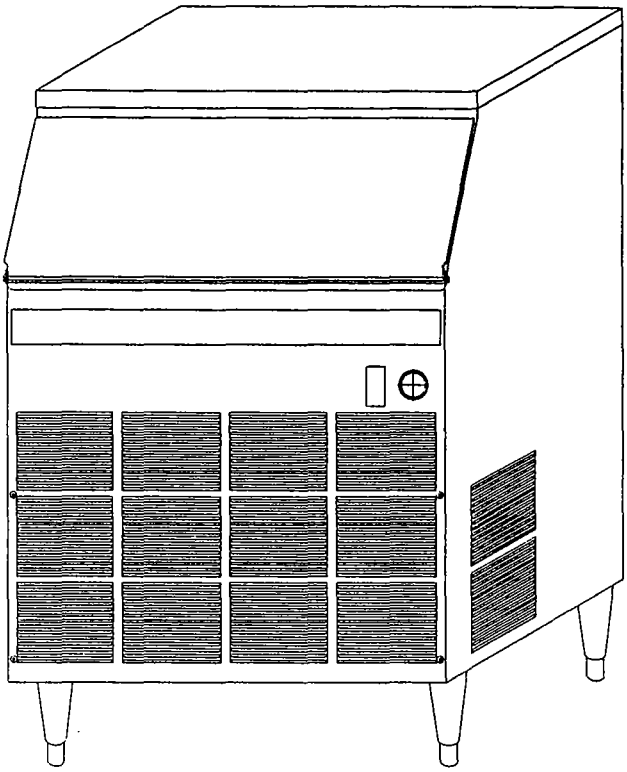
Manitowoc®
ICE MACHINES

Series G150

SERVICE MANUAL



SV1161

This product qualifies for the following listings:

We reserve the right to make product improvements at any time. Specifications and design are subject to change without notice.

Recycled Paper

Part No. 80-0876
Rev I (8-91)
Rev 2 (8-92)

TABLE OF CONTENTS

MANITOWOC ICE, INC.
2110 South 26th Street P.O. Box 1720 Manitowoc, WI 54221-1720
Phone: (920) 682-0161
Fax: (920) 683-7585
Web Site: www.manitowocice.com

GENERAL SPECIFICATIONS

This section is not intended to be a guideline to install the ice machine. Refer to Installation Manual for installation procedures.

Ambient Air Temperature: 35°F minimum, 110°F maximum (minimum five-inch clearance rear and sides)

Ice Making Water Supply:
Pressure — 20 psig minimum, 80 psig maximum
Supply Line — 3/8 inch FPT
Drain Line — 3/4 inch FPT
Water Temperature — 33°F minimum, 90°F maximum

Water-Cooled Condenser Water Supply:
Water Regulating Valve Setting — 225 psig ± 5 (Factory preset)
Pressure — 20 psig minimum, 150 psig maximum
Supply Line — 1/2 inch FPT
Drain Line — 1/2 inch FPT
Temperature — 33°F minimum, 90° maximum

Heat of Rejection (BTU/Hr):
Average 3,800, Peak 4,700

Refrigerant R502
Air-Cooled — 13 oz. ± 1/4 oz.
Water-Cooled — 8 oz. ± 1/4 oz.

ELECTRICAL REQUIREMENTS

Ice machine is supplied with a 9 foot power cord rated at 125 VAC, 16-3 connector with a standard 3 prong straight blade grounded plug. (NEM configuration 5-15P)

Voltage Phase Cycle	AIR	WATER
	TOTAL AMPS	TOTAL AMPS
115/1/60	8.6	5.8
208-230/1/60	3.1	2.9
220-240/1/50	3.4	2.9
Numbers Listed Are Amps		

MANITOWOC ICE MACHINES ARE AIR CONDITIONING REFRIGERATION INSTITUTE (ARI) CERTIFIED AND RATED IN ACCORDANCE WITH AIR CONDITIONING REFRIGERATION INSTITUTE STANDARD 810-87

NOTE
Test conditions for standard ratings at **90°F air, 70°F water**, and 30 ± 2 psig water inlet pressure.

Model Designation	Capacity (Lb. per 24 Hr.)	Potable Water Used (Gal. per 100 Lb. of Ice)	Condenser Water Used (Gal. per 100 Lb. of Ice)	Power Input (kW/Hr. 100 Lb. of Ice)
GR0150A	112	36	--	15.4
GR0151W	112	36	200	10.0
GD0152A	120	36	--	14.3
GD0153W	120	36	200	9.3

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

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 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.

Please contact your local Manitowoc Distributor or Manitowoc Ice, Inc. for further information regarding warranty coverage. (NOTE: Have model and serial numbers of ice machine available when calling. See Figure 1 for location of model and serial numbers.)

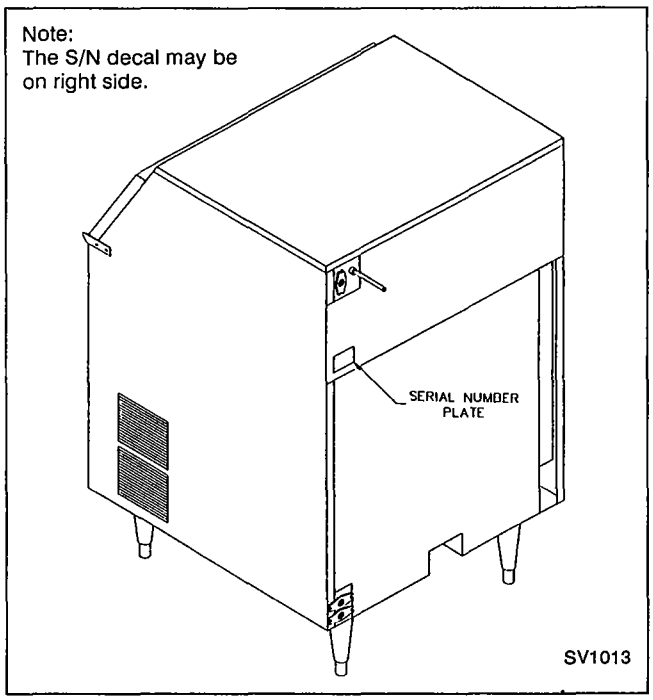


FIGURE 1. MODEL/SERIAL NUMBERS LOCATION

DIMENSIONS

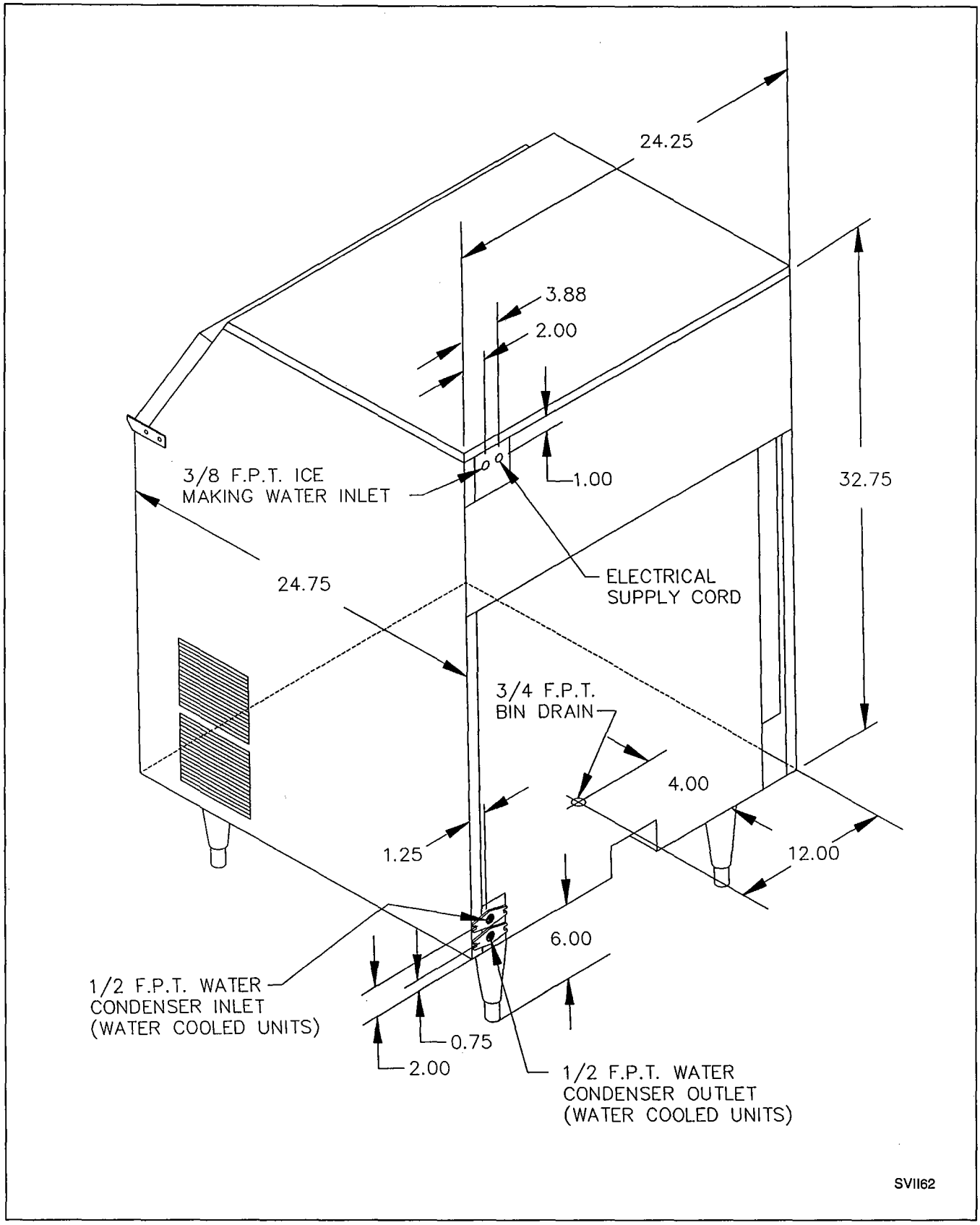


FIGURE 2. DIMENSIONS

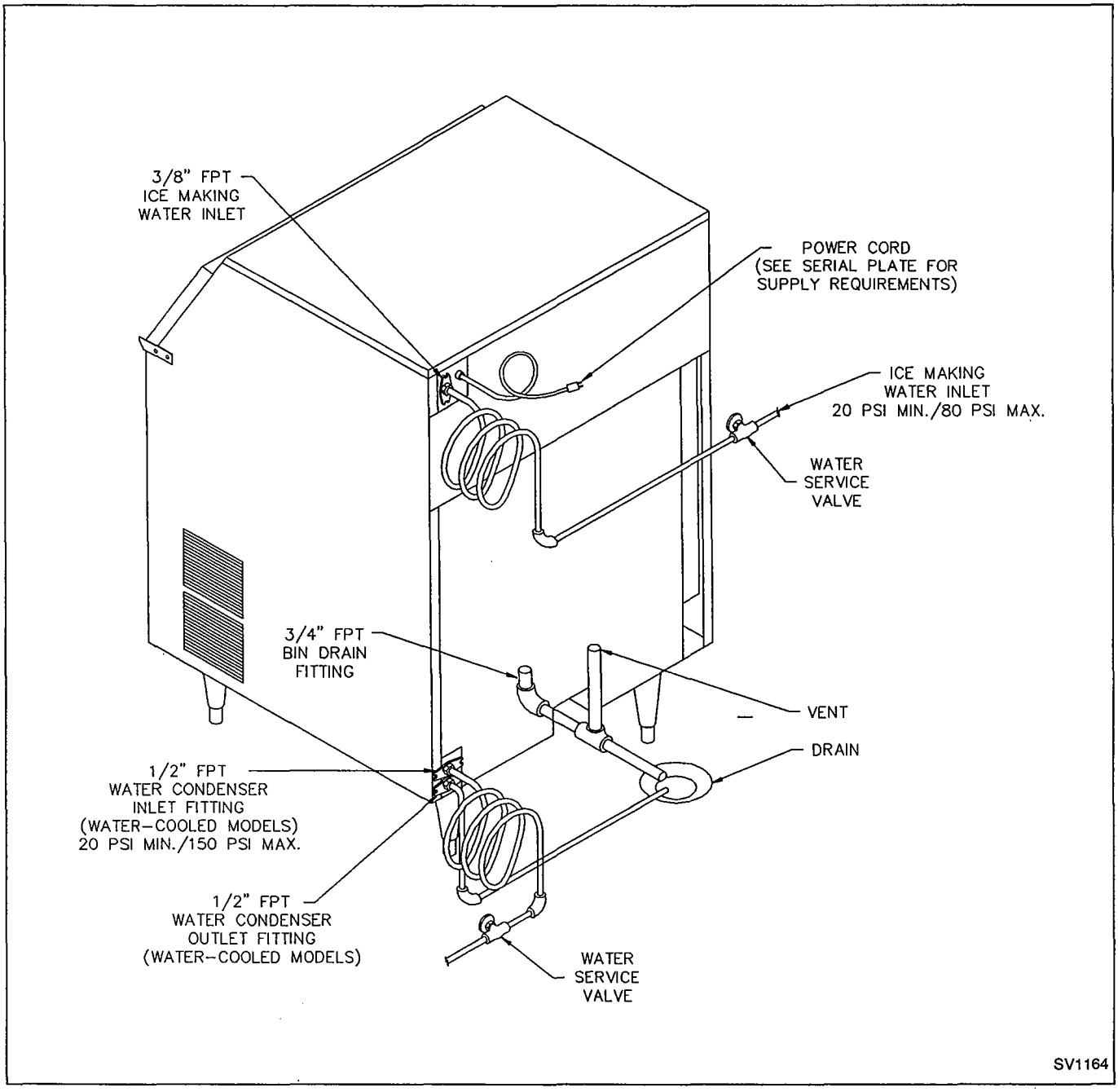
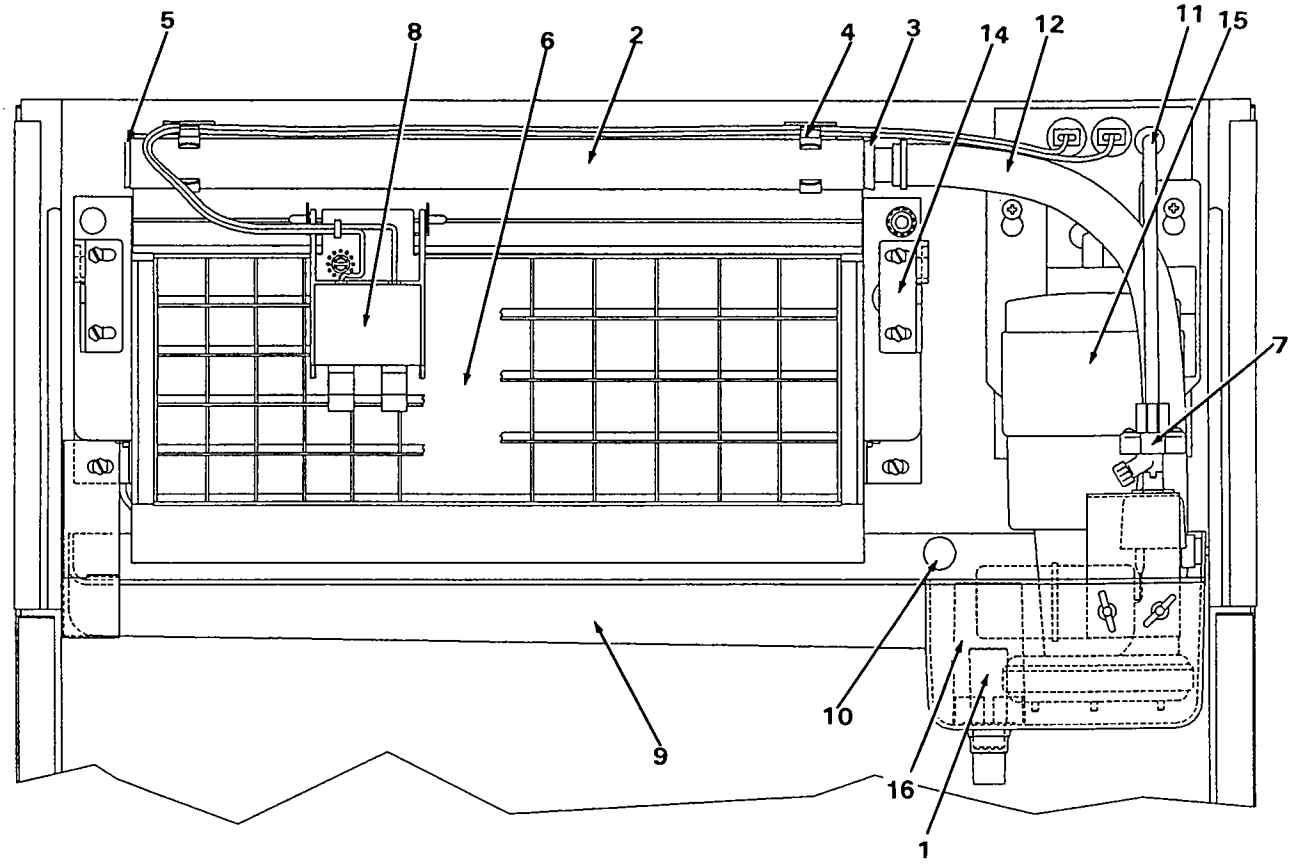


FIGURE 3. TYPICAL INSTALLATION

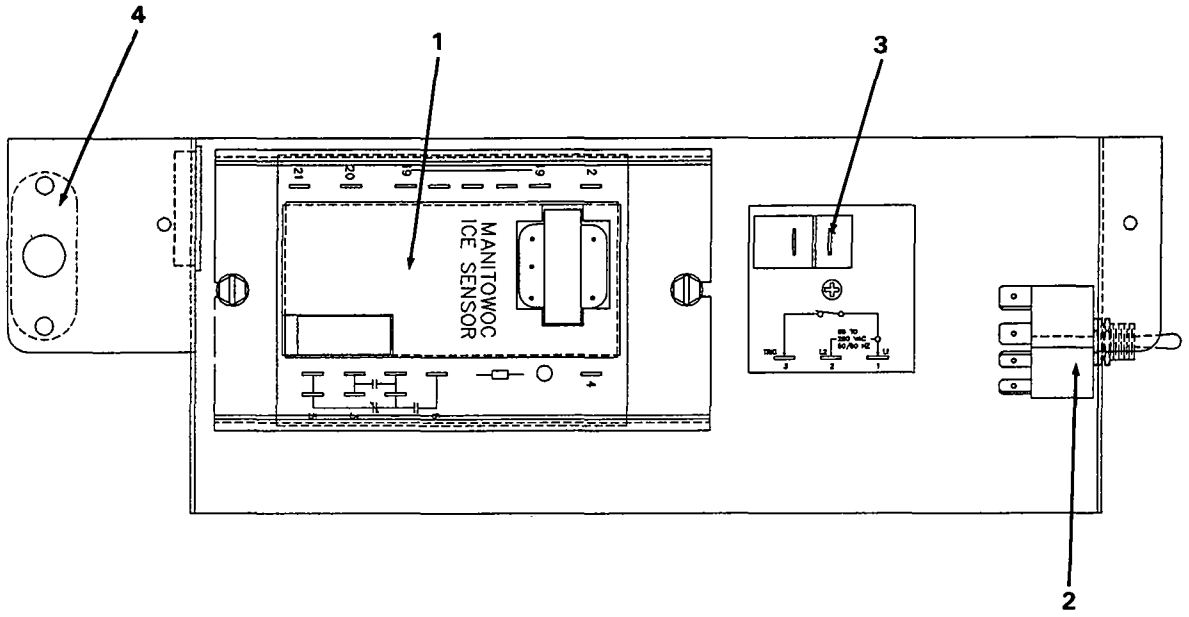
COMPONENT IDENTIFICATION



1. OVERFLOW TUBE
2. DISTRIBUTION TUBE
3. DISTRIBUTION TUBE SEAL
4. DISTRIBUTION TUBE SPRING CLIP
5. END PLUG
6. EVAPORATOR
7. FLOAT VALVE
8. ICE THICKNESS CONTROL
9. SUMP TROUGH
10. THUMB SCREW
11. TUBING 1/4" OVERFLOW
12. TYGON TUBING, 1/2" ID X 3/4" OD
13. WATER CURTAIN (NOT SHOWN)
14. CURTAIN BRACKET
15. WATER PUMP
16. FLUSH CAP

SV1163

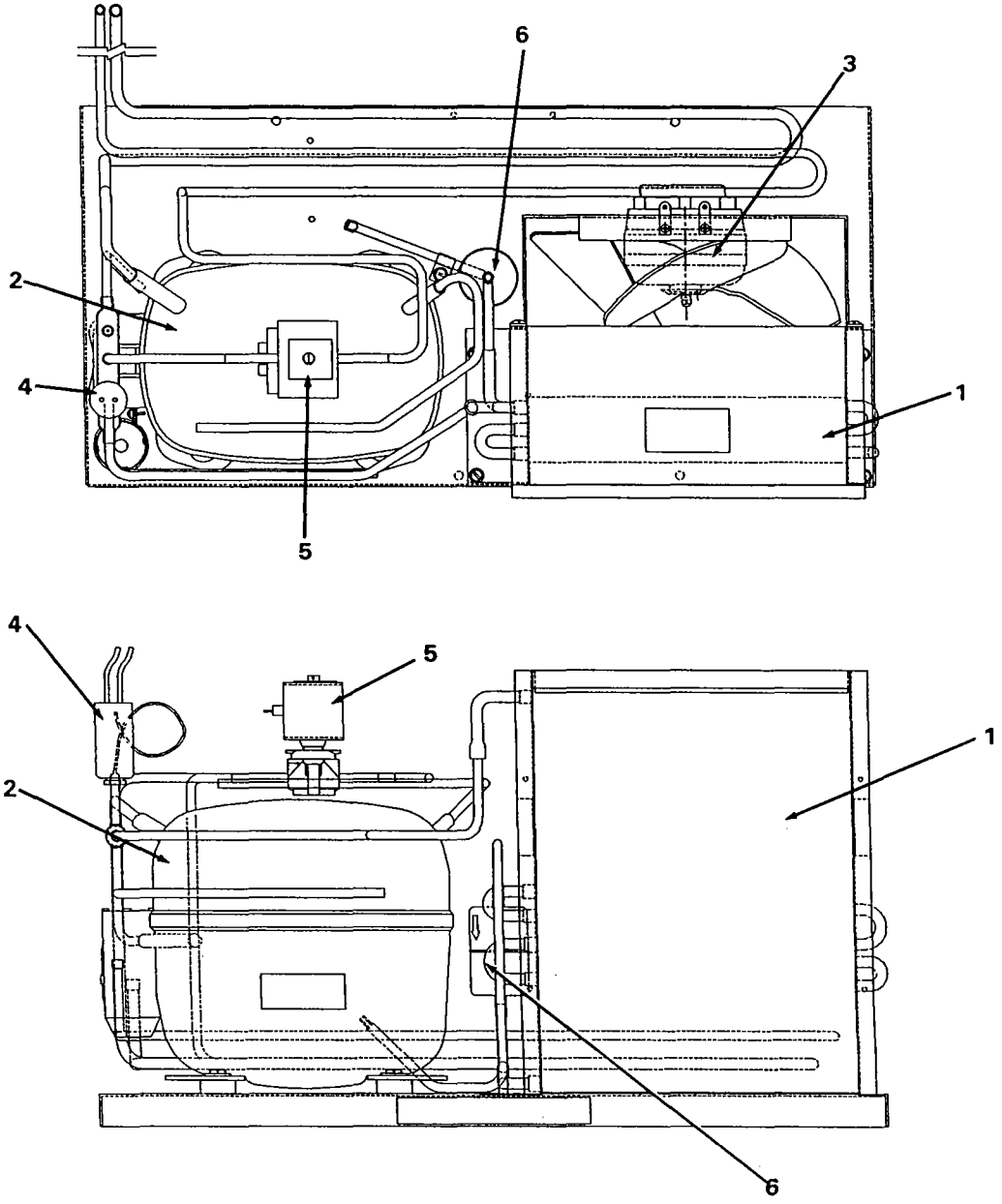
FIGURE 4. WATER DISTRIBUTION GROUP



1. UNITIZED ICE SENSOR BOARD
2. TOGGLE SWITCH
3. 7-SECOND OFF DELAY RELAY
4. HIGH PRESSURE CUTOUT

SV1165

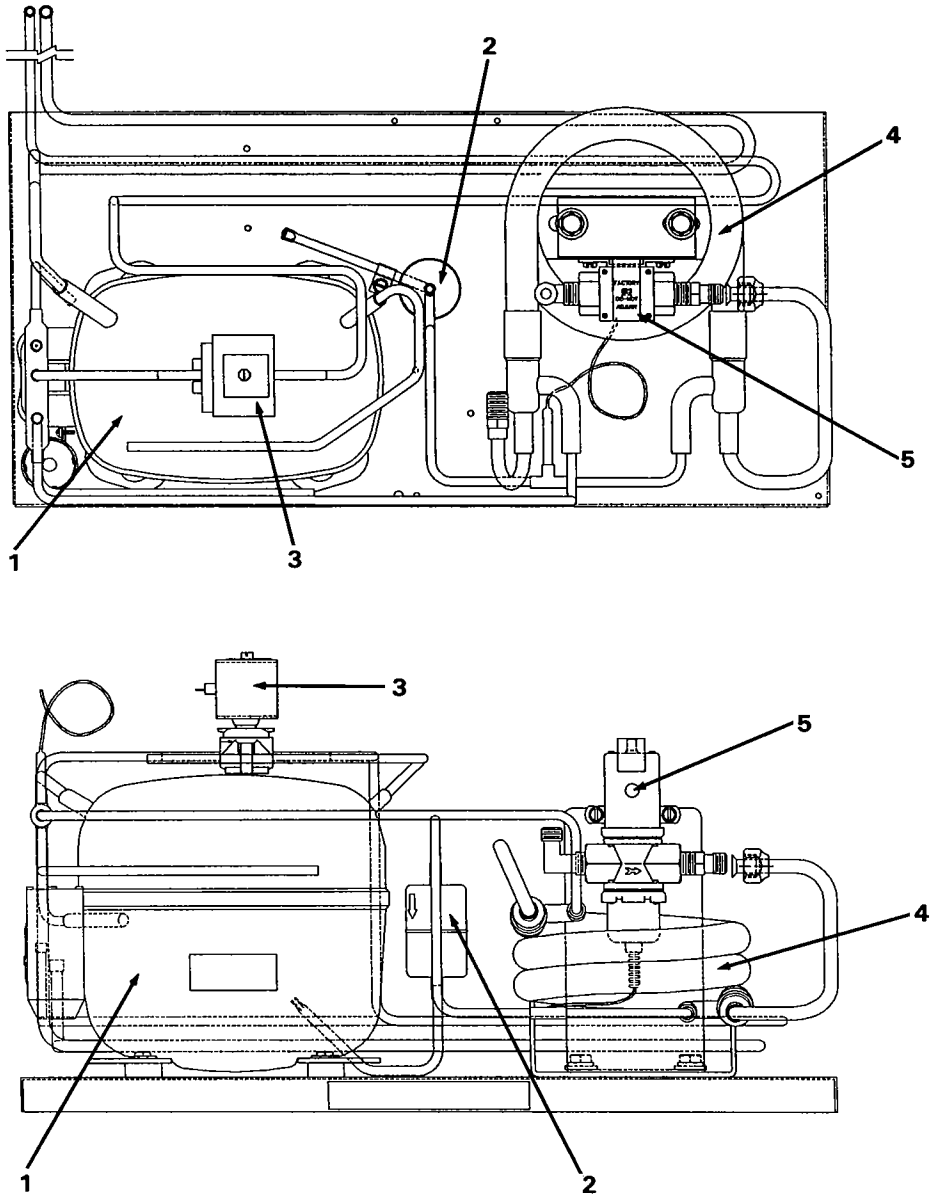
FIGURE 5. CONTROL BOX ASSEMBLY



1. AIR CONDENSER
2. COMPRESSOR
3. FAN
4. FAN CYCLING CONTROL
5. HOT GAS SOLENOID
6. DRIER

SV1166

FIGURE 6. COMPRESSOR COMPARTMENT (AIR-COOLED)



1. COMPRESSOR
2. DRIER
3. HOT GAS SOLENOID
4. WATER-COOLED CONDENSER
5 WATER REGULATING VALVE

SV1167

FIGURE 7. COMPRESSOR COMPARTMENT (WATER-COOLED)

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.

REMOVAL OF PARTS FOR CLEANING

1. Loosen two screws holding top cover in place and remove.

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(s). (See Figure 3)

⚠ WARNING
Disconnect electric power to ice machine before proceeding.

4. Remove all ice from bin.

5. Remove water curtain.

6. Remove overflow tube from water trough and allow water to drain into bin.

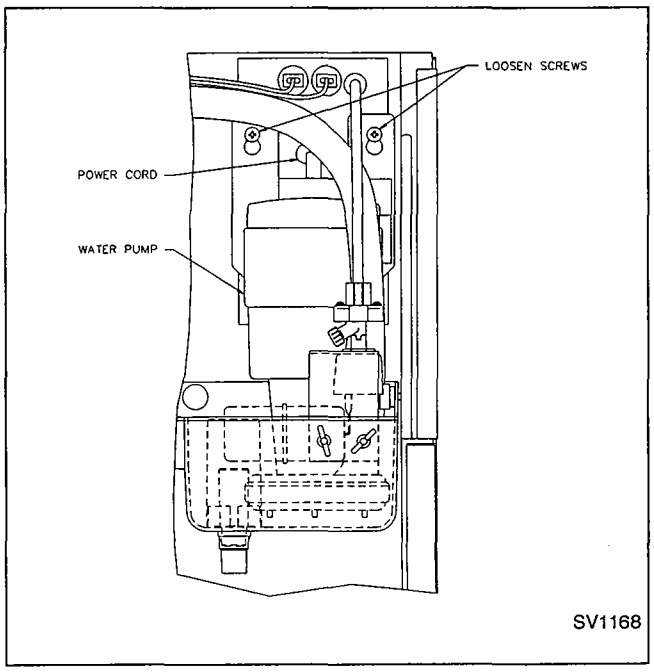


FIGURE 8. WATER PUMP REMOVAL

REMOVE WATER PUMP (Figure 8)

1. Disconnect water pump power cord.

2. Disconnect hose from pump outlet.

3. Remove two screws holding pump mounting bracket to bulkhead.

4. Lift pump and bracket assembly off screws.

REMOVE FLOAT VALVE (Figure 9)

1. Turn valve splash shield clockwise a full turn or two, then pull the valve off the mounting bracket.

2. Disconnect the water inlet tube from the float valve at the compression fitting.

3. Unscrew filter screen and cap.

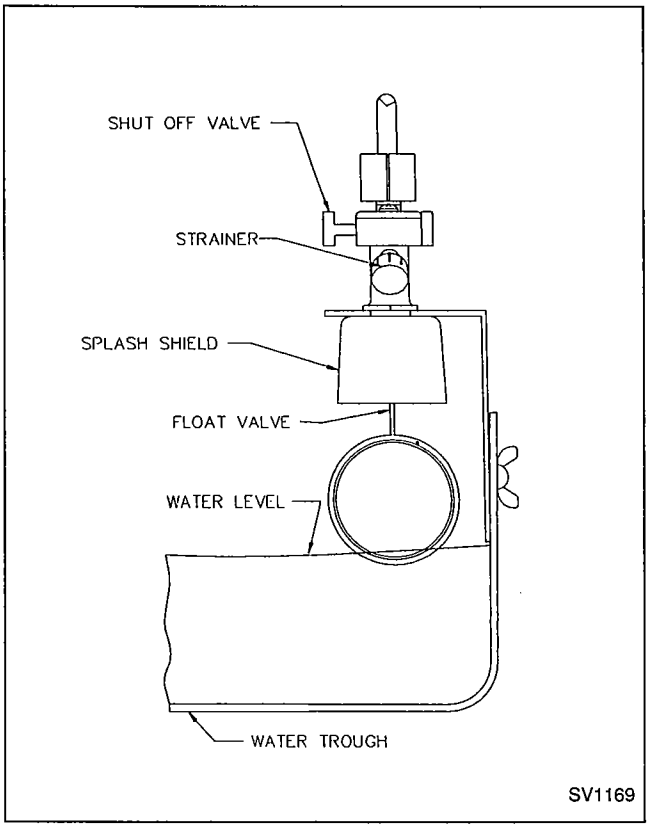


FIGURE 9. FLOAT VALVE REMOVAL

REMOVE DISTRIBUTION TUBE (Figure 10)

1. Remove distribution tube from the two spring clips holding it in place.

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

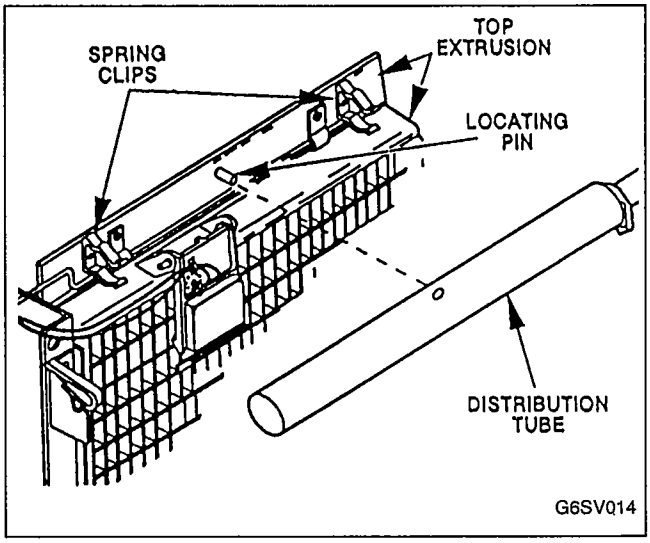


FIGURE 10. DISTRIBUTION TUBE REMOVAL

DISASSEMBLE DISTRIBUTION TUBE (Figure 11)

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.

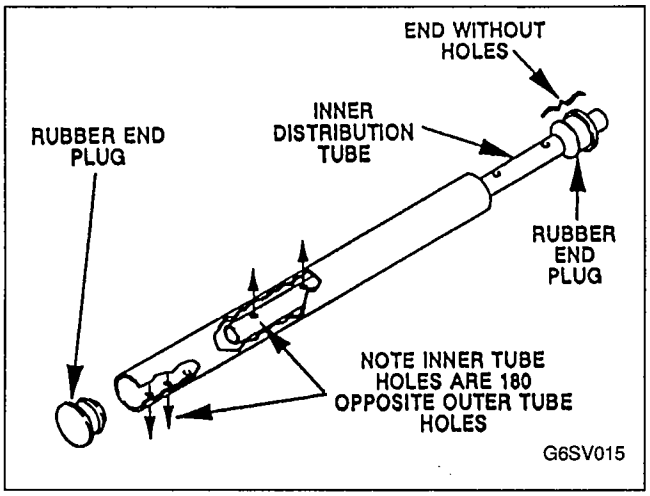


FIGURE 11. DISTRIBUTION TUBE DISASSEMBLY

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 12)

⚠ WARNING
Disconnect electric power to ice machine 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.

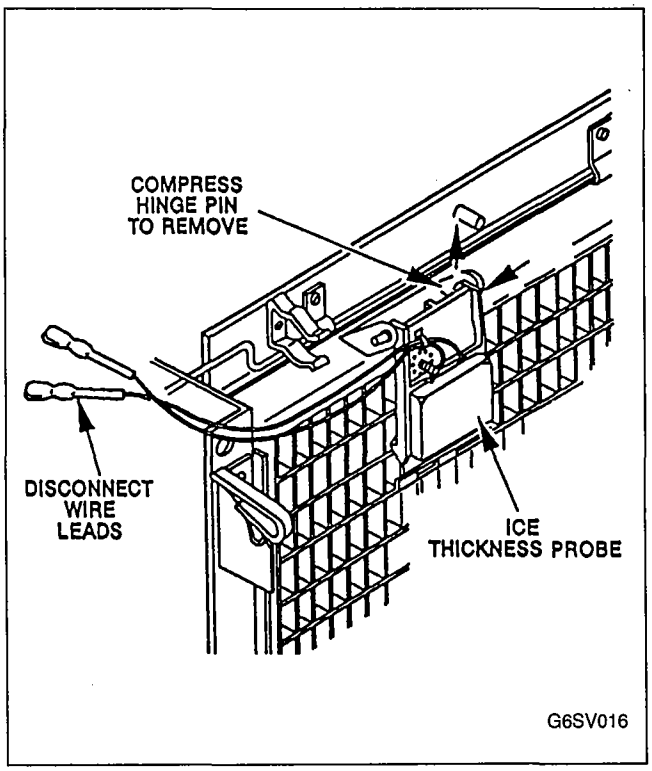


FIGURE 12. ICE THICKNESS PROBE REMOVAL

REMOVE WATER TROUGH (Figure 13)

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

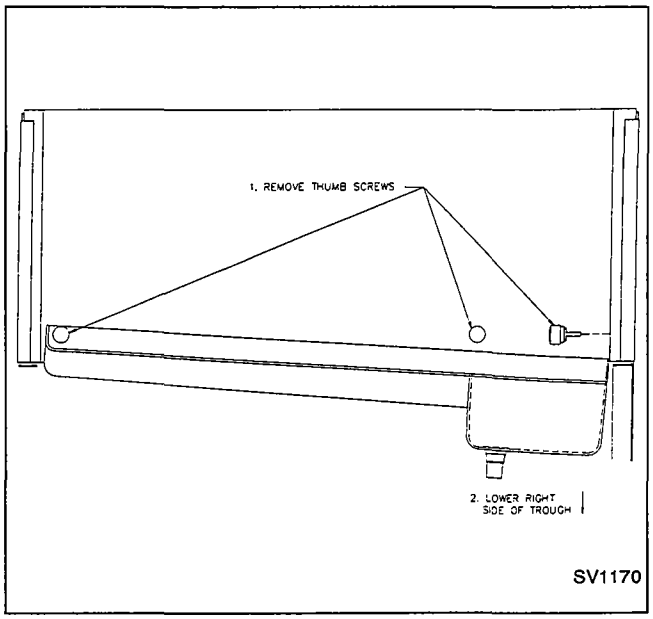


FIGURE 13. WATER TROUGH REMOVAL

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 thickness probe so as not to move the adjusting 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 10, 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 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 verify float valve is open, Figure 22.

2. Allow trough to fill to proper operating level, Figure 22.

3. Set ICE/OFF/WATER PUMP switch at WATER PUMP.

4. Add two ounces of cleaner to water trough and allow solution to circulate a maximum of 10 minutes.

> **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 9.

7. Drain water trough by removing overflow tube.

8. Thoroughly rinse trough with clean water, then reinstall overflow tube.

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. Refer to Owner/Operator Use and Care Guide.

SANITIZING

Sanitizer is used for removal of algae or 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 top cover in place and remove top cover.

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. Remove water curtain, Figure 25.

4. Remove all ice from bin.

5. Set ICE/OFF/WATER PUMP switch at WATER PUMP.

6. Add one ounce of sanitizer to water trough and allow solution to circulate a minimum of one minute.

7. Drain solution from trough by removing overflow tube, Figure 22.

8. Thoroughly rinse trough with clean water, then reinstall drain plug.

9. Wash all surfaces requiring sanitizing (ice machine and bin) with a solution of one ounce of sanitizer to up to four gallons of water.

10. Thoroughly rinse all sanitized surfaces with clean water.

11. Set ICE/OFF/WATER PUMP switch at ICE.

12. Perform Operational Checks. Refer to Owner/ Operator Use and Care Guide. Discard first batch of ice.

SEQUENCE OF OPERATION

FREEZE CYCLE

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

The water flows over the evaporator, forming ice on evaporator. The freeze cycle will last approximately 10-30 minutes, depending on air and water conditions. (Refer to Cycle Time Chart, page 33.)

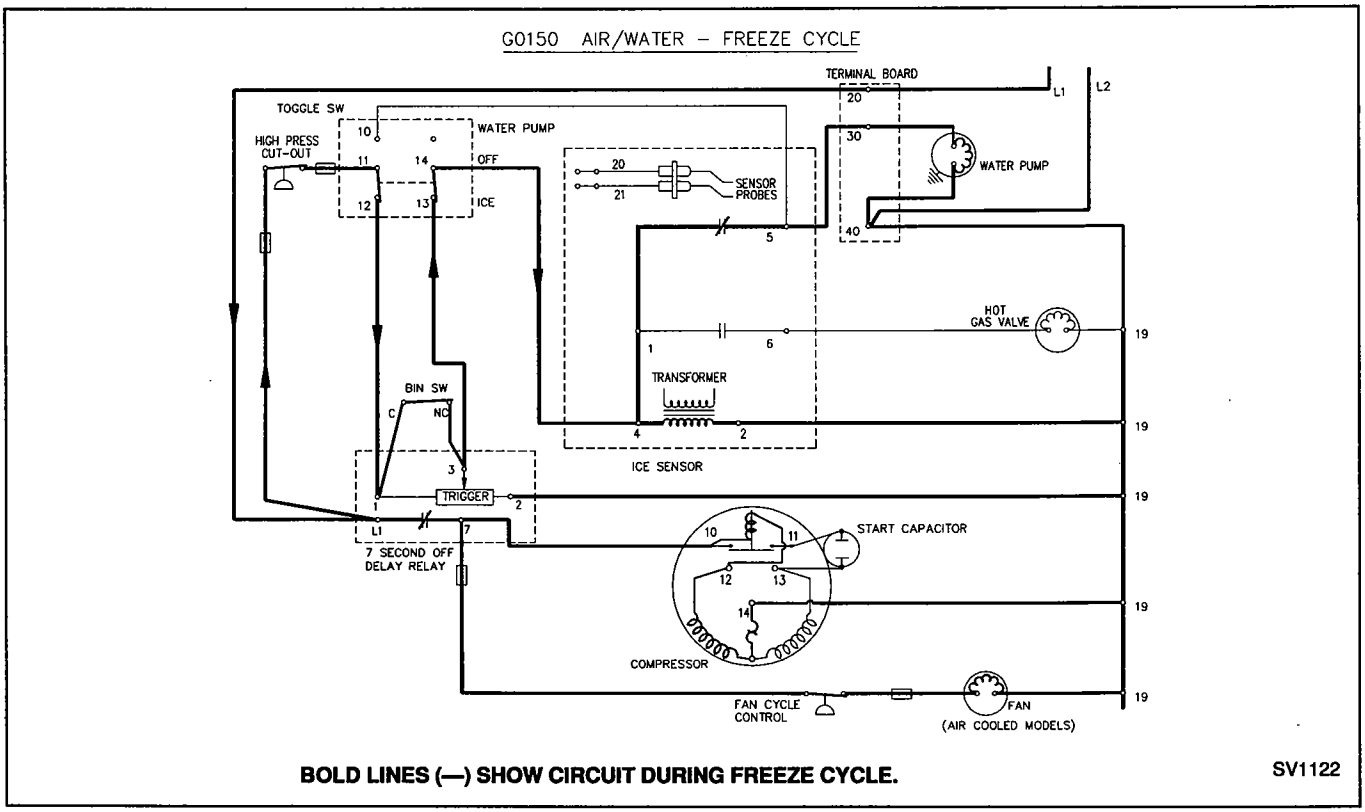


FIGURE 14. FREEZE CYCLE ELECTRICAL SEQUENCE

Freeze Cycle Electrical Sequence

1. Bin switch . . . . . closed
2. High Pressure Cut-Out control . . . . . closed
3. Toggle switch . . . . . ice position
4. Primary power to transformer . . . . . yes
5. Ice Sensor Relay . . . . . not energized
   - A) Ice Sensor Relay contact #6 . . . . . open
     1. Hot gas solenoid . . . . . not energized
   - B) Ice Sensor Relay contact #5 . . . . . closed
     1. Water pump . . . . . on
6. 7-Second Delay Relay (contacts between L1 and 7) . . . . . closed
   - A) Fan motor (air-cooled models) . . . . . on
     (fan cycle control may cycle fan on and off)
   - B) Compressor . . . . . on

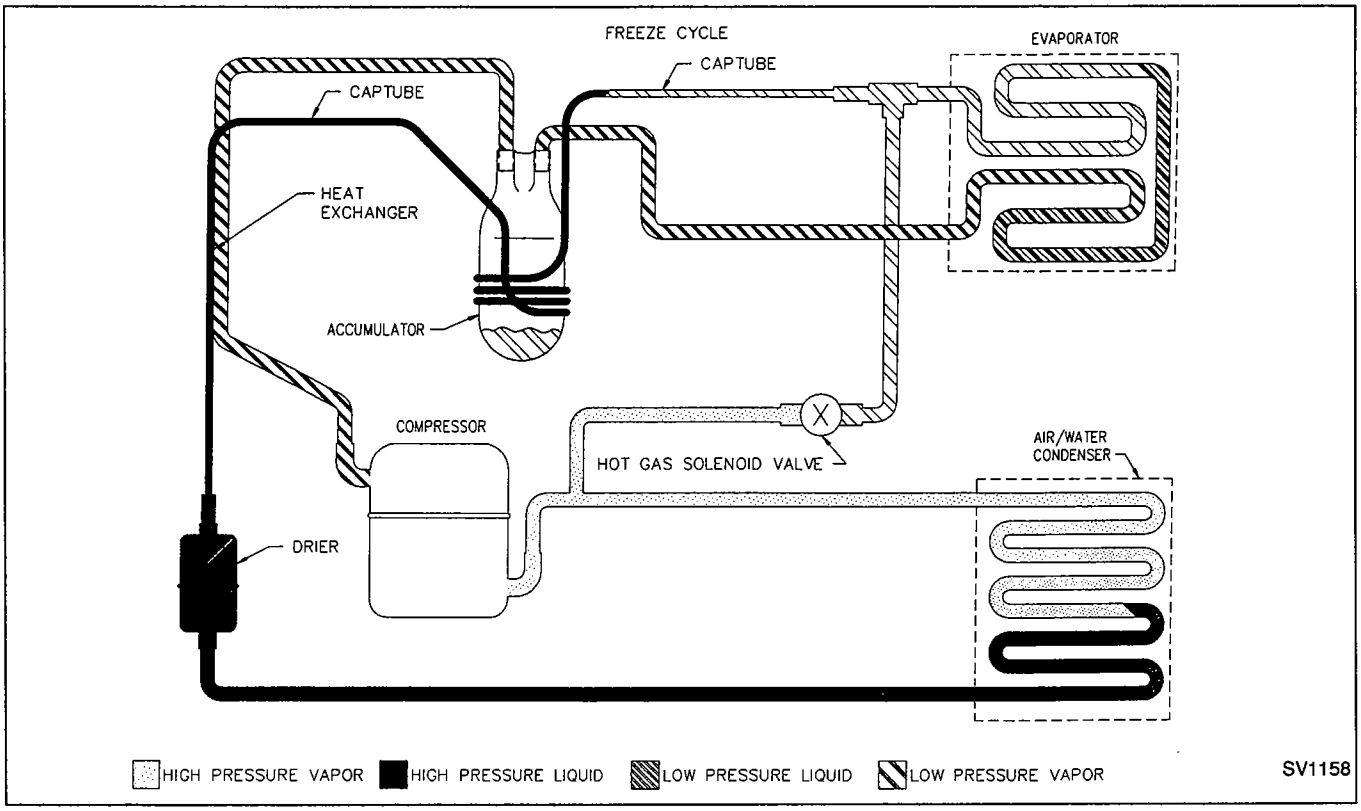


FIGURE 15. FREEZE CYCLE REFRIGERATION SEQUENCE

Freeze Cycle Refrigeration Sequence

The refrigerant is absorbing heat from the water running over the evaporator surface. The suction pressure gradually drops as ice forms.

FREEZE CYCLE PRESSURES		
Ambient Temp. °F	**Head Pressure PSIG**	**Suction Pressure PSIG**
Air Cooled		
50	175-225	35-18
70	180-250	35-18
80	215-270	35-18
90	230-290	35-18
100	240-340	40-20
Water Cooled		
50	220-230	35-25
70	220-230	35-25
80	220-230	35-25
90	220-230	35-25
100	220-230	35-25

Freeze Cycle Water Flow Sequence

The water from the sump trough is pumped to the distribution tube above the evaporator. If flows evenly over the evaporator forming ice. The float valve maintains the proper water level in the sump trough.

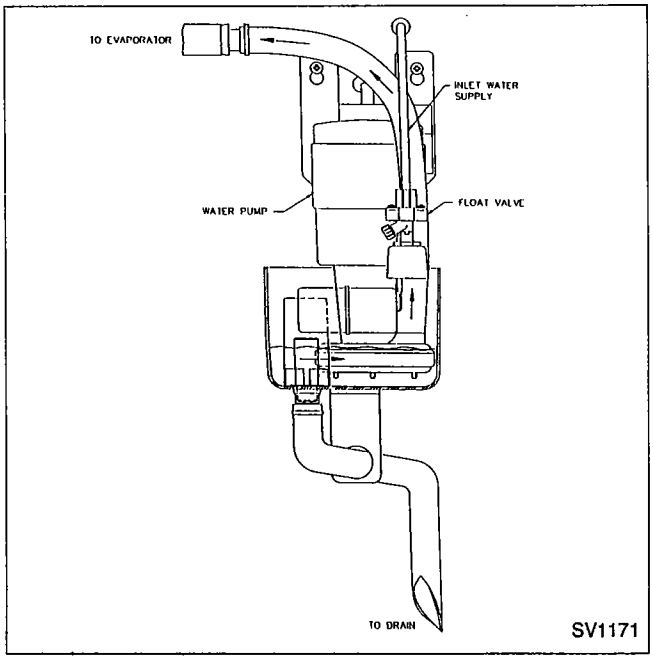


FIGURE 16. FREEZE CYCLE WATER FLOW SEQUENCE

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 in the unitized sensor board is energized, changing contacts #5 and #6.

As hot gas warms the evaporator, the ice cubes slide, as a unit, off the evaporator into the storage bin. The harvest cycle will last approximately 1 to 2 minutes. **Back to freeze cycle prechill:** the falling ice swings the bottom of the water curtain out, momentarily activating (opening) the bin switch. This interrupts the primary power supply at the transformer, de-energizing the ice sensor relay on the unitized sensor board.

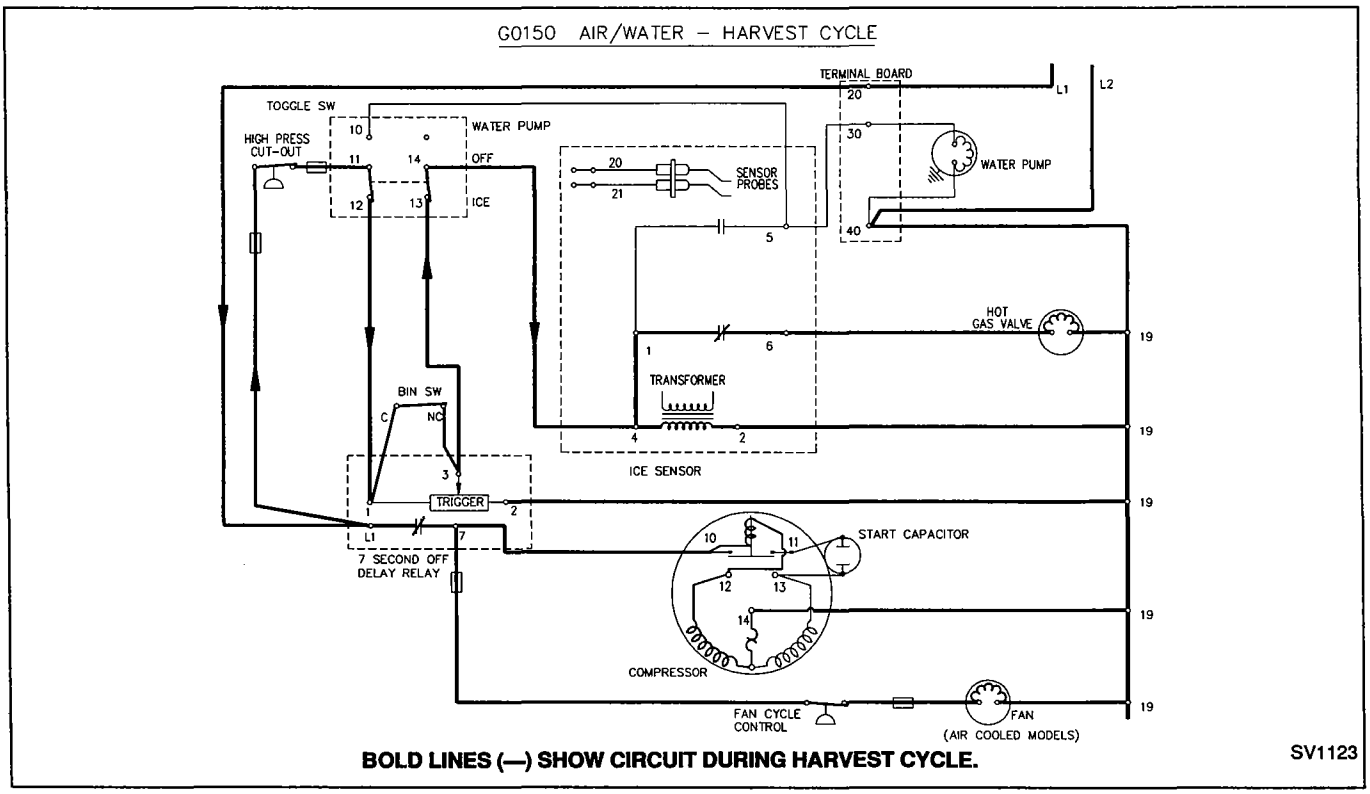


FIGURE 17. HARVEST CYCLE ELECTRICAL SEQUENCE

Harvest Cycle Electrical Sequence

1. Bin switch . . . . . closed
2. High Pressure Cut-Out control . . . . . closed
3. Toggle switch . . . . . ice position
4. Primary power to transformer . . . . . yes
5. Ice Sensor Relay . . . . . energized
   - A) Ice Sensor Relay contact #6 . . . . . closed
     - 1. Hot gas solenoid . . . . . energized
   - B) Ice Sensor Relay contact #5 . . . . . open
     - 1. Water pump . . . . . off
6. 7-Second Delay Relay (contacts between L1 and 7) . . . . . closed
   - A) Fan motor (air-cooled models) . . . . . on
     (fan cycle control may cycle fan on and off)
   - B) Compressor . . . . . on

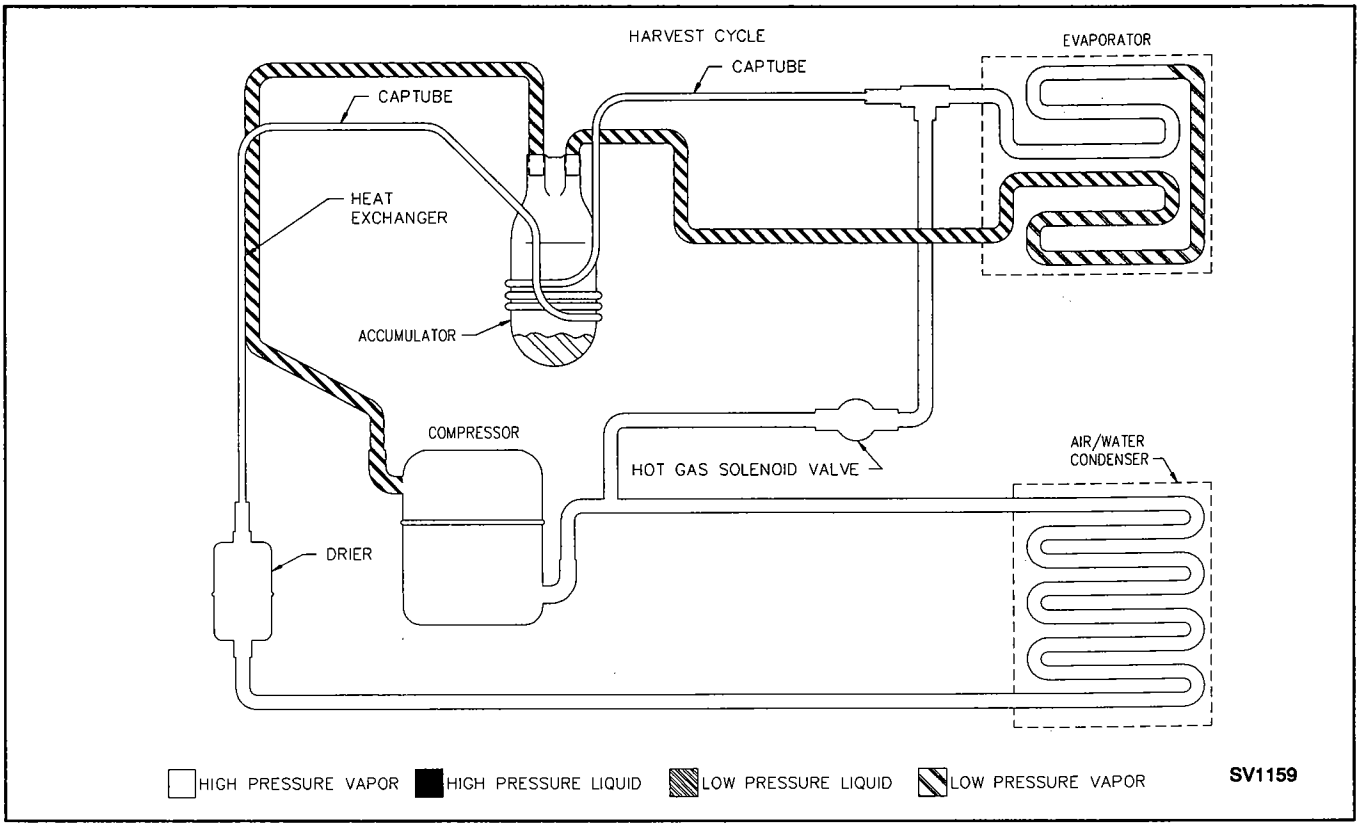


FIGURE 18. HARVEST CYCLE REFRIGERATION SEQUENCE

Harvest Cycle Refrigeration Sequence

Hot gas flows through the energized hot gas valve heating the evaporator. The hot gas valve is sized to allow the proper amount of refrigerant into the evaporator. This specific sizing assures proper heat transfer without the refrigerant condensing and slugging the compressor.

HARVEST CYCLE PRESSURES

Ambient Temp. °F	Head Pressure PSIG	Suction Pressure PSIG
Air Cooled		
50	125-175	65-100
70	125-175	65-100
80	135-185	75-110
90	160-200	75-120
100	170-215	75-155
Water Cooled		
50	160-200	85-100
70	160-200	90-105
80	160-200	90-105
90	160-200	95-110
100	160-200	100-115

Harvest Cycle Water Flow Sequence

With the water pump off, the water from the sump trough flows through the overflow tube and down the drain. The flushing of the minerals after each freeze cycle helps to keep the cubes clear and reduces the frequency of the ice machine cleanings.

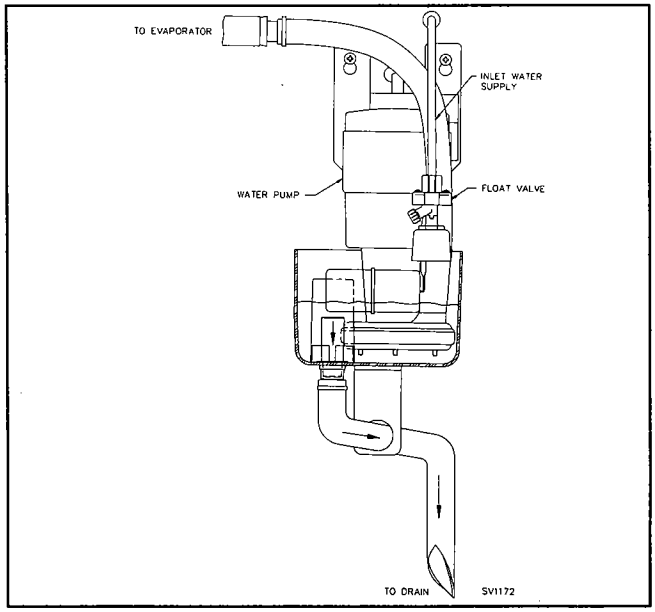


FIGURE 19. HARVEST CYCLE WATER FLOW SEQUENCE

AUTOMATIC SHUT-OFF (Full Bin of Ice)

When ice storage bin becomes full, the last 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 delay relay opens, de-energizing the compressor and fan motor. The open bin switch disconnects power to the other components. The return of the water curtain closes the bin switch and the ice machine starts a new freeze cycle.

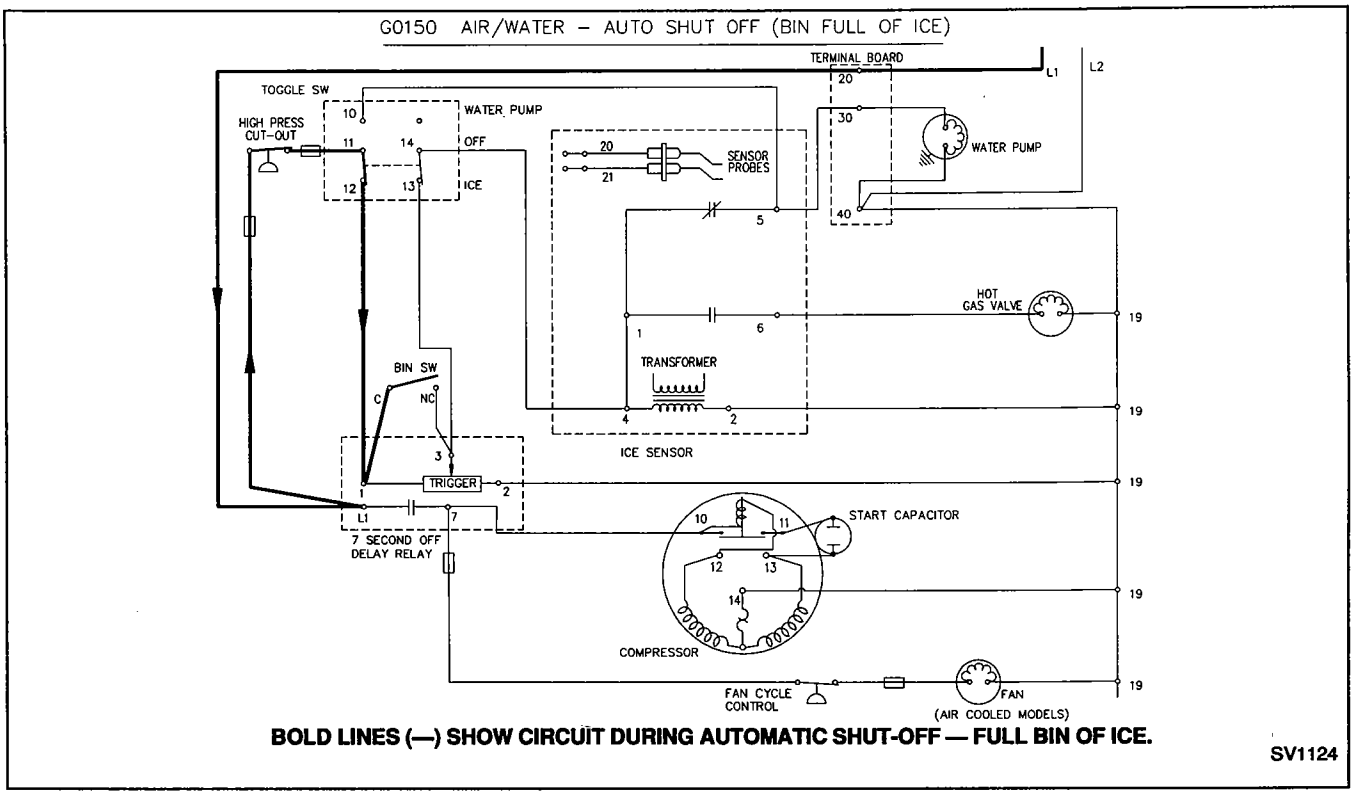


FIGURE 20. AUTOMATIC SHUT-OFF ELECTRICAL SEQUENCE

Automatic Shut-Off Electrical Sequence

1. Bin switch . . . . . open
2. High Pressure Cut-Out control . . . . . closed
3. Toggle switch . . . . . ice position
4. Primary power to transformer . . . . . no
5. Ice Sensor Relay . . . . . not energized
   - A) Ice Sensor Relay contact #6 . . . . . open
     1. Hot gas solenoid . . . . . not energized
   - B) Ice Sensor Relay contact #5 . . . . . closed
     1. Water pump . . . . . off
6. 7-Second Delay Relay (contacts between L1 and 7) . . . . . open
   - A) Fan motor (air-cooled models) . . . . . off
     (fan cycle control may cycle fan on and off)
   - B) Compressor . . . . . off

SERVICE DIAGNOSTIC CHART

Symptom	Possible Cause	Corrective Action
Ice machine will not run.	ICE/OFF/WATER PUMP switch: a. Not in ICE position. b. Defective/miswired. High pressure cut-out control tripped: a. Condenser water pressure low or off (water cooled). b. Condenser water temperature above 90°F (water cooled). c. Dirty condenser. d. Refrigerant overcharge. e. High side refrigerant lines or component plugged. f. H.P.C.O. control defective. Circuit breaker tripped or blown fuse. Bin switch: a. Out of adjustment. b. Defective. Voltage too low. 7-second off delay relay defective.	 Set Switch at ICE. Check ICE/OFF/WATER PUMP switch, page 24. Open water service valve at water condenser inlet. Maintain water supply temperature between 33°F minimum and 90°F maximum. Clean condenser. Evacuate/recharge, page 41. Repair line/change drier. Check control, page 23. Reset circuit breaker or replace fuse. Check adjustment, page 22. Check bin switch, page 22. Electrical service must not fluctuate more than ±10%. Check delay relay, page 26.
Water pump does not start.	ICE/OFF/WATER PUMP switch defective. Water pump defective.	Check ICE/OFF/WATER PUMP switch, page 24. Check water pump, page 25.
Compressor cycles intermittently or will not run.	Voltage too low. Defective start relay. Defective start capacitor. Wiring to compressor. Defective compressor. 7-second off delay relay defective.	Electrical service must not fluctuate more than ±10% of nameplate voltage. Check relay, page 29. Check capacitor, page 30. Check for loose connection/miswiring or open and replace. Check compressor, page 29. Check delay relay, page 26.
Fan motor will not start.	Defective fan cycling control. Defective fan motor. 7-second off delay relay defective.	Check fan cycling control, page 22. Check fan motor, page 26. Check delay relay, page 26.
Ice machine will not cycle into harvest.		Refer to page 27 for Diagnostic Procedures.
Ice machine repeatedly cycles into harvest with little or no ice formation.		Refer to page 28 for Diagnostic Procedures.
Ice machine does not cycle from harvest to freeze when ice falls into bin.	Bin switch out of adjustment. Defective bin switch.	Adjust bin switch, page 22. Check bin switch, page 22.

Symptom	Possible Cause	Corrective Action
Ice cubes too large/small.	Ice thickness probe out of adjustment.	Adjust ice thickness probe, page 24.
Shallow or incomplete cubes; incomplete ice fill pattern on evaporator.	Ice thickness probe out of adjustment. Ice machine dirty. Water filtration. Ice making water inlet supply too warm. Incorrect incoming water pressure. Refrigeration problem.	Adjust ice thickness probe, page 24. Clean and sanitize ice machine, refer to pages 10 and 14. Replace filters. Maintain water supply temperature between 33°F minimum and 90°F maximum. Water pressure must be 20-80 psig. Refer to page 35.
Ice machine does not release ice or is slow to harvest.	Ice machine dirty. Air-cooled models — low ambient. Water regulating valve leaking during harvest cycle (water-cooled models). R.T.V. sealant between white plastic and metal evaporator missing. Refrigeration problem.	Clean and sanitize ice machine. Refer to pages 10 and 14. Minimum ambient is 35°F. Clean water regulating valve and condenser. Reseal with food grade R.T.V. sealant. Refer to page 35.
Low ice capacity.		Refer to page 35.

COMPONENT FUNCTION, SPECIFICATIONS AND CHECK PROCEDURES

BIN SWITCH

Function

Bin switch operation is controlled by movement of the water curtain (refer to Water Curtain, page 25). It resets ice machine to freeze cycle by momentarily interrupting power to the unitized ice sensor board as ice falls from the evaporator. The bin switch also shuts the ice machine off when the bin is full.

Specifications

Single pole/single throw, normally closed.

> **NOTE**
> The N.O. terminal is not used.

Check Procedure

1. Pull water curtain away from evaporator until ice machine shuts off, Figure 21.

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

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, step b.
   d. If bin switch clicks too far into 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 21):
   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 across N.C. and C. terminal while depressing and releasing activating pin. If bin switch does not open and close properly, replace switch.

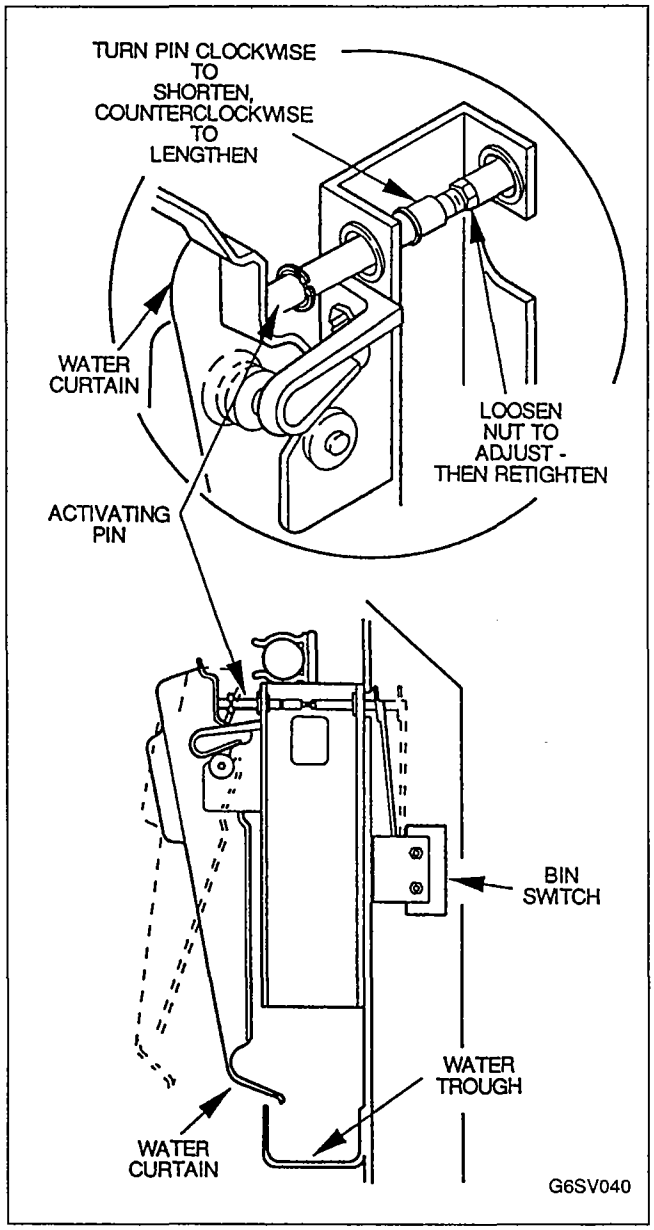


FIGURE 21. BIN SWITCH ACTIVATING PIN ADJUSTMENT

FAN CYCLE CONTROL (Air-Cooled Models)

Function

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

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

Specifications
Cut-out — 175 psig (±5 psig)
Cut-in — 225 psig (±5 psig)

Check Procedure
1. Verify fan motor windings are not open or grounded and fan spins freely.
2. Hook voltmeter in parallel (across) to the fan cycle control, leaving wires attached.
3. Pressure below 175 psig — read line voltage and fan should be off.

Replace Fan Cycle Control if:
Control does not operate within psig range listed above.

FLOAT VALVE

Function
Maintains correct water level in water trough.

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

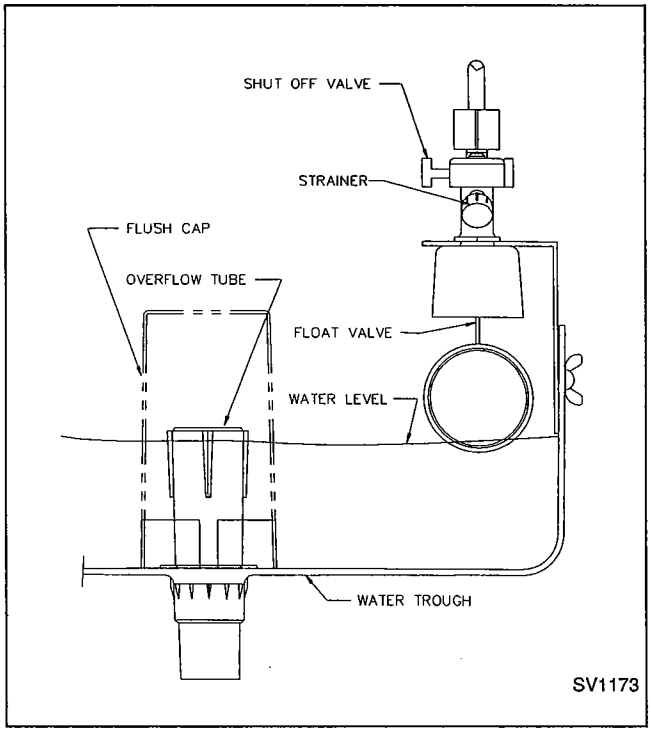


FIGURE 22. FLOAT VALVE CHECK

2. Remove the flush cap and overflow tube from water trough and allow water to drain.
3. Reinstall overflow tube on trough and allow trough to refill to proper level of 3/16 inch from top of overflow tube.

   The float valve is factory set to maintain correct water level. If adjustment is necessary, carefully bend the float arm to achieve correct level.
4. Install flush cap.

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.

Specifications
Cut-out — 440 psig ± 10.
Cut-in — manual reset (below 300 psig 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. Procedures:
   a. Water-Cooled Machines — Close the water service valve to the water condenser inlet. See Typical Installation illustration, page 5.
   b. Air-Cooled Machines — Disconnect fan motor.
4. 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.

Replace the H.P.C.O. control if:
1. The control will not reset. (Note: High-side pressure must be below 300 psig before resetting.)
2. The control does not open at the specified cut-out point of 440 psig ± 10.

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 23) on ice thickness probe clockwise to increase thickness, counterclockwise to decrease thickness.

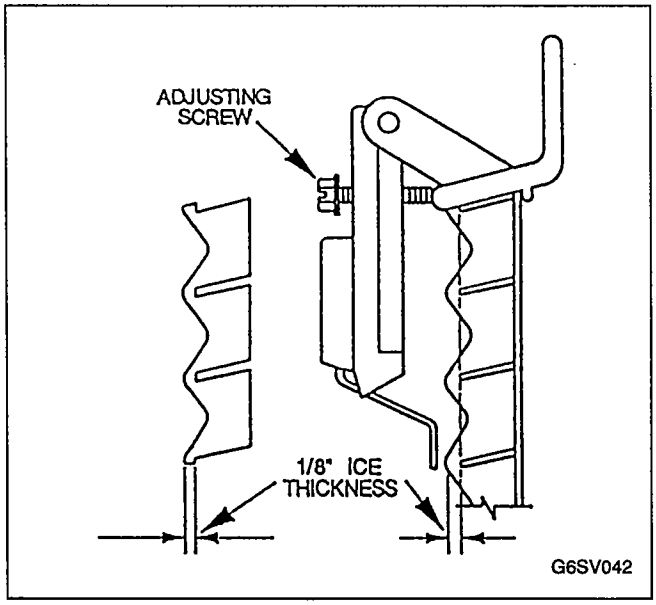


FIGURE 23. ICE THICKNESS CHECK

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, page 27.

ICE/OFF/WATER PUMP TOGGLE SWITCH

Function
Place ice machine in ICE, OFF, or WATER PUMP mode of operation.

Specifications
Double pole/double throw, 125V 20A.

Check Procedure

⚠ WARNING
DISCONNECT ELECTRIC POWER TO THE ICE MACHINE AT THE ELECTRIC SERVICE SWITCH BOX BEFORE PROCEEDING WITH THE FOLLOWING STEPS.

1. Inspect switch for correct wiring (Figure 24).
2. Disconnect all wires from toggle switch.
3. Check across switch terminals using a quality, calibrated Ohmmeter for correct readings as follows (replace switch if readings are incorrect):
   a. Switch set at ICE:

	Switch Position
10-11	Open
11-12	Closed
13-14	Closed

   b. Switch set at WATER PUMP:

	Switch Position
10-11	Closed
11-12	Open
13-14	Open

   c. Switch set at OFF:

	Switch Position
10-11	Open
11-12	Open
13-14	Open

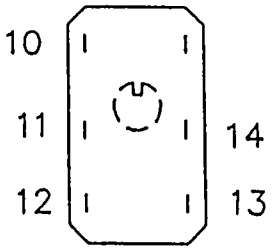


FIGURE 24. ICE/OFF/WATER PUMP SWITCH CHECK

WATER CURTAIN

Function

1. Prevent water from splashing into bin.

2. Acts as a lever to depress and release bin switch activating pin (refer to Bin Switch, page 22) as ice falls from the evaporator.

Check Procedure

1. Pull bottom of water curtain (Figure 25) away from evaporator, then release. Curtain should fall back to evaporator.

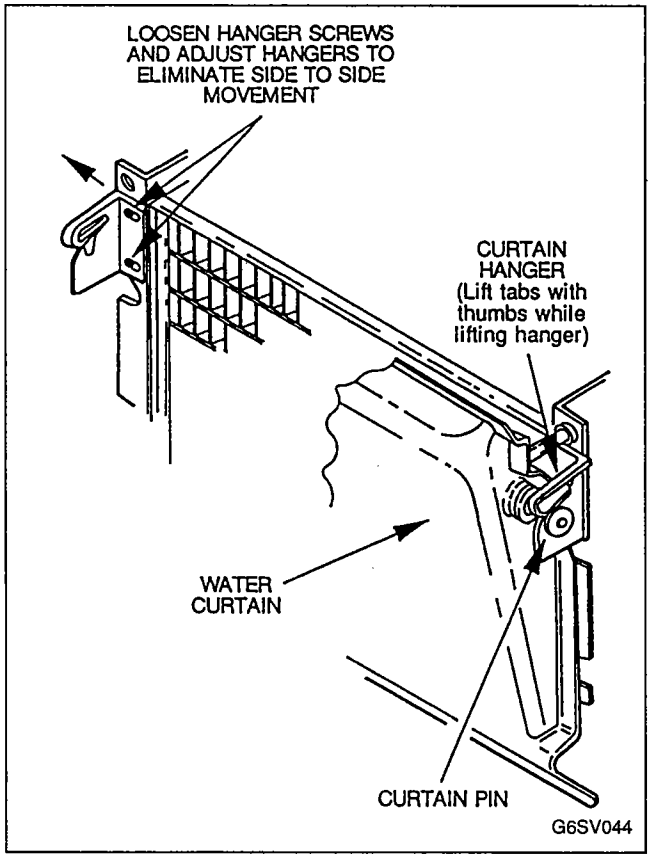


FIGURE 25. WATER CURTAIN CHECK

2. Move curtain from side to side. There should be little or no movement.

   The water curtain is factory set and should require no adjustment. If adjustment is necessary, adjust as follows:
   a. Remove water curtain.
   b. Loosen curtain hanger screws (two per hanger) and slide hangers in or out to prevent side to side movement. Water curtain pin heads must be positioned under curtain hanger tabs. Curtain must be centered on evaporator when installed.
   c. Retighten hanger screws.
   d. Reinstall water curtain.

WATER PUMP

Function

Pump water over evaporator during freeze cycle.

Specifications

Refer to ice machine serial number plate for correct voltage and running amps.

Check Procedure

> **NOTE**
> Water pump runs quietly with no water in water trough.

Set ICE/OFF/WATER PUMP switch at WATER PUMP. If water pump runs with switch at WATER PUMP and does not run with switch set at ICE, the water pump is operating properly.

If water pump will not run with switch set at WATER PUMP, check the following procedures:

1. Check for proper line voltage (±10%) to the ice machine.

2. Unplug the water pump.

3. Set ICE/OFF/WATER PUMP switch at WATER PUMP and check voltage at water pump electric plug receptacle.
   a. Line voltage — replace water pump after verifying pump impeller is not blocked by foreign objects.
   b. No voltage — Check high pressure cut-out control, page 23, bin switch, page 22 and ICE/OFF/WATER PUMP switch, page 24.

7-SECOND OFF DELAY RELAY

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 or when turned off at toggle switch.

Specifications

85-230 volt, 50/60 Hertz.

Check Procedure

Clip voltmeter leads across the normally open (N.O.) relay contacts L1 and 7. Keep all wire leads attached.

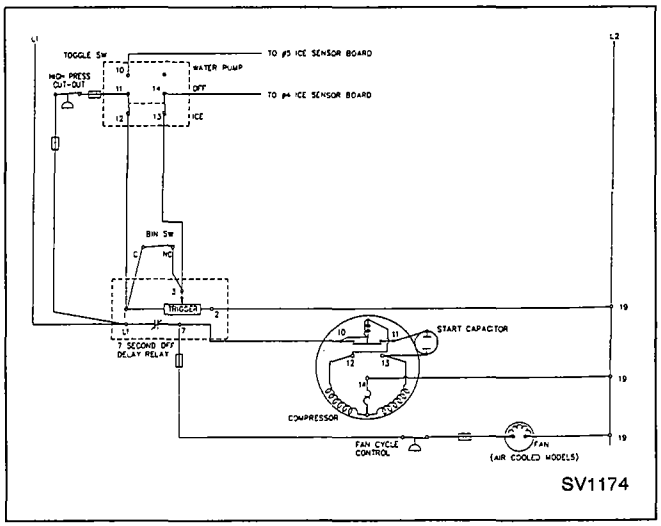


FIGURE 26. 7-SECOND OFF DELAY RELAY

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. (Replace timer.)
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. (Replace timer.)

DIAGNOSING ELECTRONIC CONTROL CIRCUITRY

UNITIZED SENSOR BOARD

The ice machine uses a unitized sensor board with a plug-in ice thickness probe to control the ice thickness by initiating the harvest cycle.

Function

1. A relay energizes or de-energizes the electrical components during the harvest cycle.
2. Electronics sense when the water is in contact with the ice thickness control probe.
3. A 6- to 10-second timer ensures that the water flowing over the evaporator completes an electrical circuit through the ice thickness control probe. This means the water must be in constant 6- to 10-second contact (not "splashing") with both probes before the ice machine cycles into harvest.
4. A safety timer ensures the ice machine does not remain in the harvest cycle for longer than 4 to 5 minutes.

⚠ 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 4 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 4 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 27.

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, page 24.
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 water trough. This will 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.

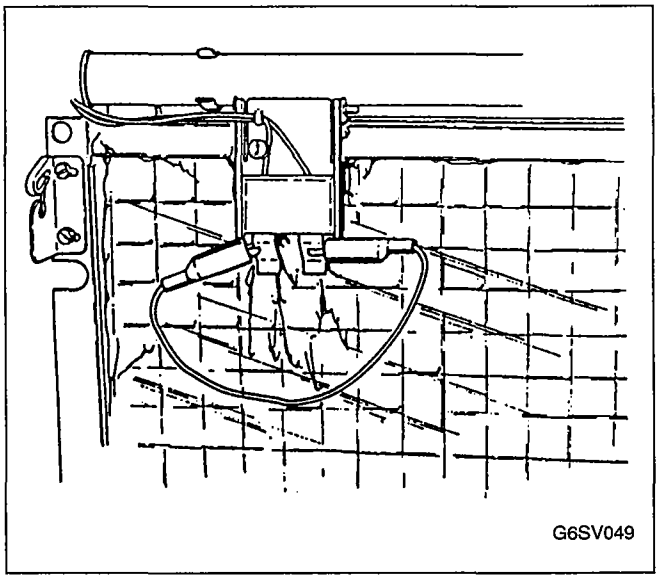


FIGURE 27. JUMPER WIRE CONNECTED TO PROBES

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

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.

Step 4: Disconnect wires from terminals 20 and 21 on board. Connect jumper wire to terminals 20 and 21, Figure 28.

Does the ice machine go into the harvest cycle?

IF NO: Install new unitized sensor board.

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

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

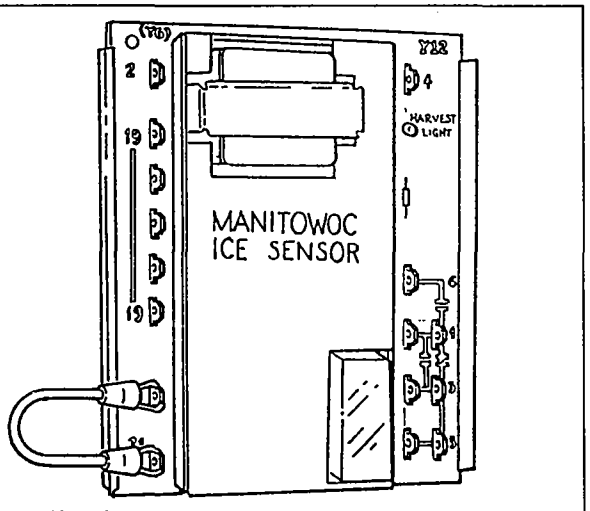


FIGURE 28. UNITIZED SENSOR BOARD

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

Step 1: Check primary voltage at transformer terminals 4 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 4 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. 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 proble is causing the malfunction. All other components are functioning properly. The ice thickness probe may be dirty. Attempt to clean before replacing.

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

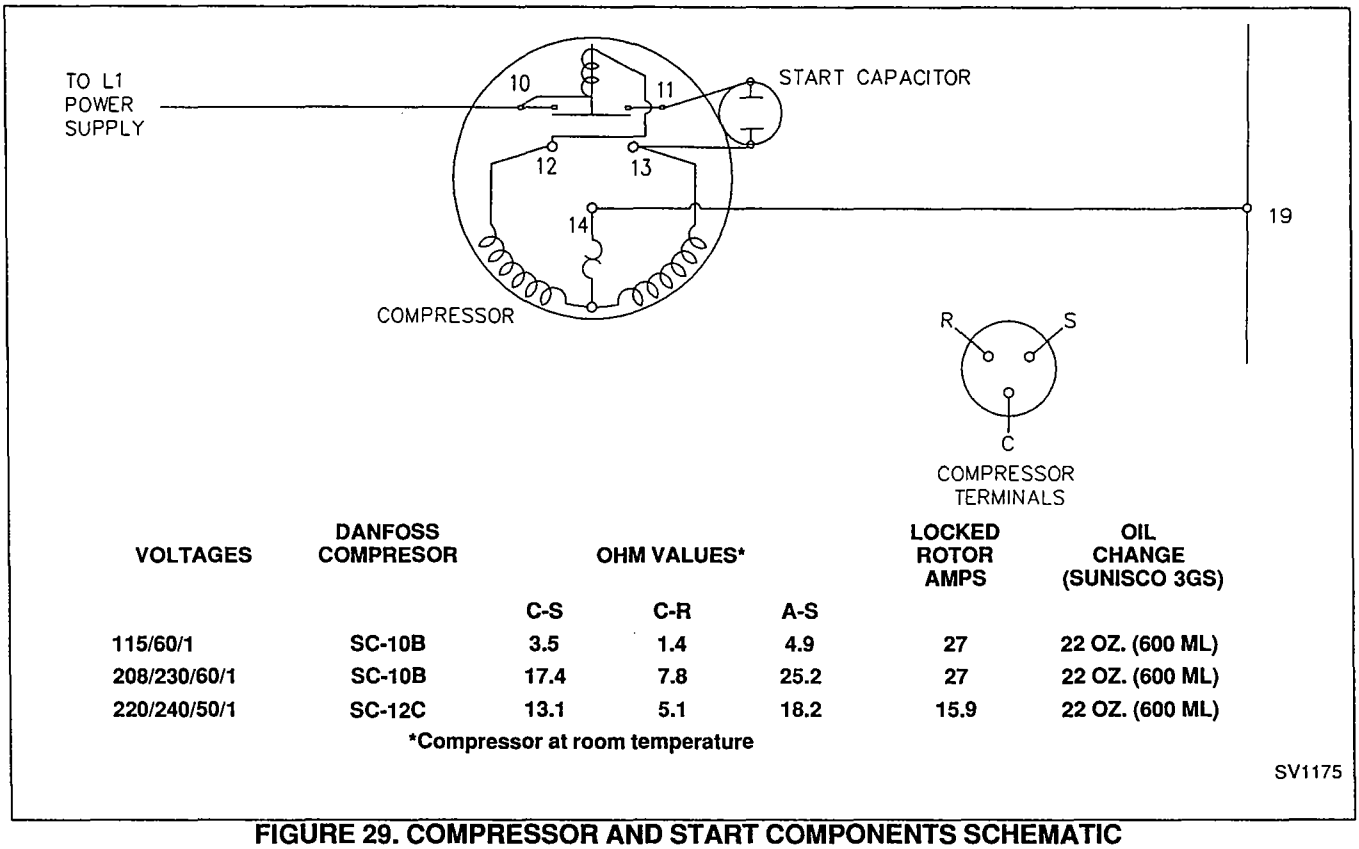
Does the ice machine stay in the freeze cycle?

IF NO: Ensure there is noo moisture between terminals 20 and 21 on board. If no moisture, install new 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 COMPRESSOR AND START COMPONENTS ELECTRICALLY



VOLTAGES	DANFOSS COMPRESOR	OHM VALUES*			LOCKED ROTOR AMPS	OIL CHANGE (SUNISCO 3GS)
		C-S	C-R	A-S		
115/60/1	SC-10B	3.5	1.4	4.9	27	22 OZ. (600 ML)
208/230/60/1	SC-10B	17.4	7.8	25.2	27	22 OZ. (600 ML)
220/240/50/1	SC-12C	13.1	5.1	18.2	15.9	22 OZ. (600 ML)

*Compressor at room temperature

SV1175

FIGURE 29. COMPRESSOR AND START COMPONENTS SCHEMATIC

Perform the following tests, in sequence, using a quality, calibrated volt-ohmmeter.

1. Verify electric power to ice machine at time of compressor start-up is ±10% of nameplate reading.

2. Verify the following control components are in the closed position:
   Bin Switch, page 22.
   High Pressure Cut-Out Control, page 23.
   ICE/OFF/WATER PUMP Switch, page 24.
   7-Second Off Delay Relay, page 26.

⚠ WARNING
DISCONNECT ELECTRIC POWER TO THE ICE MACHINE AT THE ELECTRIC SERVICE SWITCH BOX BEFORE PROCEEDING WITH THE FOLLOWING STEPS.

3. Continuity check of start relay:
   a. Disconnect wires from start relay. (If relay is being removed, keep it upright.)
   b. Terminals 10 to 11 (contact normally closed).
      Continuity — replace relay.
      No continuity — relay contacts OK.
   c. Terminals 10 to 12.
      Continuity — relay coil OK.
      No continuity — replace relay.

4. Continuity check of compressor: Overload protector may be tripped. Wait for compressor to reach room temperature.
   a. Disconnect wires from start relay and compressor terminals.
   b. Terminal C to Terminal R.
      Continuity — see step e.
      No continuity — open run winding.
      Replace compressor.
   c. Terminal C to Terminal S.
      Continuity — see step e.
      No continuity — open start winding.
      Replace compressor.
   d. Terminal C to shell of compressor.
      Continuity — compressor grounded.
      Replace compressor.
      No continuity — compressor not grounded.

e. Check winding resistance against values given in chart. The resistance values from C-R and C-S added together should equal the reading from S to R.

5. Capacitor check (run and start):
   a. Capacitors may show visual evidence of failure, such as a bulged terminal end or a ruptured membrane. However, *do not* assume a capacitor is good just because there are no visual signs of failure.
   b. An effective test is to disconnect leads to the capacitor in the ice machine and connect them to a good capacitor.
   c. Use of a capacitor analyzer is recommended when checking a suspect capacitor. Follow instructions supplied with capacitor analyzer.
   d. If all of the capacitor tests prove satisfactory and the compressor still fails to start:
      1) Replace start relay.

The new relay eliminates any faulty electrical characteristics such as improper pick-up or drop-out, which cannot be determined by the tests.

      2) If new relay fails to correct the problem, the compressor can be considered inoperative because of internal defects. Replace compressor.

REFRIGERATION AND OTHER NON-ELECTRICAL PROBLEMS

INTRODUCTION

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

You must make a visual inspection and analyze water problems before diagnosing refrigeration problems.

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 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

Possible Problem	Actual Finding	Corrective Measure
1. Ice machine not 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 back and sides 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. Water filtration restricted (if used).		Install new water filter.

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 water leaking out of sump trough during the freeze cycle and a restricted capillary tube. The characteristics of both failures are similar.

CHECK WATER RELATED PROBLEMS

Possible Problem	Acutal 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. Water leaking out of sump trough.		Stop water leak.
6. Water trough hoses leaking water.		Install properly or replace.
7. Water float valve stuck open or out of adjustment.		Readjust float, page 23.
8. Water freezing behind evaporator.		Check water flow.
9. Water freezing between white plastic extrusions and evaporator.		Seal with food-grade silicone (RTV) adhesive.
10. Water flow uneven across evaporator.		Clean ice machine. Check water flow rate.

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.

ICE PRODUCTION CHARTS
(Lbs. of Ice per 24 Hours)

Water-Cooled

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

Air-Cooled

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

These figures are based on a clean, properly maintained ice machine running continually for a 24-hour period, with an average ice weight of 1.25 lb. to 1.5 lb. per harvest.

CYCLE TIME CHARTS

NOTE
To calculate total cycle time, add harvest time to freeze time listed in charts.

Water-Cooled

Ambient Temp. °F	Freeze Time Water Temp. 50°F	70°F	90°F	Harvest Time
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	

Air-Cooled

Condenser Ambient Temp. °F	Freeze Time Water Temp. 50°F	70°F	90°F	Harvest Time
70	8-12	9-13	11-15	1-2
80	9-13	10-14	12-16	
90	9-15	10-16	14-19	
100	10-16	11-17	18-24	

Use the following to check and compare to proper ice production.

NOTE
The 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

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: 2 lb. 4 oz. convert to 2.25 lb.
4 oz. ÷ 16 oz. = .25 lb.

Compare your findings in the Ice Production Check to published specifications.

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:
Continue diagnostics.

ICE FILL PATTERN

The ice fill pattern on an evaporator helps to indicate if the proper flow of refrigerant is entering the evaporator. The copper tubing routing on the back of the evaporator must be considered when analyzing the ice fill patten.

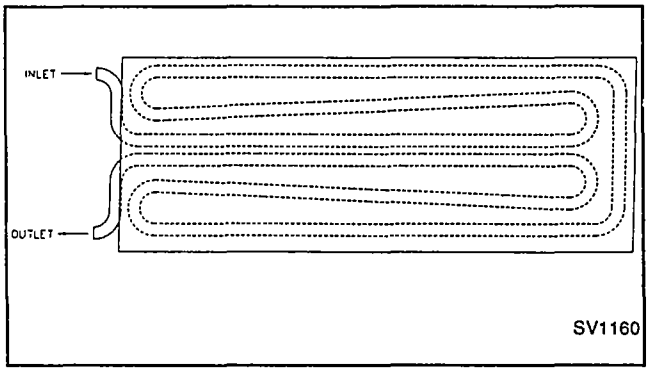


FIGURE 30. EVAPORATOR COPPER TUBING ROUTING

Compare the following ice fill patterns to the inlet and outlet of the evaporator to "see" what refrigerant is doing in the evaporator.

NORMAL ICE FILL PATTERN

The fill pattern on the evaporator is normal when the ice bridge 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. Refer to page 24. "Dimples" in the ice cubes can be considered normal. The water should freeze on the entire evaporator at the same time.

STARVING EVAPORATOR ICE FILL PATTERN

A starving evaporator will freeze ice only at the inlet of the evaporator.

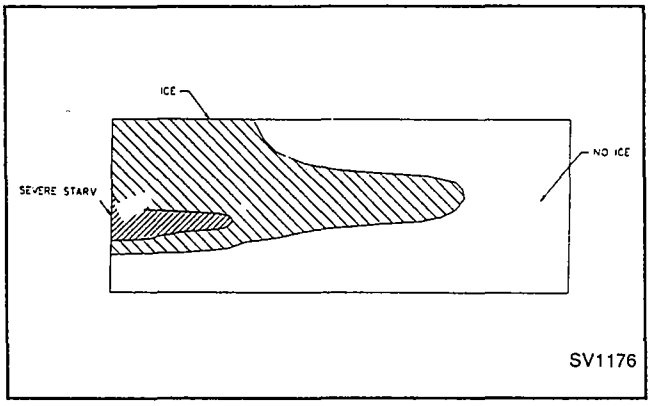


FIGURE 31. STARVING EVAPORATOR ICE FILL PATTERN

SPOTTY ICE FILL PATTERN

A "spotty" ice fill pattern indicates the copper tubing has separated from the back of the evaporator.

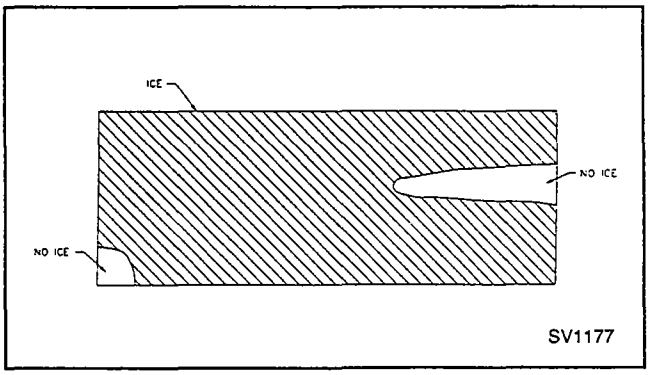


FIGURE 32. SPOTTY ICE FILL PATTERN

OPERATIONAL PRESSURE CHARTS

Air-Cooled

Ambient Temp. °F	Freeze Cycle		Harvest Cycle	
	Head Pressure PSIG	Suction Pressure PSIG	Head Pressure PSIG	Suction Pressure PSIG
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

Water-Cooled

Ambient Temp. °F	Freeze Cycle		Harvest Cycle	
	Head Pressure PSIG	Suction Pressure PSIG	Head Pressure PSIG	Suction Pressure PSIG
50	220-230	35-25	160-200	85-100
70	220-250	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

ANALYZE DISCHARGE PRESSURE

Using the Operational Pressure Charts determine if discharge pressure is correct for the ambient temperature the ice machine is operating in.

A. If discharge pressure is within normal range, proceed to analyze suction pressure.
B. If discharge pressure is not within normal range, refer to the appropriate chart.

DISCHARGE PRESSURE HIGH

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

Possible Problem	Actual Finding	Corrective Measure
1. Load conditions high (air/water temperatures).		Refer to Installation Instructions.
2. Dirty condenser.		Clean.
3. Water regulating valve (water-cooled condenser): a. Too small supply water line. b. Out of adjustment. c. Defective regulating valve.		Replace with proper size line See Proper Adjustment, page 39. Replace.
4. Fan motor/fan cycling switch defective.		Diagnose control, page 22.
5. Restriction in high side lines:		Repair, see Evacuation/Recharging Procedures, page 41.
6. Improper refrigerant charge.		Refer to Evacuation/Recharging Procedures, page 41.
7. Noncondensables in system.		Refer to Evacuation/Recharging Procedures, page 41.

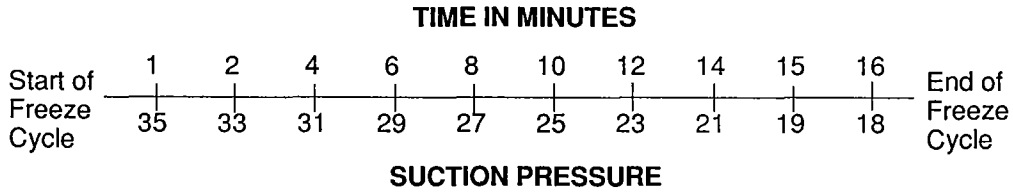
DISCHARGE PRESSURE LOW

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

Possible Problem	Actual Finding	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 condenser): a. Out of adjustment. b. Leaking water during harvest cycle. c. Defective.		Readjust/replace if necessary. Replace.
3. Fan motor/fan cycling switch defective.		Diagnose control, page 22.
4. Low refrigerant charge.		Refer to evacuation/re-charging procedures, page 41.
5. Partially plugged capillary tube.		Clean and replace as necessary.

ANALYZE SUCTION PRESSURE

To analyze suction pressure you must compare the Operational Pressure Chart, page 35, to the Cycle Time Chart, page 33. The suction pressure gradually drops as ice forms throughout the freeze cycle.



By comparing the two charts you can determine if suction pressure is properly pulling 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 puposes.

If suction pressure is not within normal range, refer to appropriate chart.

Example: G150 self-contained, air-cooled:
air temperature 90°F
water temperature 70°F

From Cycle Time Chart, page 33.
freeze time — 10 to 16 minutes
harvest time — 1 to 2 minutes
total cycle time — 11 to 18 minutes

From Operational Pressure Chart, page 35:
Suction pressure:
start of freeze — 35 psig
end of freeze — 18 psig

SUCTION PRESSURE HIGH

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

Possible Problem	Actual Finding	Corrective Measure
1. High discharge pressure affecting low side.		See Discharge Pressure High, page 35.
2. Hot gas valve stuck wide open.		Replace valve, page 38.
3. Inefficient compressor (do not perform pumpdown test).		Replace compressor as necessary.

SUCTION PRESSURE LOW

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

Possible Problem	Actual Findings	Corrective Measure
1. Low load conditions.		Relocate ice machine to location within guidelines.
2. Water system problem.		Refer to Chart 4, page 32.
3. Tubing separating from back side of evaporator.		Replace evaporator.
4. Plugged drier/restriction in liquid line.		Repair — refer to Evacuation/ Recharging Procedures, page 41.
5. Partially plugged capillary tube.		Repair — refer to Evacuation/ Recharging Procedures, page 41.
6. Improper refrigerant charge.		Refer to Evacuation/ Recharging Procedures, page 41.

INTERPRETING DISCHARGE/SUCTION PRESSURES COMBINED

Discharge Pressure	Suction Pressure	Possible Cause
No reading.	No reading	Loss of complete charge.
Lower than normal.	Lower than normal.	1. Leak in process. 2. Partially clogged capillary tube or drier.
Lower than normal.	In vacuum.	Clogged capillary tube or drier.
Discharge and suction pressures are the same or there is very little pressure difference.		Compressor valves not seating or broken.

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 Mantowoc replacement (O.E.M.) parts only. Refer to your Parts Manual for proper valve application.

2. Stuck in harvest cycle:
   Normally a hot gas valve can be repaired without changing the entire valve. Verify that the hot gas valve is not energized, then rebuild or replace the hot gas valve as required.

3. Leaking during freeze cycle:
   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.

> **⚠ CAUTION**
> HOT GAS VALVE INLET COULD BE HOT ENOUGH TO BURN YOUR HAND. TOUCH IT BRIEFLY.

INEFFICIENT COMPRESSOR SYMPTOMS

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.

   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 — 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 freeze cycle will be slightly high and become more pronounced as ambient temperature increases.
   d. Compressor dome may be hot.

> **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.

LEAK CHECKING CONDENSER AND WATER REGULATING VALVE

IMPORTANT
Both the condenser and water regulating valve must be leak checked.

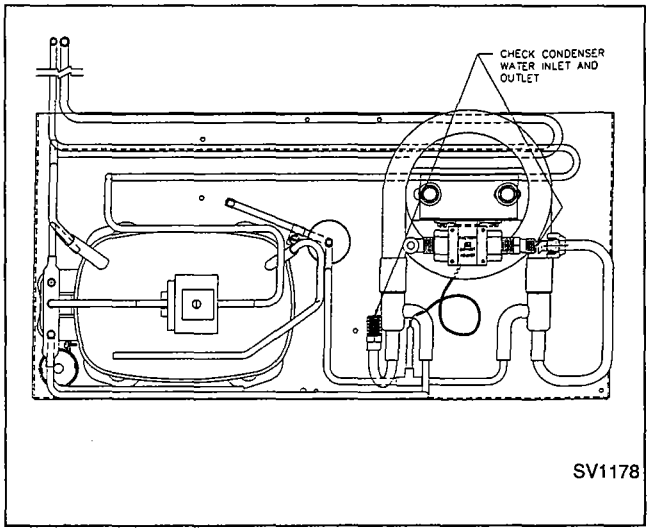


FIGURE 33. CONDENSER LEAK CHECK POINTS

LEAK CHECKING CONDENSER

3. Set ICE/OFF/WATER PUMP switch at OFF.
4. Turn off incoming condenser water supply.
5. Disconnect incoming condenser water inlet and outlet lines.
6. Disconnect water regulating valve from condenser.
7. Blow water out of condenser with compressed air.

NOTE
Water in the condenser may cause an electronic leak detector to give a false signal.

8. Ensure refrigeration system is pressurized.
9. Check condenser water inlet and outlet with electronic leak detector. If a leak is detected, replace condenser. See Figure 33.

NOTE
If no leak is detected with the ice machine off, set the ICE/OFF/WATER PUMP switch at ICE. Allow discharge pressure to reach 250 psig, then set ICE/OFF/WATER PUMP switch at OFF and recheck for leaks.

LEAK CHECKING WATER REGULATING VALVE

NOTE
Water regulating valve must be disconnected from the condenser. Completely dry water valve inlet and outlet to eliminate false readings from the leak detector.

1. Ensure refrigeration system is pressurized.
2. Leak check where cap tube meets the bellows housing. See Figure 34.
3. Leak check around bellows seal.
4. Open valve by prying open at spring with screwdriver, leak check inlet and outlet with leak detector. If leak is detected, replace valve.
5. If no leak is detected, refer to NOTE under step 7 of Leak Checking the Condenser and recheck valve for leaks.

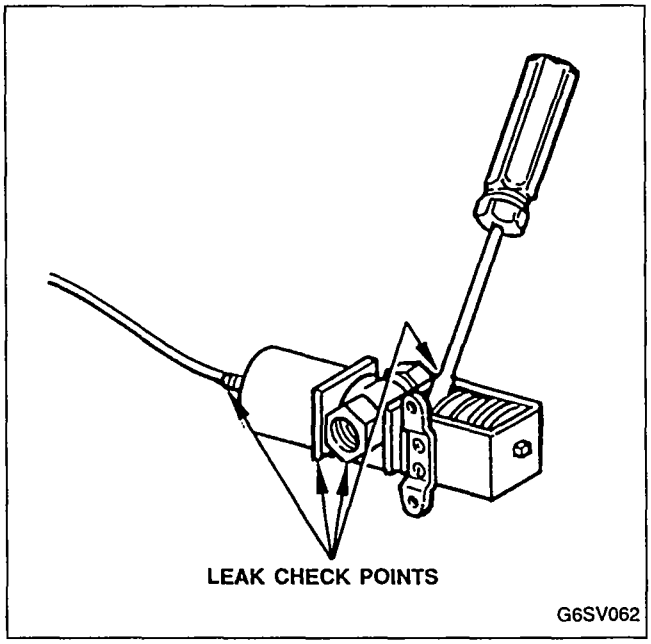


FIGURE 34. WATER REGULATING VALVE LEAK CHECK POINTS

REMOVAL FROM SERVICE/WINTERIZATION

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

⚠ CAUTION

IF WATER IS ALLOWED TO REMAIN IN THE MACHINE IN FREEZING AMBIENT TEMPERATURES, IT WILL FREEZE, RESULTING IN SEVERE DAMAGE TO COMPONENTS. A FAILURE OF THIS NATURE IS NOT COVERED BY WARRANTY.

Air-Cooled Machines

1. Disconnect electric power at circuit breaker or electric service switch.
2. Turn off water going to ice machine.
3. Remove overflow tube 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 ice machine is outside, cover machine to prevent exposure to elements.

Water-Cooled Machines

1. Perform all procedures listed under 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 35.
4. Hold valve open and blow compressed air through condenser until no water remains.
5. Ensure no water is trapped in the water lines, drain lines and distribution tube.
6. If ice machine is outside, cover machine to prevent exposure to elements.

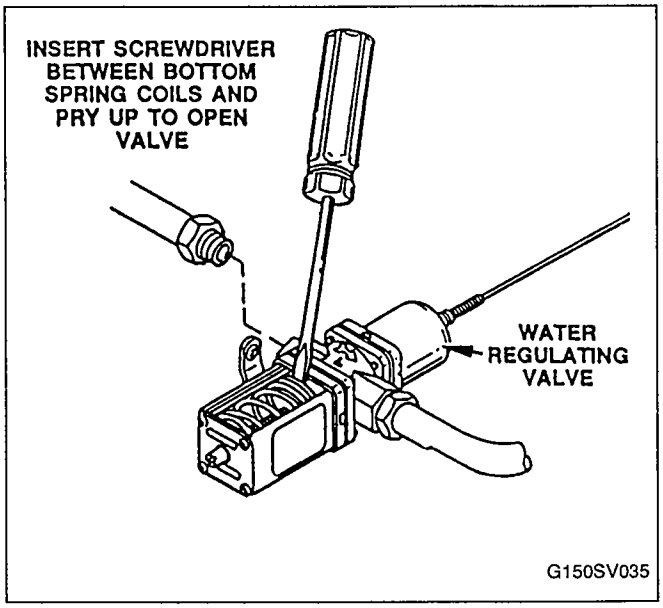


FIGURE 35. MANUALLY OPENING WATER REGULATING VALVE

EVACUATION AND RECHARGING

REMOVAL OF REFRIGERANT

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

IMPORTANT

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

GAUGE SET/VACUUM PUMP INSTALLATION PROCEDURE

IMPORTANT

Refer to refrigeration system Contamination Clean-Up Procedures, page 44, for proper clean-up procedures if system contamination is suspected or detected. Improper or insufficient clean-up will lead to repeat failures.

1. Install Shrader fittings to high and low side access stubs. Later model ice machines have factory installed service valves.

NOTE

Manitowoc recommends using an access valve core tool on the Schrader valve fittings. The tool permits removal of the access valve core for faster evacuation and charging without removing the manifold gauge hose.

2. Replace liquid line drier.

IMPORTANT

TO PREVENT VOIDING WARRANTY, USE ONLY MANITOWOC (O.E.M.) LIQUID LINE FILTER DRIERS.

3. Evacuation of the ice machine requires connections at two points as follows:
   a. Suction side.
   b. Discharge side.
   Connect manifold gauges, dial-a-charge (or weigh-in method), and vacuum pump to ice machine, Figure 36.

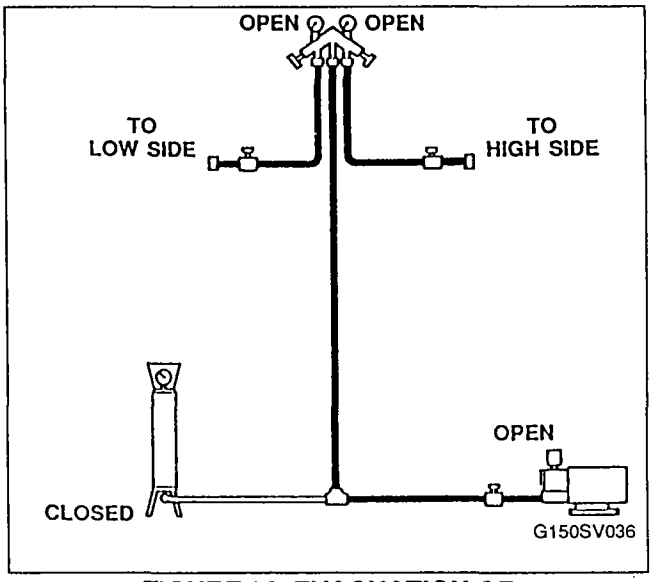


FIGURE 36. EVACUATION OF SELF-CONTAINED SYSTEMS

Procedures for Self-Contained Evacuation

1. Ensure the toggle switch is in the OFF position.
2. Open vacuum pump valve. Open high and low side on manifold gauges.
3. Start vacuum pump. Pull system down to 250 microns. Allow pump to run for 1/2 hour after reaching 250 microns.
4. Refer to Recharging Procedures and recharge ice machine.

Procedures for Self-Contained Recharging

IMPORTANT

Charge must be weighed or measured into ice machine to assure proper operation under all load conditions. Do not charge by sight glass, pressure, etc.

1. Ensure toggle switch is in OFF position.

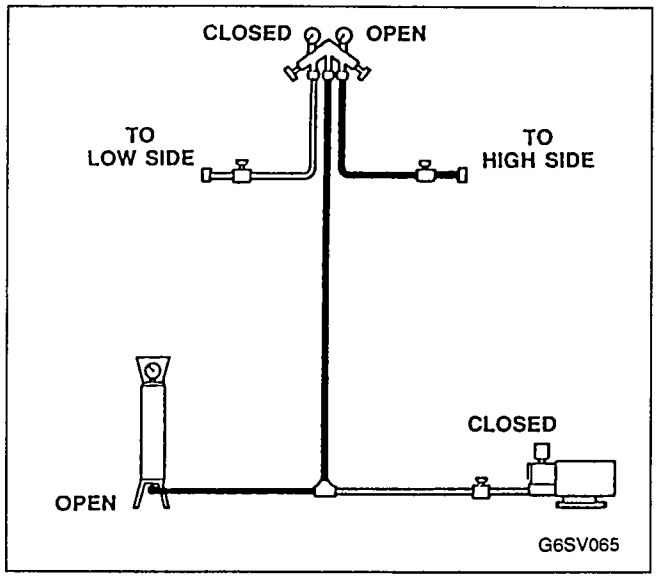


FIGURE 37. RECHARGING OF SELF-CONTAINED SYSTEMS

2. Close vacuum pump valve and low side valve on manifold gauge.
3. Open high side manifold gauge valve.
4. Open charging cylinder and add measured nameplate charge into high side.
5. Allow system to "settle" for 2 or 3 minutes after charging.
6. Close high side on manifold gauge set. Place toggle switch in ICE position 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.

NOTE
Recheck for leaks with a Halide or electronic leak detector after recharging ice machine.

MANITOWOC ICE, INC.
2110 South 26th Street P.O. Box 1720
Manitowoc, WI 54221-1720
Phone: (920) 682-0161
Fax: (920) 683-7585
Web Site: www.manitowocice.com

SEVERE SYSTEM CONTAMINATION

GENERAL

It is important to read and understand the following text regarding severe 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 recycled 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, page 39.
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, page 44.
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, page 44.
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, page 44.

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, page 39, 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 psig.
   b. Pull vacuum to 500 microns. Break vacuum with dry nitrogen and sweep system. Pressurize to a minimum of 5 psig.
   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 new valve and replace capillary tube assembly.

4. Check discharge and suction lines at compressor for burnout 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, page 39, 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 psig.
   b. Change vacuum pump oil. Pull vacuum to 500 microns. Break vacuum with dry nitrogen and sweep system. Pressurize to a minimum of 5 psig.
   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 psig differential) the filter-drier should be adequate for complete clean-up. Proceed to step 10.
   b. If pressure drop is greater than 1 psig 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, page 39.