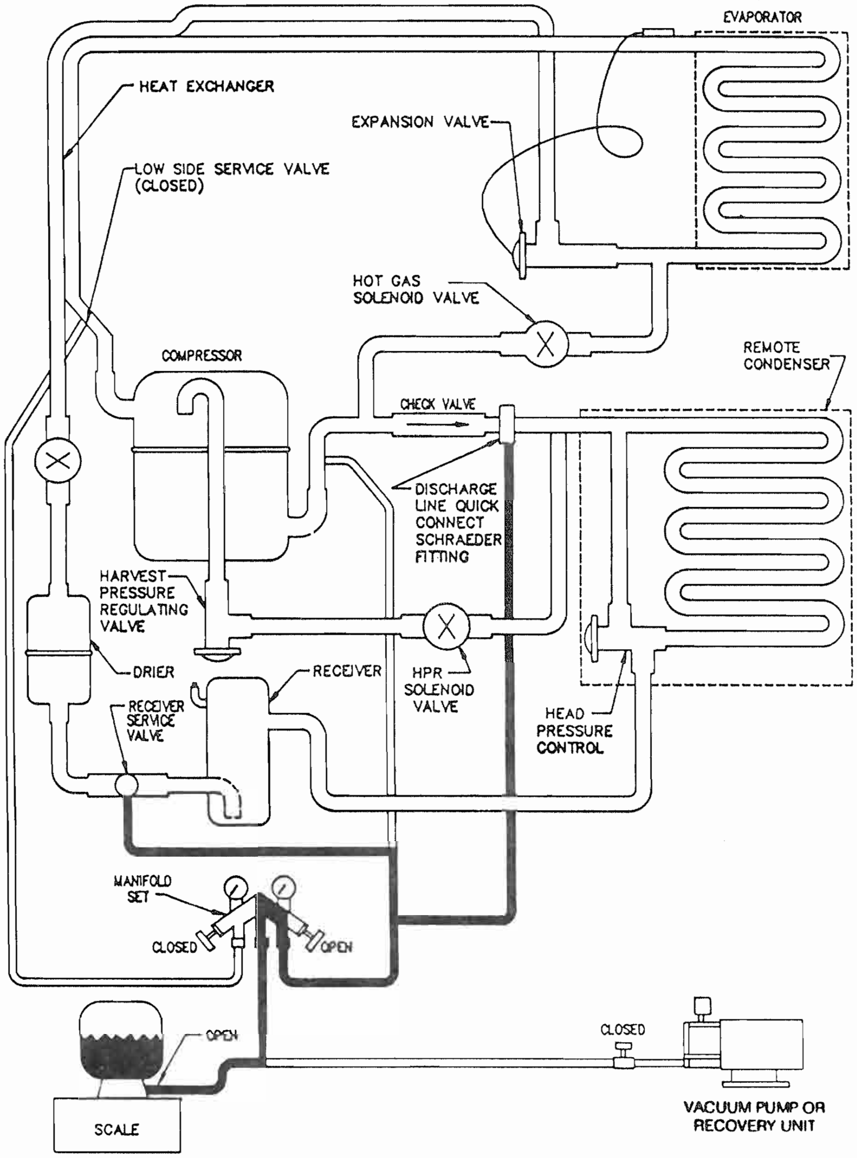
3. Add measured nameplate charge from charging scale through high side of manifold gauge set into system high side (receiver outlet valve and discharge lines quick-connect fitting).

4. If high side does not take entire charge, close high side on manifold gauge set, backset (open) low side service valve, and receiver outlet service valve. Start ice machine and add remaining charge through low side in vapor form until the machine is fully charged.

5. Ensure all vapor in charging hoses is drawn into the machine before disconnecting manifold gauges as described in Step 7 of "Self Contained Charging Procedures".

NOTE

Backseat receiver outlet service valve after charging is complete and before operating the ice machine. If access valve core removal and installation tool is used on the discharge line quick-connect fitting, reinstall Schraeder valve core before disconnecting access tool and hose.



REMOTE CHARGING CONNECTIONS

REFRIGERANT DEFINITIONS

RECOVERY

To remove refrigerant in any condition from a system and store it in an external container without necessarily testing or processing it in any way.

RECYCLING

To clean refrigerant for reuse by oil separation and single or multiple passes through devices, such as replaceable core filter-driers, which reduce moisture, acidity, and particulate matter. This term usually applies to procedures implemented at the field job site or at a local service shop.

RECLAIM

To reprocess refrigerant to new product specifications by means which may include distillation. Will require chemical analysis of the refrigerant to determine that appropriate product specifications are met. This term usually implies the use of processes or procedures available only at a reprocessing or manufacturing facility.

NOTES REGARDING RECLAIM:

"New product specifications" currently means ARI Standard 700 (latest edition). Note that chemical analysis is required to assure that this standard is met.

Chemical analysis is the key requirement in the definition of "Reclaim". Regardless of the purity levels reached by a reprocessing method, the refrigerant is not "reclaimed" unless it has been chemically analyzed and meets ARI Standard 700 (latest edition).

MANITOWOC REFRIGERANT USE POLICY

Manitowoc recognizes and supports the need for proper handling, reuse of, or disposal of, CFC and HCFC refrigerants. Manitowoc service procedures require recapturing of refrigerants, not venting to atmosphere.

It's not necessary, in or out of warranty, to reduce or compromise the quality and reliability of your customers' products to achieve this.

Manitowoc **approves** the use of:

1. *New refrigerant* (original name plate type).
2. *Reclaimed refrigerant* (original name plate type) - must meet A.R.I. Standard 700 (latest edition) specifications.
3. *Recovered or recycled refrigerant* reuse:

   A. Refrigerant must be recovered and/or recycled in accordance with latest local, state, and federal laws.

   B. Refrigerant must be recovered from the same Manitowoc product which it will be reused in. Recovered or recycled refrigerant reuse from other products is not approved.

   C. Recycling equipment must be certified to A.R.I. Standard 740 (latest edition) and be maintained to consistently meet this standard.

   D. Refrigerant recovered and reused must come from a "contaminant free" system. "Contaminant free" decision is influenced by type of previous failures, was the system cleaned, evacuated, and recharged properly after previous failures, and the present failure did not contaminate the system. Compressor motor burnouts and systems not serviced properly in the past (an acid test can help determine system condition) prevent reuse of recovered refrigerant.

   If you are not sure of the contaminant level, refer to service manual for "Determining Severity of System Contamination and Proper Clean-Up Procedures".

   E. Whether recovering and reusing, or recycling, the **service person is responsible** to assure the refrigerant is not mixed with air, other refrigerants, etc., and is "contaminant free" prior to reuse.

IMPORTANT

Manitowoc Ice, Inc. assumes no responsibility for use of contaminated refrigerant. Damage resulting from the use of contaminated, recovered, or recycled refrigerant is the sole responsibility of the servicing company.

4. *"Substitute" or "Alternative" refrigerant:*

   A. Must use only Manitowoc approved alternative refrigerants.

   B. Must follow Manitowoc published conversion procedures.

NOTES

NOTES

E200, H200, E400, and G600 Series Cuber After Dump Valve Water Flush System

E0600 series out of production at time of dump valve system introduction.

1. Freeze Mode
   Place the main toggle switch in the ICE position; this energizes the compressor, water pump (on delay of a timer), condenser fan motor, and the primary side of the transformer. On remote units, the liquid line solenoid will also energize and cuber will start after suction pressure rises. As ice begins to form, water will eventually come into contact with the bridge thickness control probes. After the sensor module waits 6-10 seconds (to assure circuit is constant), the relay will energize. This will switch the relay's contact positions.

2. Harvest Mode
   At this point, the normally closed contact #5 will open, de-energizing the condenser fan motor; normally open contact #6 will close, energizing the hot gas solenoid and the dump valve solenoid; and normally open contact #3 will close, keeping the water pump running.

   During the harvest mode, the water pump pumps water out through the energized dump valve to remove minerals from the dump trough. The hot gas flowing through the energized hot gas valve raises the evaporator temperature releasing the ice from the evaporator. The ice drops causing the water curtain to momentarily open the bin switch. This momentarily interrupts the power to the primary side of the transformer causing the relay to reset back into the freeze mode by de-energizing the relay coil.

3. Bin Full of Ice
   a. E0200, H0200, E0400 Self-Contained Cubers
      If the bin is full, the ice falling off the evaporator will hold the water curtain open which in turn opens the bin switch de-energizing the cuber. The cuber will not start again until ice is removed from the bin allowing the curtain to fall back in toward the evaporator closing the bin switch.

   b. G0600 Self Contained
      When the bin is full, the bin switch remains open, energizing the compressor off-delay timer. After 7 seconds the timer opens its normally closed switching position

(SCR) thus de-energizing the contactor, compressor, water pump, and condenser fan motor.

The off-delay timer remains energized while the cuber is off. Once the curtain closes due to ice being removed from the bin, the timer is de-energized causing the contactor to initiate a new ice making cycle.

c. E0400 and G0600 Remotes
When the bin is full, the bin switch remains open, de-energizing the liquid solenoid and sensor module. With the liquid solenoid closed, the cuber will pump down the low side. The low pressure cut-out control contact opens, de-energizing the contactor (G series only), compressor, condenser fan motor, water pump, and transformer primary.

ELECTRICAL SEQUENCE OF OPERATION

G150 Series

1. Place main toggle switch in ICE position. This energizes the compressor, fan motor (air-cooled models), and water pump.

2. When the ice forms to the preset thickness, the water comes in constant contact with the sensor probes. Within 6 seconds the ice sensor relay will energize, opening contact #5, stopping the water pump. With the closing of contact #6, the hot gas valve is energized.

3. During the harvest, the hot gas raises the evaporator temperature, releasing the ice from the evaporator. The ice drops, causing the water curtain to momentarily open the bin switch.

4. The momentary interruption of the bin switch disconnects power to the ice sensor causing it to reset contacts #5 and #6, thus de-energizing the hot gas valve and the water pump is activated.

5. Auto shut-off: When the ice storage becomes full, the harvesting ice cubes do not completely clear the water curtain. When the bin switch remains open for more than 7 seconds, the contact on the 7 second off-delay relay opens, de-energizing the compressor and fan motor. The open bin switch disconnects power to the ice sensor and other components. The return of the water curtain closes the bin switch, and the ice machine starts a new freeze cycle.

CAUTION

DISCONNECT POWER BEFORE WORKING ON ELECTRICAL CIRCUITRY.

ELECTRICAL SEQUENCE OF OPERATION

G200 and G400 Series

1. Place main toggle switch in ICE position. This energizes the compressor, fan motor (air cooled models), and water pump delay timer. After 20-25 seconds the water pump is activated.
2. When the ice forms to the preset thickness, the water comes in constant contact with sensor probes. Within 6 seconds the ice sensor relay will energize, opening contact #5, de-energizing the water pump delay timer. The water pump continues to run as contact #3 closes. Contact #6 closes to energize the hot gas valve and water dump valve.
3. During the harvest, the water pump will pump water through the water dump valve and down the drain. The hot gas raises the evaporator temperature, releasing the ice from the evaporator. The ice drops, causing the water curtain to momentarily open the bin switch.
4. The momentary interruption of the bin switch disconnects power to the sensor, resetting contacts #5, #3, and #6. The water pump, hot gas valve, and water dump valve de-energize. The water pump delay timer is energized and after 20-25 seconds the water pump is activated.
5. Auto shut-off: When the ice storage becomes full, the harvesting ice cubes do not completely clear the water curtain. When the bin switch remains open for more than 7 seconds, the contact on the 7 second off-delay relay opens, de-energizing the compressor and fan motor. The open bin switch disconnects power to the ice sensor and other components. The return of the water curtain closes the bin switch, and the ice machine starts a new freeze cycle.

CAUTION

DISCONNECT POWER BEFORE WORKING ON ELECTRICAL CIRCUITRY.

ELECTRICAL SEQUENCE OF OPERATION

G800 Series

1. Freeze Cycle (Prechill of Evaporator)
   Place main toggle switch in ICE position. This energizes the compressor, fan motor (air cooled models) and the dump valve timer. After 20 seconds the dump valve timer de-energizes the dump valve and water starts flowing over evap-

orator. (On the remote units, the liquid line solenoid is energized and cuber will start after suction pressure rises.)

2. Harvest Cycle
   The harvest cycle begins when water flowing over the ice on the evaporator contacts the probes on the ice thickness control. After a constant 6-10 seconds of water contact, the relay on the ice sensor board is energized, changing contacts #3 and #5. Contact #5 opens to de-energize the water pump, dump valve timer, and fan motor. Contact #3 closes to energize the hot gas valve and harvest pressure regulating (H.P.R.) valve on remote models.

3. Auto Shut Off (Bin full of ice)
   a. Self contained air/water cooled
      When the ice storage bin becomes full, the last harvesting of ice cubes does not completely clear the water curtain, holding it open. The bin switch opens energizing the compressor off-delay timer. After 7 seconds the timer opens its normally closed switching position (S.C.R.) thus de-energizing the contactor, and shutting off the ice machine.

      The 7-second off-delay timer remains energized while the ice machine is off. The ice machine remains off until sufficient ice is removed from the bin allowing ice to clear the water curtain. The return of the water curtain closes the bin switch, de-energizing the 7-second delay timer and energizing the contactor to initiate a new ice making cycle.

   b. Remote
      With a full bin of ice, the bin switch remains open. This de-energizes the liquid line solenoid valve. The compressor will continue to run and pump down the low side of the ice machine. The low pressure cut-out control opens and de-energizes the contactor, shutting off the ice machine.

      The ice machine will stay off until sufficient ice is removed from the bin, allowing the water curtain to return to the normal position and close the bin switch. Closing the bin switch energizes the liquid line solenoid, raising the low side pressure. This closes the low pressure cut-out control, starting a new freeze cycle.

ELECTRICAL SEQUENCE OF OPERATION

G1200 and G1700 Air and Water

1. Freeze Mode
   Place the toggle switch in the ICE MAKING position. This energizes the contactor coil, fan motor, water pump, transformer primary, and the dump valve. After 20 seconds the dump valve is de-energized.

   As ice forms to the preset thickness, the water comes in constant contact with the ice bridge thickness probe. Within 6 seconds the sensor relay will be energized, opening normally closed contact #5, de-energizing water pump and fan motor. Normally open contact #3 closes to keep the contactor coil energized as the bin switches open later in the harvest cycle. Normally open contact #6 closes, energizing both hot gas solenoids (front and rear) and relay "C" including LED light (light emitting diode) on relay board. The cuber is now in the harvest mode.

2. Harvest Mode
   During the harvest mode, the hot gas raises the evaporator temperature, causing release of the ice from the evaporators. When the ice drops, it causes the water curtains, front and rear, to momentarily open their corresponding bin switches.

   For this explanation, let's say the front evaporator drops its ice before the rear. This will momentarily open the front bin switch energizing relay "A". As the bin switch opens interlock through #3 sensor relay contacts will hold the contactor energized to keep the compressor running without momentary interruption. The N.C. contact of Relay "A" will open, de-energizing the front hot gas valve. One of the N.O. contacts will close acting as a holding circuit for relay "A" to keep it energized. The other N.O. contact will close to allow the compressor off-delay timer to start timing after the ice falls off the back evaporator. At this point in time, the ice machine is still in harvest with hot gas only running through the back evaporator.

   As the ice falls off the rear evaporator, the rear bin switch will energize relay "B". Relay "B's" N.C. contacts will open de-energizing the rear hot gas solenoid. One of relay "B's" N.O. contacts will close acting as a holding circuit, keeping relay "B" energized as the bin switch returns to its original energized position. The other N.O. contact closes allowing the compressor-off delay timer to be activated. After approximately 7 seconds the S.C.R. switch will open, causing power interruption to the transformer primary to reset the sensor relay contacts back into their normal position. The cuber is now back into the freeze mode.

3. Full Bin
   As a full bin results, the water curtains (front or rear) will be held open; and so will the corresponding bin switch. The holding contact (#3) of the sensor relay opens, de-activates the contactor, which in turn, shuts off the ice cuber. Upon ice removal and return of water curtain, the bin switches close and the cuber is reactivated immediately.

ELECTRICAL SEQUENCE OF OPERATION

G1200 and G1700 Remotes

To fully understand this sequence of operation, first read sequence of operation for the G1200 and G1700 air and water.

1. Freeze Mode
   Place main toggle switch in ICE position. This energizes the liquid solenoid and sensor module. As the low pressure equalizes, the low pressure cut-out control contacts close, energizing the compressor, condenser fan motor(s), water pump, and dump valve. After 20 seconds the dump valve is de-energized.

   As ice forms to the preset thickness, the water comes in constant contact with the ice bridge thickness probe. Within 6 seconds the sensor relay will be energized, opening contact #5, de-energizing water pump and fan motor(s). Contact #3 and #6 close, thus energizing both hot gas solenoids (front and rear), the H.P.R. solenoid, and relay "C" including L.E.D. light on relay board. The cuber is now in the harvest mode.

2. Harvest Mode
   During the harvest mode, the hot gas raises evaporator temperature, thus causing release of the ice from the evaporators. When the ice drops, it causes the water curtains (front and rear) to momentarily open the bin switches.

   The momentary interruption of the bin switches energizes relay "A" (front) and relay "B" (rear) and the corresponding L.E.D. lights. The hot gas solenoids are de-energized in sequence with the bin switches. The delay timer (7 seconds) is activated, causing the reset of the sensor relay, de-energizing the 3 relays and the H.P.R. solenoid, re-activating the water pump, dump valve and fan motor(s).

3. Full Bin
   As a full bin results, the water curtains (front and rear) will be held open and so will the corresponding bin switch. The

holding contact (#3) of the sensor relay opens and de-activates the liquid solenoid.

With the liquid solenoid closed, the cuber will pump down the low side to approximately 15 P.S.I.G. The low pressure cut-out control contact opens, de-energizing the contactor, condenser, fan motor(s), and water pump.

SYSTEMATIC APPROACH TO DIAGNOSTICS

The symptoms of ice machine problems may often be misleading. At times they may simulate a refrigeration or electrical problem while the actual cause may be a commonly overlooked area such as water side problems.

Ice machine problems can have many causes. By following a systematic approach to problem analysis – and by starting from the frequently overlooked basics and progressing to the refrigeration systems – you will be able to quickly arrive at a correct diagnosis.

Manitowoc outlines step-by-step procedures for both refrigeration and electrical related problems. The step-by-step process of elimination will save time and prevent needless replacement of electrical and/or refrigeration system parts.

ELECTRONIC CONTROL CIRCUITRY

The ice machine uses either a transformer board with a plug-in sensor module or a unitized sensor board to control the ice thickness and initiate the harvest cycle. See Figure 19.

The transformer board and sensor module are not available as replacement parts. If either fails, replace both with a unitized sensor board.

Refer to ice machine Sequence of Operation, refer to Table of Contents, for operation of control circuitry.

SENSOR MODULE

The plug-in module has four functions:

1. A relay to energize and de-energize electrical components utilized during the harvest cycle.
2. Electronics to sense when water is in contact with the ice thickness control probe.
3. A 6 to 10 second timer ensuring the water flowing over the evaporator completes an electrical circuit through the ice thickness control probe.
4. A safety timer ensuring the ice machine does not remain in the harvest cycle for longer than 4 to 5 minutes.

TRANSFORMER BOARD

The transformer board reduces line voltage to the sensor module to 12-24 VAC.

UNITIZED SENOR BOARD

This board combines the functions of the sensor module and transformer board into one assembly.

ICE THICKNESS CONTROL PROBE

The ice thickness control probe adjusts the ice thickness. Water comes into contact with the two probes for 6 to 10 seconds and completes an electrical circuit initiating the harvest cycle.

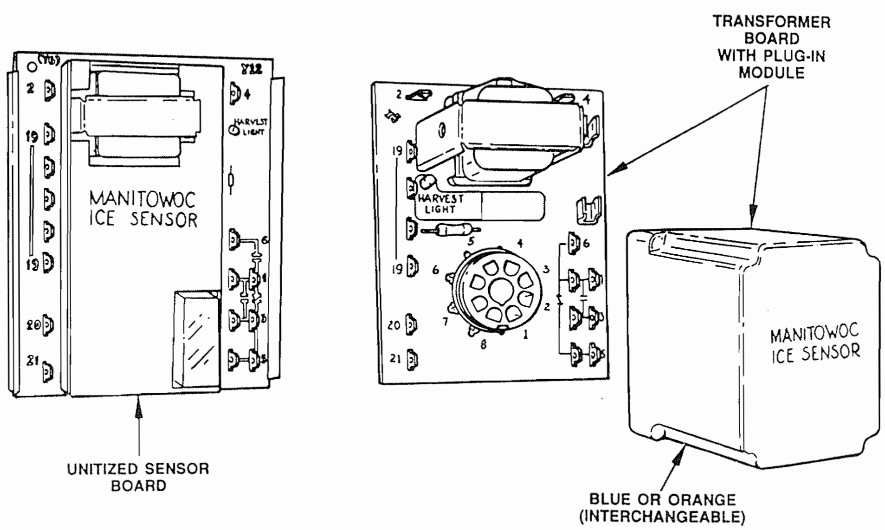


FIGURE 19. ELECTRONIC CONTROLS

DIAGNOSING ELECTRONIC CONTROL CIRCUITRY

On all machines with bulkhead connection for thickness control.

> **IMPORTANT**
>
> The transformer board and sensor module are not available as replacement parts. If either fails, replace both with Unitized Sensor Board.

> **CAUTION**
>
> **THESE PROCEDURES MUST BE PERFORMED BY A QUALIFIED TECHNICIAN.**

Do not make adjustments or turn the ice machine off until the malfunction is identified. The problem may be intermittent and you may lose the opportunity to make the checks while it is malfunctioning.

Follow the systematic approach throughout the diagnosis and write down information as it is collected. This will keep you organized.

A. POSSIBLE PROBLEM: ICE MACHINE WILL NOT GO INTO HARVEST

> **NOTE**
>
> These procedures require the use of a jumper wire with clip ends attached.

Step 1: Check primary voltage at transformer terminals #1 and #2 on board.

Does voltmeter indicate line voltage (± 10%)?

IF NO: Check for correct wiring and loose or corroded connections. Also follow control circuitry to check components wired in series with terminals #1 and #2.

Do not proceed until line voltage is restored.

IF YES: Proceed to Step 2.

Step 2: Clip the leads of the jumper wire to the ice thickness control probe, Figure 20.

Does the ice machine go into the harvest cycle?

IF NO: The ice machine still will not harvest. Proceed to Step 3.

IF YES: The entire control circuitry is functioning properly. Check the following:

a. Ice thickness probe adjustment.
b. Ice thickness probe has scale build-up acting as an insulator. Clean probe.
c. The water to the ice machine may not offer a low enough resistance across the probes for proper operation. To check, put a small amount of salt into the water trough to lower the resistance level of the water. If the ice machines goes into harvest after putting salt into the water trough, order Resistor Kit, part number 76-2266-3, from your local Manitowoc Distributor. Install Resistor Kit across terminals #20 and #21. The ice machine will now operate properly.

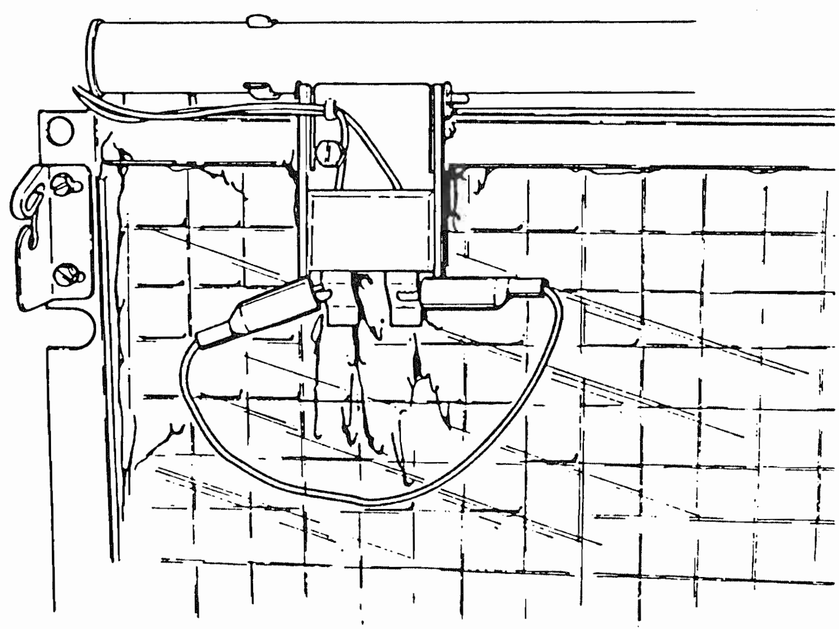


FIGURE 20. JUMPER WIRES CONNECTED TO PROBES

Step 3: Disconnect ice thickness control probe wires from bulkhead (upper left corner). Connect the jumper wire to the bulkhead terminals, Figure 21.

Does the ice machine go into the harvest cycle?

IF NO: Proceed to Step 4.

IF YES: The ice thickness probe is the cause of malfunction. All other components are operating properly. The ice thickness probe may be dirty. Attempt to clean before replacing.

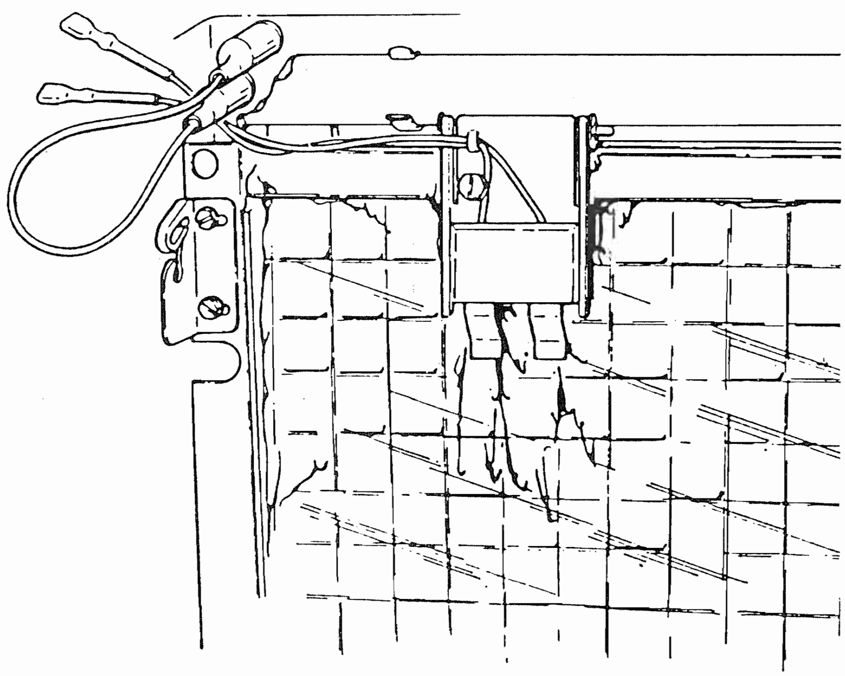


FIGURE 21. JUMPER WIRE CONNECTED TO BULKHEAD TERMINALS

Step 4: Disconnect wires from terminals #20 and #21 on board. Connect jumper wire to terminals #20 and #21, Figure 22.

Does the ice machine go into the harvest cycle?

IF NO: Install new unitized sensor board.

If ice machine you are working on is transformer board/sensor module system, replace both components with unitized sensor board.

> **IMPORTANT**
>
> Failure to check primary voltage (Step 1) can result in a misdiagnosis.

IF YES: The wires between terminals #20 and #21 and the bulkhead are faulty. Check for loose terminals before replacing wires.

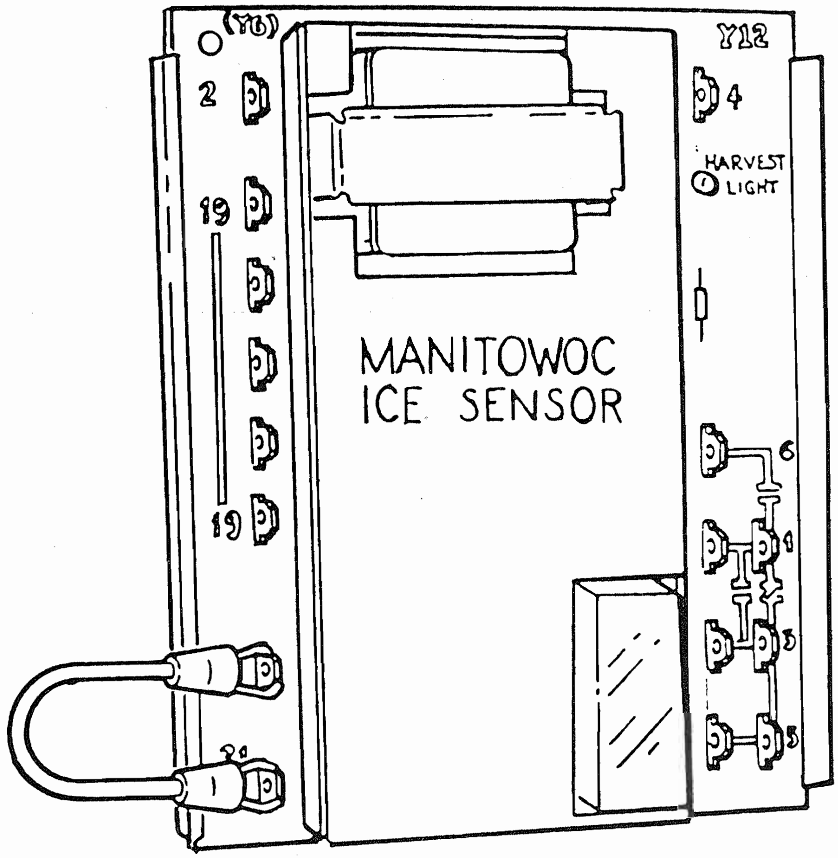


FIGURE 22. UNITIZED SENSOR BOARD

> **NOTE**
>
> **BOARD MUST BE IN ICE MACHINE WITH ALL WIRES ATTACHED.**

B. POSSIBLE PROBLEM: ICE MACHINE PREMATURELY GOES INTO HARVEST WITHOUT ICE FORMATION

Step 1: Check primary voltage at transformer terminals #1 and #2 on board.

Does voltmeter indicate line voltage (± 10%)?

IF NO: Check for correct wiring and loose or corroded connections. Also follow control circuitry to check components wired in series with terminals #1 and #2.

Do not proceed until line voltage is restored.

IF YES: Proceed to Step 2.

Step 2: Disconnect ice thickness probe wires from bulkhead, Figure 23. Activate bin switch to cycle the ice machine into the freeze cycle.

Does the ice machine stay in the freeze cycle?

IF NO: Proceed to Step 3.

IF YES: The ice thickness probe is causing the malfunction. All other components are functioning properly. The ice thickness probe may be dirty. Attempt to clean before replacing.

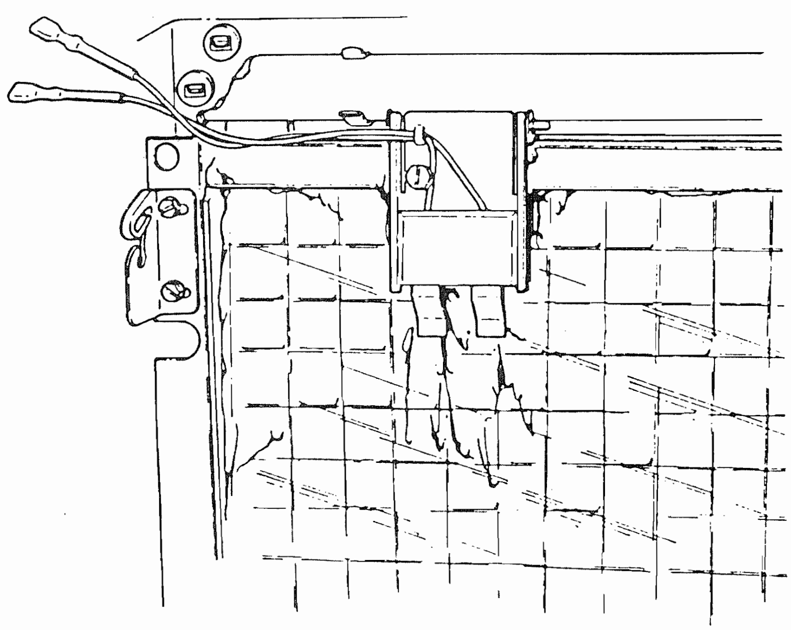


FIGURE 23. DISCONNECT PROBE WIRES FROM BULKHEAD TERMINALS

Step 3: Disconnect wires on terminals #20 and #21 on unitized sensor board. Activate bin switch to cycle ice machine into the freeze cycle.

Does the ice machine stay in the freeze cycle?

IF NO: Ensure there is no moisture between terminals #20 and #21 on board. If no moisture, install new unitized sensor board.

If ice machine you are working on has transformer board/sensor module controls, replace both components with unitized sensor board.

IMPORTANT

Failure to check primary voltage (Step 1) can result in a misdiagnosis.

IF YES: Check for moisture where the ice thickness control probe wires connect to the bulkhead. Dry bulkhead terminals and reconnect.

DIAGNOSING ELECTRONIC CONTROL CIRCUITRY

On all machines without bulkhead connection for thickness control.

> **IMPORTANT**
>
> The transformer board and sensor module are not available as replacement parts. If either fails, replace both with Unitized Sensor Board.

> **CAUTION**
>
> **THESE PROCEDURES MUST BE PERFORMED BY A QUALIFIED TECHNICIAN.**

Do not make adjustments or turn the ice machine off until the malfunction is identified. The problem may be intermittent and you may lose the opportunity to make the checks while it is malfunctioning.

Follow the systematic approach throughout the diagnosis and write down information as it is collected. This will keep you organized.

A. POSSIBLE PROBLEM: ICE MACHINE WILL NOT GO INTO HARVEST

> **NOTE**
>
> These procedures require the use of a jumper wire with clip ends attached.

Step 1: Check primary voltage at transformer terminals #1 and #2 on board.

Does voltmeter indicate line voltage (± 10%)?

IF NO: Check for correct wiring and loose or corroded connections. Also check 7-second delay timer and Harvest Pressure Limiter Control.

Do not proceed until line voltage is restored.

IF YES: Proceed to Step 2.

Step 2: Clip the leads of the jumper wire to the ice thickness control probe, Figure 24.

Does the ice machine go into the harvest cycle?

IF NO: The ice machine still will not harvest. Proceed to Step 3.

IF YES: The entire control circuitry is functioning properly. Check the following:

a. Ice bridge thickness probe adjustment.
b. Ice bridge thickness probe has scale build-up acting as an insulator. Clean the probe.
c. The water to the ice machine may not offer a low enough resistance across the probes for proper operation. To check, put a small amount of salt into water trough to lower the resistance level of the water. If the ice machine goes into harvest after putting salt into the water trough, order Resistor Kit, part number 76-2266-3, from your local Manitowoc Distributor. Install Resistor Kit across terminals #20 and #21. The ice machine will now operate properly.

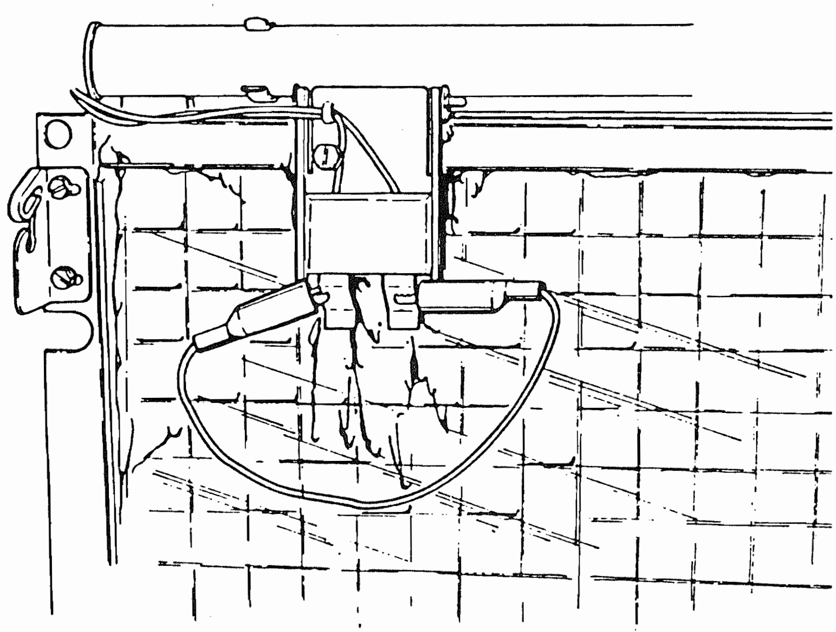


FIGURE 24. JUMPER WIRE CONNECTED TO PROBES

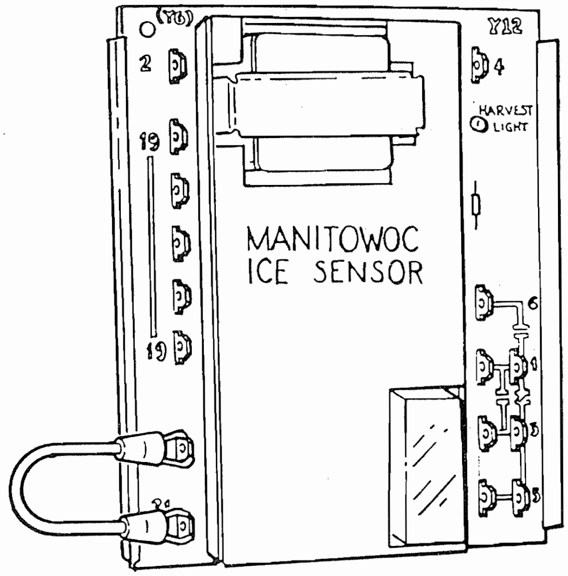


FIGURE 25. UNITIZED SENSOR BOARD

> **NOTE**
>
> **BOARD MUST BE IN ICE MACHINE WITH ALL WIRES ATTACHED.**

Step 3: Disconnect wires from terminals #20 and #21 on board. Connect jumper wire to terminals #20 and #21, Figure 25.

Does the ice machine go into the harvest cycle?

IF NO: Install new unitized sensor board.

If ice machine you are working on is transformer board/sensor module system, replace both components with unitized sensor board.

> **IMPORTANT**
>
> Failure to check primary voltage (Step 1) can result in a misdiagnosis.

IF YES: The ice thickness probe is causing the malfunction. All other components are operating properly. The ice thickness probe may be dirty. Clean the probe before replacing.

B. POSSIBLE PROBLEM: ICE MACHINE PREMATURELY GOES INTO HARVEST WITHOUT ICE FORMATION

Step 1: Check primary voltage at transformer terminals #1 and #2 on board.

Does voltmeter indicate line voltage (± 10%)?

IF NO: Check for correct wiring and loose or corroded connections. Also check 7-second delay timer and Harvest Pressure Limiter Control.

Do not proceed until line voltage is restored.

IF YES: Proceed to Step 2.

Step 2: Disconnect wires on terminals #20 and #21 on unitized sensor board. Activate bin switch(es) to cycle ice machine into the freeze cycle.

Does the ice machine stay in the freeze cycle?

IF NO: Ensure there is no moisture between terminals #20 and #21 on board. If no moisture, install new unitized sensor board.

If ice machine you are working on has transformer board/sensor module controls, replace both components with unitized sensor board.

> **IMPORTANT**
>
> Failure to check primary voltage (Step 1) can result in a misdiagnosis.

IF YES: The ice thickness probe is causing the malfunction. All other components are functioning properly. The ice bridge thickness probe may only be dirty. Clean the probe before replacing.

DIAGNOSING IMPROPER LINE VOLTAGE TRANSFORMER BOARD/SENSOR BOARD TERMINALS #1 AND #2

> **CAUTION**
>
> **These procedures must be performed by a qualified technician.**

> **NOTE**
>
> These procedures are used when there is improper line voltage at terminal #1 and #2 on the transformer board or unitized sensor board; the compressor runs and it is verified the proper line voltage is coming to the ice machine. (Line voltage must be ± 10% of nameplate voltage.)

SINGLE EVAPORATOR

Improper line voltage at transformer/sensor board terminals #1 and #2 with other components functioning is rare. Check for proper wiring and loose or corroded connections. Also follow control circuitry to check components wired in series with terminal #1 and #2.

DUAL EVAPORATOR

Verify contactor and 5 amp fuse (if used) are functioning properly before proceeding to the following steps:

STEP 1: Connect voltmeter to terminal #1 on transformer/sensor board and terminal #19 on 3-relay board (bottom board). Leave all wires connected to their original terminals.

Does voltmeter indicate line voltage (± 10%)?

IF YES: Check for proper installation of wire between terminal #2 on transformer board and terminal #19 on 3-relay board (bottom board).

IF NO: Proceed to Step 2.

STEP 2: Connect voltmeter to terminal #1 on transformer/sensor board and terminal #1 on 7-second timer. Leave all wires connected to their original terminals.

Does voltmeter indicate line voltage (± 10%)?

IF YES: Check for proper installation of wire between terminals #19 on 3-relay board and #1 on 7-second timer.

IF NO: Proceed to Step 3.

STEP 3: Connect voltmeter to terminal #1 on transformer/sensor board and to terminal #2 on the 7-second timer. Leave all wires connected to their original terminals.

Does voltmeter indicate line voltage (± 10%)?

IF YES: Replace the 7-second timer.

IF NO: **SELF-CONTAINED:** Verify contactor and 5 amp fuse (if used) are functioning properly. **REMOTE:** Proceed to Step 4.

STEP 4: Connect voltmeter to terminal #1 on the transformer/sensor board and terminal #40.

Does voltmeter indicate line voltage (± 10%)?

IF YES: Harvest pressure limiter is open. Check for high suction pressure/faulty limiter.

IF NO: Verify that the contactor, and 5 amp fuse (if used) are functioning properly.

WATER PUMP DELAY TIMER

Models E/H/G200, E/G400, E/G600, E1100

Function

The timer (Figure 26) delays the water pump from starting at the beginning of the freeze cycle, prechilling the evaporator. The timer is adjustable and factory set at 20 seconds with R-502 and 30 seconds with R-12.

Specifications

115/220 volt, 50/60 Hertz.
N.O. silicon rectifier (SCR) switch.

Check Procedure

IMPORTANT

The water pump must be functioning properly to check timer (refer to Water Pump).

Clip voltmeter leads to terminals #1 and #3. Keep all wire leads attached. See Figure 26.

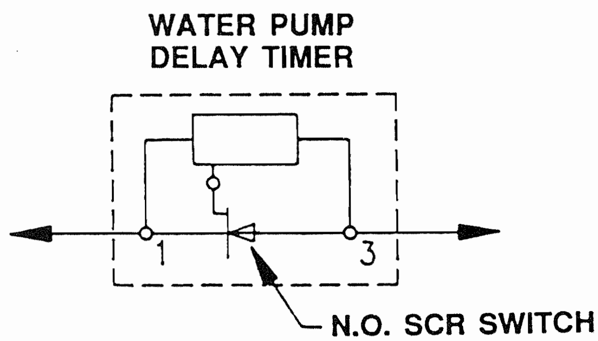


FIGURE 26. WATER PUMP DELAY TIMER CHECK

NORMAL OPERATIONAL SEQUENCE

1st 20-30 sec. into freeze cycle – line voltage.	Water pump off.
After 20-30 sec. into freeze cycle – 0 volt (1 to 4 volt bleed is OK).	Water pump on.

WATER PUMP DELAY TIMER FAILURE CHART

Symptom	Voltage Terminals #1 and #3	Cause
Water pump does not run.	Continual line voltage.	S.C.R. failed open.
Water pump on. No 20-30 second delay at start of freeze cycle. (May experience slushing in sump trough.)	Continual 0 voltage (or 1-4 volt bleed).	S.C.R. failed closed.
Water pump off or running slow.	Approximately 1/2 line voltage.	S.C.R. failed half-wave.

DUMP VALVE TIMER

Models G800, G1200, G1700

Function
The S.C.R. switch is normally closed (N.C.) and energizes the dump valve for the first 20 seconds of the freeze mode. This prechills the evaporator while flushing the water from the last freeze mode. The timer is factory set at 20 seconds and should require no further adjustment.

Specifications
208/230 volt, 50/60 Hertz.
Normally closed silicon rectifier (S.C.R.) switch.

Check Procedure
Clip voltmeter leads across S.C.R. switch terminals #1 and #2. Keep all wire leads attached.

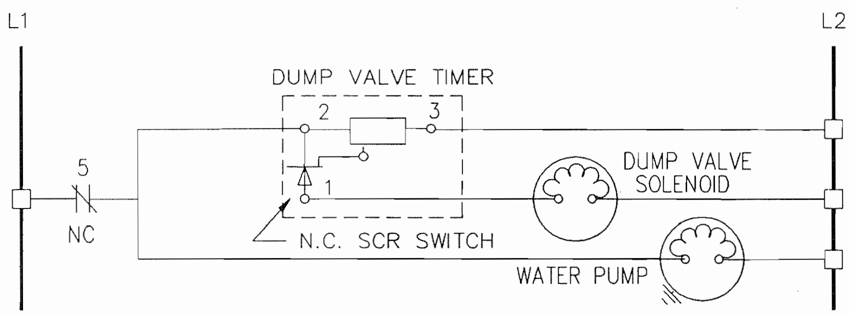


FIGURE 27. DUMP VALVE TIMER CHECK

NORMAL OPERATIONAL SEQUENCE
(No Failure)

No Failure	Voltage Reading Terminals #1 and #2
First 20 seconds of freeze cycle. Dump valve energized.	0-4 Volts
After 20 seconds into freeze cycle. Dump valve de-energized.	Line Voltage

DUMP VALVE TIMER FAILURE CHART

Symptom	Voltage Terminals #1 and #2	Cause
Dump valve will not energize.	Line voltage.	S.C.R. switch failed open and will not close.
Dump valve energized and will not de-energize after 20 seconds.	0-4 volts.	S.C.R. switch failed closed and will not open.
Dump valve de-energized and may be chattering.	Approximately 1/2 line voltage.	S.C.R. switch failed half-wave.

7-SECOND DELAY TIMER

Models G600 and G800
(Self-Contained Air or Water Cooled)

Function

The normally closed S.C.R. switch is in series with the contactor and prevents interruption of compressor operation when cycling from the harvest mode to freeze mode. The S.C.R. switch will open and de-energize the contactor, shutting the ice machine off when the bin switch is tripped for longer than 7 seconds, as with a full bin of ice. The ice machine will remain off until removal of ice permits the bin switch to return to normal position.

Specifications

208/230 volt, 50/60 Hertz.
Normally closed silicon rectifier (S.C.R.) switch.

Check Procedure

Clip voltmeter leads across S.C.R. switch terminals #1 and #2. Keep all wire leads attached.

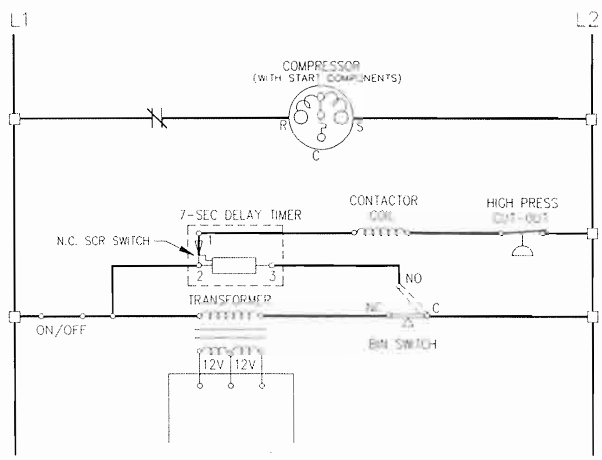


FIGURE 28. 7-SECOND COMPRESSOR DELAY TIMER

NORMAL OPERATIONAL SEQUENCE
(No Failure)

No Failure	Voltage Reading Terminals #1 and #2
Bin Empty	0-4 Volts
Bin Full (Bin switch tripped for 7 seconds)	Line Voltage

7-SECOND DELAY TIMER FAILURE CHART

Symptom	Voltage Terminals #1 and #2	Cause
Ice machine will not start, no voltage at contactor coil.	Line voltage.	S.C.R. switch failed open and will not close.
The ice machine functions properly with an empty bin. The ice machine does not shut off on a full bin of ice. (Bin switch tripped for 7 seconds.)	0-4 Volts.	S.C.R. switch failed closed and will not open.
Contactor does not pull in or chatters.	Approximately 1/2 line voltage.	S.C.R. switch failed half-wave.

7-SECOND DELAY TIMER

Models E1100, G1200, G1700

Function

The normally closed S.C.R. switch is in series with the primary of the transformer. The timer resets the ice machine to the freeze mode by momentarily interrupting the power to the transformer. The time delay is initiated after relays A and B are both energized through the front and rear bin switches. On completion of delay period (7 seconds) the S.C.R. switch opens and the transformer power supply is interrupted. This cycles the ice machine back into the freeze mode.

Specifications

208/230 volt, 50/60 Hertz.
Normally closed silicon rectifier (S.C.R.) switch.

Check Procedure

Clip voltmeter leads across S.C.R. switch terminals #1 and #2. Keep all wire leads attached. The transformer and Harvest Pressure Limiter Control (remote models) must operate properly to check 7-second delay timer.

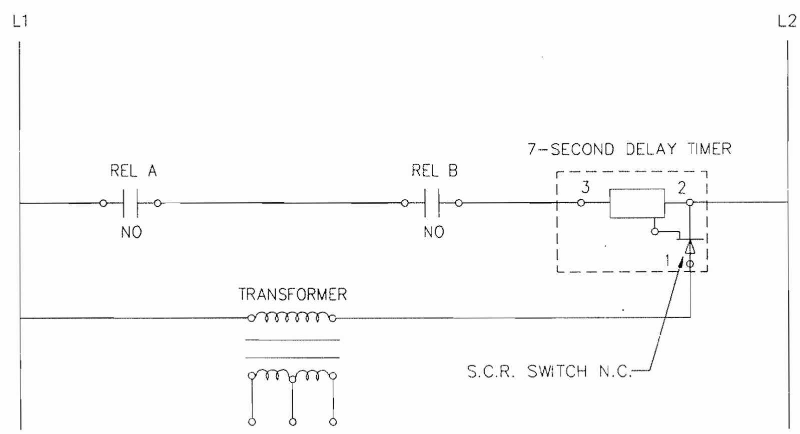


FIGURE 29. 7-SECOND DELAY TIMER

NORMAL OPERATIONAL SEQUENCE
(No Failure)

Toggle Switch in ICE Position: Voltage between terminals #1 and #2 must be 0-4 volts. The ice machine will freeze ice and cycle into Harvest mode. Approximately 7 seconds after relays A and B are both energized during harvest, the voltage will "jump" to line voltage, then back to 0-4 volts.

7-SECOND DELAY TIMER FAILURE CHART

Symptom	Voltage Terminals #1 and #2	Cause
Ice machine will freeze ice but will not go into harvest cycle.	Line voltage.	S.C.R. switch failed open and will not close.
Ice machine will not cycle from harvest mode on the 7-second delay timer. It will cycle back into freeze mode on 4-1/2 to 5 minute safety timer or harvest pressure limiter (remotes).	0-4 volts continually after both relays A and B are energized during harvest.	S.C.R. switch failed closed and will not open.
The hot gas valves chatter during the harvest cycle.	Approximately 1/2 line voltage.	S.C.R. switch failed half-wave.

7-SECOND OFF DELAY RELAY

Models G150, G200, G400

Function

1. Prevents interruption of compressor operation when going from the harvest cycle to the freeze cycle.
2. De-energizes the compressor and fan motor (air cooled only) when bin is full of ice or when turned off at toggle switch.

Specifications

85/230 volt, 50/60 Hertz.

Check Procedures

1. Clip voltmeter leads across the normally open relay contacts L1 and #7. Keep all wire leads attached.

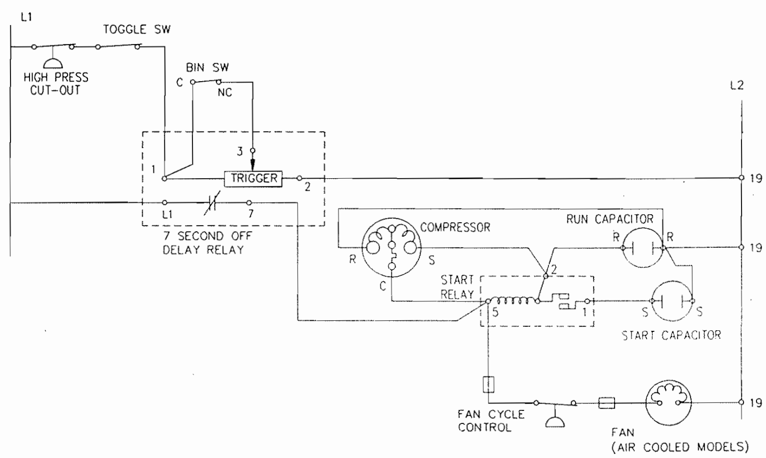


FIGURE 30. 7-SECOND OFF DELAY RELAY

NORMAL OPERATIONAL SEQUENCE
(No Failure)

No Failure	Voltage Reading Terminals L1 and #7
Bin Empty	0 Volts
Bin Full (Bin switch tripped for 7 seconds)	Line Voltage

7-SECOND OFF DELAY RELAY FAILURE CHART

Symptom	Voltage Terminals L1 and #7	Cause
Compressor and fan (air cooled) will not start with the bin switch closed (empty bin)	Line voltage.	Relay contacts staying open and will not close.
The ice machine functions properly with an empty bin. The compressor and fan (air cooled) will not shut off on a full bin of ice. (Bin switch tripped for 7 seconds.)	0 Volts.	Relay contacts staying closed and will not open.

DIAGNOSING COMPRESSOR (AND START COMPONENTS) ELECTRICAL FAILURES

Compressor will not start or will trip repeatedly on overload.

A. CHECK RESISTANCE (OHM) VALUES
Compressors winding can have very low OHM values. The use of a properly calibrated meter is recommended.

The resistance test is done after the compressor is cool. The compressor dome should be cool enough to touch (approximately 120°F) to assure overload is closed and resistance readings will be accurate.

1. Single phase compressors
   a. Disconnect power to cuber; remove wires from compressor terminals.
   b. With wires removed, the resistance values must be within guidelines for the compressor. The resistance value from C to S and C to R added together, should equal value from S to R.
   c. An open overload will give a resistance reading from S to R and a "0" reading from C to S and C to R. Allow the compressor to cool, then recheck readings.

2. Three phase compressors
   a. Disconnect power to cuber; remove wires from compressor terminals.
   b. With wires removed, the resistance values must be within guidelines for the compressor. L1 to L2; L2 to L3; and L1 to L3, should all be equal to each other.
   c. An open overload will give a resistance reading of "0" from L1 to L2; L2 to L3; and L1 to L3. Allow compressor to cool, then recheck reading.

B. CHECK MOTOR WINDINGS TO GROUND
Check continuity between all three terminals and the compressor shell or copper refrigeration line (be sure to scrape metal surface clean to get good contact). If continuity is present, the compressor windings are grounded and the compressor should be replaced.

C. DETERMINE IF THE COMPRESSOR IS "SEIZED"
Check amp draw while compressor is trying to start.

1. Compressor drawing locked rotor, the two likely causes would be a defective starting component or a mechanically seized compressor. To determine which you have:
   a. Install high and low side gauges.
   b. Try to start compressor (watch pressures closely).
   c. If pressures do not move, compressor is seized up. Replace compressor.
   d. If pressures move, the compressor is turning slowly and is not seized. Check capacitors and start relay.

2. Compressor drawing high amps
   The continuous amperage draw on start-up should not near the maximum fuse size as indicated on the serial tag.
   Check the following:
   Low voltage – The voltage at the time the compressor is trying to start must be within ±10% of the nameplate voltage (exception – E200 Series 1/3 HP compressor and 1100 Series using Tecumseh compressor are ±5%).

D. DIAGNOSING CAPACITORS AND RELAYS
1. Capacitors
   If the compressor attempts to start, or hums and trips the overload protector, you must check the starting components before replacing a compressor.
   a. Capacitors can show visual evidence of failure, such as a bulged terminal end or a ruptured membrane. **Do not assume a capacitor is good** if no visual signs are evident.
   b. A good test is to install a known good substitute capacitor.
   c. Use of a capacitor tester is recommended when checking a suspect capacitor. Remember to clip the bleed resistor off the capacitor terminals before testing.

2. Relays
   Potential type:
   Potential relay contacts are closed during the initial starting cycle, and open as the compressor comes up to speed.
   Check Procedure
   a. Disconnect power supply.
   b. Remove wires from relay.
   c. Use a high voltage OHM meter to check the relay coil – open – replace; continuity – ok.
   d. Use an OHM meter to check across the contacts. Potential relay contacts are normally closed.

Current type:
Current relay contacts are normally open.
Check Procedure

a. Disconnect power supply.
b. If relay is on the compressor, pull off.
c. Keeping relay upright, check continuity with OHM meter. Closed – replace.

> **NOTE**
> Turning relay upside down will give a closed reading.

d. Check continuity through relay coil, replace if no continuity.

REFRIGERATION AND OTHER NON-ELECTRICAL PROBLEMS

INTRODUCTION TO THE SIX-STEP DIAGNOSTIC PROCEDURE

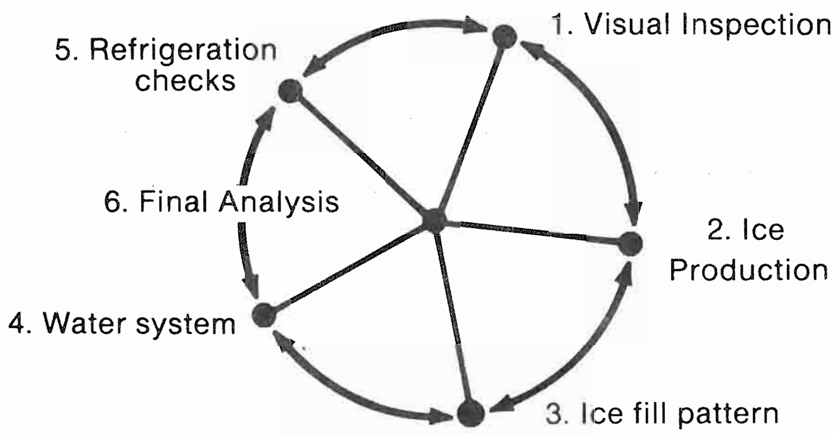


FIGURE 31. SIX-STEP DIAGNOSTIC PROCEDURE

The Six-Step Procedure is designed to increase the accuracy of your service call, while decreasing the time required to identify any problems.

Refrigeration components will react and try to compensate for nonrefrigeration component problems. By following this procedure step by step, problems that affect the refrigeration sequence can be identified without needless changing of components.

Each of the six steps have several items to check before proceeding to the next step. Follow each step carefully as the problem may be identified prior to the completion of all six steps.

Step 6 required the use of information gathered in the previous steps. Write down information as you collect it and record it on the proper Refrigeration Component Diagnostic Chart. This will keep you organized and simplify the 6th step of determining the malfunction.

> **NOTE**
>
> Do not make adjustments or turn the ice machine off until you have identified the malfunction. The problem may not repeat itself.

IMPORTANT

The Six-Step Procedure is basically the same for all E and G Series ice machines, with the exception of **Step 5D**. Be sure to follow appropriate procedure (for the ice machine on which you are working) when performing this step.

STEP 1 – VISUAL INSPECTION

Talk to the ice machine user to identify the perceived problem(s). The user's information could help you start in the right direction and may be a determining factor in your final diagnosis.

Following are a few questions to consider when talking to the ice machine user:

- When is the ice machine malfunctioning? (Night, day, all the time, during the freeze cycle, harvest cycle, etc.)
- When do you notice low production? (One day a week, every day, weekends, etc.)
- Can you describe exactly what the ice machine seems to be doing?
- Has anyone been working on the ice machine?
- Were items such as boxes obstructing air flow moved from around the ice machine before you arrived?

EQUIPMENT VISUAL INSPECTION

(Record Your Findings on Refrigeration Component Diagnostic Chart)

Possible Problem	Actual Finding	Corrective Measure
1. Ice machine no properly installed.		Reinstall in accordance with installation manual.
2. Air temperatures/ air flow restrictions, etc.		Reinstall in accordance with installation manual.

3. Air space clearances at back and sides of ice machine.		Must have a minimum of 5 inches clearance around all sides and top of machine.
4. Ice machine not level side-to-side, back-to-front.		Level machine.
5. Air-cooled condenser dirty.		Clean condenser.
6. Ice machine not on separate fused electrical circuit.		Install electrical in accordance with installation manual.
7. Drains not run separate and/or vented.		Run drains separate and vent according to installation manual.
8. Water filtration restricted (if used).		Install new water filter.
9. Remote condenser line set not properly installed.		Refer to Installation Instructions.

NOTE

Steps 2, 3 and 4 can be completed in conjunction with each other. Be careful not to interfere with the ice production check.

STEP 2 – ICE PRODUCTION

The amount of ice a machine produces is in direct relationship to water and air temperatures. This means an ice machine produces more ice in a 70°F room with 50°F water than in a 90°F room with 70°F water.

Use the following to check and compare ice production:

IMPORTANT
Water curtain must be in place to assure no water is being lost while checking ice production.

OPERATING CONDITIONS

1. Condenser inlet air temperature ________________
2. Water inlet temperature (taken at float outlet)________
3. The published 24-hour ice production at the above conditions: _______________lb/24 hours

ICE PRODUCTION CHECK

1. Freeze time _________ + harvest time __________ = ____________ total cycle time
2. 1440 ÷ total cycle time ________ = _____cycles/day
3. Weight 1 harvest ________ x cycles/day __________ = lb/24 hours

NOTE
To use the 24-hour ice production formulas, time must be in minutes and weight of ice in pounds.

Times are in minutes.
Example: 1 min. 15 sec. convert to 1.25 min.
15 sec. ÷ 60 sec.=.25 min.

Weights are in pounds.
Example: 9 lbs. 4 oz. convert to 9.25 lbs.
4 oz. ÷ 16 oz. = .25 lb.

Compare your findings in the Ice Production Check to published specifications in Operating Conditions. Record your findings on Refrigeration Diagnostic Chart.

A. Ice Production OK:
   Determine if another ice machine is needed, more storage capacity, or if moving existing equipment to lower load conditions will meet the customer's needs. (Contact local Manitowoc Distributor for options and accessories available.)

B. Low Ice Production:
   Record your findings on the Refrigeration Diagnostic Chart. Continue through Six-Step Procedures.

STEP 3 – ICE FILL PATTERN

The fill patterns on the evaporators are normal when the thickness is a uniform 1/8 inch from top to bottom and side to side. (The ice bridge is the inter-connecting waffle between the cubes.) The water should freeze on the entire evaporator at the same time. Ice forming on the bottom of an evaporator then working its way up to the top is not normal and must be noted as "thin on top and thick on bottom".

> **IMPORTANT**
>
> The water curtain must be in place to ensure no water is being lost while checking ice fill pattern.

Examples of ice fill patterns:

Normal ice fill – uniform 1/8-inch bridge thickness on entire evaporator surface.
Thick on top and thin on bottom.
Thin on top and thick on bottom.
Spotty ice fill (i.e.: corner not filling, etc.).

Record your findings for fill patterns on the Refrigeration Diagnostic Chart.

STEP 4 – WATER SYSTEM

Water related problems in ice machines often have the same symptoms as a refrigeration system malfunction.

Water area failures must be identified and eliminated prior to changing of refrigeration components. An example is a water dump valve leaking during the freeze cycle and starving TXV. The characteristics of both failures are similar.

CHECK WATER RELATED PROBLEMS

(Record Your Findings on Refrigeration Component Diagnostic Chart.)

Possible Problem	Actual Finding	Corrective Measure
1. Water area (evaporator) dirty.		Clean.
2. Water inlet pressure not between 20-80 psi.		Install water regulator valve or increase water pressure.
3. Incoming water supply temperature must be 35°F to 90°F.		Too hot — check hot water line check valves in other store equipment.
4. Water filter restricted (if used).		Replace filter.
5. Dump valve malfunctioning.		Clean dump valve. Replace as needed.
6. Vent tube not installed on water outlet drain.		See installation instructions.
7. Water trough hoses leaking water.		Install properly or replace.
8. Water float valve stuck open or out of adjustment.		Readjust float.
9. Water freezing behind evaporators.		Check water flow.
10. Water freezing between white plastic extrusions and evaporators.		Seal with food-grade silicone (RTV) adhesive.
11. Water flow uneven across evaporator(s).		Clean ice machine. Check water flow rate.

STEP 5 – REFRIGERATION

The refrigeration section requires taking several checks to gather information.

> **NOTE**
>
> Only proceed to Refrigeration System Step 5 after Steps 1-4 have been thoroughly checked and a final diagnosis could not be determined.

STEP 5A – Analyze Discharge Pressure

Using the Operational Pressure Chart, determine if the discharge pressure is correct for the ambient temperature the ice machine is located in.

A. If discharge pressure is within normal range, proceed to Step 5B to analyze suction pressure.

B. If discharge pressure is not within normal range, refer to the appropriate chart on the following pages.

C. Record findings on Refrigeration Diagnostic Chart.

DISCHARGE PRESSURE HIGH

Eliminate possible problems in the order listed on chart and follow appropriate corrective measures.

Possible Problem	Actual Findings	Corrective Measure
1. Excessive load conditions (air/water temperatures).		Relocate ice machine to location within guidelines (refer to Installation Instructions).
2. Dirty condenser.		Clean.
3. Water regulating valve (water-cooled condenser):		
a. Too small supply water line.		Replace with proper size line.
b. Out of adjustment.		Readjust.
c. Defective regulating valve.		Replace.
d. Dirty (scaled).		Clean.
4. Fan motor/fan cycling switch defective (air-cooled models).		Diagnose control, replace if necessary.
5. Restriction in high side lines.		Repair, see Evacuation/Charging Procedures.
6. Headmaster Control Valve defective (remote machines).		Refer to Headmaster Control Valve Diagnostics.
7. Improper refrigerant charge.		Refer to Evacuation/ Charging Procedures.
8. Noncondensables in system.		Refer to Evacuation/ Charging Procedures.

DISCHARGE PRESSURE LOW

Eliminate possible problems in the order listed on chart and follow appropriate corrective measures.

Possible Problem	Actual Findings	Corrective Measure
1. Load conditions low (air/water temperatures).		Relocate ice machine to location within guidelines (refer to Installation Instructions).
2. Water regulating valve (water-cooled condensers):		
a. Out of adjustment.		Readjust.
b. Leaking water during harvest cycle.		Readjust/replace if necessary.
c. Defective.		Replace.
3. Fan motor/fan cycling switch defective (air-cooled models).		Diagnose control, replace if necessary.
4. Headmaster Control Valve defective (remote machines).		Refer to Headmaster Control Valve Diagnostics.
5. Low refrigerant charge.		Continue through Six-Step Procedures.

STEP 5B – Analyze Suction Pressure

NOTE

Discharge pressure must be analyzed before suction pressure.

To analyze suction pressure you must compare the Operational Pressure Chart to the Cycle Time Chart for the particular ice machine on which you are working. The suction pressure gradually drops as ice forms throughout the freeze cycle.

A. **Normal suction pressure:** Proceed through Six-Step Procedure. (Example: 33 psig after 9 minutes into the freeze cycle is normal at 90°F air and 70°F water for a G1200 air cooled.)
B. **Low suction pressure:** Refer to Suction Pressure Low chart. (Example: 12 psig after 3 minutes into the freeze cycle is considered low for a G1200 air cooled.)
C. **High suction pressure:** Refer to Suction Pressure High chart. (Example: 38 psig after 10 minutes into the freeze cycle is considered high for a G1200 air cooled.)

TIME IN MINUTES

Start of Freeze Cycle	1	2	3	4	5	6	7	8	9	10	11	11.5	End of Freeze Cycle
	44	43	43	42	40	38	36	34	32	30	29	28	

SUCTION PRESSURE

By comparing the two charts you can determine if suction pressure is properly pulled down. Develop a chart as above and you will easily see where the suction pressure should be compared to the amount of time the ice machine is into the freeze cycle.

NOTE

If the ice machine is located in other than 90°F air and 70°F water another chart must be developed for comparison purposes.

Example: G1200 self-contained, air-cooled:
air temperature 90°F
water temperature 70°F

From Cycle Time Chart:
freeze time – 10.0 to 11.5 minutes
harvest time – 1.0 to 2.5 minutes
total cycle time – 11.0 to 14.0 minutes

From Operational Pressure Chart, Suction Pressure:
start of freeze – 44 psig
end of freeze – 28 psig

SUCTION PRESSURE HIGH

Eliminate the possible problems in the order listed on chart and follow appropriate corrective measure.

Possible Problem	Actual Findings	Corrective Measure
1. High discharge pressure affecting low side.		Refer to Discharge Pressure High Chart.
2. Hot gas valve stuck wide open.		Replace valve.
3. TXV flooding.		Continue through Six-Step Procedure.
4. Inefficient compressor (do not perform pumpdown test).		Continue through Six-Step Procedure.
5. Harvest pressure regulating solenoid valve leaking (remote machines).		Replace valve.

SUCTION PRESSURE LOW

Eliminate the possible problems in the order listed on chart and follow appropriate corrective measure.

Possible Problem	Actual Findings	Corrective Measures
1. Low load conditions.		Relocate ice machine to location within guidelines.
2. Water area problem		Refer to Step 4.
3. Tubing separating from backside of evaporator.		Replace evaporator.
4. Plugged drier/restriction in liquid line.		Repair — refer to Evacuation/Charging Procedures.
5. TXV is starving/low on charge.		Continue through Six-Step Procedure.

Step 5C – Hot Gas Valve Check

POSSIBLE PROBLEMS:

1. Improper valve.
   A hot gas valve requires a specific orifice size which meters the proper amount of hot gas flow into the evaporator during the harvest cycle. Replace defective hot gas valves with original Manitowoc replacement (O.E.M.) parts only. Refer to your Parts Manual for proper valve application.

2. Stuck in harvest cycle: Check for voltage at coil.

   IF YES: Refer to Electrical Sequence of Operation.

   IF NO: Normally a hot gas valve can be repaired without changing the entire valve. Rebuild or replace the hot gas valve as required.

3. Leaking during freeze cycle.
   a. Symptoms of leaking hot gas valve:
      1) Ice production loss will be minimal.
      2) Ice fill on evaporators will be normal.
      3) Suction pressure at the end of the freeze cycle will be slightly high. (This 1 to 4 psig increase can be difficult to detect.)
   b. Check procedures.

NOTE

On dual evaporator ice machines, procedures must be performed twice, once for each hot gas valve.

1) Feel **hot gas valve inlet** after 5 minutes into freeze cycle.

CAUTION

HOT GAS VALVE INLET COULD BE HOT ENOUGH TO BURN YOUR HAND. TOUCH IT BRIEFLY.

2) Determine if the inlet of hot gas valve is hot or close to compressor discharge line temperature.
3) A **good hot gas** valve inlet line will be hot to touch during the harvest cycle and be cool enough to touch after approximately 5 minutes into the freeze cycle. With a **leaking hot gas valve,** the inlet temperature will remain close to the discharge line temperature (hot to touch) during the freeze cycle.

Record your findings on the Refrigeration Component Diagnostic Chart.

STEP 5D

IMPORTANT

The Six-Step Procedure is basically the same for all E and G Series ice machines, with the exception of **Step 5D.** Be sure to follow appropriate procedure below for ice machine you are working on when performing this step.

Step 5D1 – Dual Evaporator E & G Series Ice Machines

Step 5D2 – All Single Evaporator E Series and G600 and G800 Series

Step 5D3 – G200 and G400 Series

STEP 5D1
Dual Evaporator E&G Series Ice Machines.

Thermal Expansion Valve (TXV) Checks

POSSIBLE PROBLEMS:

1. Improper valve.
   An improper valve will not achieve a uniform ice fill on the evaporator or proper ice production under all load conditions. Manitowoc O.E.M. expansion valves use special bulb gas charges, port sizes and stroke lengths to achieve this. Refer to the Parts Manual for proper valve usage.

2. TXV not installed properly.
   Refer to TXV Installation Procedures.

3. TXV starving or flooding.
   It is extremely rare for two TXV's to fail at the same time. When both TXV's are flooding or starving, it indicates that both valves are operating normally and the symptom indicates trouble in another area.

A starving or flooding expansion valve may be reacting to or trying to compensate for other refrigeration problems. All conditions that could cause a good TXV to starve or flood must be eliminated. The following example emphasizes this point:

An ice machine low on charge will cause both TXV's to starve.

A service technician forgets to verify system charge and changes both TXV's for starving.

While changing the TXV's the evacuation/charging procedures are performed correctly, and the proper charge put into the ice machine. The ice machine functions properly and the technician thinks he has diagnosed the problem correctly (bad TXV's). In reality the problem was corrected because the proper charge was put into the ice machine.

a. Symptoms of a starving valve:
   1) Ice production will be low or ice machine may not make ice.
   2) The suction pressure will be lower than normal.
   3) The ice pattern will be thin on top and thick on bottom of evaporator fed by a starving TXV and normal on evaporator fed by a good TXV.
b. Symptoms of a flooding valve:
   1) Ice production will be low or ice machine may not make ice.
   2) The suction pressure will be higher than normal.
   3) The ice pattern will be thick on top and thin on bottom of evaporator fed by flooding TXV and normal on evaporator fed by a good TXV.

4. TXV operation check is used to determine how the TXV's are functioning. As temperature readings must be accurate, a thermocouple type of temperature meter is recommended.

NOTE

Measure the **inlet** temperature of both evaporators at least 5 minutes into the freeze cycle. Compare the temperatures to each other.

a. Temperature indications:
   1) Properly operating TXV's will maintain the inlet temperatures within 5° of each other.
   2) An ice machine with one good TXV and one starving TXV will maintain the inlet temperatures of the evaporators within 5° of each other.
   3) An ice machine with one good TXV and one flooding TXV will not maintain the inlet temperatures of the evaporators within 5° of each other. This indicates the TXV feeding the warmer of the two temperatures is a flooding TXV.

STEP 5D2
All Single Evaporator E Series and G600 and G800 Series.

Thermal Expansion Valve (TXV) Checks

POSSIBLE PROBLEMS:

1. Improper valve.
   An improper valve will not achieve a uniform ice fill on the evaporator or proper ice production under all load conditions. Manitowoc O.E.M. expansion valves use special bulb gas charges, port sizes and stroke lengths to achieve this. Refer to the Parts Manual for proper valve usage.

2. TXV not installed properly.

3. TXV starving or flooding.
   a. Symptoms of a starving valve:
      1) Low ice production (may not make ice).
      2) Ice fill pattern — thin on top of evaporator and thick on bottom of evaporator.
      3) Suction pressure — lower than normal during freeze cycle.
   b. Symptoms of a flooding valve:
      1) Low ice production (may not make ice).
      2) Ice fill pattern — thick on top of evaporator and thin on bottom of evaporator.
      3) Suction pressure — higher than normal during freeze cycle.

4. TXV operation check.

> **NOTE**
> This temperature check is used in conjunction with all information gathered during the entire Six-Step Procedure. COMPLETE ALL 6 STEPS BEFORE CHANGING A TXV.

1) Measure the inlet and outlet temperatures of evaporator copper lines after at least 5 minutes into the freeze cycle.
2) A properly operating valve will maintain the inlet and outlet temperatures of the evaporator within approximately 5°F of each other.
3) An evaporator inlet temperature more than 5°F colder than the outlet indicates a starving TXV.
4) An evaporator inlet temperature more than 5°F warmer than the outlet indicates a flooding TXV.

STEP 5D3
G200/G400 Series only

Thermal Expansion Valve (TXV)/Suction Line Temperature at Compressor

TXV POSSIBLE PROBLEMS:

1. Improper valve.
   An improper valve will not achieve a uniform ice fill on the evaporator or proper ice production under all load conditions. Manitowoc O.E.M. expansion valves use special bulb gas charges, port sizes and stroke lengths to achieve this. Refer to the Parts Manual for proper valve usage.
2. TXV not installed properly.
3. TXV starving or flooding.
   A starving or flooding expansion valve may be reacting to or trying to compensate for other refrigeration problems. All conditions that could cause a good TXV to starve or flood must be eliminated. The following example emphasizes the point.

   An ice machine low on charge will cause a good TXV to starve. A service technician forgets to verify system charge and replaces the TXV for starving.

While changing the TXV the evacuation/charging procedures are performed correctly, and the peroper charge put into the ice machine. The ice machine functions properly and the technician thinks he has diagnosed the problem correctly (bad TXV.) In reality the problem was corrected because the proper charge was put into the machine.

a. Symptoms of a starving valve:
   1) Low ice production (may not make ice).
   2) Ice fill pattern — thin on top of evaporator and thick on bottom of evaporator.
   3) Suction pressure — lower than normal during freeze cycle.
b. Symptoms of a flooding valve:
   1. Low ice production (may not make ice).
   2) Ice fill pattern — thick on top of evaporator and thin on bottom of evaporator.
   3) Suction pressure — higher than normal during freeze cycle.

4. Suction Line Temperature Check.
   Measure the suction line temperature at the inlet of the compressor after 5 minutes into the freeze cycle.

   Temperature indications:
   a. No failure – a properly operating ice machine will maintain a temperature between 40°F and 70°F.
   b. Hot gas valve leaking (not wide open) – temperatures will remain normal (between 40°F and 70°F).
   c. Starving TXV – the temperatures will begin to climb above 50°F and, depending on how severe the failure, may go beyond the normal high of 70°F.
   d. Flooding TXV – the temperatures will drop below the normal low of 40°F.
   e. Inefficient compressor (suction valves) – during the early stage of the failure, temperature will be normal. As failure becomes worse, the temperatures will rise above the normal high of 70°F.

STEP 5E

Compressor

1. Suction valves (inefficient compressor).
   An inefficient compressor can be hard to detect. Components or problems that are not directly related to the compressor can simulate a faulty compressor.

   To diagnose a faulty compressor, systematically check other components and rule them out one by one, following the entire Six-Step Procedure. Step 6 will then indicate if a compressor change is needed.

   Symptoms of an inefficient compressor:
   a. Reduced ice production will be noticeable at lower ambient conditions and become more pronounced as ambient temperatures increase.
   b. Ice fill pattern (both evaporators) normal at lower ambients, although in extreme high ambient cases, there may be little or no ice formation.
   C. Suction pressures at the end of the freeze cycle will be slightly high and become more pronounced as ambient temperature increases.
   d. There may be intermittent flooding by the TXV's.

NOTE

An inefficient compressor may "pump down" and hold; therefore this type of test must not be used as a determining factor for replacing compressors.

2. Discharge valves.
   a. The compressor shell will become hot and compressor may cycle on overload.
   b. Suction pressure will be high.
   c. Discharge pressure will be lower than normal.
   d. Check procedure for discharge valves:
      1) Ensure compressor is running.
      2) Turn ice machine off.
      3) Immediately feel suction line – it will turn hot if the discharge valve is leaking or broken.

DUAL EVAPORATOR
E & G MODEL ICE MACHINE REFRIGERATION COMPONENT DIAGNOSTIC CHART

This chart is used with a detailed outline of each of the Six Steps listed.
Failure to follow the details of each step in order will result in a misdiagnosis.

MANITOWOC DUAL EVAPORATOR STEPS	HOT GAS VALVE LEAKING (not wide open)	TXV STARVING	TXV FLOODING	INEFFICIENT COMPRESSOR	ACTUAL FINDINGS
1. Visual Inspection	Visual inspection includes checking for proper installation, location, dirty condensers, etc., and talking to the ice machine user to identify the perceived problem(s).				
2. Ice Production	Normal ice production.	1. Low ice production. - or - 2. Not making ice.	1. Low ice production. - or - 2. Not making ice.	1. Ice production is close to normal. - or - 2. Low ice production.	

(Continued)

DUAL EVAPORATOR
ICE MACHINE REFRIGERATION COMPONENT DIAGNOSTIC CHART (Continued)

MANITOWOC DUAL EVAPORATOR STEPS	HOT GAS VALVE LEAKING (not wide open)	TXV STARVING	TXV FLOODING	INEFFICIENT COMPRESSOR	ACTUAL FINDINGS
3. Ice Fill Pattern	Ice fill is normal on both evaporators. ☐	1. Ice fill is thick on the bottom portion of one evaporator and thin on the top. or 2. No ice. ☐	1. Ice fill is thin on the bottom portion of one evaporator and thick on the top. or 2. No ice. ☐	Ice fill is normal on both evaporators. ☐	Front ________ ________ Rear ________ ________
4. Water System	Water related problems can simulate a refrigeration component malfunction. Water related problems must be eliminated before proceeding to Step 5.				

(Continued)

DUAL EVAPORATOR
ICE MACHINE REFRIGERATION COMPONENT DIAGNOSTIC CHART (Continued)

MANITOWOC DUAL EVAPORATOR STEPS	HOT GAS VALVE LEAKING (not wide open)	TXV STARVING	TXV FLOODING	INEFFICIENT COMPRESSOR	ACTUAL FINDINGS
5. Refrigeration System 5A. Freeze Cycle Discharge Pressure	**Normal** discharge pressure - proceed to Step 5B. **High or low** discharge pressure - refer to high or low discharge pressure problem analysis charts., before proceeding to Step 5B.				
5B. Freeze Cycle Suction Pressures	Normal.	Lower than normal throughout freeze cycle.	Higher than normal throughout freeze cycle.	Higher than normal throughout freeze cycle - pressures may pull down although it takes a long time.	
5C. Hot Gas Valve Inlet Feel Check	The inlet of one hot gas valve is **hot** and approaches the temperature of a **hot** compressor discharge line.	The inlet of both hot gas valves are **cooler** then the temperature of a **hot** compressor discharge line..	The inlet of both hot gas valves are **cool** and the compressor discharge line is **cool.**	The inlet of both hot gas valves are **cooler** than the temperature of a **hot** compressor discharge line.	Front H.G.V. ________ ________ Rear H.G.V. ________ ________ Comp. Discharge ________

(Continued)

DUAL EVAPORATOR
ICE MACHINE REFRIGERATION COMPONENT DIAGNOSTIC CHART (Continued)

	MANITOWOC DUAL EVAPORATOR STEPS	HOT GAS VALVE LEAKING (not wide open)	TXV STARVING	TXV FLOODING	INEFFICIENT COMPRESSOR	ACTUAL FINDINGS
5. Refrigeration System	5D. Evaporator Inlet Temperatures	Evaporator inlet temperatures within 5°F of each other. ☐	Evaporator inlet temperatures within 5°F of each other. ☐	Evaporator inlet temperatures not within 5°F: warmer temperature indicates a flooding valve. ☐	Evaporator inlet temperatures within 5°F of each other. ☐	Front ______ ______ Rear ______ ______ Differenial ______ ______
	Miscellaneous	☐	☐	☐	☐	
6.	Final Analysis (number of boxes checked)	A. ☐	B. ☐	C. ☐	D. ☐	

SINGLE EVAPORATOR
ICE MACHINE REFRIGERATION COMPONENT DIAGNOSTIC CHART

This chart is used with a detailed outline of each of the Six Steps listed.
Failure to follow the details of each step in order will result in a misdiagnosis.

MANITOWOC SINGLE EVAPORATOR STEPS	HOT GAS VALVE LEAKING (not wide open)	TXV STARVING	TXV FLOODING	INEFFICIENT COMPRESSOR (suction valve)	ACTUAL FINDINGS
1. Visual Inspection	Visual inspection includes checking for proper installation, location, dirty condensers, etc., and talking to the ice machine user to identify the perceived problem(s).				
2. Ice Production	Normal ice production.	1. Low ice production. -or- 2. Not making ice.	1. Low ice production. -or- 2. Not making ice.	1. Ice production is close to normal. -or- 2. Low ice production.	
3. Ice Fill Pattern	Ice fill is normal.	1. Ice fill will be thick on bottom portion of the evaporator and thin on top. -or- 2. No ice.	1. Ice fill is thin on the bottom portion of the evaporator and thick on top. -or- 2. No ice.	Ice fill is normal.	

(Continued)

SINGLE EVAPORATOR
ICE MACHINE REFRIGERATION COMPONENT DIAGNOSTIC CHART (Continued)

MANITOWOC SINGLE EVAPORATOR STEPS	HOT GAS VALVE LEAKING (not wide open)	TXV STARVING	TXV FLOODING	INEFFICIENT COMPRESSOR (suction valve)	ACTUAL FINDINGS
4. Water System	Water related problems can simulate a refrigeration component malfunction. Water related problems must be eliminated before proceeding to Step 5.				
5A. Freeze Cycle Discharge Pressure	**Normal** discharge pressure - proceed to Step 5B. **High or low** discharge pressure - refer to high or low discharge problem analysis charts, before proceeding to Step 5B.				
5B. Freeze Cycle Suction Pressure	Normal.	Lower than normal throughout freeze cycle.	Higher than normal throughout freeze cycle.	Higher than normal throughout freeze cycle-pressures may pull down although it takes a long time.	

(Continued)

SINGLE EVAPORATOR
ICE MACHINE REFRIGERATION COMPONENT DIAGNOSTIC CHART (Continued)

	MANITOWOC SINGLE EVAPORATOR STEPS	HOT GAS VALVE LEAKING (not wide open)	TXV STARVING	TXV FLOODING	INEFFICIENT COMPRESSOR (suction valve)	ACTUAL FINDINGS
	5C. Hot Gas Valve Inlet Feel Check	The inlet of hot gas valve is **hot** and approaches the temperature of a **hot** compressor discharge line. ☐	The inlet of hot gas valve is **cooler** than the temperature of a **hot** compressor discharge line. ☐	The inlet of **hot** gas valve is **cool** and the compressor discharge is **cool.** ☐	The inlet of hot gas valve is **cooler** than the temperature of a **hot** compressor discharge line. ☐	Hot Gas Inlet ____________ ____________ Comp. Discharge ____________ ____________
IMPORTANT: Use proper Step 5D	5D. Suction Line Temperature at Compressor (G200/G400)	40°F to 70°F. ☐	Above 50°F. ☐	Below 40°F. ☐	Above 40°F. ☐	G200/G400 Series Only Temp ____________
	5D. Inlet/outlet Temperature of Evaporator (E Series/ G600/G800)	Evaporator inlet and outlet temperatures within 5°F of each other. ☐	Evaporator inlet and outlet temperatures not within 5°F; evaporator **inlet colder** than outlet temperature. ☐	Evaporator inlet and outlet temperatures not within 5°F; evaporator **inlet warmer** than outlet temperature ☐	Evaporator inlet and outlet temperatures within 5°F of each other. ☐	Inlet ____________ Outlet ____________ Differential ____________

(Continued)

SINGLE EVAPORATOR
ICE MACHINE REFRIGERATION COMPONENT DIAGNOSTIC CHART (Continued)

MANITOWOC SINGLE EVAPORATOR STEPS	HOT GAS VALVE LEAKING (not wide open)	TXV STARVING	TXV FLOODING	INEFFICIENT COMPRESSOR (suction valve)	ACTUAL FINDINGS
Miscellaneous					
6. Final Analysis (number of boxes checked)	A. ☐	B. ☐	C. ☐	D. ☐	

STEP 6 - FINAL ANALYSIS

Thoroughly following the first 5 steps has eliminated all non-refrigerant problems. The Refrigeration Component Chart will verify what is causing the problem.

Fill out the chart using the following procedures:

1. Based on the symptoms found while performing Steps 1 through 5, fill in the Actual Findings column.

2. Each time the actual finding is the same as the characteristic listed to the right of a step number, put a check in the appropriate box. (Example: the actual finding is "thin ice on top of evaporator". The box under starving TXV is the only box checked across the ice fill pattern section.)

3. Add the number of boxes checked (under) each component failure and put the total in the bottom column. Refer to the component column with the most boxes checked and follow the appropriate procedures as listed in "a" through "d" below.
   a. Hot Gas Valve Leaking column: Normally a leaking hot gas valve can be repaired without changing the entire valve. Rebuild or replace the hot gas valve as required. Refer to Refrigeration Solenoid Valve Replacement.
   b. TXV Starving column: Verify the ice machine is not low on charge before replacing the TXV. Use the following guidelines:

      On dual evaporator ice machines change only the TXV that is starving. If both TXV's are starving, the TXV's are most likely to be good and are affected by some other malfunction such as an ice machine that is low on charge.

> **NOTE**
>
> A low refrigerant charge will affect both freeze and harvest cycle pressures.

1) Add charge in 2 to 4 oz. increments to see if the problem is corrected.
2) If problem is not corrected by adding charge, change the TXV and drier.
3) If problem is corrected by adding charge, find the refrigerant leak, change the drier, evacuate and recharge. (System must operate with proper charge – do not leave running without changing drier, evacuating and recharging.)

c. TXV Flooding column: Change the TXV... On dual evaporator, change only the TXV that is flooding. If both TXV's are flooding go back through the Six-Step Procedure to locate the cause.
d. Inefficient Compressor column: Replace the compressor (and start components) and drier, evacuate, and recharge.

NOTE

To receive warranty credit on compressor, old start components must be returned with faulty compressor.

A100 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

	FREEZE TIME			HARVEST TIME
AMBIENT TEMP. °F	WATER TEMP. °F			
	50°	70°	90°	
70	14-19.5	16-22	18-25	1.5-2.5
80	15-21	17-23	19-28	
90	16-22	18-25	21-29	

Based on average ice slab weight of 1.125 lb to 1.5 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	100	95	90
80	90	85	80
90	80	75	70

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
70	101-135	18-7	70-80	40-44
90	140-180	22-8	70-80	40-44
105	165-215	24-9	70-80	42-44

A100 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

	FREEZE TIME			HARVEST TIME
AMBIENT TEMP. °F	WATER TEMP. °F			
	50°	70°	90°	
70	14-19.5	15-21	16-22	1.5-2.5
80	15-21	16-22	17-22	
90	16-22	19-25	18-25	

Based on average ice slab weight of 1.125 lb to 1.5 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	100	95	90
80	95	90	85
90	90	85	80

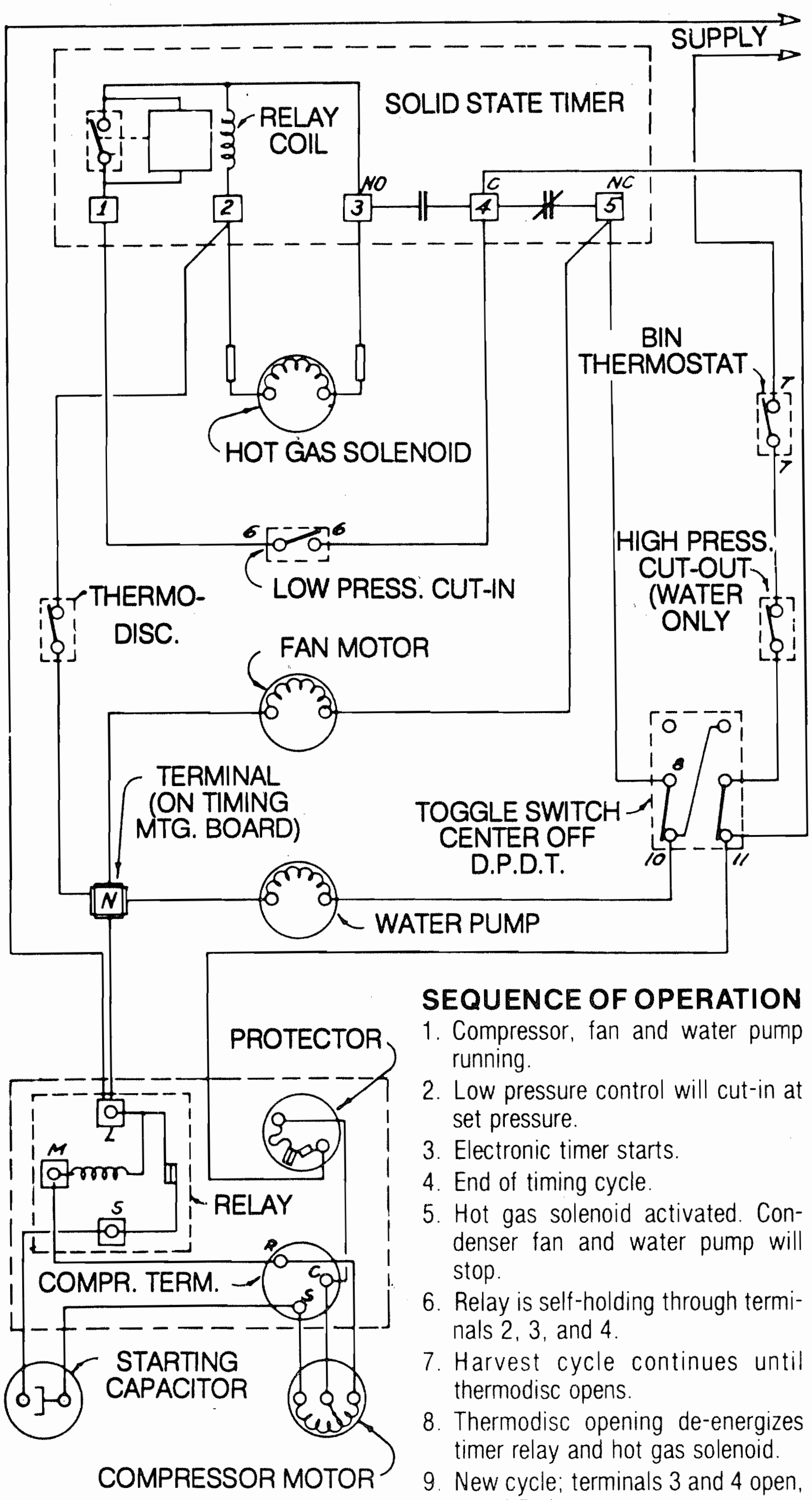
CONDENSER WATER CONSUMPTION	WATER TEMP. °F		
	50°	70°	90°
GAL/24 HR.	70	150	365

At 125 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
70	120-125	20-4	70-80	35-44
90	120-125	21-4	70-80	35-44
105	121-126	22-5	70-80	35-44

A100 SERIES AIR AND WATER
FAN ON AIR-COOLED ONLY
SHOWN AT BEGINNING OF FREEZE CYCLE
115 VAC 60 CYCLE OR 230 VAC 50 CYCLE



SEQUENCE OF OPERATION

1. Compressor, fan and water pump running.
2. Low pressure control will cut-in at set pressure.
3. Electronic timer starts.
4. End of timing cycle.
5. Hot gas solenoid activated. Condenser fan and water pump will stop.
6. Relay is self-holding through terminals 2, 3, and 4.
7. Harvest cycle continues until thermodisc opens.
8. Thermodisc opening de-energizes timer relay and hot gas solenoid.
9. New cycle; terminals 3 and 4 open, 4 and 5 close.
10. Fan and water pump start.

E200/H200 SERIES AIR COOLED
(1/2 hp Compressor)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME — WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	13-16.5	14.5-19	17-22	1.5-2.5
80	14-18	16-20.5	18-23	
90	15.5-20	18-23	21-27	
100	19-25	22-29	25-32.5	

Based on average ice slab weight of 2.38 lb to 3 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	230	205	180
80	215	190	170
90	195	170	150
100	160	140	125

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G	SUCTION PRESSURE P.S.I.G.
50	100-124	25-12	65-85	40-50
70	100-125	25-12	65-85	45-50
80	120-150	28-14	75-95	45-55
90	140-170	30-14	85-105	55-65
100	155-200	38-14	105-125	70-80
110	170-230	45-15	120-140	80-90

E200/H200 SERIES WATER COOLED
(1/2 hp Compressor)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME: WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	13-16.5	15.5-20	19-24	1.5-2.5
80	13-17	16-20.5	20-26	
90	13.5-17.5	16.5-21	21-27	
100	14-18	17.5-22.5	21.5-28	

Based on average ice slab weight of 2.38 lb to 3 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	230	195	160
80	225	190	155
90	220	185	150
100	215	175	145

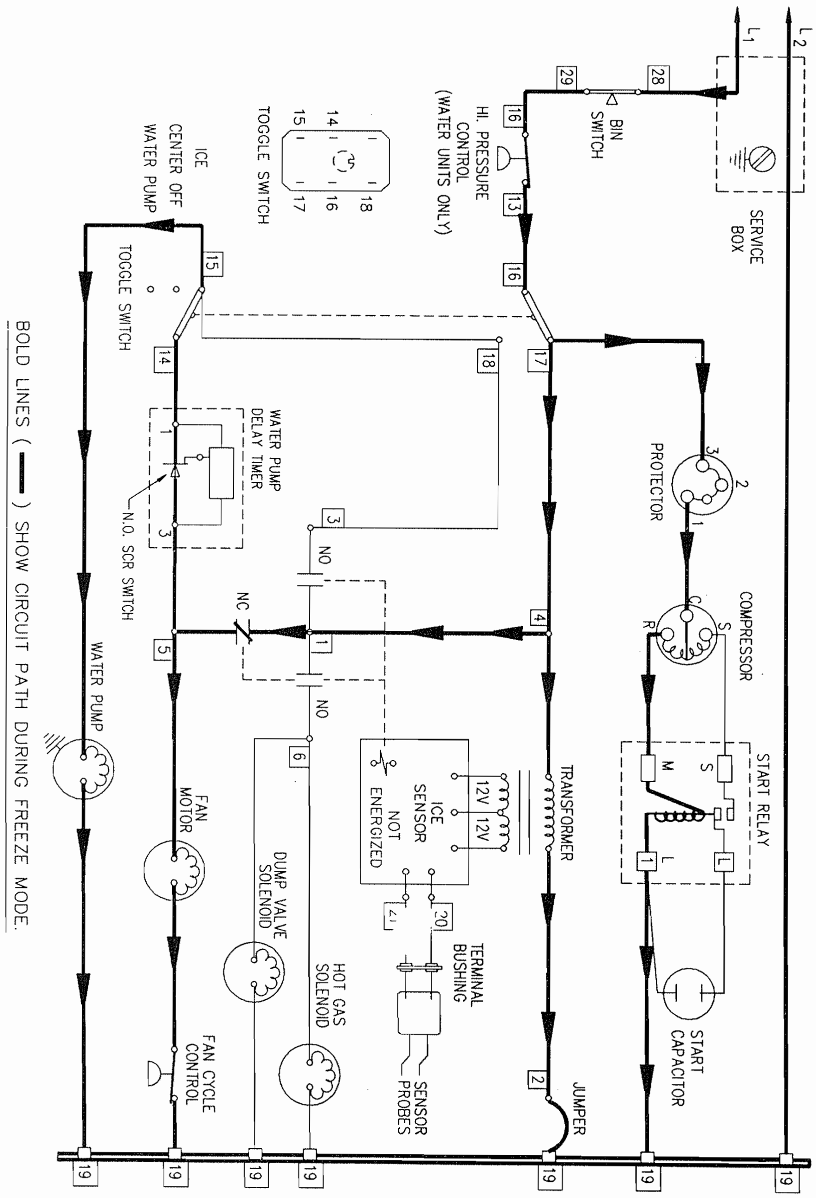
CONDENSER WATER CONSUMPTION	WATER TEMP. °F 50°	70°	90°
GAL/24 HR.	175	340	885

At 125 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE: HEAD PRESSURE P.S.I.G.	FREEZE CYCLE: SUCTION PRESSURE P.S.I.G.	HARVEST CYCLE: HEAD PRESSURE P.S.I.G.	HARVEST CYCLE: SUCTION PRESSURE P.S.I.G.
50	120-130	22-10	75-95	40-50
70	120-130	22-12	80-100	45-55
80	120-130	22-12	80-100	45-55
90	120-130	22-12	80-100	45-55
100	120-130	22-12	80-100	45-55
110	120-130	24-14	80-105	50-60

E200 AND H200 AIR AND WATER
1 PHASE — 50/60 CYCLE



E400 SERIES AIR COOLED
(3/4 hp Compressor)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
70	12.5-14.5	14.5-17	16-18.5	1.5-2.5
80	13.5-16	16-18.5	18-21	
90	15-17.5	18-21	20-23	
100	18-21	21-24	25-29	

Based on average ice slab weight of 4.125 lb. to 4.75 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	410	360	330
80	380	330	300
90	350	300	270
100	300	260	230

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	100-135	25-12	65-80	35-65
70	100-135	25-12	70-85	35-65
80	110-135	28-14	80-95	35-65
90	120-140	30-14	85-100	35-65
100	135-155	30-14	90-115	35-65

E400 SERIES WATER COOLED
(3/4 hp Compressor)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	14-16.5	15.5-18	16.5-19	1.5-2.5
80	14-16.5	15.5-18	17-20	
90	14-16.5	15.5-18	17-20	
100	14-16.5	16-18.5	18-21	

Based on average ice slab weight of 4.125 lb. to 4.75 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	370	340	320
80	370	340	310
90	370	340	310
100	370	330	300

CONDENSER WATER CONSUMPTION	WATER TEMP. °F 50°	70°	90°
GAL/24 HR.	255	410	1120

At 125 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE HEAD PRESSURE P.S.I.G.	FREEZE CYCLE SUCTION PRESSURE P.S.I.G.	HARVEST CYCLE HEAD PRESSURE P.S.I.G.	HARVEST CYCLE SUCTION PRESSURE P.S.I.G.
50	125-135	22-10	70-90	34-64
70	125-135	22-12	70-90	34-64
80	125-135	22-12	70-90	34-64
90	125-135	22-12	70-90	34-64
100	125-135	22-14	70-90	34-64

E400 SERIES REMOTE

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP.°F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
-20 to 70	13-15	14.5-17	17-20	1.5-2.75
90	13-15.5	15-17.5	18-21	
100	13.5-16	15.5-18	19-22	
110	16.5-19	18.5-21.5	21-24	

Based on average ice slab weight of 4.125 lb. to 4.75 lb.
Times in minutes

24 HOUR ICE PRODUCTION

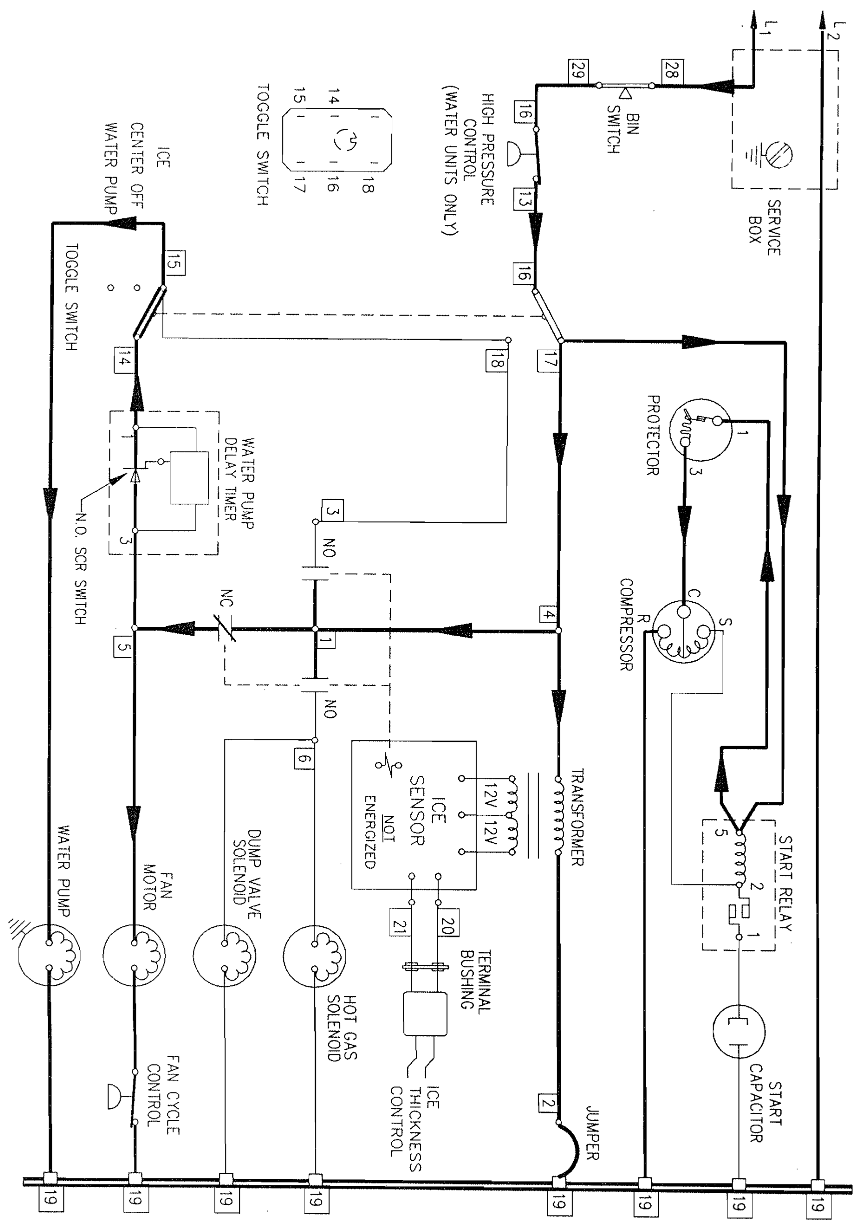
CONDENSER AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
-20 to 70	400	360	310
90	390	350	300
100	380	340	280
110	320	290	260

Based on 70° air at ice maker

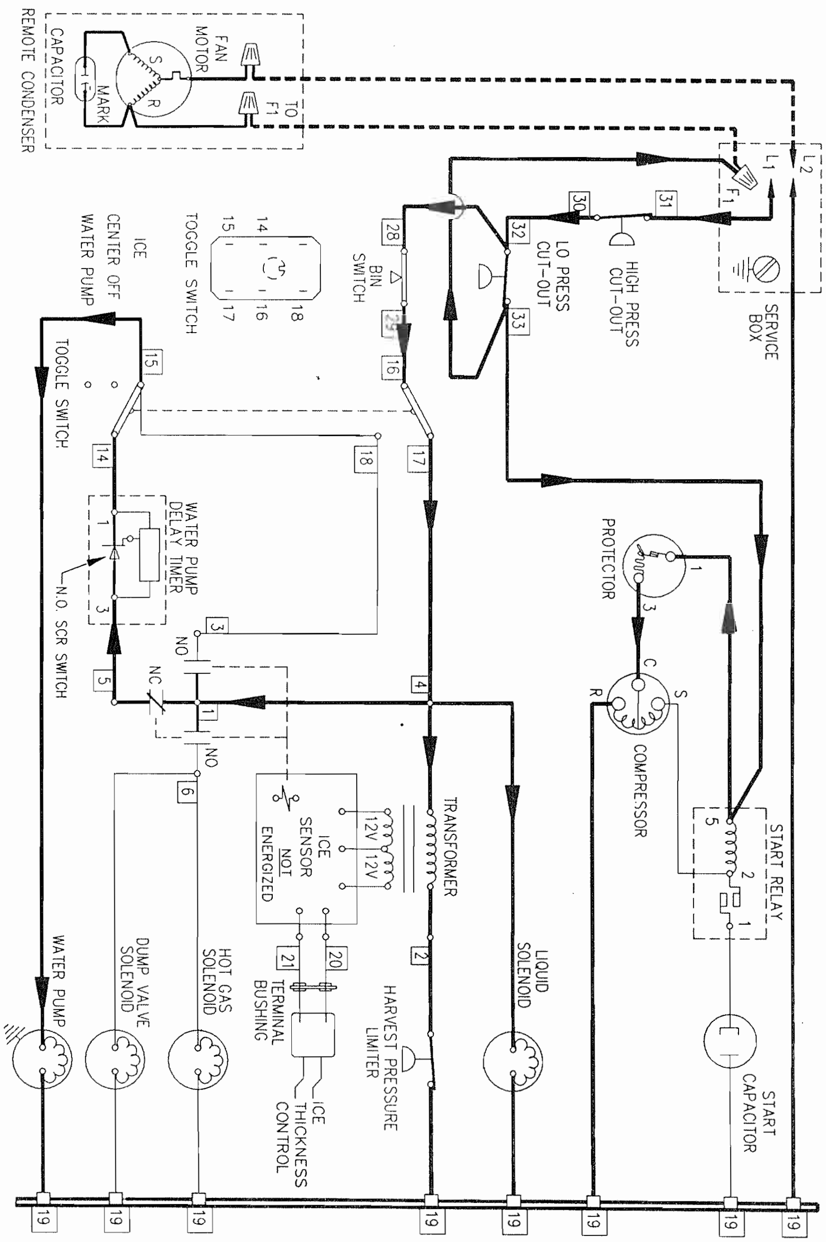
OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
With Accumulator up to S/N 880962503				
-20 to 50	110-130	22-12	65-85	40-50
70	120-140	24-14	70-90	45-55
80	120-140	24-14	70-90	45-55
90	130-150	24-14	80-100	50-60
100	140-160	25-15	90-110	50-60
110	150-170	25-15	100-120	60-70
120	170-190	25-16	110-130	70-80
With Harvest Pressure Limiter Control after S/N 880962503				
-20 to 50	110-130	22-12	65-85	35-48
70	120-140	24-14	70-90	38-48
80	120-140	24-14	70-90	40-50
90	130-150	24-14	80-100	40-50
100	140-160	25-15	90-110	42-52
110	150-170	25-15	90-115	42-52
120	170-190	25-16	100-130	44-54

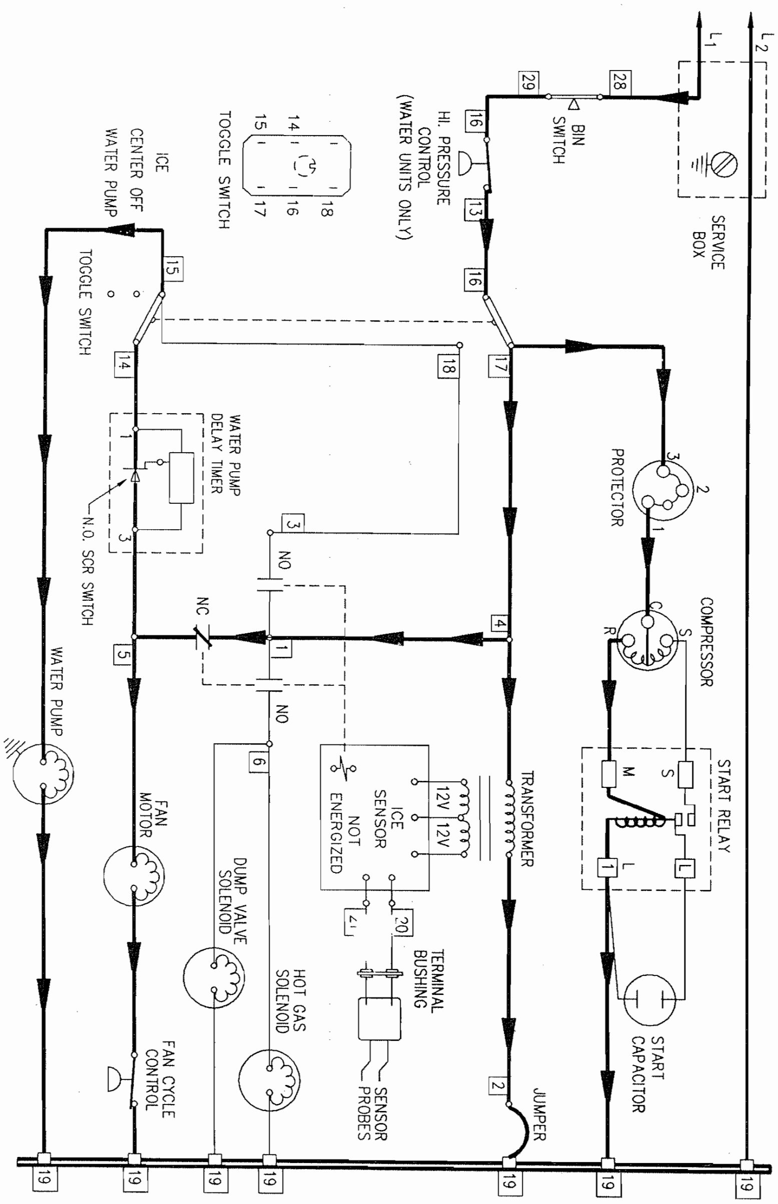
E400 AIR AND WATER
1 PHASE — 60 CYCLE



E400 REMOTE
1 PHASE — 60 CYCLE



E400 AIR AND WATER
1 PHASE — 50 CYCLE



BOLD LINES (▬) SHOW CIRCUIT PATH DURING FREEZE MODE.

E600 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
70	12.75-15	14.5-17	15-18	1.5-3.0
80	13.25-15.5	15-18	16-18.75	
90	13.75-18.25	16-18.75	18-21	
100	15.5-18.5	17.5-20.75	20-23.5	

Based on average ice slab weight of 6.25 lb. to 7.25 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	610	540	520
80	590	520	500
90	570	500	450
100	510	460	410

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	110-135	18-6	75-90	34-44
70	110-135	18-6	75-90	35-45
80	125-150	20-8	80-95	40-50
90	140-180	21-8	90-105	50-60
100	170-210	22-9	110-120	55-65

E600 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

	FREEZE TIME			HARVEST TIME
AMBIENT TEMP. °F	WATER TEMP. °F			
	50°	70°	90°	
70	13-15.5	15-17.25	17.5-20.75	1.5-3.0
80	13.25-15.75	15-18	18-21	
90	13.5-16	15.5-18.5	18.5-21.75	
100	15-17.75	17-20	19-22.5	

Based on average ice slab weight of 6.25 lb. to 7.25 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	600	530	460
80	590	520	450
90	580	510	440
100	530	470	410

CONDENSER WATER CONSUMPTION	WATER TEMP. °F		
	50°	70°	90°
GAL/24 HR.	400	470	1650

At 125 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50°	125-130	18-5	80-90	38-45
70°	125-130	19-6	80-90	38-45
80°	125-130	20-7	80-90	38-45
90°	125-130	21-8	80-90	38-45
100°	125-130	22-8	80-90	38-45

E600 SERIES REMOTE
(With AC695A Condenser)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
-20 to 70	13-15.5	14.5-17	16.5-21	1.5-3.0
90	14-16.5	15.5-18.5	16.5-21	
100	15-18	15.5-18.5	17.5-20.75	
110	16.5-21	17.5-20.75	19.5-23	

Based on average ice slab weight of 6.25 lb. to 7.25 lb.
Times in minutes

24 HOUR ICE PRODUCTION

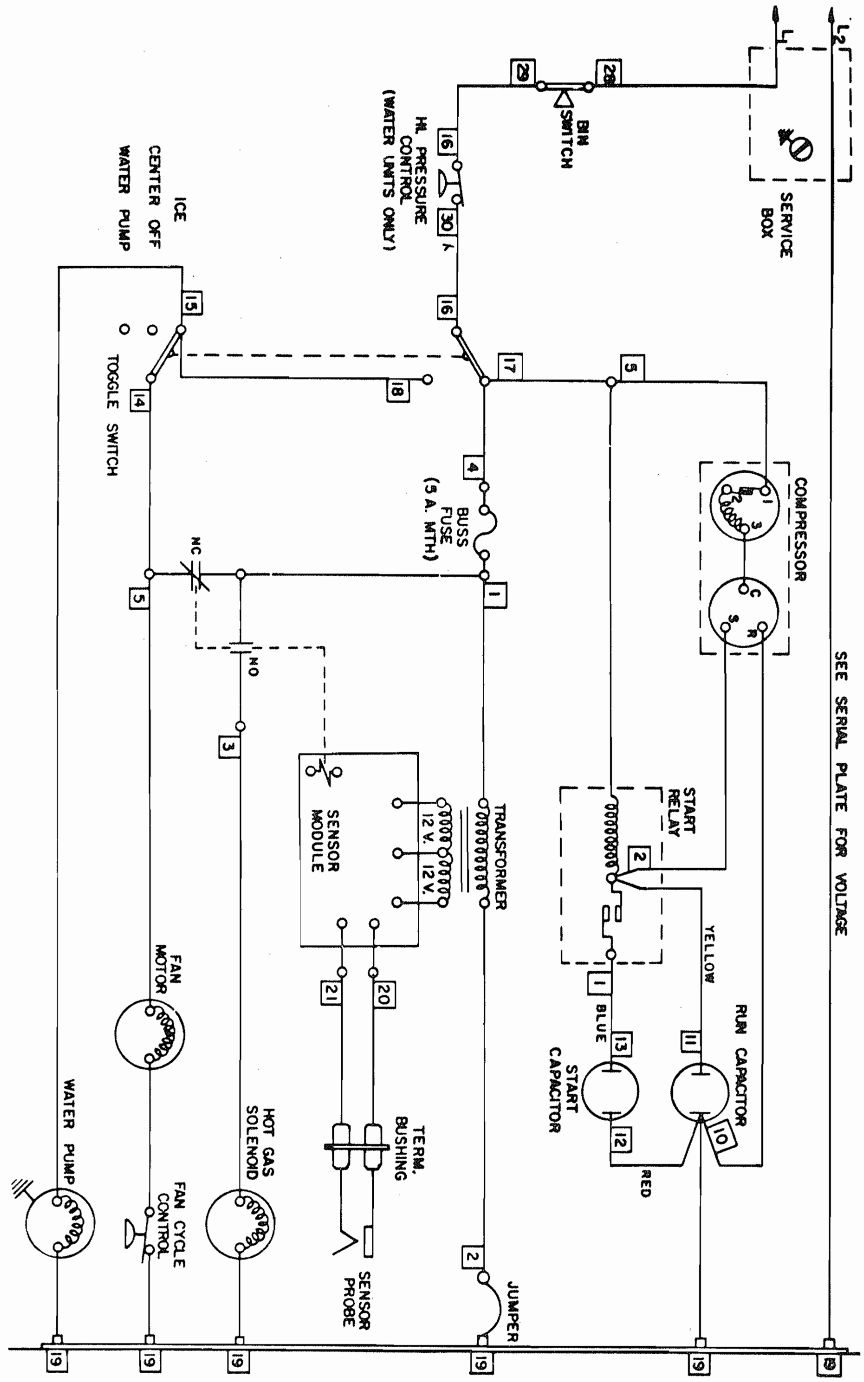
CONDENSER AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
-20 to 70	600	540	490
90	560	510	490
100	520	510	460
110	490	460	420

Based on 70° air at ice maker

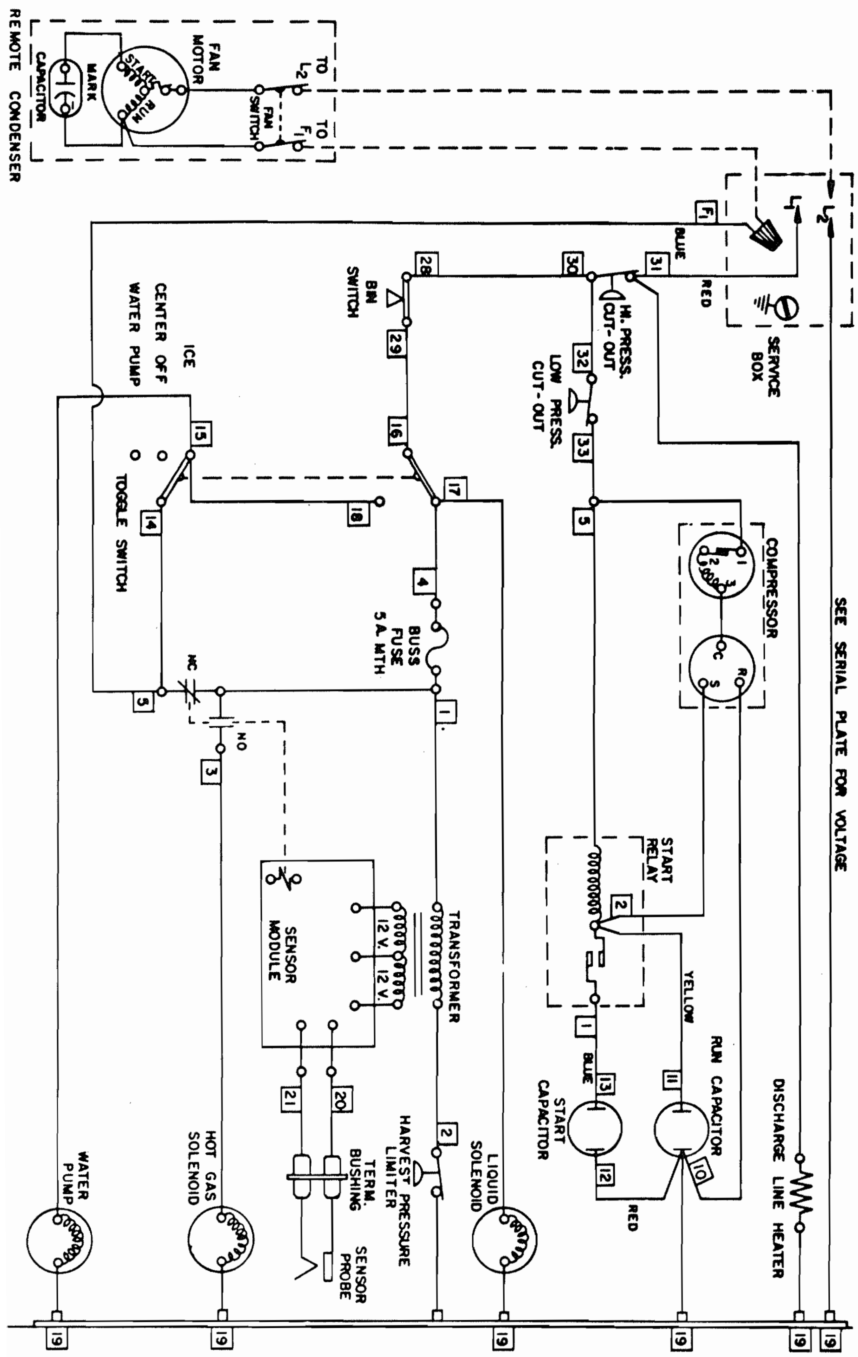
OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE HEAD PRESSURE P.S.I.G.	FREEZE CYCLE SUCTION PRESSURE P.S.I.G.	HARVEST CYCLE HEAD PRESSURE P.S.I.G.	HARVEST CYCLE SUCTION PRESSURE P.S.I.G.
-20 to 50	100-130	18-6	70-90	40-50
70	100-130	18-6	70-90	40-50
80	100-140	20-8	70-95	40-50
90	110-145	21-8	75-100	50-60
100	110-145	22-9	90-110	55-65

E600 AIR AND WATER
1 PHASE — 50/60 CYCLE



E600 REMOTE
1 PHASE — 50/60 CYCLE



E1100 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	13-16	15-18	17-21	1.5-2.5
90	14-19	16-19.5	18.5-22	
100	15.5-18.75	17.5-21	20-24	
110	16.75-20	19-23	21.75-26	

Based on average ice slab weight of 12.25 lb to 14.5 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	1160	1030	910
80	1090	970	860
90	1010	900	800
100	940	840	740

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	105-140	25-8	70-85	35-65
70	105-140	25-8	80-95	35-65
80	120-150	25-8	90-100	35-65
90	140-160	25-8	100-120	35-65
100	160-190	25-8	105-120	35-65
110	170-200	25-8	110-125	35-65

E1100 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	14-17	15.5-18.75	17-21	1.5-2.5
80	14-17	15.75-19	17.75-21.5	
90	14.5-17.5	16-19.5	18-22	
100	15-18	16.5-20	19-23	

Based on average ice slab weight of 12.25 lb to 14.5 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	1110	1010	910
80	1090	990	890
90	1070	970	870
100	1050	950	850

CONDENSER WATER CONSUMPTION	WATER TEMP. °F 50°	70°	90°
GAL/24 HR.	761	1400	3640 (EST)

At 135 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE HEAD PRESSURE P.S.I.G.	FREEZE CYCLE SUCTION PRESSURE P.S.I.G.	HARVEST CYCLE HEAD PRESSURE P.S.I.G.	HARVEST CYCLE SUCTION PRESSURE P.S.I.G.
50	125-140	25-8	60-80	30-40
70	125-140	25-8	60-80	30-40
80	125-140	25-8	80-100	35-70
90	125-140	25-8	90-110	35-70
100	125-140	25-8	100-125	35-70
110	125-140	25-8	110-130	35-70

E1100 SERIES REMOTE
(With AC 1195A Condenser)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP °F.	FREEZE TIME WATER TEMP. °F			HARVEST TIME
	50°	70°	90°	
-20 to 70	13.5-16	16-19	18-21.75	1.5-3.5
90	14-17	16.5-19.75	19-23	
100	15.5-18.75	16.5-19.75	19-23	
110	17-21	19.5-23.5	21-25.75	

Based on average ice slab weight of 12.25 lb to 14.5 lb
Times in minutes

24 HOUR ICE PRODUCTION

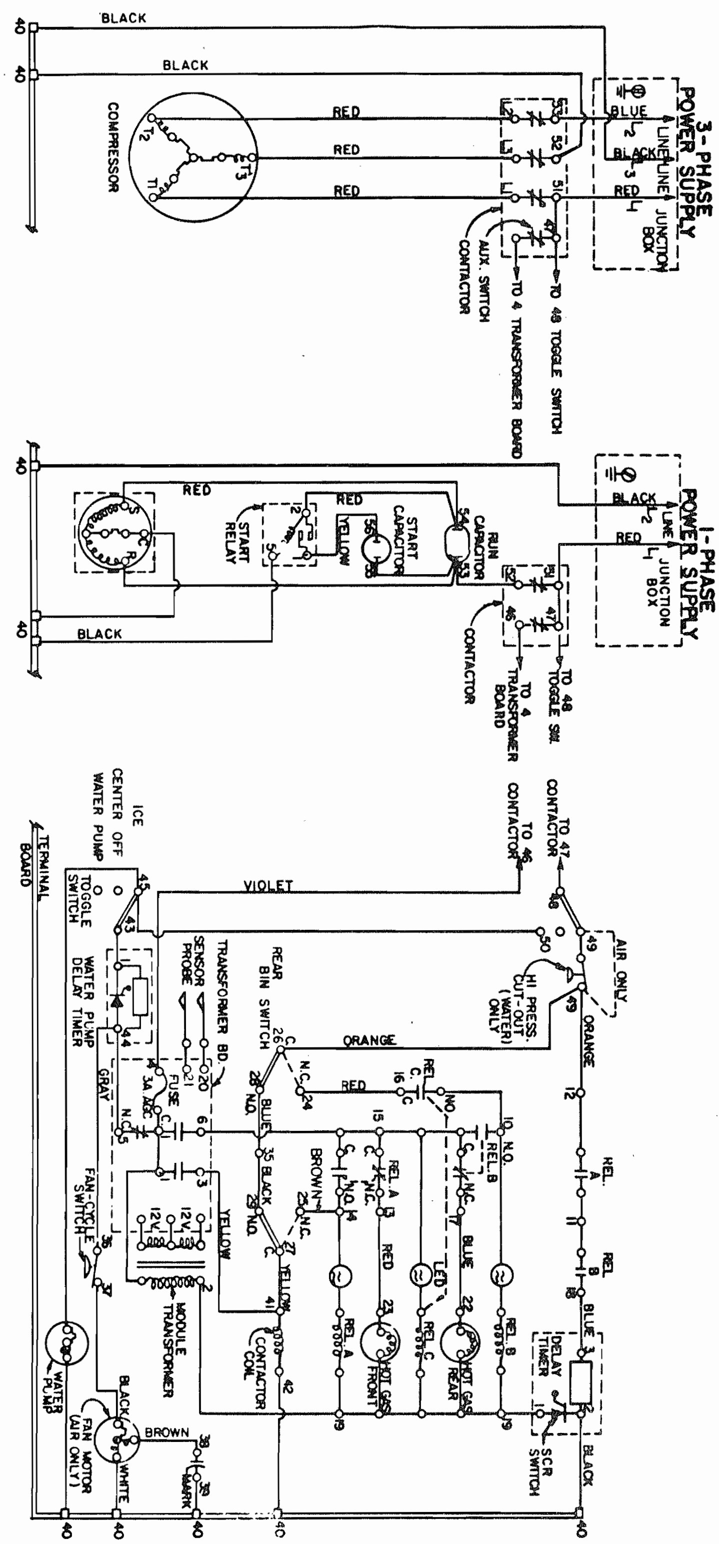
CONDENSER AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
-20 to 70	1140	980	880
90	1100	960	840
100	1010	890	800
110	910	820	760

Based on 90° air at ice maker

OPERATING PRESSURES

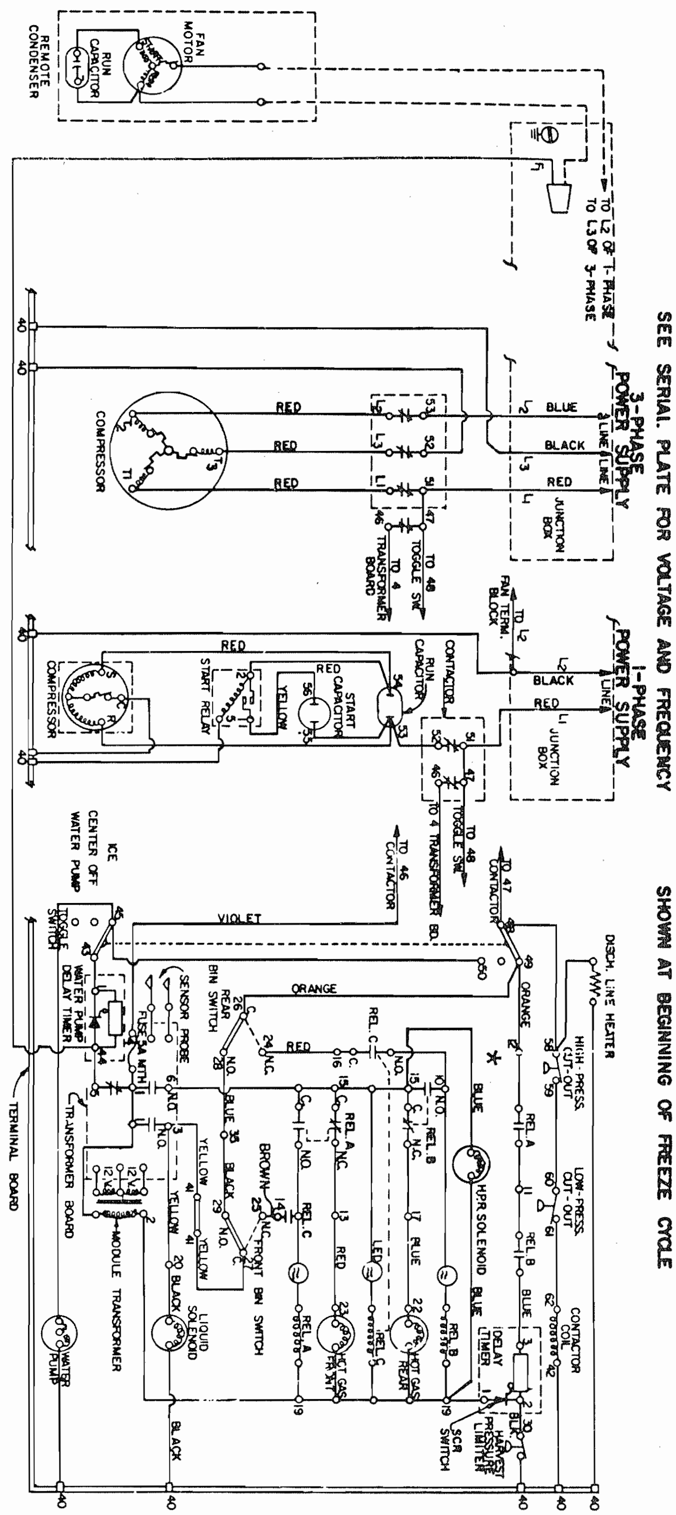
AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
-20 to 50	120-130	25-8	60-80	30-40
70	120-130	25-8	60-80	30-40
80	130-150	25-8	80-100	30-70
90	140-170	25-8	90-110	30-70
100	160-190	25-8	100-125	30-70
110	190-230	25-8	110-130	30-70

E1100 AIR AND WATER
1 PHASE — 50/60 CYCLE



SEE SERIAL PLATE FOR VOLTAGE AND FREQUENCY SHOWN AT BEGINNING OF FREEZE CYCLE

E1100 REMOTE
1 or 3 PHASE — 50/60 CYCLE



* Not Shown H.P.R. delay timer

G150 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
70	8-12	9-13	11-15	1-2
80	9-13	10-14	12-16	
90	9-15	10-16	14-17	
100	10-16	11-17	18-24	

Based on average ice slab weightof 1.25 lb. to 1.5 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	180	160	150
80	160	140	130
90	140	120	110
100	120	100	90

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	175-225	35-18	125-175	65-100
70	180-250	35-18	125-175	65-100
80	215-270	35-18	135-185	75-110
90	230-290	35-18	160-200	75-120
100	240-340	40-20	170-215	75-155

G150 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
70	8-12	9-14	11-16	1-2
80	8-12	9-14	12-18	
90	8-12	10-15	12-18	
100	8-12	10-15	12-18	

Based on average ice slab weight of 1.25 lb. to 1.5 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	145	130	115
80	140	125	110
90	135	120	105
100	130	115	100

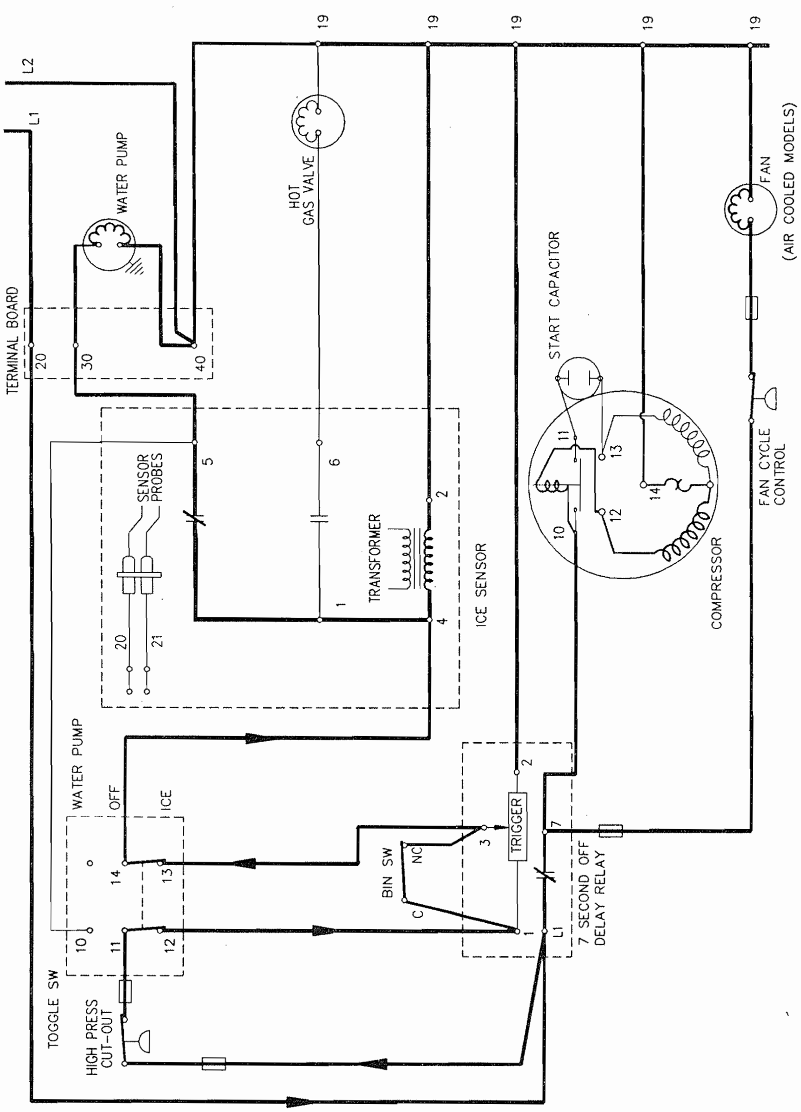
CONDENSER WATER CONSUMPTION	WATER TEMP. °F		
	50°	70°	90°
GAL/24 HR.	140	245	833

At 225 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	220-230	35-25	160-200	85-100
70	220-230	35-25	160-200	90-105
80	220-230	35-25	160-200	90-105
90	220-230	35-25	160-200	95-110
100	220-230	35-25	160-200	100-115

G150 SERIES AIR AND WATER COOLED
1 PHASE — 50/60 CYCLE



G200 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
70	11-14	12-15	13-17	1-2
80	13-17	14-18	17-20	
90	15-21	17-22	19-24	
100	18-25	23-29	23-29	

Based on average ice slab weight of 2.38 lb. to 3.0 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	270	255	230
80	240	220	200
90	205	185	165
100	175	150	140

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	175-225	44-24	125-150	85-100
70	175-225	44-24	125-150	85-100
80	200-250	44-26	135-165	85-110
90	240-280	46-26	160-200	95-120
100	265-310	48-28	170-210	125-145

G200 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
70	13-17	15-20	18-24	1-2
80	13-17	16-20	19-25	
90	13-17	16-21	20-26	
100	14-18	16-21	20-26	

Based on average ice slab weight of 2.38 lb to 3 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	240	205	170
80	235	200	165
90	230	195	160
100	225	190	155

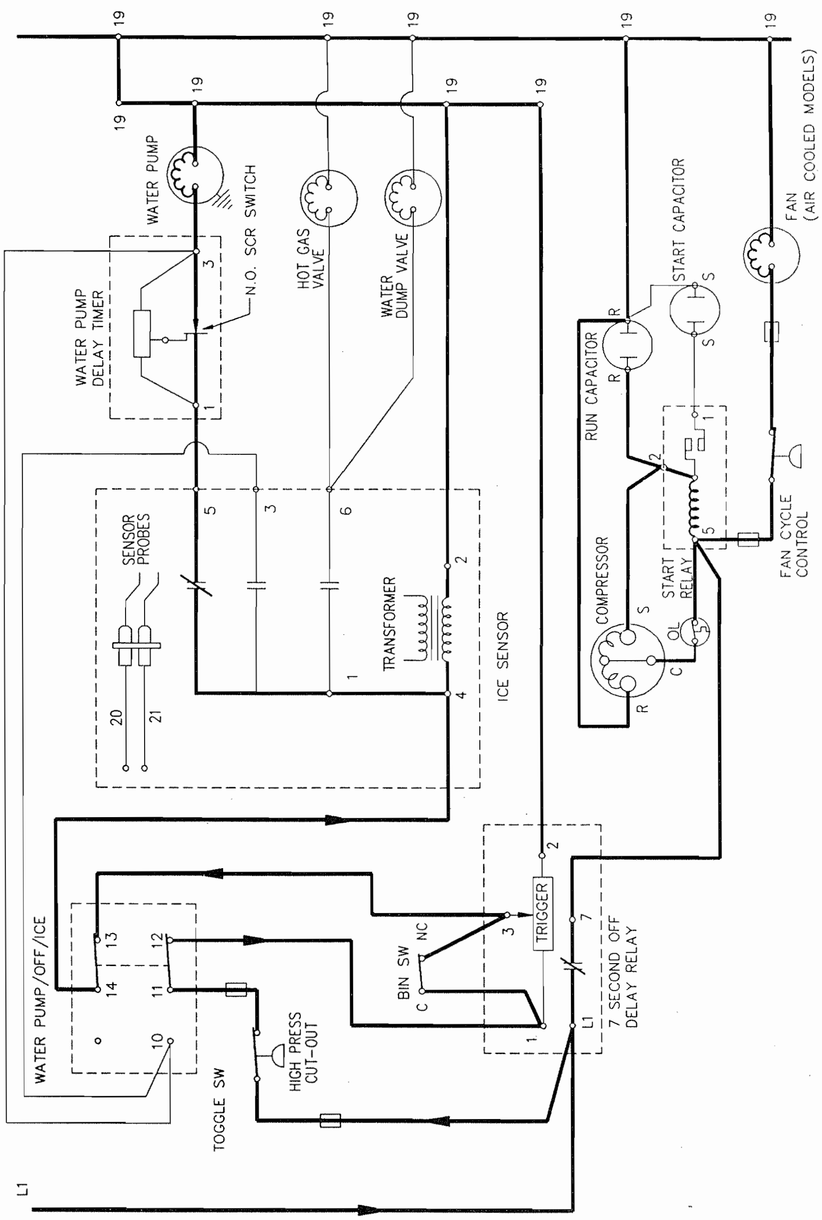
CONDENSER WATER CONSUMPTION	WATER TEMP. °F		
	50°	70°	90°
GAL/24 HR.	188	340	1335

At 225 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	220-230	44-26	125-150	70-90
70	220-230	44-26	125-150	75-95
80	220-230	46-26	125-150	80-100
90	220-230	46-26	125-150	85-105
100	220-230	46-26	125-150	85-105

G200/G400 SERIES AIR/WATER COOLED
1 PHASE — 50/60 CYCLE



G400 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	12-14	13-15.5	15.5-18	1-2
80	14-16	15-17.5	17-20	
90	15.5-18	17-20	20-22	
100	17.5-20	19.5-23	21-25	

Based on average ice slab weight of 4.125 lb to 4.75 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	450	400	350
80	390	360	320
90	350	320	290
100	310	280	260

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	175-225	44-26	120-145	60-80
70	175-225	46-26	125-150	65-85
80	210-260	48-28	140-160	75-95
90	250-300	48-30	160-180	90-110
100	300-350	48-32	200-240	110-130

G400 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP.°F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
70	12-14	13.5-16	16-18.5	1-2
80	12.5-14.5	14-16	16-19	
90	13-15	14-16.5	16.5-19	
100	13-15	14-16.5	16.5-19.5	

Based on average ice slab weight of 4.125 lb to 4.75 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	435	390	340
80	425	385	335
90	415	380	330
100	410	375	325

CONDENSER WATER CONSUMPTION	WATER TEMP. °F		
	50°	70°	90°
GAL/24 HR.	326	575	2703

At 240 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	235-245	42-32	140-165	80-100
70	235-245	42-32	140-165	80-100
80	235-245	44-32	150-175	80-100
90	235-245	44-32	170-200	85-105
100	235-245	46-32	190-210	85-105

G400 SERIES REMOTE
(With AC0496B Condenser)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
-20 to 70	12.5-15	14-16.5	16-18.5	1-2
80	13-15.5	15-17.5	17-20	
90	14-16.5	16-18.5	18-21	
100	16-18.5	17.5-20	19.5-23	

Based on average ice slab weight of 4.125 lb to 4.75 lb
Times in minutes

24 HOUR ICE PRODUCTION

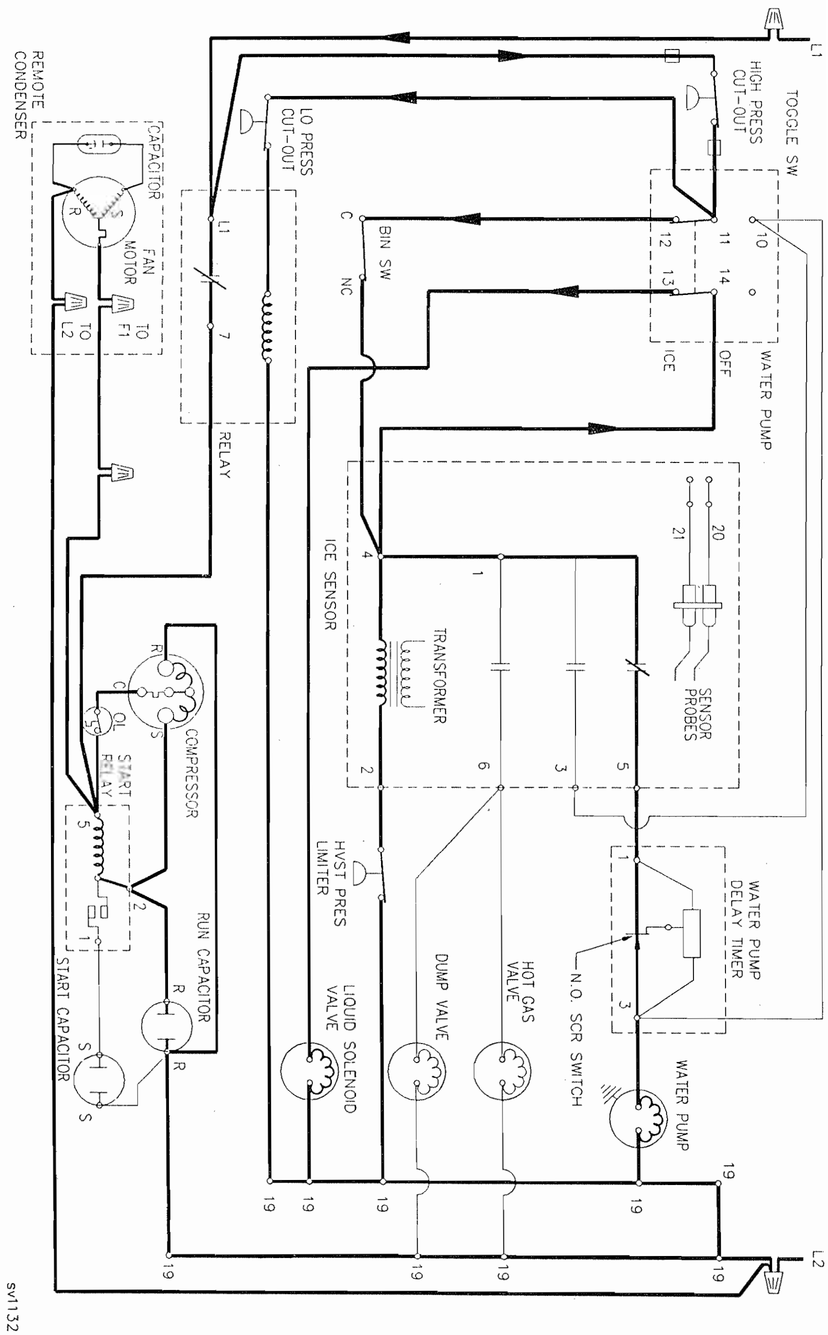
CONDENSER AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
-20 to 70	420	380	340
80	400	360	320
90	380	340	300
100	340	310	280

Based on 70° air at ice machine

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
-20 to 50	175-190	44-28	100-120	60-80
70	190-210	44-28	100-120	70-90
80	215-255	44-28	100-120	70-90
90	220-260	44-30	100-120	70-90
100	245-280	46-32	105-125	70-90
110	285-320	46-32	155-185	75-95

G400 REMOTE
1 PHASE — 50/60 CYCLE



G600 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	8.5-10	10-11.5	10.5-12.5	1.25-2.25
80	9.0-10.5	10.5-12	11.5-13.5	
90	10.5-12	11.5-13.5	12.5-14.5	
100	13-14.5	14-16.5	15-17.5	

Based on average ice slab weight of 4.125 lb to 4.75 lb.
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	600	520	480
80	560	500	450
90	500	460	400
100	430	380	360

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE HEAD PRESSURE P.S.I.G.	FREEZE CYCLE SUCTION PRESSURE P.S.I.G.	HARVEST CYCLE HEAD PRESSURE P.S.I.G.	HARVEST CYCLE SUCTION PRESSURE P.S.I.G.
50	175-220	36-20	120-150	55-80
70	180-225	40-22	140-170	65-80
80	200-250	42-24	160-180	70-85
90	240-280	44-26	170-200	85-100
100	260-300	46-26	200-220	100-115
110	300-350	48-28	225-250	120-130

G600 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP			
	50°	70°	90°	
70	8.5-10.5	10-12.5	12.5-14	1.25-2.25
80	9-10.5	10.5-12.5	12.5-14.5	
90	9-10.5	10.5-12.5	12.5-14.5	
100	9.5-11	11-13	13-15.5	

Based on average ice slab weight of 4.125 lb to 4.75 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	580	500	440
80	570	490	430
90	560	480	420
100	550	470	400

CONDENSER WATER CONSUMPTION	WATER TEMP. °F		
	50°	70°	90°
GAL/24 HR.	425	700	2575

At 220 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	Head Pressure P.S.I.G.	Suction Pressure P.S.I.G.	Head Pressure P.S.I.G.	Suction Pressure P.S.I.G.
50	215-225	38-24	130-160	70-85
70	215-225	40-26	140-160	70-85
80	215-225	42-26	150-170	70-85
90	215-225	42-26	150-170	70-85
100	215-225	44-26	155-175	75-90
110	215-225	44-26	160-180	75-90

G600 SERIES REMOTE
(With AC0895A CONDENSER)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
-20 to 70	8-10	9.5-11.5	10.5-12.5	1.25-2.25
90	9-10.5	10.5-12.5	12.5-14.5	
100	10.5-12.5	12.5-14.5	13.5-16	
110	12.5-14	14-16.5	15.5-18	

Based on average ice slab weight of 4.125 lb to 4.75 lb
Times in minutes

24 HOUR ICE PRODUCTION

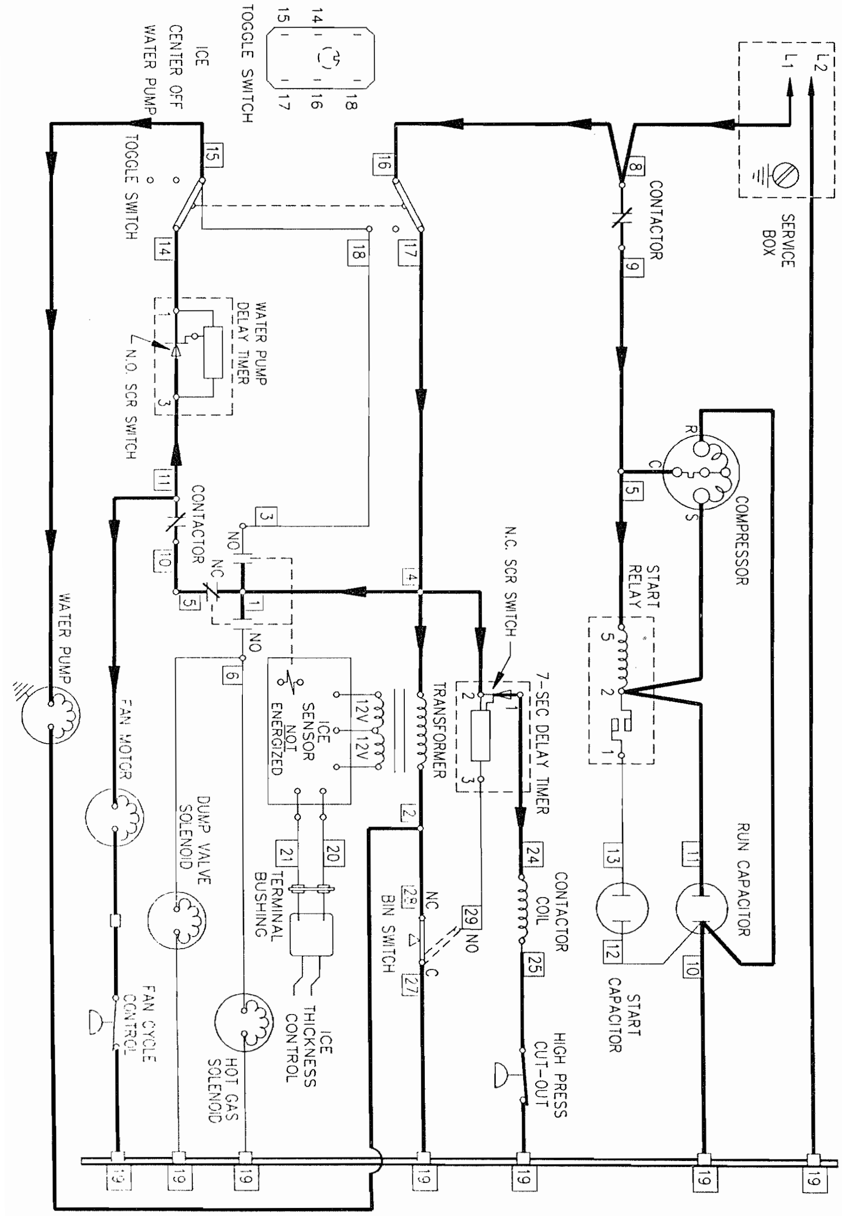
CONDENSER AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
-20 to 70	620	530	480
90	560	480	430
100	500	430	390
110	440	380	350

Based on 70° air at ice maker

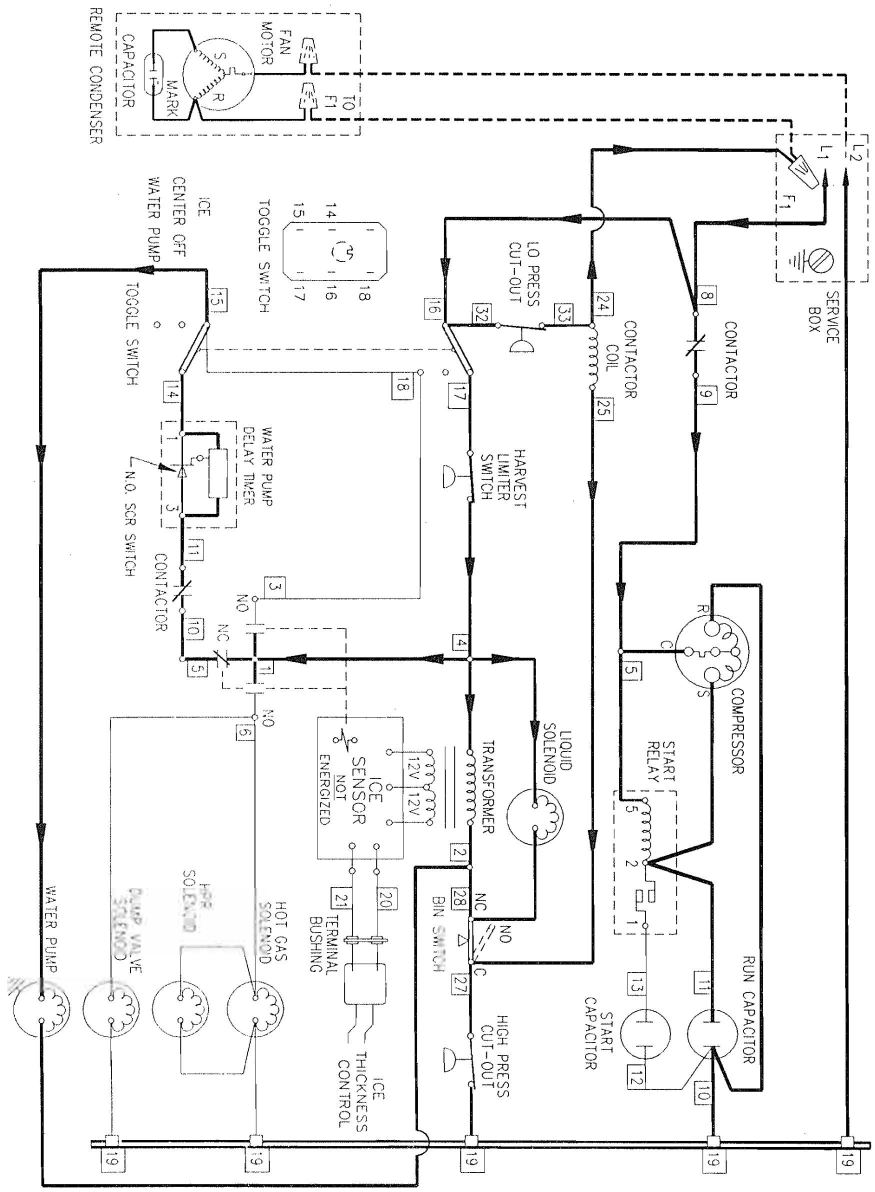
OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
-20 to 50	175-195	38-22	150-170	75-85
70	180-210	38-22	150-170	80-90
90	210-250	40-24	160-180	85-95
100	240-280	40-24	160-180	85-95
110	270-320	42-26	170-190	90-100
120	300-360	46-28	180-200	95-105

G600 AIR AND WATER
1 PHASE — 50/60 CYCLE



G600 REMOTE
1 PHASE — 50/60 CYCLE



G800 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	9.5-11.5	11-13	12.5-14.5	1.25-2.25
80	11.5-13.5	12-14	12.5-16	
90	12-14	13.5-16	15.5-18	
100	14-16.5	15.5-18.5	16.5-20.5	

Based on average ice slab weight of 6.25 lb to 7.25 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	800	720	640
80	740	670	600
90	670	600	530
100	580	520	490

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	175-220	38-24	125-150	65-80
70	175-225	40-24	140-170	70-85
80	220-270	42-24	160-180	75-90
90	250-300	44-26	185-215	80-105
100	275-325	46-28	210-230	105-120
110	310-360	48-28	225-250	120-130

G800 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

	FREEZE TIME			HARVEST TIME
AMBIENT TEMP °F.	WATER TEMP. °F			
	50°	70°	90°	
70	9.5-11.5	11.5-13.5	13.5-16	1.25-2.25
80	10.5-12.5	12-14	13.5-16	
90	10.5-12.5	12-14	13.5-16	
100	11.5-13.5	12.5-15	14-16.5	

Based on average ice slab weight of 6.25 lb to 7.25 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	800	680	600
80	750	670	600
90	730	660	600
100	700	630	570

CONDENSER WATER CONSUMPTION	WATER TEMP. °F		
	50°	70°	90°
GAL/24 HR.	500	800	1700

At 240 p.s.i.g head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	235-245	38-24	130-170	65-80
70	235-245	40-24	130-170	65-80
80	235-245	40-24	140-180	65-80
90	235-245	42-24	150-190	65-80
100	235-245	44-24	160-200	65-80
110	235-245	46-26	170-200	70-90

G800 SERIES REMOTE
(With AC0895A Condenser)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME — WATER TEMP. °F 50°	70°	90°	HARVEST TIME
-20 to 70	9.5-11	11-13	11.5-13.5	1.25-2.25
90	10-11.5	11.5-13.5	12.5-15	
100	10.5-12.5	12-14.5	14-16.5	
110	13.5-16	14.5-17.5	16.5-19.5	

Based on average ice slab weight of 6.25 lb to 7.25 lb
Times in minutes

24 HOUR ICE PRODUCTION

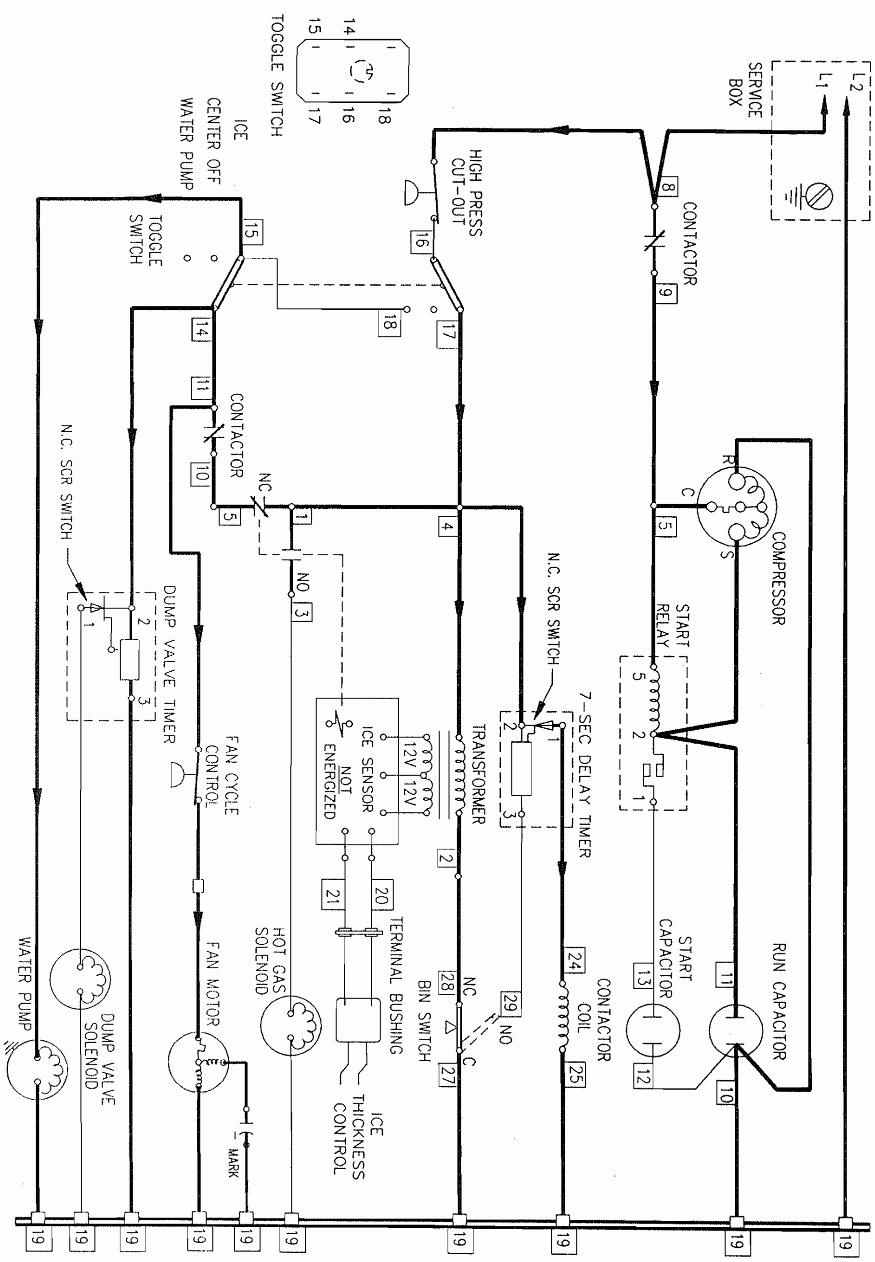
CONDENSER AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
-20 to 70	810	720	680
90	780	700	630
100	730	650	580
110	600	550	490

Based on 70° air at ice maker

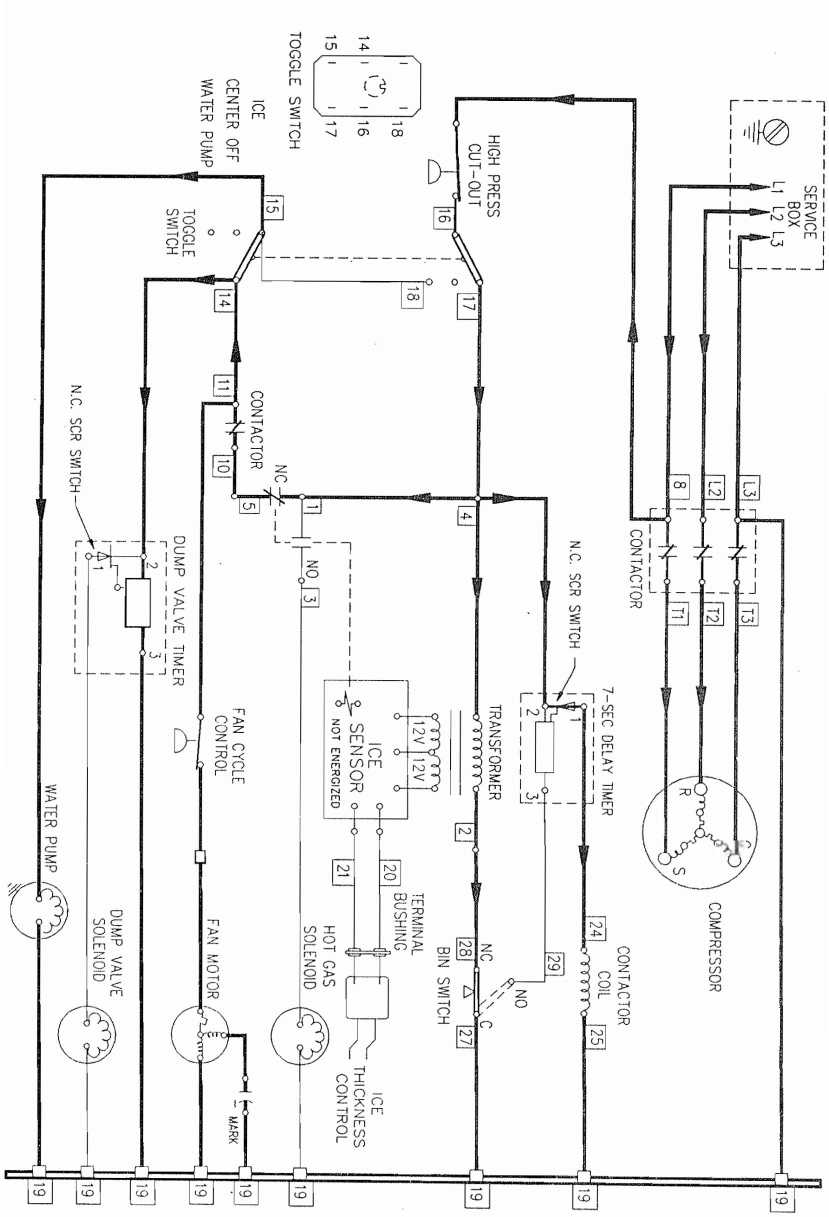
OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
-20 TO 50	170-190	38-24	140-160	75-85
70	180-210	40-26	150-170	75-85
80	220-260	42-26	160-180	80-90
90	240-290	44-28	160-180	80-90
100	270-330	44-28	160-180	85-95
110	300-360	46-30	160-180	85-95

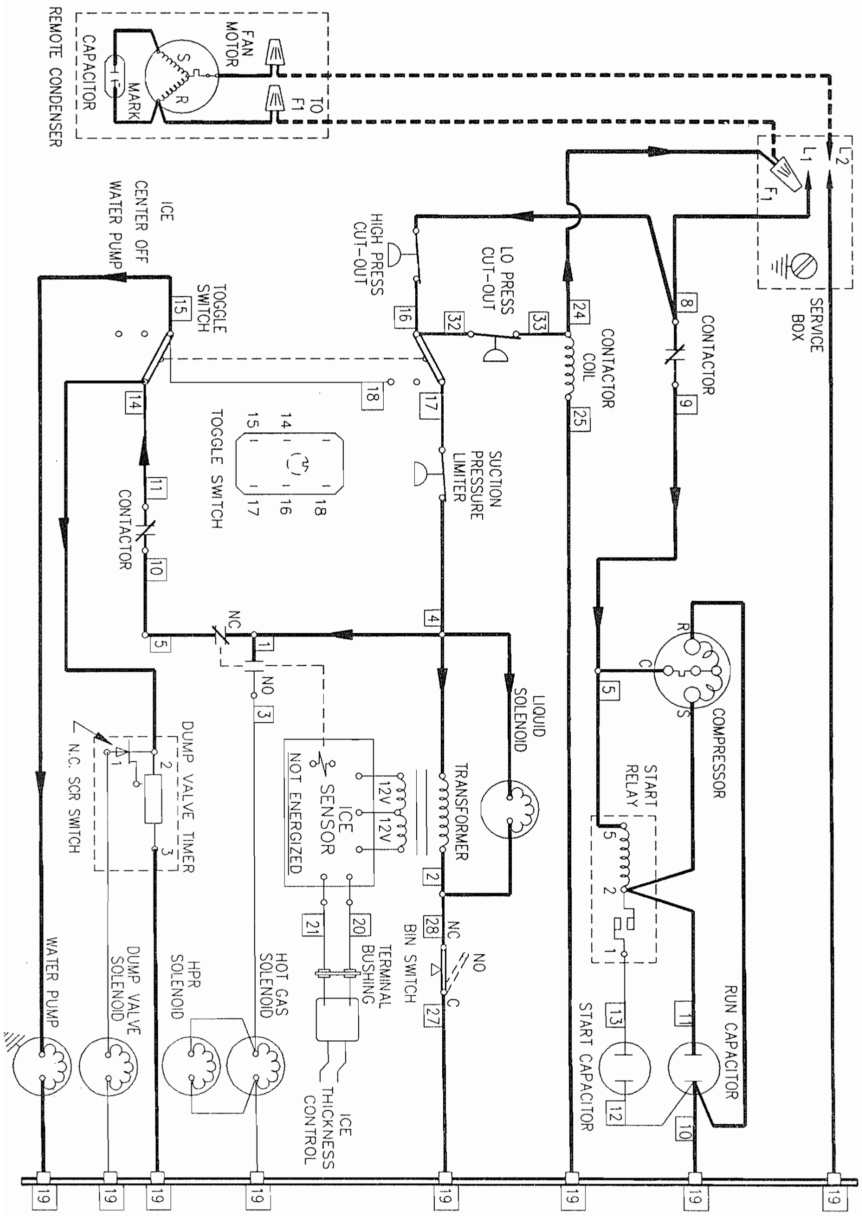
G800 AIR AND WATER
1 PHASE — 50/60 CYCLE



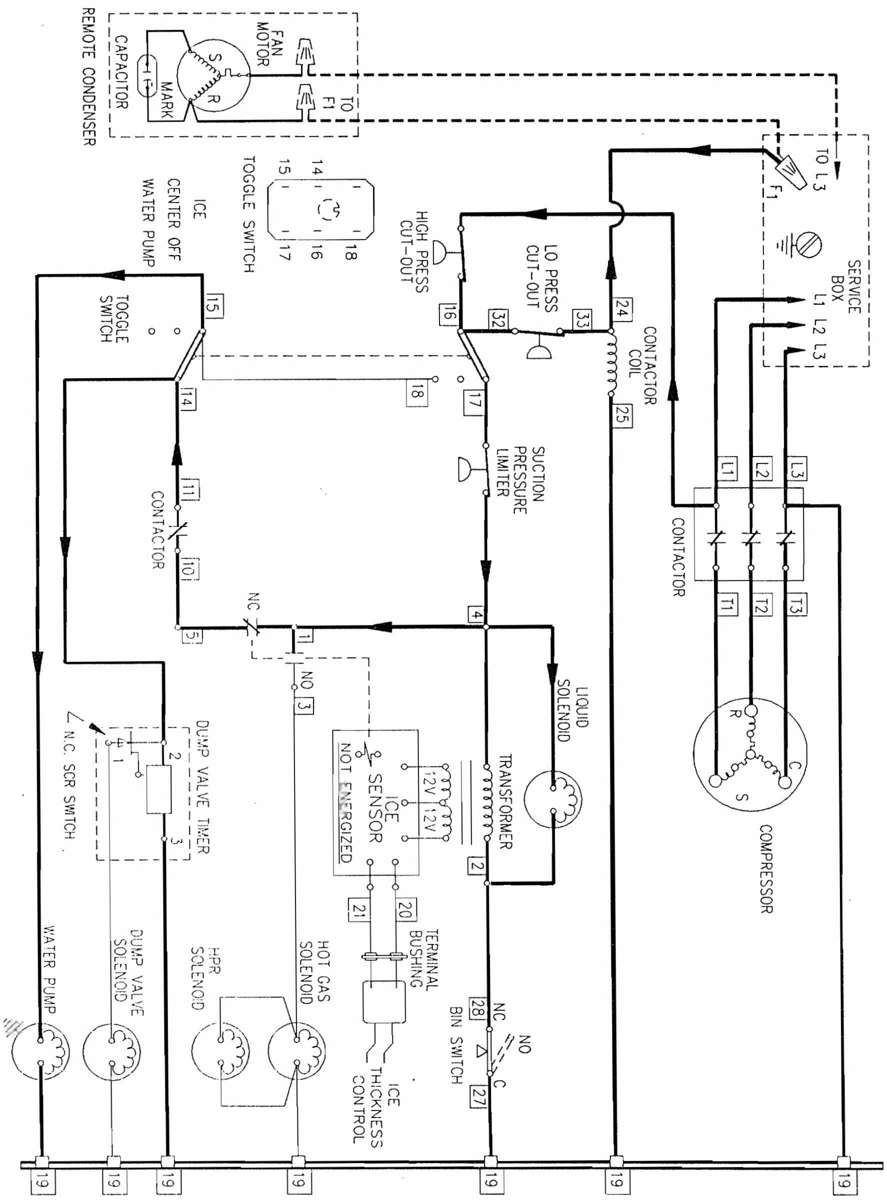
G800 AIR AND WATER
3 PHASE — 50/60 CYCLE



G800 REMOTE
1 PHASE — 50/60 CYCLE



G800 REMOTE
3 PHASE — 50/60 CYCLE



G1200 SERIES AIR COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME			HARVEST TIME
	WATER TEMP. °F			
	50°	70°	90°	
70	7.5-9	8.5-10	9.5-11	1-2.5
80	8-9.5	9-10.5	10.5-12	
90	8.5-10	10-11.5	11.5-13	
100	9.5-11	11-12.5	12.5-14	

Based on average ice slab weight of 8.125 lb to 9.25 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
70	1260	1170	1080
80	1200	1100	1000
90	1150	1040	930
100	1040	930	840

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	175-225	38-24	125-150	65-75
70	175-225	40-26	125-150	65-75
80	200-250	42-27	140-165	72-82
90	220-270	44-28	150-175	80-90
100	275-325	46-30	175-200	100-110
110	300-350	48-30	185-210	105-115

G1200 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	7.5-9	8.5-10	10-11.5	1-2.5
80	7.5-9	8.5-10	10-11.5	
90	8-9.5	9-10.5	10.5-12	
100	8-9.5	9-10.5	10.5-12	

Based on average ice slab weight of 8.125 lb to 9.25 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	1290	1150	1010
80	1280	1140	1000
90	1270	1130	990
100	1260	1120	980

CONDENSER WATER CONSUMPTION	WATER TEMP. °F 50°	70°	90°
GAL/24 HR.	985	1950	5280

At 230 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE HEAD PRESSURE P.S.I.G.	FREEZE CYCLE SUCTION PRESSURE P.S.I.G.	HARVEST CYCLE HEAD PRESSURE P.S.I.G.	HARVEST CYCLE SUCTION PRESSURE P.S.I.G.
50	225-235	38-24	130-160	72-76
70	225-235	38-24	135-165	74-78
80	225-235	38-24	135-165	76-80
90	225-235	40-24	140-170	78-82
100	225-235	44-24	145-175	78-82

G1200 SERIES REMOTE
(With AC 1295A Condenser)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
-20 to 70	8-9.5	9-10.5	10.5-12	1-2.5
90	8.5-10	9.5-11	11-12.5	
100	9.5-11	10.5-12	12-13.5	
110	10.5-12	11.5-13.5	13.5-15.5	

Based on average ice slab weight of 8.125 lb to 9.25 lb
Times in minutes

24 HOUR ICE PRODUCTION

CONDENSER AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
-20 to 70	1200	1100	1000
90	1130	1030	930
100	1060	960	860
110	990	890	790

Based on 70° air at ice maker

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE HEAD PRESSURE P.S.I.G.	FREEZE CYCLE SUCTION PRESSURE P.S.I.G.	HARVEST CYCLE HEAD PRESSURE P.S.I.G.	HARVEST CYCLE SUCTION PRESSURE P.S.I.G.
-20 to 50	170-200	36-22	110-140	76-84
70	175-200	36-22	110-140	76-84
80	200-225	38-22	120-150	76-84
90	225-275	40-24	130-170	76-84
100	250-300	41-24	140-180	76-84
110	280-300	44-26	150-190	76-84

G1700 SERIES WATER COOLED

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME WATER TEMP. °F 50°	70°	90°	HARVEST TIME
70	8-10	9.5-11.5	10.5-13	1.5-2.5
80	8-10	9.5-11.5	10.5-13	
90	8.5-10.5	9.5-12	11-13.5	
100	8.5-10.5	9.5-12	11-13.5	

Based on average ice slab weight of 12.25 lb to 14.5 lb
Times in minutes

24 HOUR ICE PRODUCTION

AIR TEMP. °F	WATER TEMP. °F 50°	70°	90°
70	1710	1530	1390
80	1700	1520	1380
90	1690	1510	1370
100	1680	1500	1360

CONDENSER WATER CONSUMPTION	WATER TEMP. °F 50°	70°	90°
GAL/24 HR.	1500	2600	7500

At 220 p.s.i.g. head pressure

OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
50	210-230	40-26	110-150	65-80
70	210-230	40-26	110-150	65-80
80	210-230	42-28	120-160	70-85
90	210-230	42-28	120-160	70-85
100	210-230	42-28	120-160	75-90
110	210-230	42-28	120-160	75-90

G1700 SERIES REMOTE
(With AC1796B Condenser)

These are approximate characteristics that may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

AMBIENT TEMP. °F	FREEZE TIME — WATER TEMP. °F			HARVEST TIME
	50°	70°	90°	
-20 to 70	8-10	9-11	10-12	1.5-2.5
90	8-10	9.5-11.5	10.5-13	
100	8.5-10.5	10-12	11-15	
110	9-11	10.5-13	12-15.5	

Based on average ice slab weight of 12.25 lb to 14.5 lb
Times in minutes

24 HOUR ICE PRODUCTION

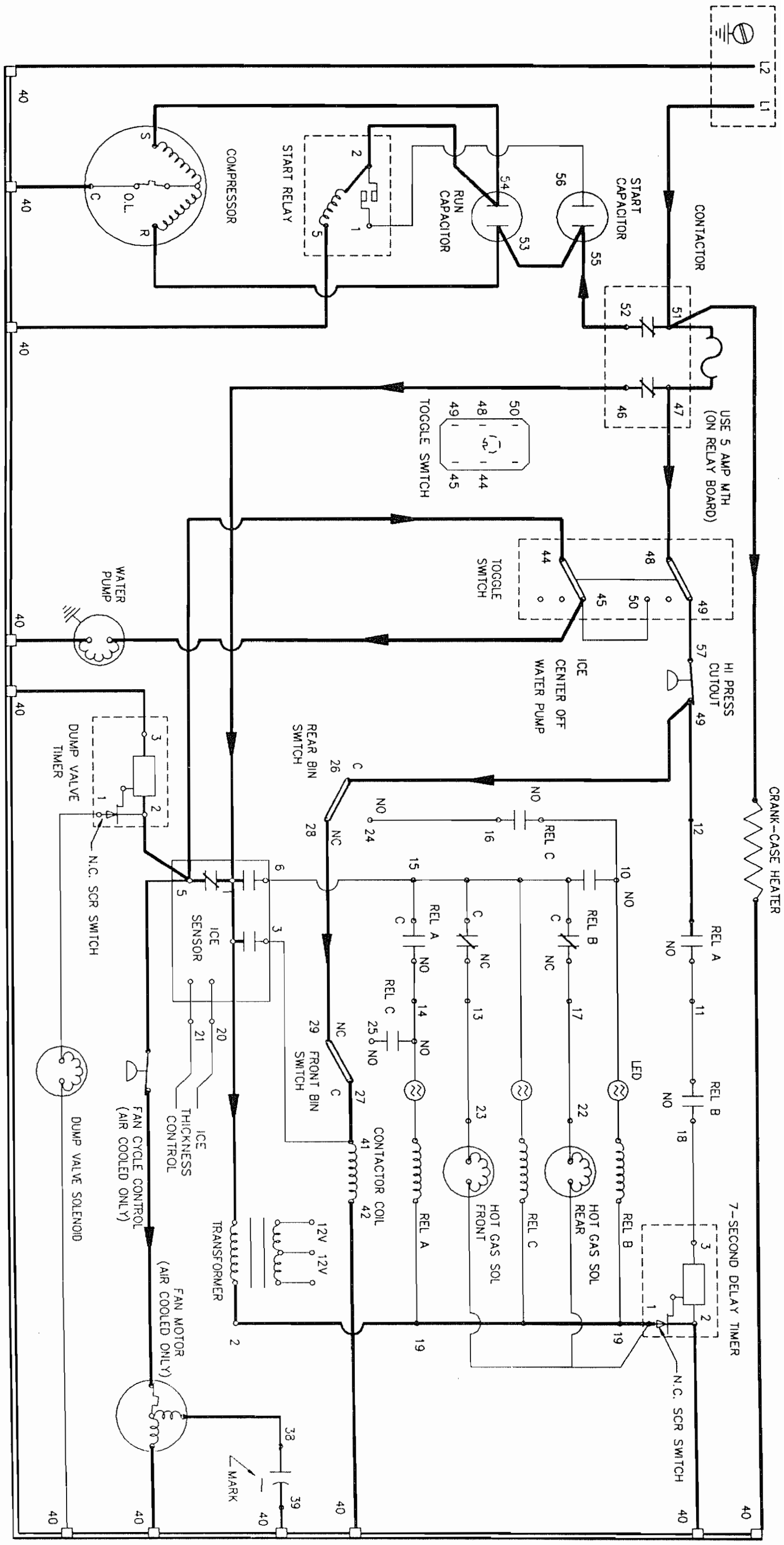
CONDENSER AIR TEMP. °F	WATER TEMP. °F		
	50°	70°	90°
-20 to 70	1780	1600	1460
90	1715	1500	1365
100	1630	1450	1290
110	1520	1365	1205

Based on 70° air at ice maker

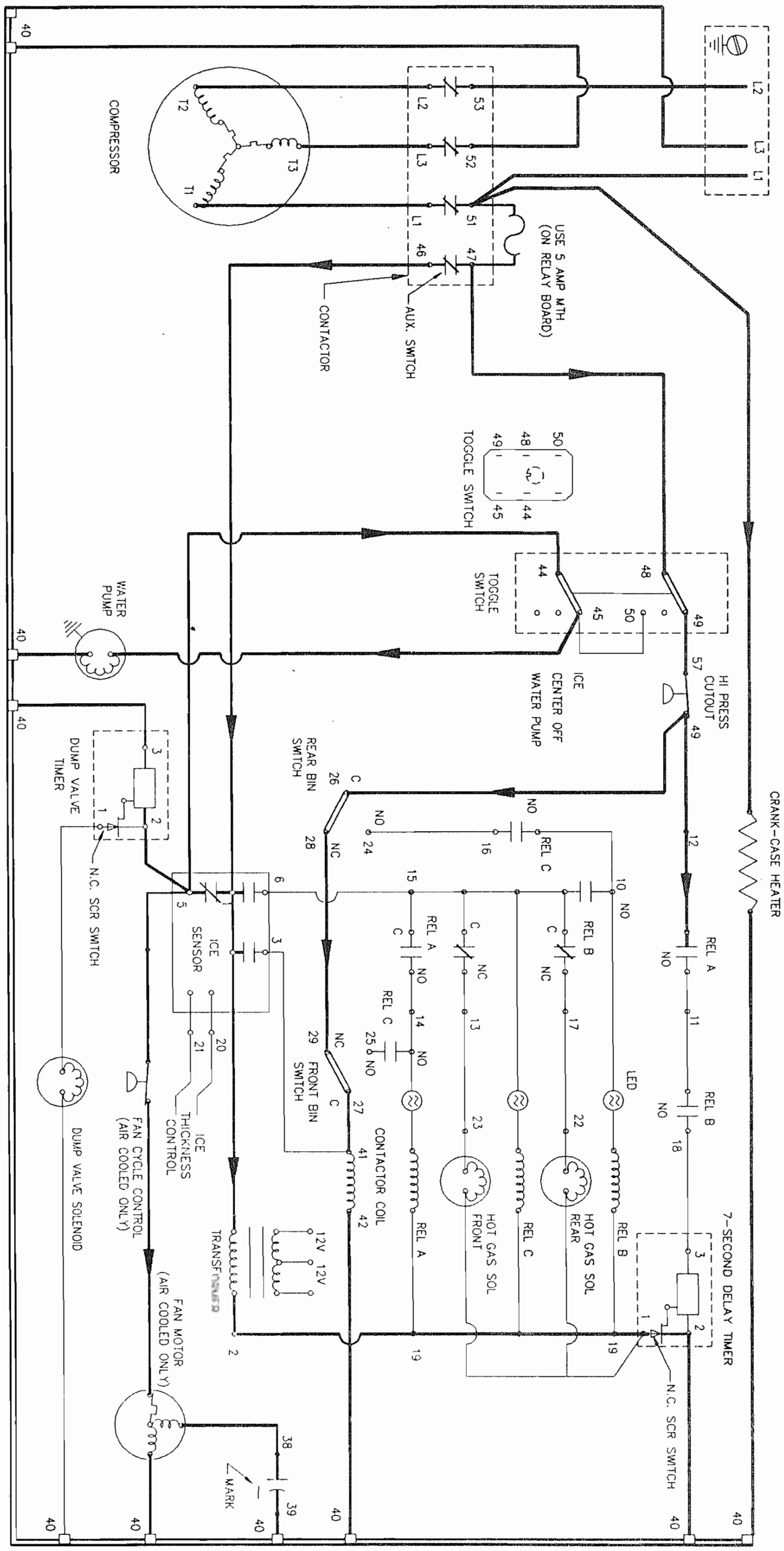
OPERATING PRESSURES

AMBIENT TEMP. °F	FREEZE CYCLE		HARVEST CYCLE	
	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.	HEAD PRESSURE P.S.I.G.	SUCTION PRESSURE P.S.I.G.
-20 TO 50	170-190	40-25	90-140	71-79
70	175-200	40-25	90-140	71-79
80	200-225	40-25	100-150	71-79
90	220-250	42-26	110-160	71-79
100	250-330	44-28	120-170	71-79
110	290-330	46-30	120-180	71-79

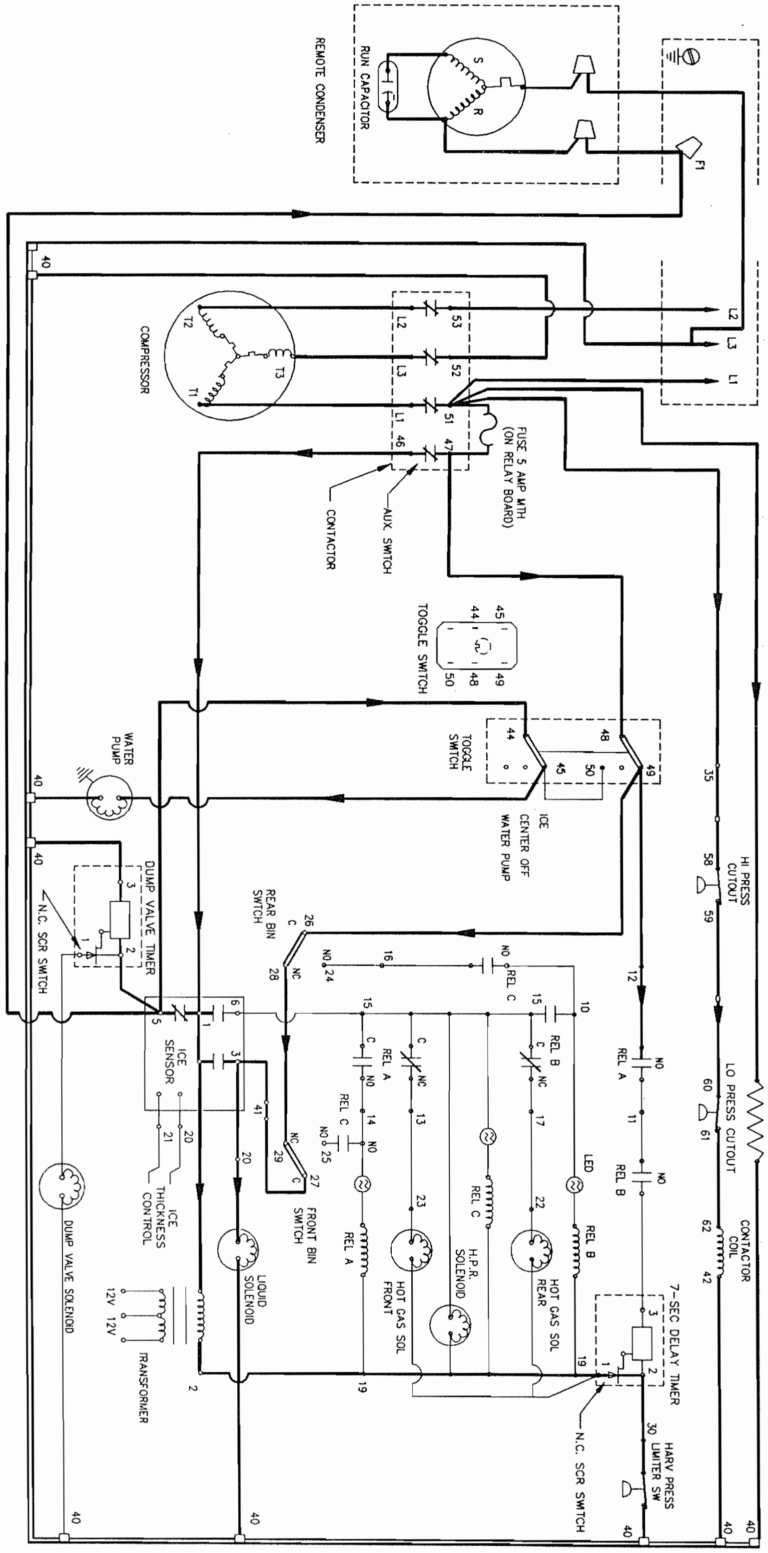
G1200 AND G1700 AIR AND WATER
208/230V — 1 PHASE — 50/60HZ FREEZE CYCLE



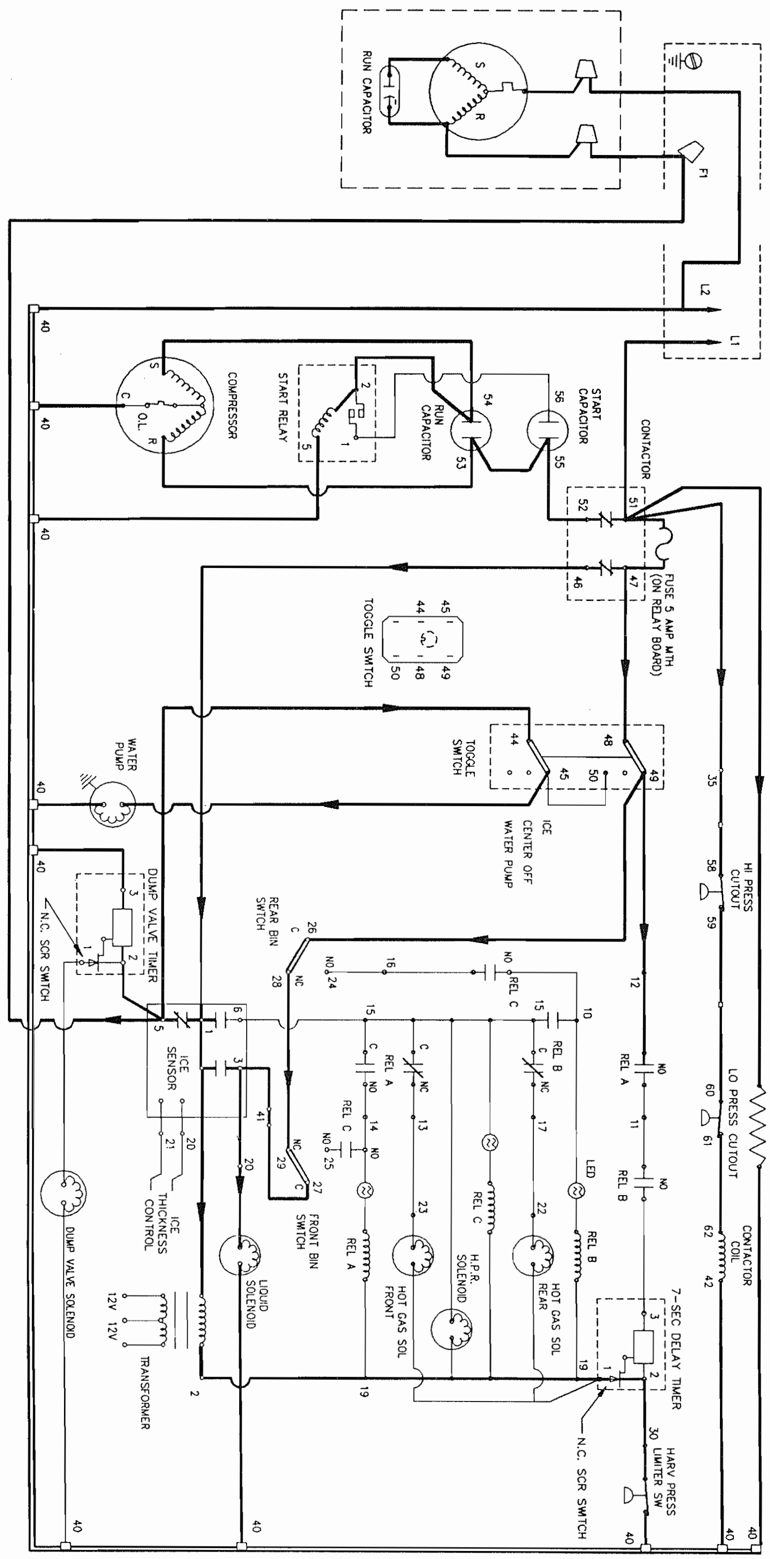
G1200 AND G1700 AIR AND WATER
208/230V — 3 PHASE — 50/60 HZ FREEZE CYCLE



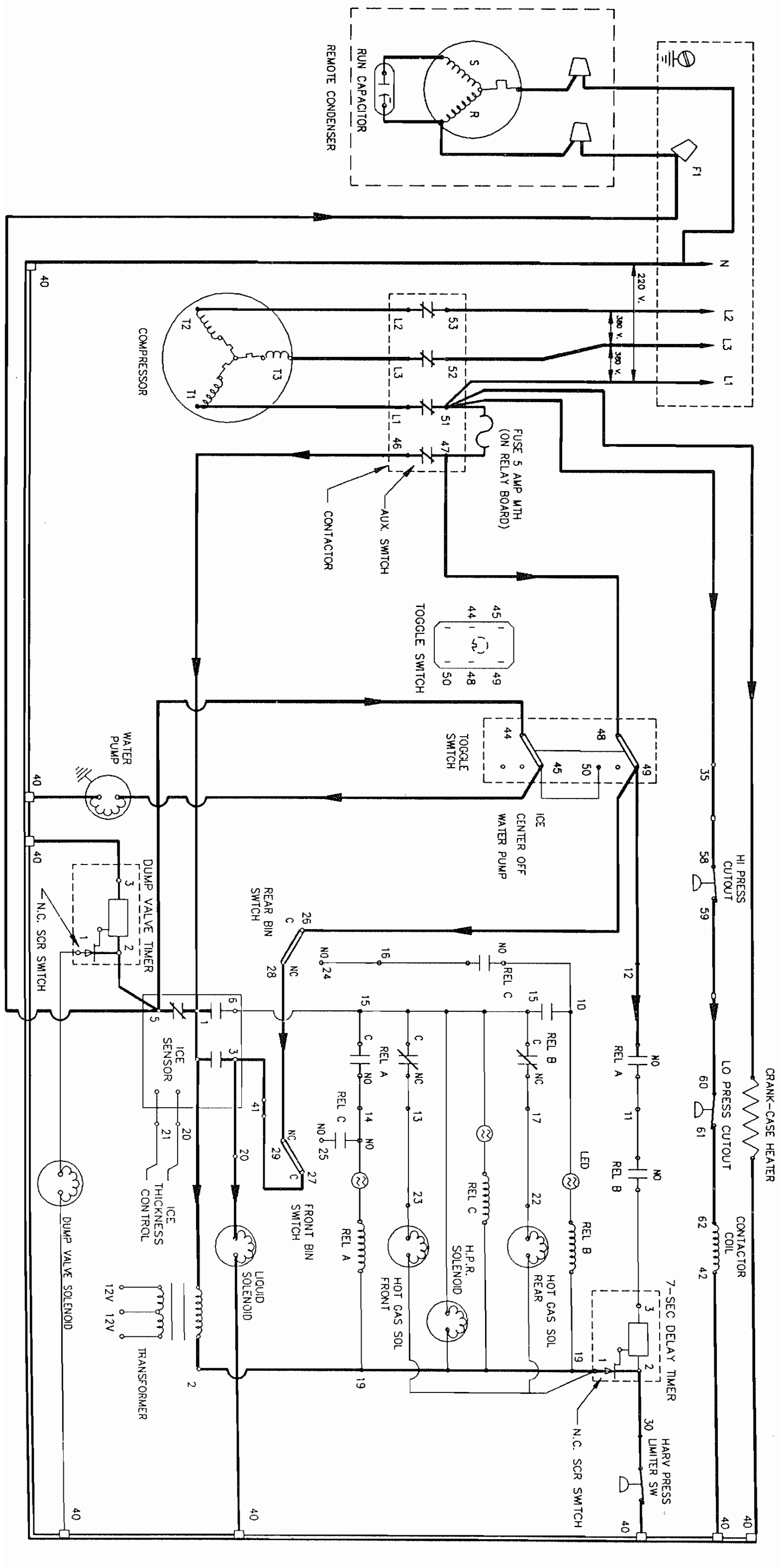
G1200 AND G1700 REMOTE
208/230V — 3 PHASE — 50/60HZ FREEZE CYCLE



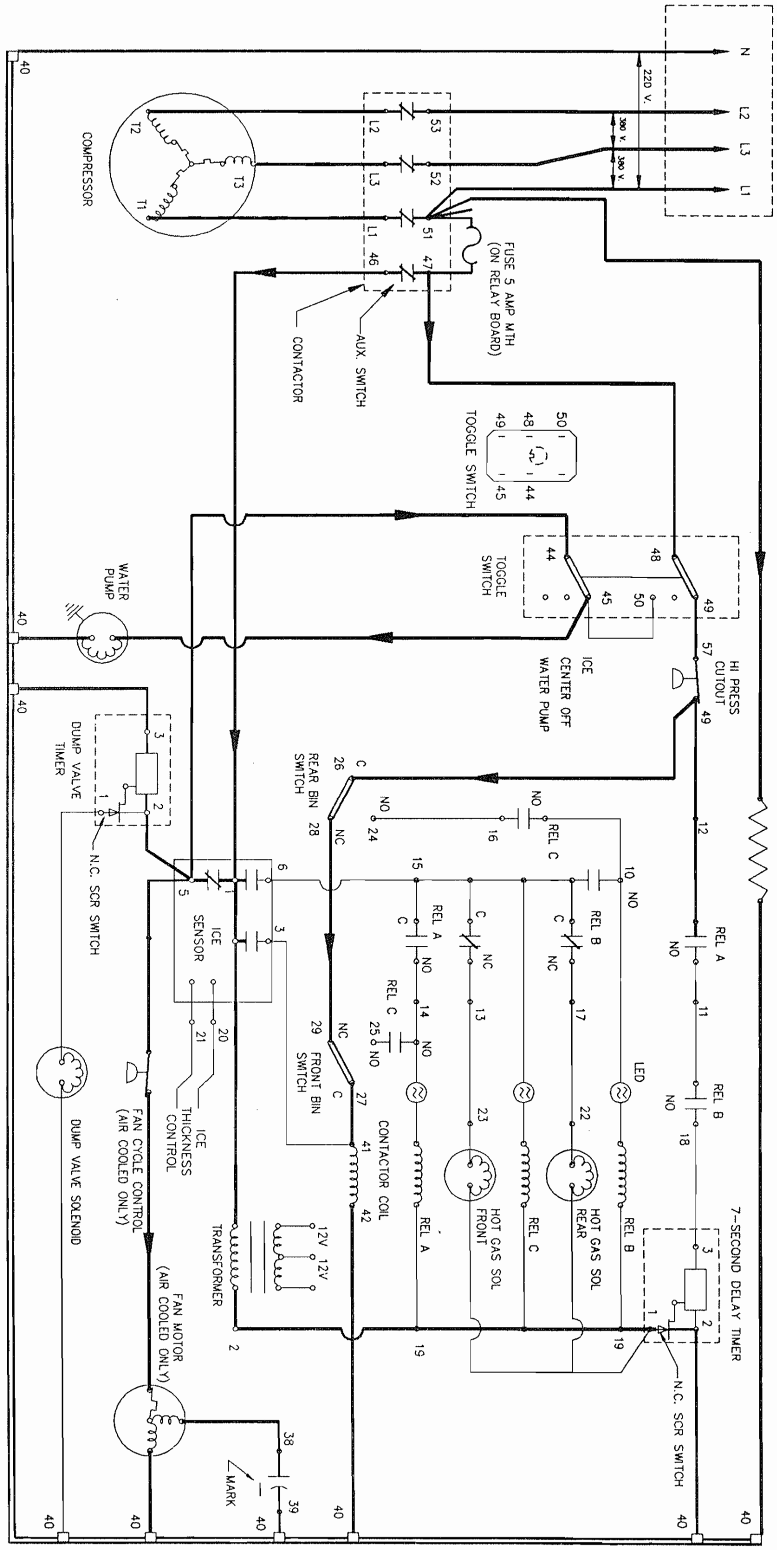
G1200 AND G1700 REMOTE
208/230V — 1 PHASE — 50/60HZ FREEZE CYCLE



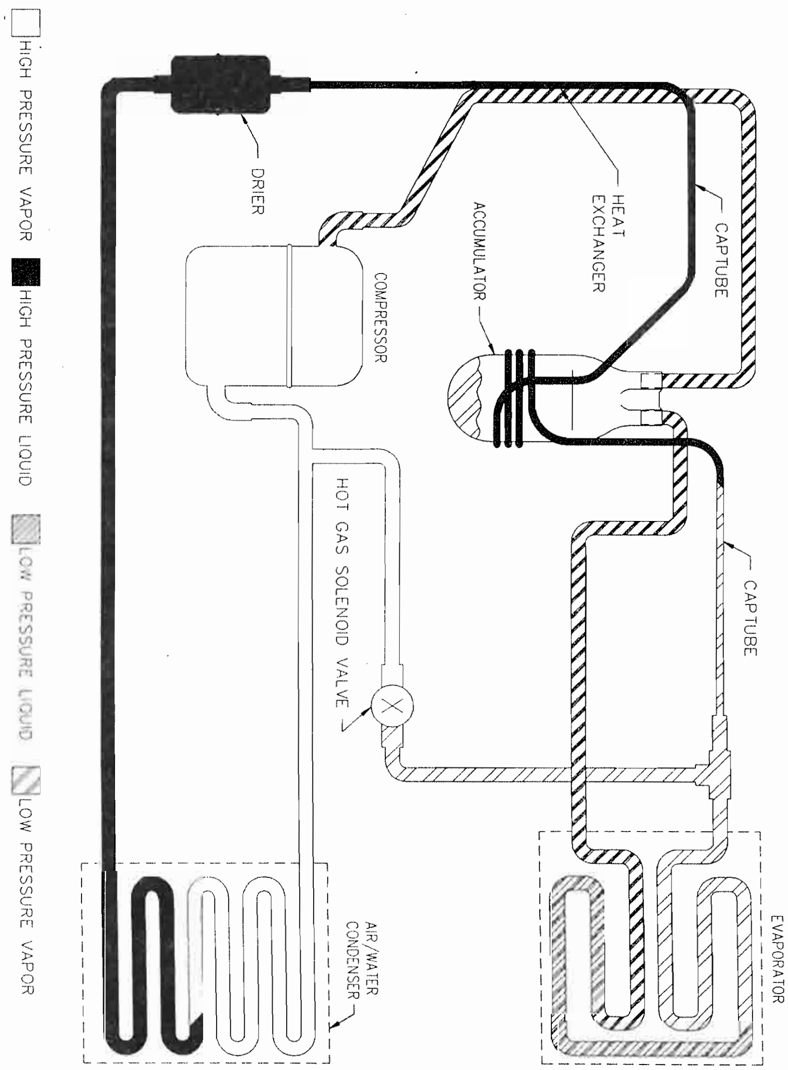
G1200 AND G1700 REMOTE
3 PHASE — 50 CYCLE
4-Wire Hook Up 380/220 VAC



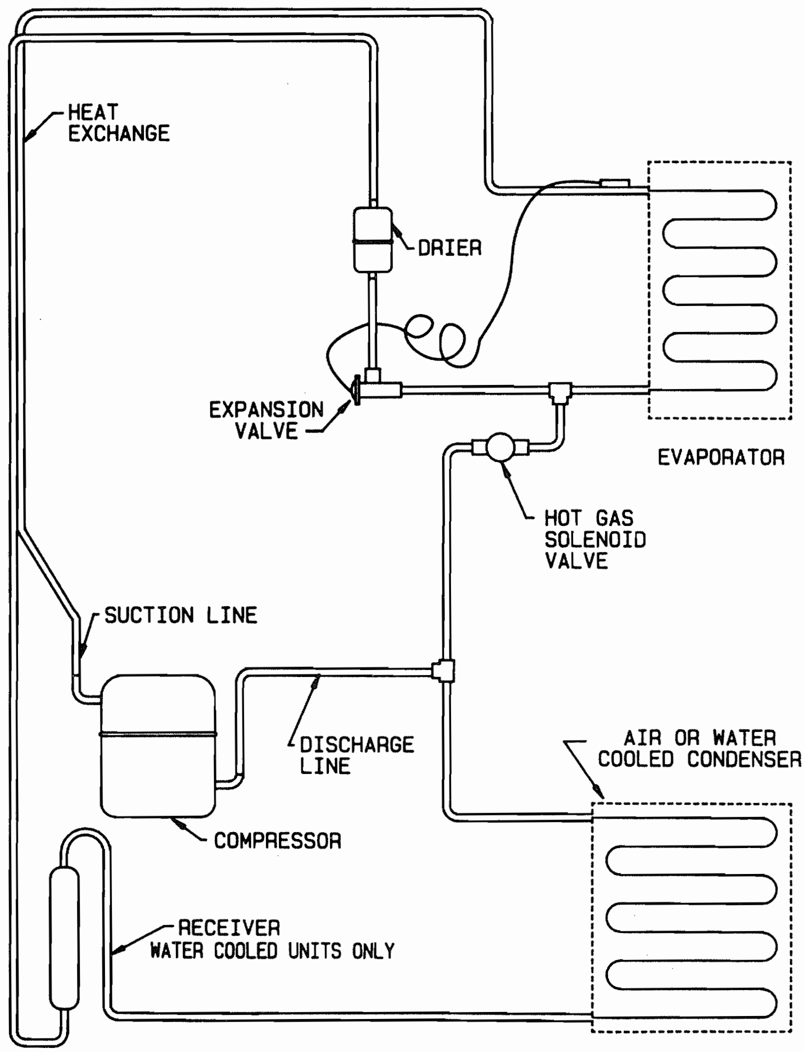
G1200 AND G1700* AIR AND WATER
3 PHASE — 50 CYCLE
4-Wire Hook Up 380/220 VAC
**G1700 Comes in Water Cooled and Remote Only*



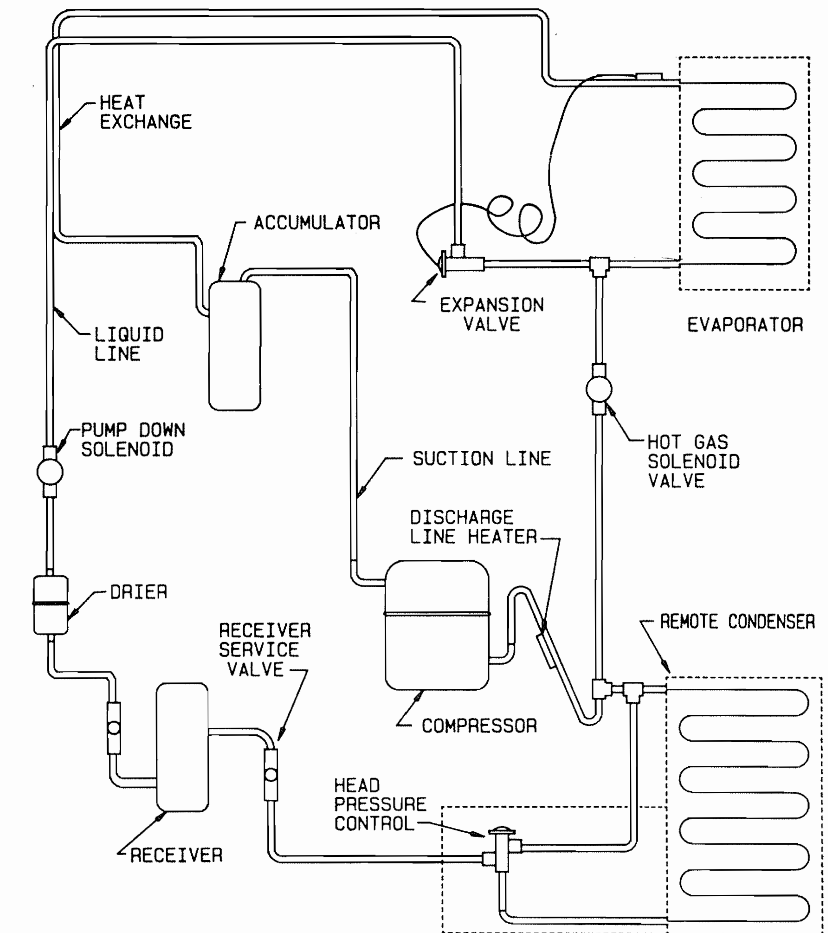
TUBING SCHEMATIC
G150 AIR AND WATER COOLED
Shown in Freeze Cycle



TUBING SCHEMATIC
E/H200, E400, E600, G200, G400, G600, G800
AIR AND WATER

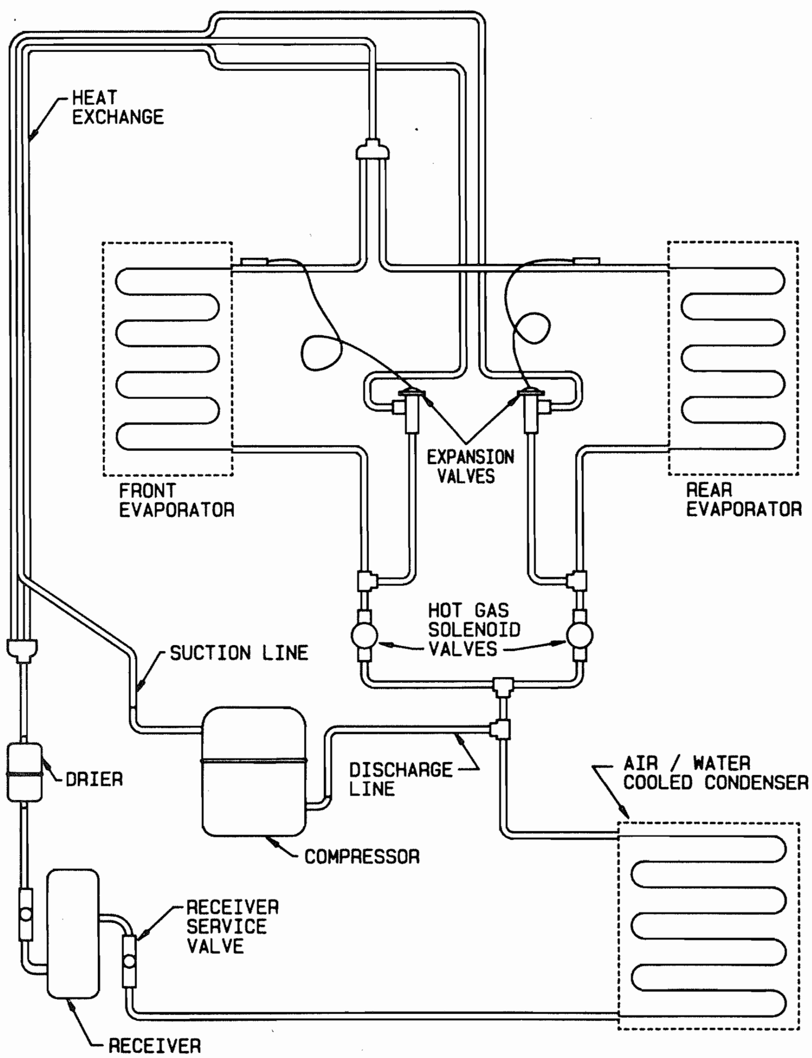


TUBING SCHEMATIC
E400 AND E600 REMOTE
(With Accumulator)

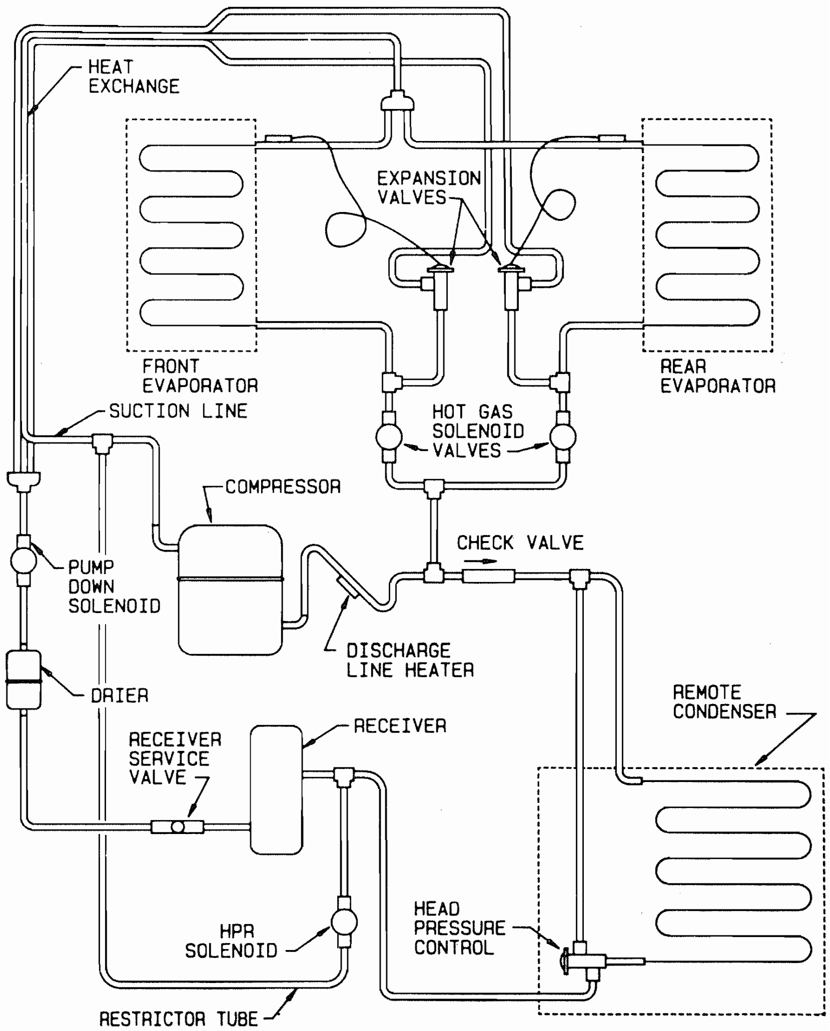


* THE HEAD PRESSURE CONTROL IS LOCATED IN THE REMOTE CONDENSER UNIT FOR THE E0400

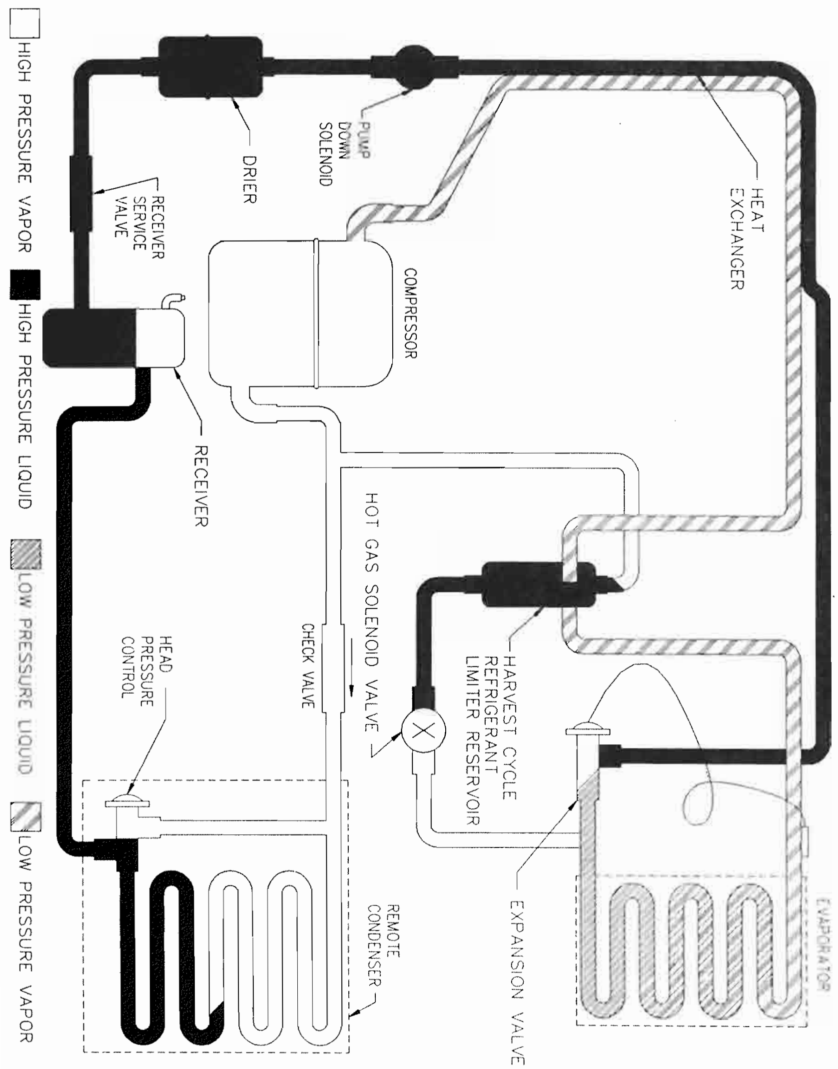
TUBING SCHEMATIC
E1100 AIR AND WATER



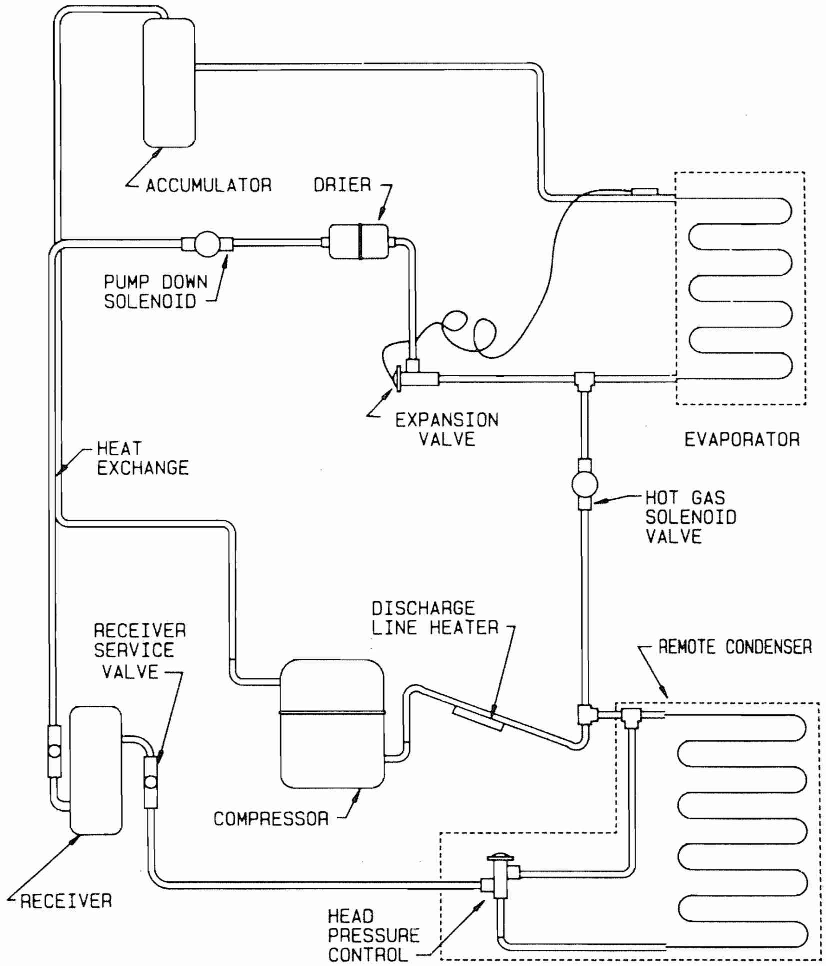
TUBING SCHEMATIC
E1100 REMOTE



TUBING SCHEMATIC
E400 AND G400 REMOTE
(With Harvest Reservoir)

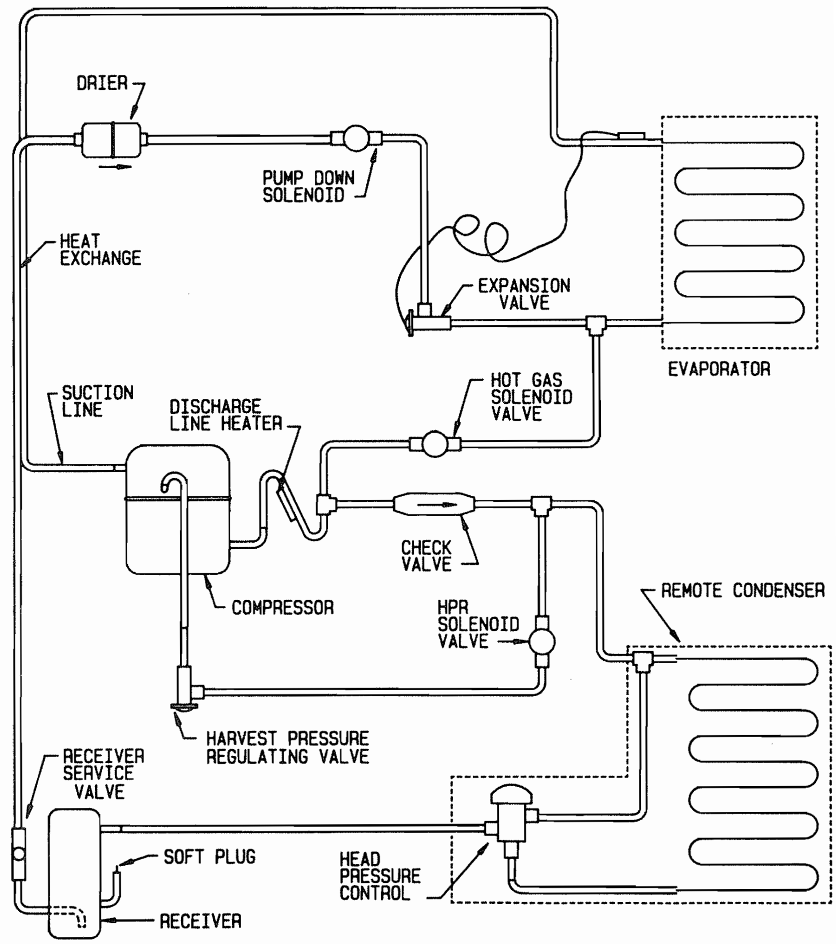


TUBING SCHEMATIC
G600 AND G800 REMOTE
(With Accumlator)



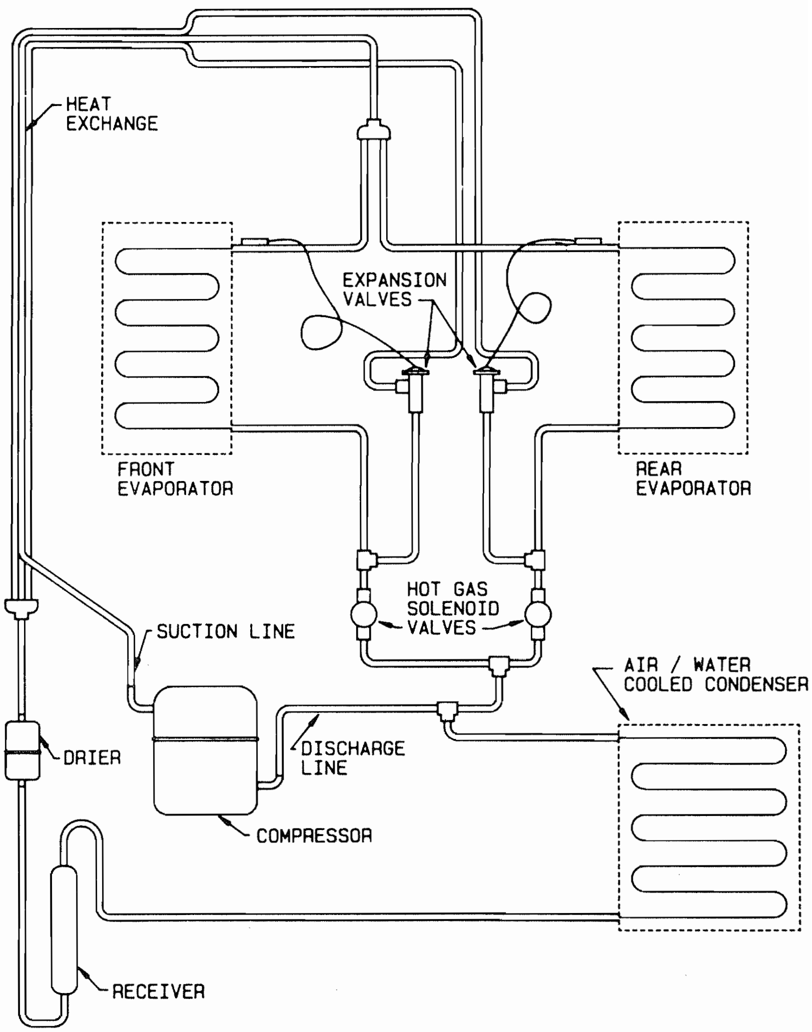
* THE HEAD PRESSURE CONTROL IS LOCATED IN THE REMOTE CONDENSER UNIT.

TUBING SCHEMATIC
G600 AND G800 REMOTE
(With HPR System)

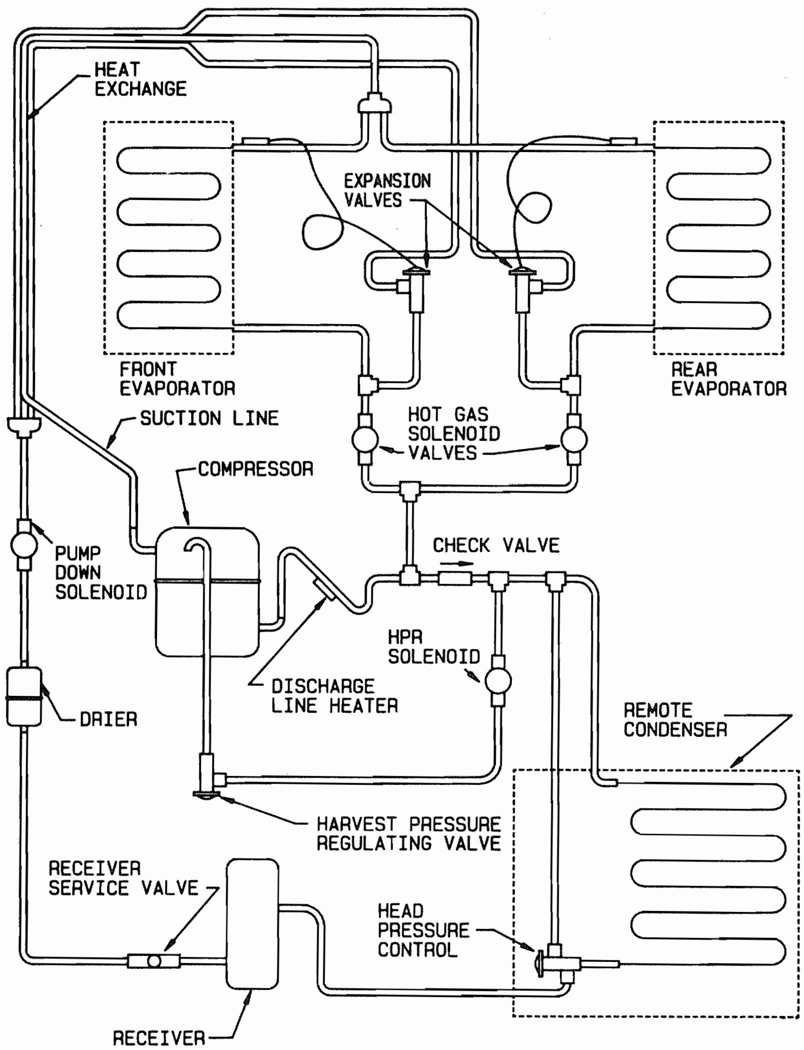


* THE HEAD PRESSURE CONTROL IS LOCATED IN THE REMOTE CONDENSER UNIT.

TUBING SCHEMATIC
G1200 AIR AND WATER
G1700 WATER



TUBING SCHEMATIC
G1200/G1700 REMOTE



SYSTEM CONTAMINATION

GENERAL

It is important to read and understand the following text regarding system contamination. The purpose is to describe the basic requirements for restoring contaminated systems to reliable service.

> **IMPORTANT**
>
> Manitowoc Ice, Inc. assumes no responsibility for use of contaminated refrigerant. Damage resulting from the use of contaminated recycled refrigerant is the sole responsibility of the servicing company.

DETERMINING SEVERITY OF CONTAMINATION AND CLEAN-UP PROCEDURES

System contamination is generally caused by the introduction of either moisture or residue from compressor burnout into the refrigeration system.

Inspection of the refrigerant is usually the first indication of contaminants in the system. If obvious moisture or an acrid odor indicating burnout is present in the refrigerant, steps must be taken to determine the severity of contamination as well as the required clean-up procedure.

If visible moisture or an acrid odor is detected, or if contamination *is suspected*, the use of a Total Test Kit from Totaline or similar diagnostic tool is recommended. These devices read refrigerant, therefore eliminating the need for an initial oil sample for testing.

If a refrigerant test kit indicates harmful levels of contamination, or if the kit is not available, then inspect the compressor oil as follows.

1. Remove refrigerant charge from ice machine.
2. Remove compressor from the system.
3. Check odor and condition (appearance) of the oil.
4. Inspect open suction and discharge lines at compressor for burnout deposits.

5. Perform an acid oil test if contamination signs are not evident per the above procedure to ensure no harmful contamination is present.

   The following chart lists findings and matches them with required clean-up procedure. Use this chart for determining type of clean-up required.

CONTAMINATION/CLEAN-UP CHART

Symptoms/Findings	Required Clean-Up Procedure
No symptoms or suspicion of contamination	Normal evacuation and recharging procedures.
Moisture/Air Contamination (one or more of the following conditions will exist) —Refrigeration system open to atmosphere for prolonged periods —Refrigeration test kit and/or acid oil test shows contamination —Leak in water-cooled condenser —Oil appears muddy, or visible moisture in oil	Mild contamination clean-up procedures.
Mild Compressor Burnout —Oil appears clean with acrid odor and/or —Refrigeration test kit or acid oil test shows harmful acid content —No burnout deposits in open compressor lines	Mild contamination clean-up procedures.
Severe Compressor Burnout —Oil discolored and acidic with acrid odor, burnout deposits in compressor, discharge and suction lines and other components	Severe contamination clean-up procedures.

MILD SYSTEM CONTAMINATION CLEAN-UP PROCEDURES

1. Replace failed components if applicable. If compressor checks good, change oil in compressor.
2. Replace liquid line drier.
3. Follow normal evacuation procedure except replace the evacuation step with the following:

> **NOTE**
>
> If contamination is from moisture, the use of heat lamps or heaters is recommended during evacuation. Place heat lamps at the compressor, condenser, and at the evaporator prior to evacuation. (Ensure heat lamps are not positioned too close to plastic components such as evaporator extrusions, water trough, etc., as they could melt, warp, etc.)

> **IMPORTANT**
>
> Dry nitrogen is recommended for this procedure to prevent C.F.C. release into the atmosphere.

   a. Pull vacuum to 1000 microns. Break vacuum with dry nitrogen and sweep system. Pressurize to a minimum of 5 psi.
   b. Pull vacuum to 500 microns. Break vacuum with dry nitrogen and sweep system. Pressurize to a minimum of 5 psi.
   c. Change vacuum pump oil. Pull system down to 250 microns. When 250 microns have been achieved, allow vacuum pump to run for 1/2 hour on self-contained models, 1 hour for remotes. A standing vacuum test may be performed at this time as a preliminary means of leak checking; however, the use of an electronic leak detector after the system has been charged is recommended.

4. Charge system with proper refrigerant to nameplate charge.
5. Operate ice machine.

SEVERE SYSTEM CONTAMINATION CLEAN-UP PROCEDURES

1. Remove refrigerant charge.
2. Remove compressor.
3. Disassemble hot gas solenoid valve. If burnout deposits are found inside valve, install rebuild kit and replace TXV. If contaminants are found, replace harvest pressure limiter control.
4. Check discharge and suction lines at compressor for burn-out deposits. Wipe out as necessary.
5. Sweep through open system with dry nitrogen.

> **NOTE**
>
> Refrigerant sweeps are not recommended, as they release C.F.C.'s into the atmosphere.

6. Installation Procedures:
   a. Install new compressor and start components.
   b. Install an adequately sized suction line filter-drier with acid/moisture removal capability and inlet/outlet access valves. Place the filter-drier as close to the compressor as practical.
   c. Replace liquid line filter-drier.
7. Follow normal evacuation procedures except replace the evacuation step with the following:

> **IMPORTANT**
>
> Dry nitrogen is recommended for this procedure to prevent C.F.C. release into the atmosphere.

   a. Pull vacuum to 1000 microns. Break vacuum with dry nitrogen and sweep system. Pressurize to a minimum of 5 psi.
   b. Change vacuum pump oil. Pull vacuum to 500 microns. Break vacuum with dry nitrogen and sweep system. Pressurize to a minimum of 5 psi.

c. Change vacuum pump oil. Pull system down to 250 microns. When 250 microns have been achieved, allow vacuum pump to run for 1/2 hour for self-contained models, 1 hour for remotes. A standing vacuum test may be performed at this time as a preliminary means of leak checking; however, the use of an electronic leak detector after the system has been charged is recommended.

8. Charge system with proper refrigerant to nameplate charge.

9. Operate ice machine.
   a. Check pressure drop across the suction line filter-drier after 1 hour running time. If pressure drop is not excessive (up to 1 psi differential), the filter-drier should be adequate for complete clean-up. Proceed to step 10.
   b. If pressure drop is greater than 1 psi after 1 hour run time, change the suction line filter-drier and liquid line drier. Repeat until ice machine will run 1 hour without pressure drop.

10. Remove suction line filter-drier after 48-72 hours run time. Change liquid line drier and follow normal evacuation procedures.

Refrigerant Field Conversion

R502 to DuPont SUVA® HP81 (R402B)

Order field conversion kit 76-2559-3 from your Manitowoc Distributor to convert any G-Model R502 ice machine to DuPont SUVA® HP81

SYSTEM PERFORMANCE AFTER CONVERSION

Operating discharge (high) pressure — Air-cooled models will run 20-30 psig (138-207 kPa gauge) higher than R-502 pressures published in service manuals. Set water-cooled head pressure same as R-502 settings.

Operating suction (low) pressure — Will run 1-3 psig (7-21 kPa gauge) higher than R-502 pressures published in service manuals.

System performance after conversion to HP81.

Daily Ice Production		Energy Efficiency
G150	Same	Same
G200	Up to 5% increase	Up to 5% increase
G400	Up to 8% increase	Up to 5% increase
G600	Up to 5% increase	Up to 5% increase
G800	Up to 10% increase	Up to 5% increase
G1200	Up to 10% increase	Up to 5% increase
G1700	Same	Up to 3% increase

Total refrigerant charge — The HP81 system charge is identical to R502 charge listed on model/serial tag.

Refrigerant Field Conversion

R12 to DuPont SUVA® MP39 (R401A)

Order field conversion kit 76-2622-3 from your local Manitowoc Distributor for instructions (including oil type needed, TXV usage, etc.) to convert the following R-12 ice machines to DuPont SUVA® MP39 (R401A).

Ice Machines Approved for Conversion	System Charge After Conversion MP39 (R401A) Ounces	Kilograms
A0100A	7	.1984
A0100W	6	.1701
E0200A	14	.3969
E0200W	10	.2835
H0200A	14	.3969
H0200W	10	.2835
E0400A	15	.4252
E0400W	12	.4252
E0400N	192 (12 lbs.)	5.4430

SYSTEM PERFORMANCE AFTER CONVERSION

Operating Discharge (High) Pressure
Air-cooled - Discharge pressure is 5-35 psig (34-241 kPa gauge) higher than R-12 pressures published in service manuals.

Water-cooled - Discharge pressure is reset to 135 psig (931 kPa gauge).

Operating Suction (Low) Pressure
Air or water-cooled - Suction pressure is 1-3 psig (7-21 kPa gauge) higher than R-12 pressures published in service manuals.

Daily Ice Production
The daily ice production remains the same as "R-12 production" published in service manuals.

NOTES

NOTES

Factory School

- Improve Your Service Techniques.
- 4 Days of Intensive Training on Manitowoc Ice Machines, Dispensers, and Reach-Ins.
- Contact Your Distributor For Dates and Further Information.

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