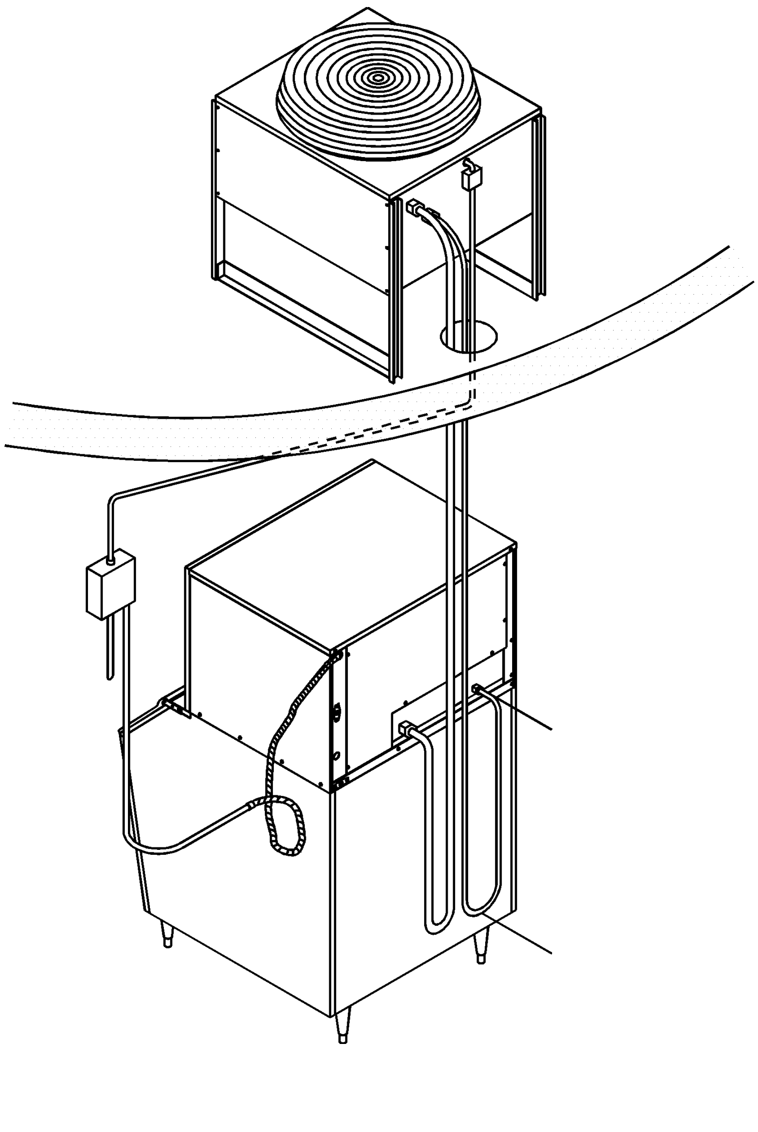
Manitowoc®

Ice Machines



J Model Service Manual

Part No. 83-5631-9
Rev A 8/97

Safety Notices

As you work on a J-Series Ice Machine, be sure to pay close attention to the safety notices in this manual. Disregarding the notices may lead to serious injury and/or damage to the ice machine.

Throughout this manual, you will see the following types of safety notices:

> **⚠ WARNING**
> Text in a Warning box alerts you to a potential personal injury situation. Be sure to read the Warning statement before proceeding, and work carefully.

> **⚠ CAUTION**
> Text in a Caution box alerts you to a situation in which you could damage the ice machine. Be sure to read the Caution statement before proceeding, and work carefully.

Procedural Notices

As you work on a J-Series Ice Machine, be sure to read the procedural notices in this manual. These notices supply helpful information which may assist you as you work.

Throughout this manual, you will see the following types of procedural notices:

> **Important**
> Text in an Important box provides you with information that may help you perform a procedure more efficiently. Disregarding this information will not cause damage or injury, but it may slow you down as you work.

NOTE: Text set off as a Note provides you with simple, but useful, extra information about the procedure you are performing.

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(Refer to Installation Manual for complete Installation Guidelines)

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Section 1
Warranty

Coverage

GENERAL

The following Warranty outline is provided for your convenience. For a detailed explanation, read the warranty bond shipped with each product.

Contact your local Manitowoc representative or Manitowoc Ice, Inc. if you need further warranty information.

PARTS

1. Manitowoc warrants the ice machine against defects in materials and workmanship, under normal use and service for three (3) years from the date of original installation.
2. The evaporator and compressor are covered by an additional two (2) year (five years total) warranty beginning on the date of the original installation.

LABOR

1. Labor required to repair or replace defective components is covered for three (3) years from the date of original installation.
2. The evaporator is covered by an additional two (2) year (five years total) labor warranty beginning on the date of the original installation.

EXCLUSIONS

The following items are not included in the ice machine's warranty coverage:

1. Normal maintenance, adjustments and cleaning as outlined in the Owner/Operator Use and Care Guide.
2. Repairs due to unauthorized modifications to the ice machine or the use of non-standard parts without prior written approval Manitowoc Ice, Inc.
3. Damage caused by improper installation of the ice machine, electrical supply, water supply or drainage, or damage caused by floods, 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. Additional labor charges resulting from the inaccessibility of the ice machine are also excluded.
5. Parts or assemblies subjected to misuse, abuse, neglect or accidents.
6. Damage or problems caused by installation, cleaning and/or maintenance procedures inconsistent with the technical instructions provided in the Installation Manual and the Owner/Operator Use and Care Guide.

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.

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Section 2

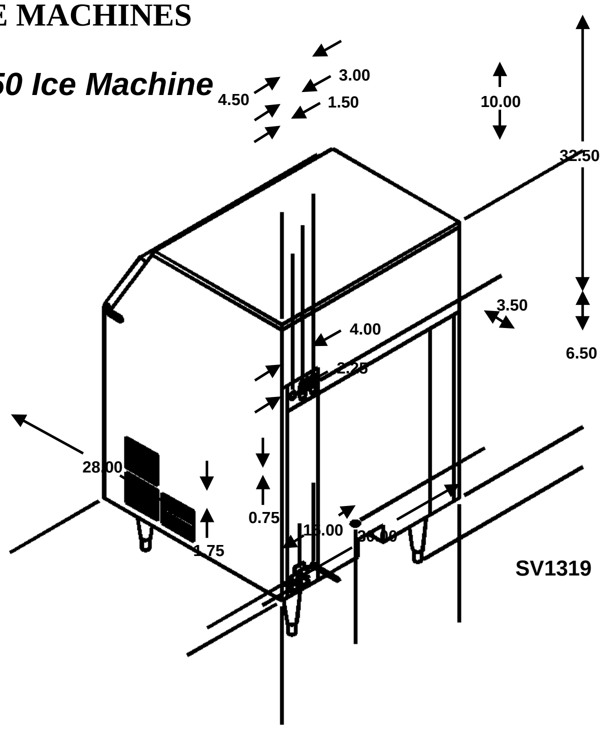
Installation References

Refer to Installation Manual for complete installation guidelines

Dimensions

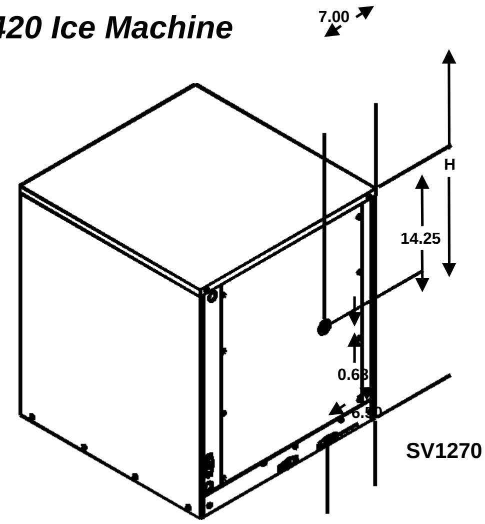
ICE MACHINES

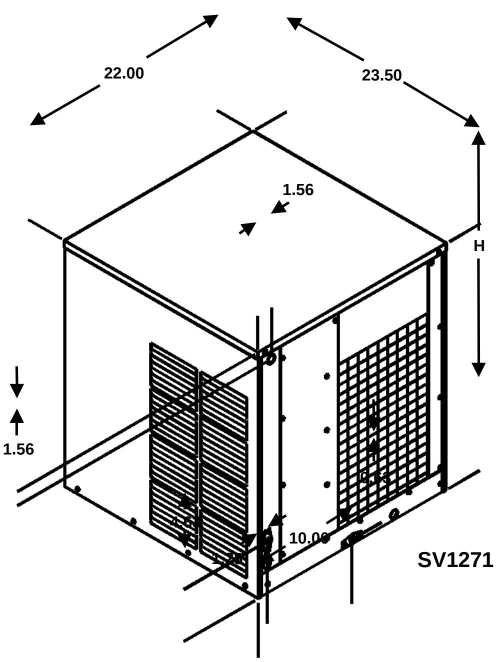
J250 Ice Machine



NOTE: All measurements are in inches.

J320/J420 Ice Machine

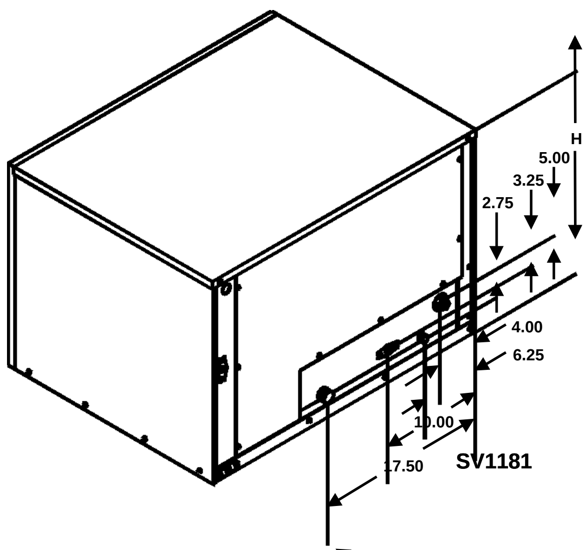


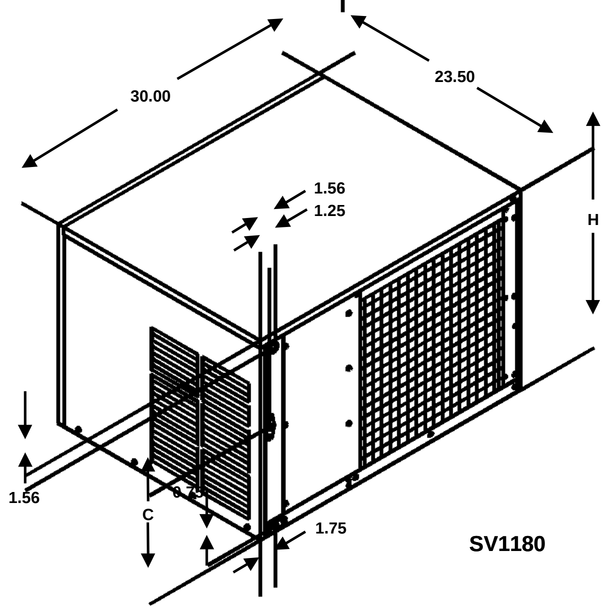


NOTE: All measurements are in inches.

Ice Machine	Dimension H
J320	20.00
J420	25.00

J200-J1000 Ice Machines

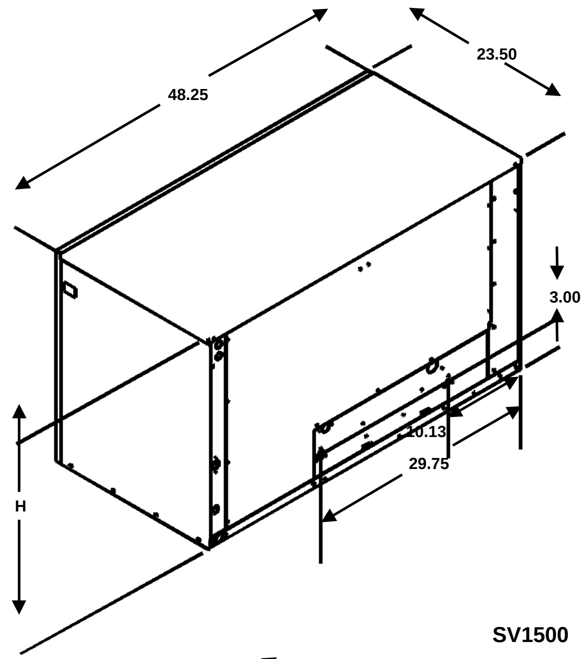


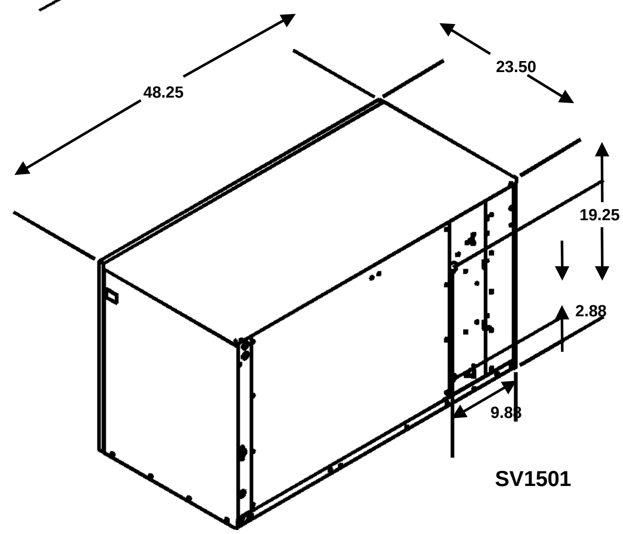


NOTE: All measurements are in inches.

Ice Machine	Dimension H	Dimension C
J200	16.50	7.25
J450	20.00	10.50
J600	20.00	10.50
J800	25.00	10.50
J1000	28.00	10.50

J1300/J1800 Ice Machines



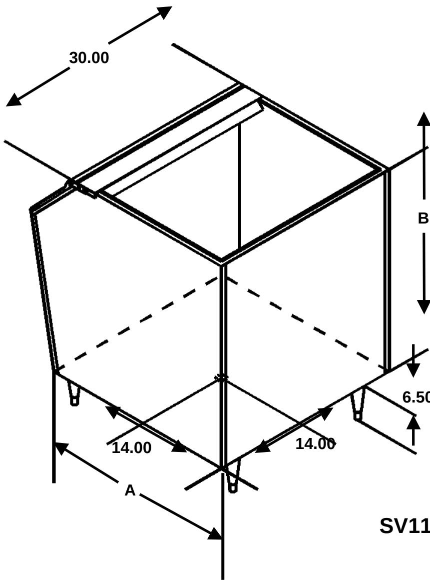


NOTE: All measurements are in inches.

Ice Machine	Dimension H
J1300	28.00
J1800	28.00

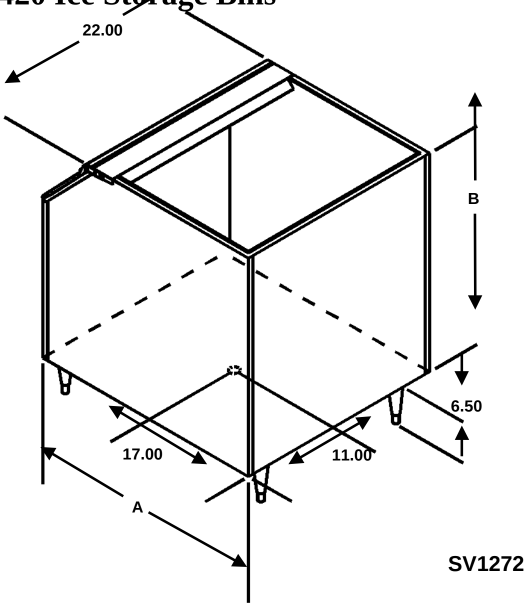
ICE STORAGE BINS

C170/C400/C470/C570 Ice Storage Bins



Bin Model	Dimension A	Dimension B
C170	28.25	19.06
C400	34.00	31.37
C470	29.50	44.00
C570	34.00	44.00

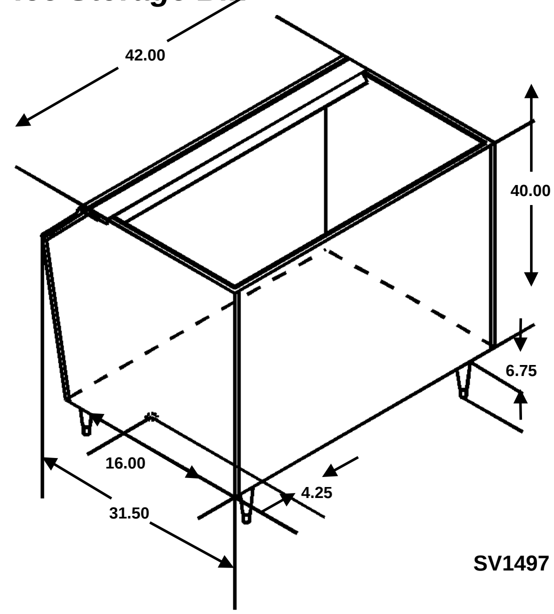
C320/C420 Ice Storage Bins



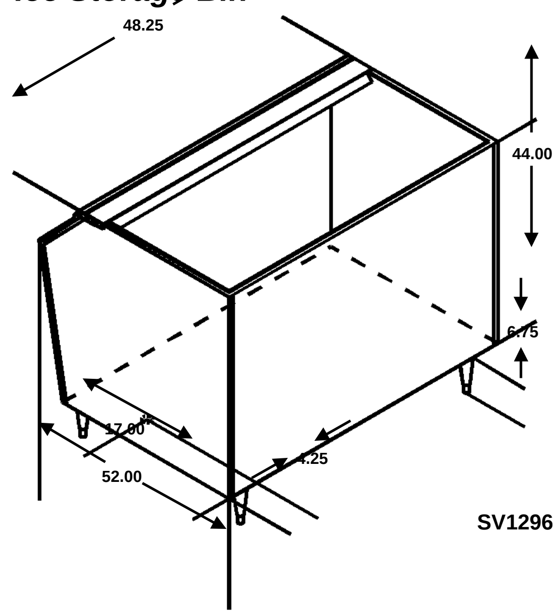
NOTE: All measurements are in inches.

Bin Model	Dimension A	Dimension B
C320	34.00	32.00
C420	34.00	44.00

C730 Ice Storage Bin



C970 Ice Storage Bin



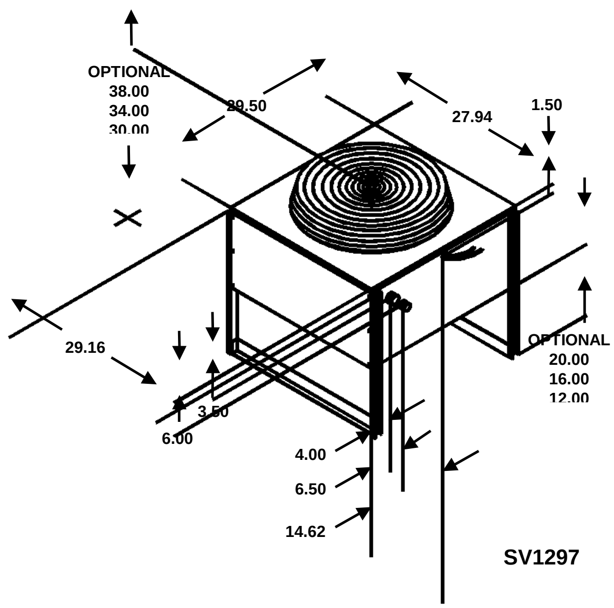
⚠ WARNING

All Manitowoc ice machines require an ice storage system with an ice deflector. The J1300 and J1800 require a Manitowoc Ice Deflector Kit (K00092) when installing with a non-Manitowoc ice storage system.

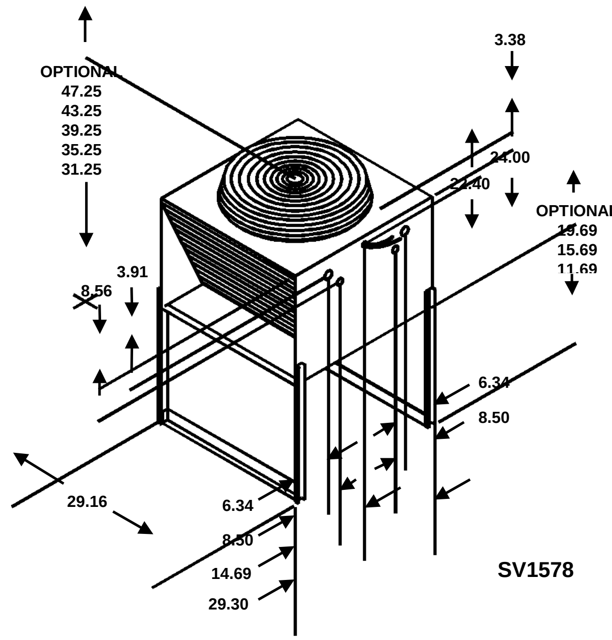
For other Manitowoc Ice Machines, do not use a non-Manitowoc ice storage system before confirming with the manufacturer that their ice deflector is compatible with Manitowoc ice machines.

REMOTE CONDENSERS

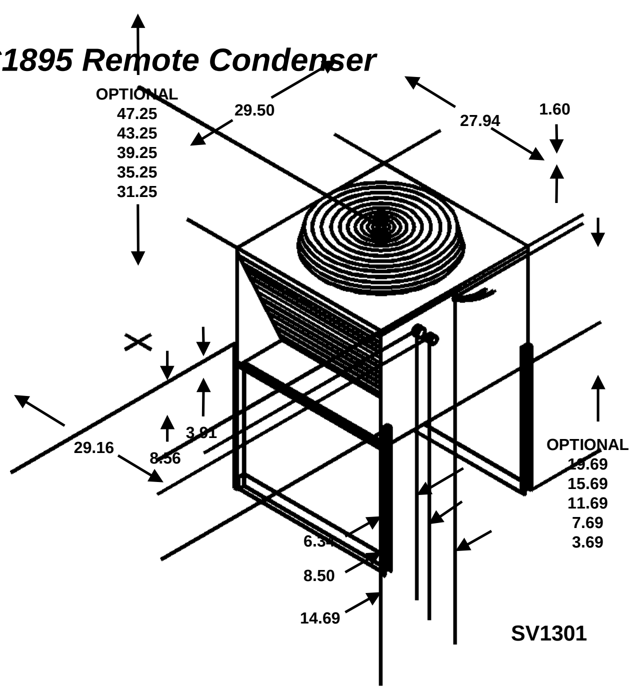
JC0495/JC0895/JC1095/JC1395 Condensers



Dual Circuit Condenser - DC0862



JC1895 Remote Condenser



NOTE: All measurements are in inches.

Location of Ice Machine

A Manitowoc ice machine operates most efficiently when it is:

1. Located Away From Heat Sources
   Do not install the ice machine near heat-generating equipment or in an area of direct sunlight.

Air Temperature Around Ice Machine	
Minimum	Maximum
35°F (1.7°C)	110°F (43.3°C)

CAUTION

The ice machine must be protected if it will be subjected to temperatures below 32°F (0°C). Failure caused by exposure to freezing temperatures is not covered by the warranty. See “Winterization” in the Owner/Operator Use and Care Guide.

2. Located in a Contaminant-Free Area
   Airborne contaminants can damage ice machines. Air-cooled models are particularly vulnerable.
3. Provided with Sufficient Air Clearance
   Adequate airflow through and around the ice machine is essential for maximum ice production and long component life.

Air Clearance Around Ice Machine		
Model	Area	Clearance
Self-Contained Air-Cooled	Top	8” (20 cm)
	Sides	8” (20 cm)
	Back	5” (12 cm)
Water-Cooled or Remote	Top	5” (12 cm)[1]
	Sides	
	Back	

[1] This clearance is not required, but it is recommended for efficient operation and servicing.

Important

Two stacked ice machines may share a single ice storage bin. A stacking kit is required for stacking two ice machines. Follow the instructions supplied with the stacking kit.

Heat of Rejection

Ice machines, like other refrigeration equipment, reject heat through the condenser.

It is helpful to know the amount of heat rejected by the ice machine when you are sizing air conditioning equipment for the ice machine installation area.

This information is also necessary when evaluating 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 with 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 condensing unit. The peak figure is used for sizing the cooling tower.

Series	Heat of Rejection[1]	
Ice Machine	Air Conditioning[2]	Peak
J250	4,000	5,200
J320	4,600	6,200
J420	7,000	9,600
J200	3,800	5,000
J450	7,000	9,600
J600	9,000	13,900
J800	12,400	19,500
J1000	16,000	24,700
J1300	24,000	35,500
J1800	36,000	50,000

[1] B.T.U./Hour

[2] Because the heat of rejection varies during the ice making cycle, the figure shown is an average.

Electrical Fuse Size/Circuit Ampacity

⚠ WARNING
All electrical work, including wire routing and grounding, must conform to local, state and national electrical codes.

VOLTAGE

The maximum allowable voltage variation is +/- 10% of the rated voltage, at start-up (when the electrical load is the highest).

FUSE/CIRCUIT BREAKER

A separate fuse/circuit breaker must be provided for each ice machine. Circuit breakers must be H.A.C.R. rated. (H.A.C.R. rating does not apply in Canada.)

MINIMUM CIRCUIT AMPACITY

The minimum circuit ampacity is used to help select the wire size of the electrical supply. (It is NOT the ice machine's running amp load.)

The wire size, or gauge, is also dependent upon the location, materials used, length of run, etc., and therefore must be determined by a qualified electrician.

J250 Ice Machines with Power Cord (Cord is 6' long, with NEMA 5-15P plug configuration.)

Ice Machine	Voltage, Phase, Cycle	Air-Cooled		Water-Cooled	
		Maximum Fuse/Circuit Breaker	Total Amps	Maximum Fuse/Circuit Breaker	Total Amps
J250	115/1/60	15	8.8	15	8.0

J250 Ice Machines Requiring Direct Wiring

Ice Machine	Voltage, Phase, Cycle	Air-Cooled		Water-Cooled	
		Maximum Fuse/Circuit Breaker	Minimum Circuit Amps	Maximum Fuse/Circuit Breaker	Minimum Circuit Amps
J250	208-230/1/60	15	4.8	15	4.2
	230/1/50	15	4.8	15	4.2

J320/J420 Ice Machines

Ice Machine	Voltage, Phase, Cycle	Air-Cooled		Water-Cooled	
		Maximum Fuse/Circuit Breaker	Minimum Circuit Amps	Maximum Fuse/Circuit Breaker	Minimum Circuit Amps
J320	115/1/60	15	11.3	15	10.9
	208-230/1/60	15	4.8	15	4.2
	230/1/50	15	4.6	15	4.0
J420	115/1/60	20	12.7	20	11.8
	208-230/1/60	15	7.8	15	7.4
	230/1/50	15	5.7	15	5.4

J200 - J1000 Ice Machines

Ice Machine	Voltage, Phase, Cycle	Air-Cooled		Water-Cooled		Remote	
		Maximum Fuse/ Circuit Breaker	Minimum Circuit Amps	Maximum Fuse/ Circuit Breaker	Minimum Circuit Amps	Maximum Fuse/ Circuit Breaker	Minimum Circuit Amps
J200	115/1/60	15	10.5	15	10.0	N/A	N/A
	208-230/1/60	15	5.4	15	4.8	N/A	N/A
	230/1/50	15	4.8	15	4.2	N/A	N/A
J450	115/1/60	20	12.7	20	11.8	20	13.7
	208-230/1/60	15	7.8	15	7.4	N/A	N/A
	230/1/50	15	5.7	15	5.4	N/A	N/A
J600	208-230/1/60	15	7.4	15	6.9	15	8.2
	230/1/50	15	6.4	15	6.1	15	6.5
J800	208-230/1/60	20	11.8	20	11.1	20	12.1
	208-230/3/60	15	7.7	15	6.7	15	7.6
	230/1/50	15	10.7	15	9.9	15	9.7
J1000	208-230/1/60	20	13.3	20	12.3	20	12.8
	208-230/3/60	15	10.1	15	9.1	15	10.3
	230/1/50	15	13.6	15	12.1	15	12.9
J1300	208-230/1/60	30	19.0	30	17.4	30	18.4
	208-230/3/60	20	12.9	20	11.3	20	10.6
	230/1/50	30	19.9	30	18.7	30	18.1
	380-415/3/50	N/A	N/A	N/A	N/A	15	7.3
J1800	208-230/1/60	35	23.8	35	22.2	35	22.3
	208-230/3/60	20	17.0	20	15.4	20	15.1
	230/1/50	35	23.0	35	21.5	35	20.6
	380-415/3/50	N/A	N/A	N/A	N/A	15	9.1

Electrical Wiring Connections

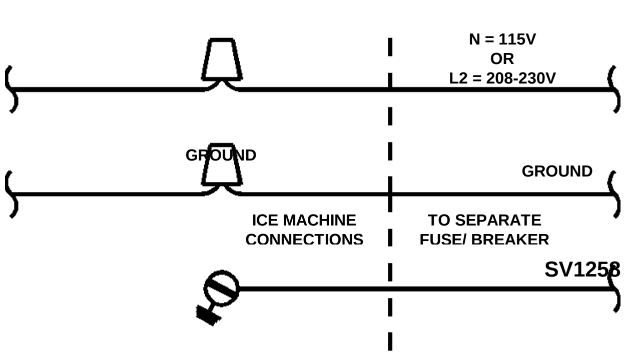
SELF-CONTAINED ELECTRICAL CONNECTIONS

⚠ WARNING

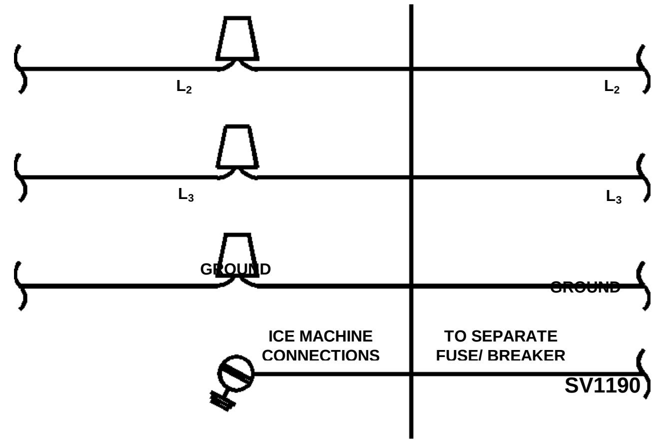
These diagrams are not intended to show proper wire routing, wire sizing, disconnects, etc., only the correct wire connections.

All electrical work, including wire routing and grounding, must conform to local, state and national electrical codes.

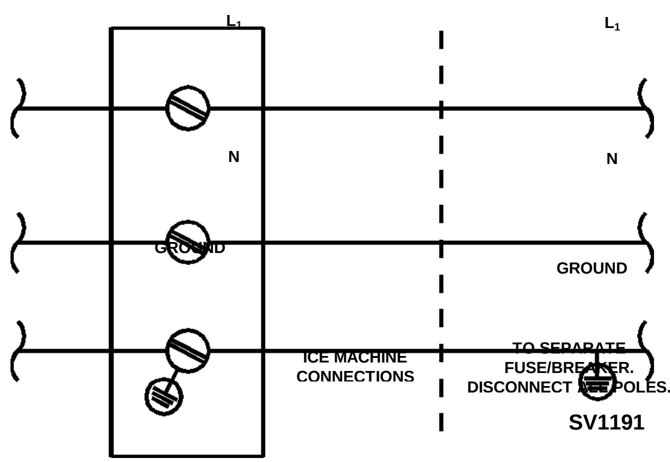
Self Contained Ice Machine 115/1/60 or 208-230/1/60



Self Contained Ice Machine 208-230/3/60



Self Contained Ice Machine 208-240/1/50



REMOTE ELECTRICAL CONNECTIONS

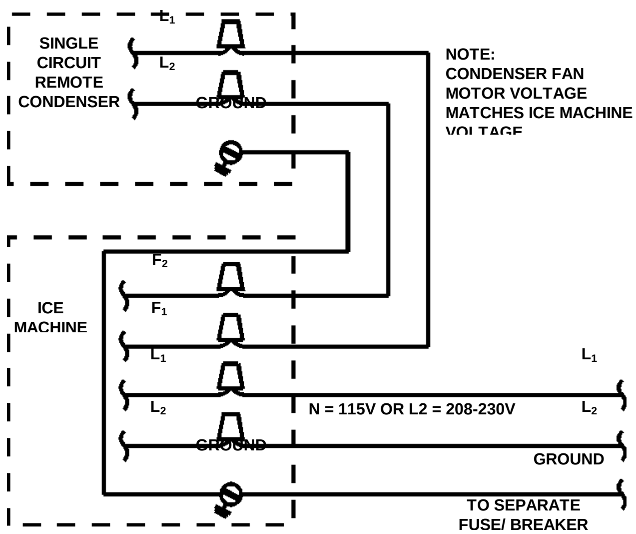
⚠ WARNING

These diagrams are not intended to show proper wire routing, wire sizing, disconnects, etc., only the correct wire connections.

All electrical work, including wire routing and grounding, must conform to local, state and national electrical codes.

NOTE: The single circuit condenser should be wired directly to the ice machine's electrical panel. The condenser fan runs only when the ice machine is operating.

Remote Ice Machine
With Single Circuit Model Condenser
115/1/60 or 208-230/1/60



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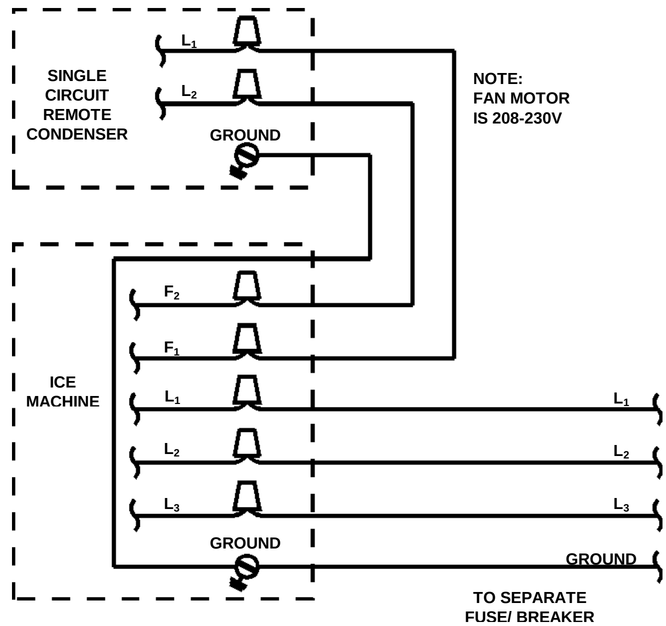
Remote Ice Machine
With Single Circuit Model Condenser
208-230/3/60 or 380-415/3/50



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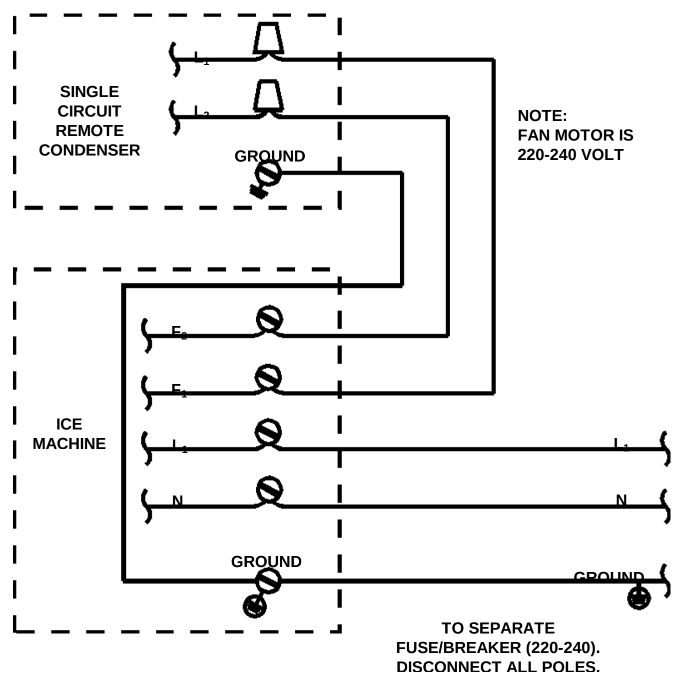
Remote Ice Machine
With Single Circuit Model Condenser
230/1/50



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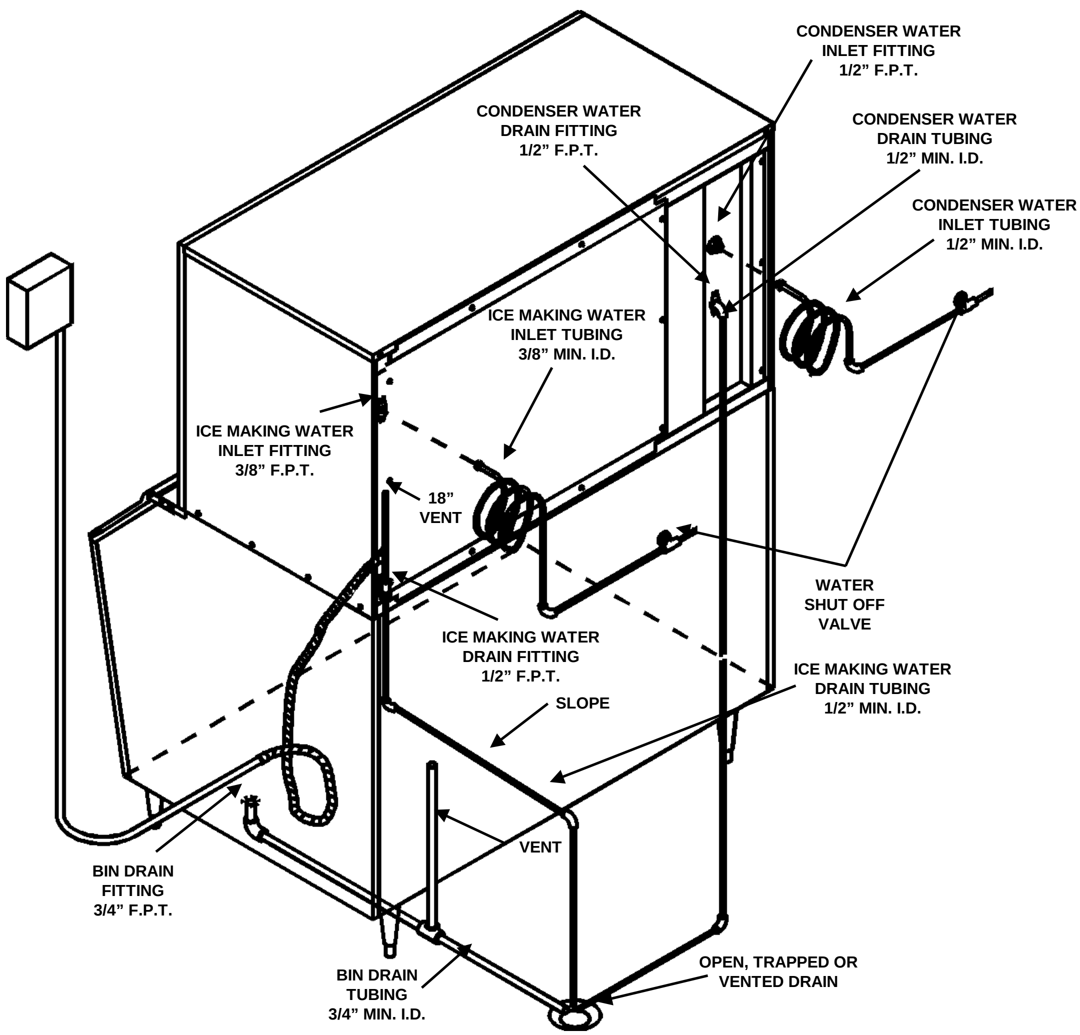
Water Connections and Drains

⚠ CAUTION
Plumbing must conform to local and state codes.

Location	Water Temperature	Water Pressure	Female Pipe Fitting (F.P.T.)[1] Size	Tube Size Up to Ice Machine Fitting
Ice making water inlet	33°F (0.6°C) min. 90°F (32.2°C) max	20 psi min. 80 psi max	3/8” F.P.T.	3/8”
Ice making water drain	-	-	1/2” F.P.T.	1/2”
Condenser water inlet	33°F (0.6°C) min. 90°F (32.2°C) max	20 psi min. 150 psi max	J1300/J1800 - 1/2” F.P.T. All Others - 3/8” F.P.T.	
Condenser Water Drain	-	-	1/2” F.P.T.	1/2”
Bin Drain	-	-	3/4” F.P.T.	3/4”

[1] F.P.T. - Female Pipe Thread



SV1304

Cooling Tower Applications (Water-Cooled Models)

A water cooling tower installation does not require modification of 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 valves (inlet and outlet) when using a cooling tower on an ice machine.

- Water entering the condenser must not exceed 90°F (32.2°C).
- Water flow through the condenser must not exceed 5 gallons per minute.
- Allow for a pressure drop of 7 psi between the condenser water inlet and the outlet of the ice machine.
- Water exiting the condenser must not exceed 110°F (43.3°C).

Remote Condenser/Line Set Installation

Ice Machine	Remote Single Circuit Condenser	Line Set*
J490	JC0495	RT-20-R404A
J690	JC0895	RT-35-R404A
J890		RT-50-R404A
J1090	JC1095	
J1390	JC1395	RL-20-R404A
J1890	JC1895	RL-35-R404A
		RL-50-R404A

*Line Set	Discharge Line	Liquid Line
RT	1/2” (12.7 mm)	5/16” (7.9 mm)
RL	1/2” (12.7 mm)	3/8” (9.5 mm)

Air Temperature Around the Condenser	
Minimum	Maximum
-20°F (-28.9°C)	130°F (54.4°C)

REMOTE ICE MACHINES REFRIGERANT CHARGE

Each remote ice machines ships from the factory with a refrigerant charge appropriate for installation with line sets of up to 50’ (15.25 m). The serial tag on the ice machine indicates the refrigerant charge.

Additional refrigerant may be required for installations using line sets between 50’ and 100’ (15.25-30.5 m) long. If additional refrigerant is required, an additional label located next to the serial tag states the amount of refrigerant to be added.

Typical Additional Refrigerant Label

IMPORTANT
EPA CERTIFIED TECHNICIANS

If remote line set length is between 50’ and 100’ (15.25-30.5 m), add **1.5 lb (24 oz) (0.68 kg)** of refrigerant to the nameplate charge.

Tubing length: ____________________________
Refrigerant added to nameplate: ______________
New total refrigerant charge: _________________

If there is no additional label, the nameplate charge is sufficient for line sets up to 100’ (30.5 m). (See the chart below.)

Ice Machine	Nameplate Charge (Total Charge Shipped in Ice Machine)	Refrigerant to be Added for 50’-100’ Line Sets	Maximum System Charge (Never Exceed)
J490	6 lb. (96 oz.)	None	6 lb. (96 oz.)
J690	8 lb. (128 oz.)	None	8 lb. (128 oz.)
J890	8 lb. (128 oz.)	None	8 lb. (128 oz.)
J1090	9.5 lb. (152 oz.)	None	9.5 lb. (152 oz.)
J1390	12.5 lb. (200 oz.)	1.5 lb (24 oz)	14 lb. (224 oz.)
J1890	15 lb. (240 oz.)	2.0 lb (32 oz)	17 lb. (272 oz.)

ROUTING LINE SETS

General

Condensers must be mounted horizontally with the fan motor on top.

Remote condenser installations consist of vertical and horizontal line set distances between the machine and the condenser. When combined, they must fit within approved specifications. The following guidelines, drawings and calculation methods must be followed to verify a proper remote condenser installation.

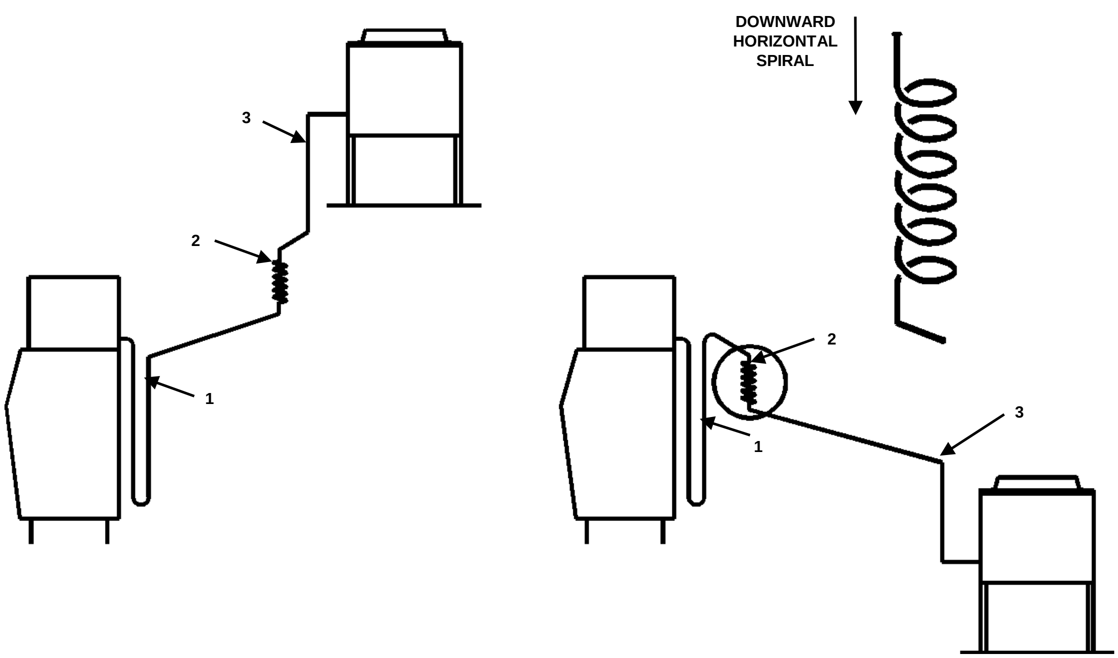
> ⚠ **CAUTION**
>
> The 60 month compressor warranty (including the 36 month labor replacement warranty) will not apply if the remote ice machine is not installed according to specifications.
>
> This warranty also will not apply if the refrigeration system is modified with a condenser, heat reclaim device, or other parts or assemblies not manufactured by Manitowoc Ice Inc, unless specifically approved in writing by Manitowoc Ice Inc.

Guidelines for Routing Line Sets

First, cut a 2.5” (63.5 mm) circular hole in the wall or roof for tubing routing. Connect the line set end with the 90° bend to the ice machine. Connect the straight end to the remote condenser.

Then, follow these guidelines when routing the refrigerant lines. This will help insure proper performance and service accessibility.

1. Make the service loop in the line sets as shown below. This permits easy access to the ice machine for cleaning and service. Do not use hard rigid copper at this location.
2. Do not form traps in the refrigeration lines (except the service loop). Refrigerant oil must be free to drain toward the ice machine or the condenser. Route excess tubing in a supported downward horizontal spiral as shown below. Do not coil tubing vertically.
3. Keep outdoor refrigerant line runs as short as possible.



SV1204

CALCULATING REMOTE CONDENSER INSTALLATION DISTANCES

Line Set Length
The maximum length is 100' (30.5 m).

The ice machine compressor must have the proper oil return. The receiver is designed to hold a charge sufficient to operate the ice machine in ambient temperatures between -20°F (-28.9°C) and 130°F (54.4°C), with line set lengths of up to 100' (30.5 m).

Line Set Rise/Drop
The maximum rise is 35' (10.7 m).
The maximum drop is 15' (4.5 m).

> ⚠ **CAUTION**
> If a line set has a rise followed by a drop, another rise cannot be made. Likewise, if a line set has a drop followed by a rise, another drop cannot be made.

Calculated Line Set Distance
The maximum distance is 150' (45.7 m).

Line set rises, drops, horizontal runs (or combinations of these) in excess of the stated maximums will exceed compressor start-up and design limits. This will cause poor oil return to the compressor.

Make the following calculations to make sure the line set layout is within specifications.

1. Insert the **measured rise** into the formula below. Multiply by 1.7 to get the **calculated rise**.

   (Example: A condenser located 10 feet above the ice machine has a **calculated rise** of 17 feet.)

2. Insert the **measured drop** into the formula below. Multiply by 6.6 to get the **calculated drop**.

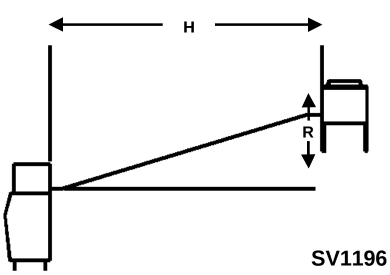
   (Example. A condenser located 10 feet below the ice machine has a **calculated drop** of 66 feet.)

3. Insert the **measured horizontal distance** into the formula below. No calculation is necessary.

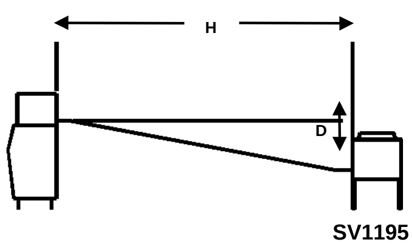
4. Add together the **calculated rise**, **calculated drop**, and **horizontal distance** to get the **total calculated distance**. If this total exceeds 150' (45.7 m), move the condenser to a new location and perform the calculations again.

Maximum Line Set Distance Formula

Step 1.	Measured Rise (35' [10.7 m] Maximum)	______ x 1.7	=	_______	Calculated Rise
Step 2.	Measured Drop (15' [4.5 m] Maximum)	______ x 6.6	=	_______	Calculated Drop
Step 3.	Measured Horizontal Distance (100' [30.5 m] Maximum)		=	_______	Horizontal Distance
Step 4.	Total Calculated Distance 150' (45.7 m)		=	_______	Total Calculated Distance



Combination of a Rise and a Horizontal Run



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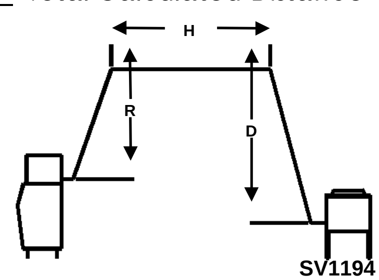
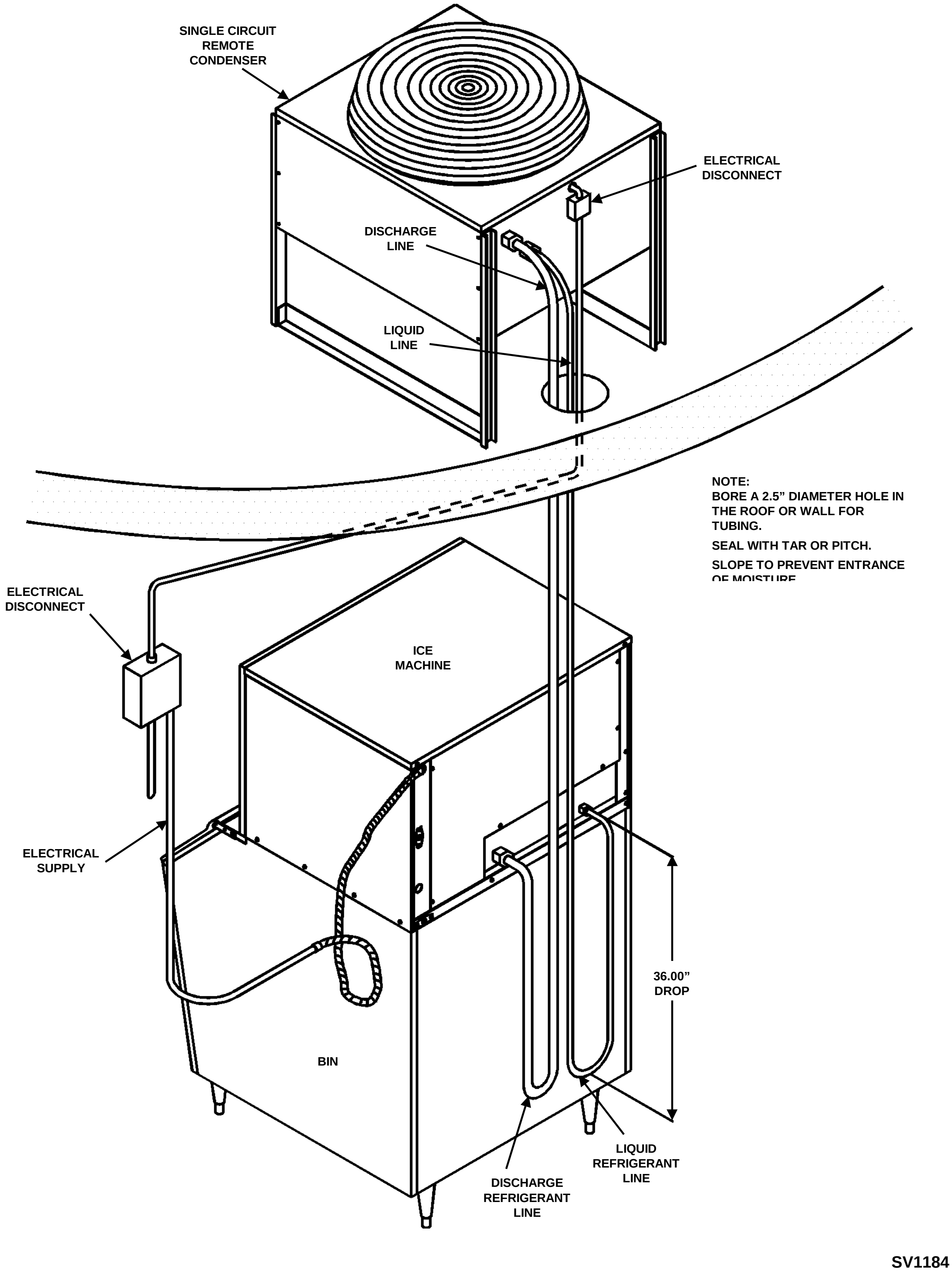


Combination of a Rise, a Drop and a Horizontal Run



Typical Single Circuit Remote Condenser Installation

Usage With Non-Manitowoc Multi-Circuit Condensers

WARRANTY

1. 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 outlined in the Installation Manual.
2. The foregoing warranty shall not apply to any ice machine installed and/or maintained inconsistent with the technical instructions provided by Manitowoc Ice, Inc..
3. Performance may vary from sales specification.
4. J Model ARI certified standard ratings only apply when used with a Manitowoc remote condenser.
5. Manitowoc ice machines are UL listed with Manitowoc condensers only.
6. If the design of the condenser meets the specifications laid out, Manitowoc will only approve warranty coverage on the Manitowoc-manufactured portion of the system.
7. Since Manitowoc does not test the condenser in conjunction with the ice machine, Manitowoc will not endorse, recommend, or approve of the condenser, and will not be responsible for its performance or reliability.

LINE SET ROUTING AND SIZING

Remote condenser installations consist of vertical and horizontal line set distances to the condenser that, when combined, must fit within approved guidelines. The line set sizing guidelines, drawings, and length calculation methods must be followed to verify a proper remote condenser installation. Refer to the Installation Instructions for specifications for remote line sets and maximum remote condenser location.

HEAD PRESSURE CONTROL VALVE

Any remote condenser connected to a Manitowoc J-model ice machine must have a head pressure control valve (P/N 836809-3), available from Manitowoc distributors, installed on the condenser package. Manitowoc will not accept substitute off-the-shelf head pressure control valves.

⚠ CAUTION

Do not use a fan cycle control to maintain discharge pressure. Compressor failure will result.

FAN MOTOR

The condenser fan must be on during the complete ice machine freeze cycle. Do not cycle with a fan cycle control.

The ice machine has a condenser fan motor circuit designed for use with a Manitowoc condenser. It is recommended that this circuit be used to control the condenser fan(s) on the multi-circuit condenser. This will assure it is on at the proper time.

Do not exceed the rated amps for the fan motor circuit listed on the ice machine serial tag.

INTERNAL CONDENSER VOLUME

The multi-circuit condenser internal volume must not be less, nor greater, than that used by Manitowoc.

> **⚠ CAUTION**
> Do not exceed internal volume and try to add charge to compensate. Compressor failure will result.

CONDENSER ΔT

ΔT is the difference in temperature between the condensing refrigerant and the entering air. The ΔT should be 15-20°F at the beginning of the freeze cycle (peak load conditions) and drop to 12-17°F during the last 75% of the freeze cycle (average load conditions).

REFRIGERANT CHARGE

Remote ice machines have the serial plate refrigerant charge (total system charge) located in the ice maker section. Remote condensers and line sets are supplied with only a vapor charge.

> **⚠ CAUTION**
> Never add more than nameplate charge to ice machine for any reason.

QUICK-CONNECT FITTINGS

The ice machine and the line sets come with quick-connect fittings. It is recommended that matching quick-connects (available from Manitowoc distributors) be installed in the multi-circuit condenser, and a vapor "holding" charge (5 oz.) of refrigerant be added.

Model	Refrigerant		Heat of Rejection		Internal Condenser Volume (cu. ft.)		Design Pressure	Quick-Connect Stubs-Male Ends		Head Pressure Control Valve
	Type	Charge	Avg. BTU/Hr	Peak BTU/Hr	Min.	Max.		Discharge	Liquid	
J450	R404-A	6 lb.	7,000	9,600	0.020	0.035	500 psig	coupling	coupling	Manitowoc
J600	R404-A	8 lb.	9,000	13,900	0.045	0.060	safe working	P/N 83-6035-3	P/N 83-6034-3	P/N 83-6809-3
J800	R404-A	8 lb.	12,400	19,500	0.045	0.060	pressure,	mounting	mounting	NO SUBSTITUTES
J1000	R404-A	9.5 lb.	16,000	24,700	0.065	0.085	2500 psig	flange	flange	
J1300	R404-A	14 lb.[1]	24,000	35,500	0.085	0.105	burst	P/N 83-6006-3	P/N 83-6005-3	
J1800	R404-A	17 lb.[1]	36,000	50,000	0.130	0.170	pressure			

[1]Amount reflects additional refrigerant added to nameplate charge to ensure proper operation at all ambient conditions. J1300 has an additional 1.5 lb., J1800 has an additional 2.0 lb.

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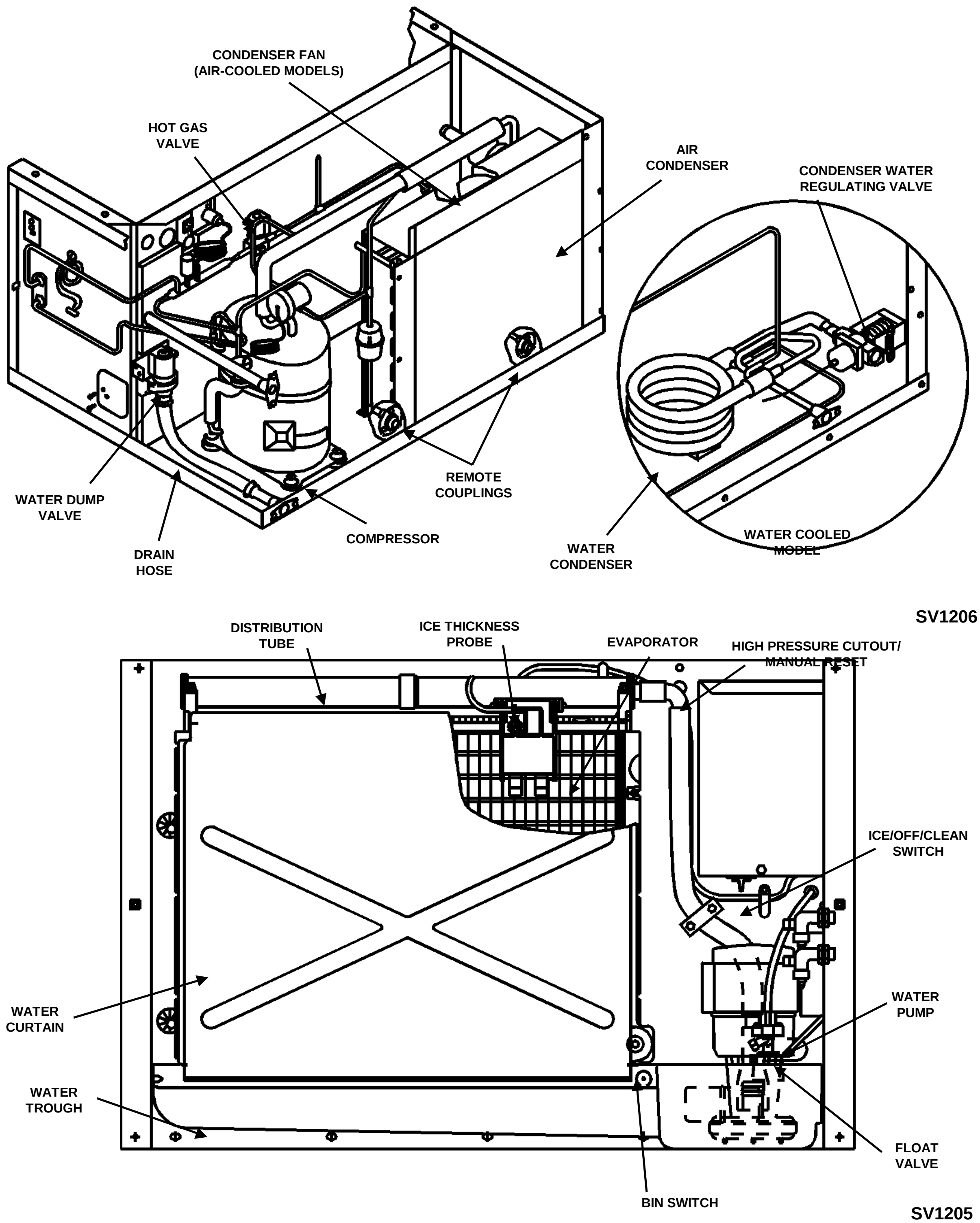
Section 3
Maintenance

Component Identification



Component Identification (Typical Q450 Shown)

Operational Checks

Manitowoc ice machines are factory-operated and adjusted before shipment. Normally, new installations do not require any adjustment.

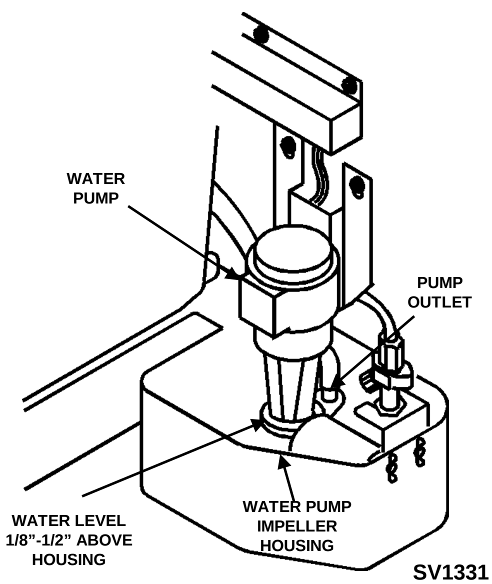
To ensure proper operation, always follow the Operational Checks:

- when starting the ice machine for the first time
- after a prolonged out of service period
- after cleaning and sanitizing

NOTE: Routine adjustments and maintenance procedures are not covered by the warranty.

WATER LEVEL CHECK

1. Check the water level while the ice machine is in the freeze mode and the water pump is running. The correct water level is 1/8”-1/2” (3-12.5 mm) above the water pump impeller housing.



Water Level Check

2. The float valve is factory-set for the proper water level. If adjustments are necessary:
   A. Loosen the two screws on the float valve bracket.
   B. Raise or lower the float valve assembly as necessary, then tighten the screws.
   C. If further adjustment is required, carefully bend the float arm to achieve the correct water level.

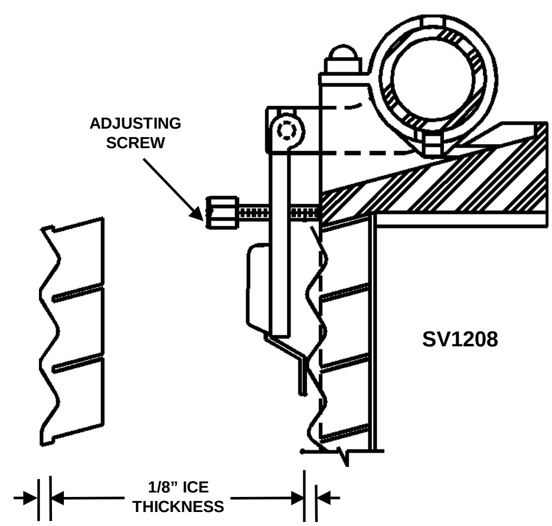
ICE THICKNESS CHECK

The ice thickness probe is factory-set to maintain the ice bridge thickness at 1/8” (3.2 mm).

NOTE: Make sure the water curtain is in place when performing this check. It prevents water from splashing out of the water trough.

1. Inspect the bridge connecting the cubes. It should be about 1/8” (3.2 mm) thick.
2. If adjustment is necessary, turn the ice thickness probe adjustment screw clockwise to increase bridge thickness, counterclockwise to decrease bridge thickness.

NOTE: Turning the adjustment 1/3 of a turn will change the ice thickness about 1/16” (1.5 mm).



Ice Thickness Check

3. Make sure the ice thickness probe wire and the bracket do not restrict movement of the probe.

Cleaning the Condenser

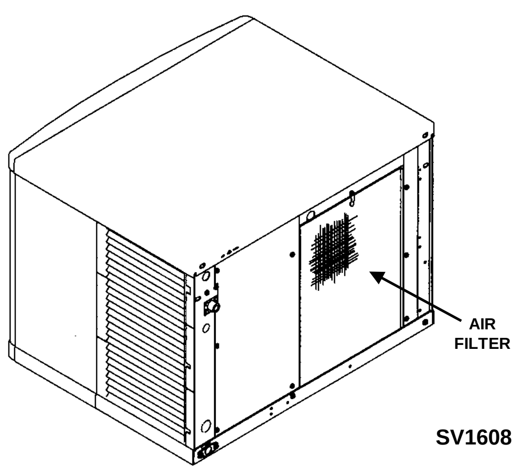
⚠ WARNING
Disconnect electric power to the ice machine and the remote condenser at the electric service switch before cleaning the condenser.

AIR-COOLED CONDENSER (SELF-CONTAINED AND REMOTE MODELS)

A dirty condenser restricts airflow, resulting in excessively high operating temperatures. This reduces ice production and shortens component life. Clean the condenser at least every six months. Follow the steps below.

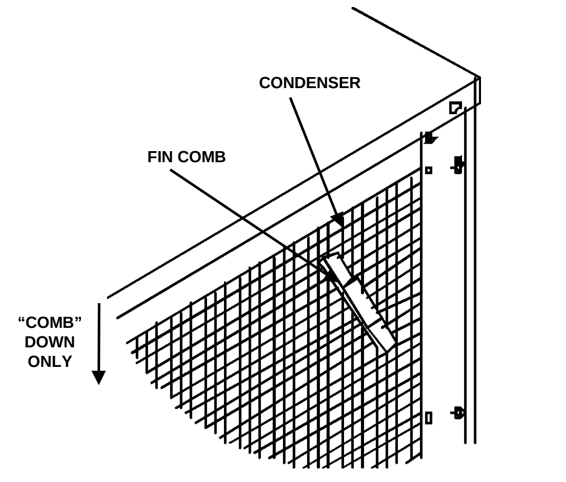
⚠ CAUTION
The condenser fins are sharp. Use care when cleaning them.

1. The washable aluminum filter on self-contained ice machines is designed to catch dust, dirt, lint and grease. This helps keep the condenser clean. Clean the filter with a mild soap and water solution.



Self-Contained Air-Cooled Filter

2. Clean the outside of the condenser (bottom of a remote condenser) with a soft brush or a vacuum with a brush attachment. Clean from top to bottom, not side to side. Be careful not to bend the condenser fins.
3. Shine a flashlight through the condenser to check for dirt between the fins. If dirt remains:
   A. Blow compressed air through the condenser fins from the inside. Be careful not to bend the fan blades.
   B. Use a commercial condenser coil cleaner. Follow the directions and cautions supplied with the cleaner.
4. Straighten any bent condenser fins with a fin comb.



Straighten Bent Condenser Fins

5. Carefully wipe off the fan blades and motor with a soft cloth. Do not bend the fan blades. If the fan blades are excessively dirty, wash with warm, soapy water and rinse thoroughly.

⚠ CAUTION
If you are cleaning the condenser fan blades with water, cover the fan motor to prevent water damage.

Continued on next page...

WATER-COOLED CONDENSER AND WATER REGULATING VALVE

Symptoms of restrictions in the condenser water circuit include:

- Low ice production
- High water consumption
- High operating temperatures
- High operating pressures

If the ice machine is experiencing any of these symptoms, the water-cooled condenser and water regulating valve may require cleaning due to scale build-up.

The cleaning procedures require special pumps and cleaning solutions. Follow the manufacturer's instructions for the specific cleaner being used.

Interior Cleaning and Sanitizing

GENERAL

Clean and sanitize the ice machine every six months for efficient operation. If the ice machine requires more frequent cleaning and sanitizing, consult a qualified service company to test the water quality and recommend appropriate water treatment or installation of AuCS™ accessory (Automatic Cleaning System). If required, an extremely dirty ice machine may be take apart for cleaning and sanitizing.

> ⚠ **CAUTION**
> Use only Manitowoc approved Ice Machine Cleaner (part number 94-0546-3) and Sanitizer (part number 94-0565-3). It is a violation of Federal law to use these solutions in a manner inconsistent with their labeling. Read and understand all labels printed on bottles before use.

> ⚠ **CAUTION**
> Do not mix Cleaner and Sanitizer solutions together. It is a violation of Federal law to use these solutions in a manner inconsistent with their labeling.

> ⚠ **WARNING**
> Wear rubber gloves and safety goggles (and/or face shield) when handling ice machine Cleaner or Sanitizer.

CLEANING PROCEDURE

Ice machine cleaner is used to remove lime scale or other mineral deposits. It is not used to remove algae or slime. Refer to the section on Sanitizing for removal of algae and slime.

Step 1 Set the toggle switch to the OFF position after ice falls from the evaporator at the end of a Harvest cycle. Or, set the switch to the OFF position and allow the ice to melt off the evaporator.

> ⚠ **CAUTION**
> Never use anything to force ice from the evaporator. Damage may result.

Step 2 To start self-cleaning, place the toggle switch in the CLEAN position. The water will flow through the water dump valve and down the drain. The Clean light will turn on to indicate the ice machine is in the Self-Cleaning mode.

Step 3 Wait about one minute or until water starts to flow over the evaporator.

Step 4 Add the proper amount of Manitowoc Ice Machine Cleaner to the water trough.

Model	Amount of Cleaner
Q200 Q320 Q420	3 ounces (90 ml)
Q450 Q600 Q800	5 ounces (150 ml)
Q1000 Q1300 Q1800	9 ounces (270 ml)

Step 5 The ice machine will automatically time out a ten minute cleaning cycle, followed by six rinse cycles, and stop. The Clean light will turn off to indicate the Self-Cleaning mode is completed. This entire cycle lasts approximately 25 minutes.

Step 6 When the self-cleaning process stops, move the toggle switch to OFF position. Refer to "Sanitizing Procedure" on the next page.

Step 7

A. The ice machine may be set to start and finish a self-cleaning procedure then automatically start ice making again.
B. You must wait about one minute into the cleaning cycle (until water starts to flow over the evaporator) then move the switch from CLEAN to ICE position.
C. When the self-cleaning cycle is completed, an ice making sequence will start automatically.

> **Important**
> After the toggle switch is moved to the ICE position, opening the curtain switch will interrupt the cleaning sequence. The sequence will resume from the point of interruption when the curtain switch closes.

SELF SANITIZING PROCEDURE

Use sanitizer to remove algae or slime. Do not use it to remove lime scale or other mineral deposits.

Step 1 Set the toggle switch to the OFF position after ice falls from the evaporator at the end of a Harvest cycle. Or, set the switch to the OFF position and allow the ice to melt off the evaporator.

> **⚠ CAUTION**
> Never use anything to force ice from the evaporator. Damage may result.

Step 2 To start self-sanitizing, place the toggle switch in the CLEAN position. The water will flow through the water dump valve and down the drain. The Clean light will turn on to indicate the ice machine is in the Self-Cleaning mode.

Step 3 Wait about one minute or until water starts to flow over the evaporator.

Step 4 Add the proper amount of Manitowoc Ice Machine Sanitizer to the water trough.

Model	Amount of Sanitizer
Q200 Q320 Q420	3 ounces (90 ml)
Q450 Q600 Q800 Q1000	3 ounces (90 ml)
Q1300 Q1800	6 ounces (180 ml)

Step 5 The ice machine will automatically time out a ten minute sanitizing cycle, followed by six rinse cycles, and stop. The Clean light will turn off to indicate the Self-Cleaning mode is completed. This entire cycle lasts approximately 25 minutes.

If the bin requires sanitizing, remove all the ice and sanitize it with a solution of one ounce (30ml) of sanitizer with up to 4 gallons (15 L)of water.

Step 6 When the self-sanitizing process stops, move the toggle switch to ICE position to start ice making again.

Step 7

A. The ice machine may be set to start and finish a self-sanitizing procedure then automatically start ice making again.

B. You must wait about one minute into the sanitizing cycle (until water starts to flow over the evaporator) then move the switch from CLEAN to ICE position.

C. When the self-sanitizing cycle is completed, the clean light will turn off and a ice making sequence will start automatically.

> **Important**
> After the toggle switch is moved to the ICE position, opening the curtain switch will interrupt the sanitizing sequence. The sequence will resume from the point of interruption when the curtain switch closes.

PROCEDURE TO CANCEL A SELF-CLEANING OR SANITIZING CYCLE AFTER IT HAS STARTED

If less than 45 seconds into cycle:

Move the toggle switch to the OFF position. The cycle is now canceled.

If more than 45 seconds into cycle:

Step 1 Move toggle switch to OFF position.
Step 2 Move toggle switch to ICE position.
Step 3 Move toggle switch to OFF position.
The cycle is now canceled.

AUCS™ ACCESSORY

This accessory monitors ice making cycles and initiates self-cleaning (or sanitizing) procedures automatically. The AuCS™ Accessory can be set to automatically clean or sanitize the ice machine every 2, 4, or 12 weeks.

> **⚠ CAUTION**
> Refer to the AuCS™ Accessory Installation - Use and Care Guide for complete details on the installation, operation, maintenance and cautionary statements of this accessory.

AUTOMATIC OPERATION

The following occurs when the toggle switch is in the ICE position:

- The ice machine control board counts the number of ice harvest cycles.
- The AuCS™ accessory interrupts the ice making mode and starts the automatic cleaning (or sanitizing) mode when the harvest count equals the “Frequency of Cleaning” setting of the AuCS™.
- When the automatic cleaning (or sanitizing) cycle is complete (approximately 25 minutes), ice making resumes automatically, and the “Harvest Count” is reset to zero.

> **Important**
> Opening the curtain switch will interrupt the cleaning or sanitizing sequence. The sequence will resume from the point of interruption when the curtain recloses.

MANUAL START OPERATION

Step 1 Set the toggle switch to the OFF position after ice falls from the evaporator at the end of a Harvest cycle. Or, set the switch to the OFF position and allow the ice to melt off the evaporator.

> **⚠ CAUTION**
> Never use anything to force ice from the evaporator. Damage may result.

Step 2 To start the automatic cleaning system, move the toggle switch to the CLEAN position. The water will flow through the water dump valve and down the drain. (New style circuit boards will also energize the Clean light.) The AuCS™ then automatically adds cleaner of sanitizer to the ice machine.

Step 3 The ice machine will automatically time out a ten minute cleaning or sanitizing cycle, followed by six rinse cycles, (de-energize the Clean light) and stop. This entire cycle lasts approximately 25 minutes.

Step 4 After the cleaning or sanitizing cycle stops, move the toggle switch to ICE position.

Step 5

A. The ice machine may be set to start and finish a self-cleaning or sanitizing cycle, then automatically start ice making again.

B. You must wait about one minute into the cleaning cycle (until water starts to flow over the evaporator), then move the toggle switch from CLEAN to ICE position.

C. When the self-cleaning cycle or sanitizing is completed, an ice making sequence will start automatically.

REMOVAL OF PARTS FOR CLEANING/SANITIZING

1. Turn off the water supply to the ice machine at the water service valve.

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

2. Remove the following parts:
   - water trough
   - water curtain
   - water pump
   - water distribution tube
   - ice thickness probe

   (See the following pages for removal procedures for these parts.)

⚠ CAUTION
Do not mix Cleaner and Sanitizer solutions together. It is a violation of Federal law to use these solutions in a manner inconsistent with their labeling.

⚠ WARNING
Wear rubber gloves and safety goggles (and/or face shield) when handling Cleaner or Sanitizer solution.

3. Soak the removed parts in a properly mixed solution.

Solution Type	Water	Mixed With
Cleaner	1 gal. (4 l)	16 oz (500 ml) cleaner
Sanitizer	4 gal. (15 l)	1 oz (30 ml) sanitizer

4. Use a soft-bristle brush or sponge (NOT a wire brush) to carefully clean the parts.

⚠ CAUTION
Do not immerse the water pump motor in the cleaning or sanitizing solution.

5. Use the solution and a brush to clean the top, sides, and bottom evaporator extrusions; the inside of the ice machine panels; and the entire inside of the bin.
6. Thoroughly rinse all of the parts and surfaces with clean water.
7. Install the removed parts.

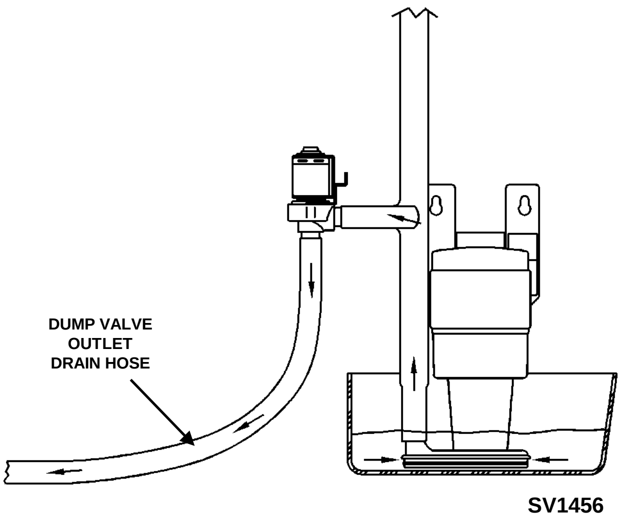
NOTE: Incomplete rinsing of the ice thickness probe may leave a residue. This could cause the ice machine to go into the harvest cycle prematurely. For best results, brush or wipe the probe off while rinsing it. Thoroughly dry the probe before installing it.

8. Turn on the water and electrical supply.

WATER DUMP VALVE

The water dump valve normally does not require removal for cleaning. To determine if removal is necessary:

1. Locate the water dump valve.
2. Set the toggle switch to ICE.
3. While the ice machine is in the freeze mode, check the dump valve's clear plastic outlet drain hose for leakage.



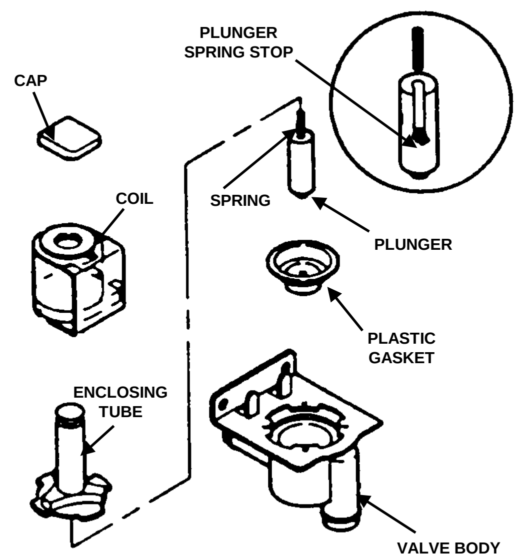
Dump Valve Outlet Drain Hose

A. If the dump valve is leaking, remove, disassemble and clean it.
B. If the dump valve is not leaking, do not remove it. Instead, follow the "Cleaning Procedure" on page 3-5.

Follow the procedure below to remove the dump valve.

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

1. If so equipped, remove the water dump valve shield from its mounting bracket.
2. Lift and slide the coil retainer cap from the top of the coil.
3. Note the position of the coil assembly on the valve for assembly later. Leaving the wires attached, lift the coil assembly off the valve body and the enclosing tube.
4. Press down on the plastic nut on the enclosing tube and rotate it 1/4 turn. Remove the enclosing tube, plunger, and plastic gasket from the valve body.



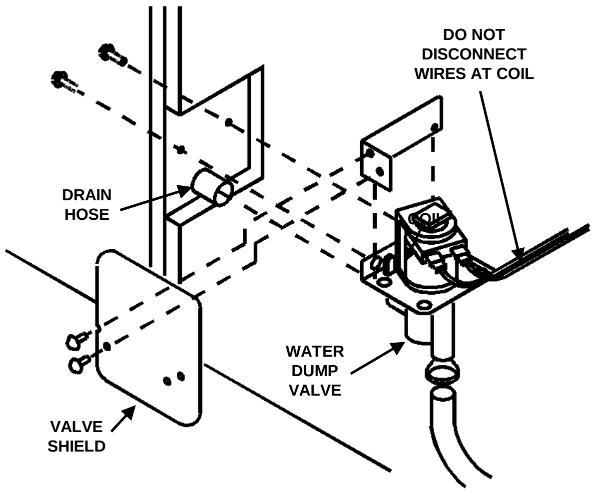
Dump Valve Disassembly

NOTE: At this stage, the water dump valve can easily be cleaned. If complete removal is desired, continue with step 5 on the next page.

> **Important**
> The plunger and the inside of the enclosing tube must be completely dry before assembly.

NOTE: During cleaning, do not stretch, damage or remove the spring from the plunger. If it is removed, slide the spring's flared end into the plunger's slotted top opening until the spring contacts the plunger spring stop.

5. Remove the tubing from the dump valve by twisting the clamps off.
6. Remove the two screws securing the dump valve and the mounting bracket.

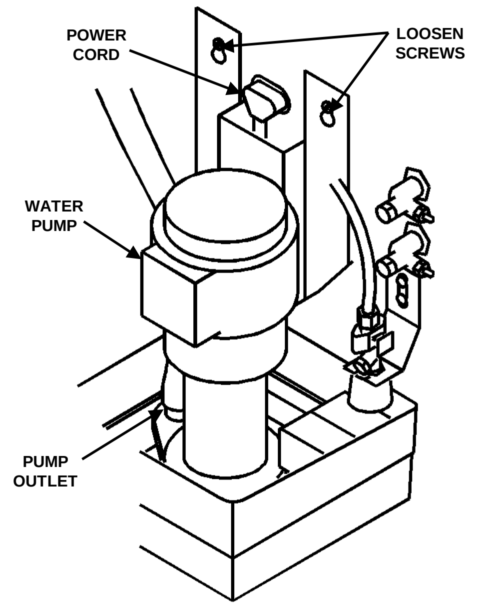


Dump Valve Removal

WATER PUMP

> **⚠ WARNING**
> Disconnect the electric power to the ice machine at the electric service switch box and turn off the water supply.

1. Disconnect the water pump power cord.

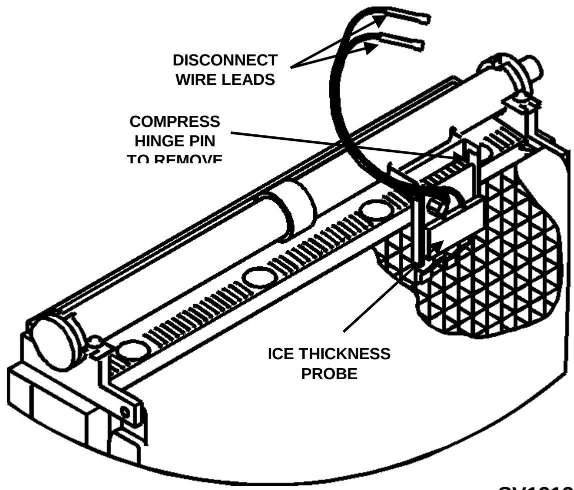


Water Pump Removal

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

ICE THICKNESS PROBE

1. Compress the side of the ice thickness probe near the top hinge pin and remove it from the bracket.



Ice Thickness Probe Removal

NOTE: At this stage, the ice thickness probe can easily be cleaned. If complete removal is desired, continue with step 2 below.

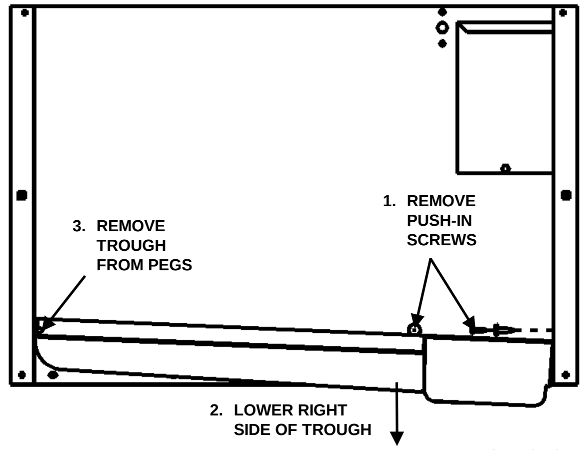
> **⚠ WARNING**
> Disconnect the electric power to the ice machine at the electric service switch box.

2. Disconnect the wire leads from the control board inside the electrical control box.

WATER TROUGH

Water trough removal varies slightly by model. The following procedure is typical.

1. Remove the push-in screws holding the trough in place.

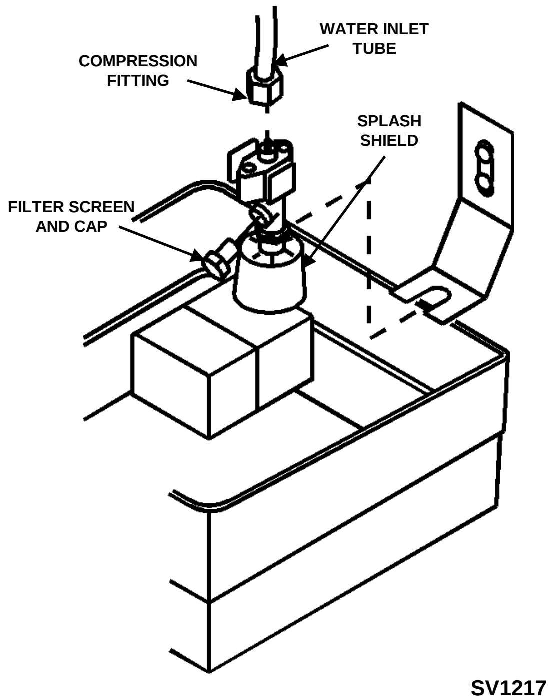


Water Trough Removal

2. Lower the right side of the trough into the bin.
3. Disengage the left side of the trough from its holding pegs and remove the trough.

FLOAT VALVE

1. Turn off the water supply to the ice machine at the water service valve.
2. Turn the splash shield counterclockwise one or two turns.

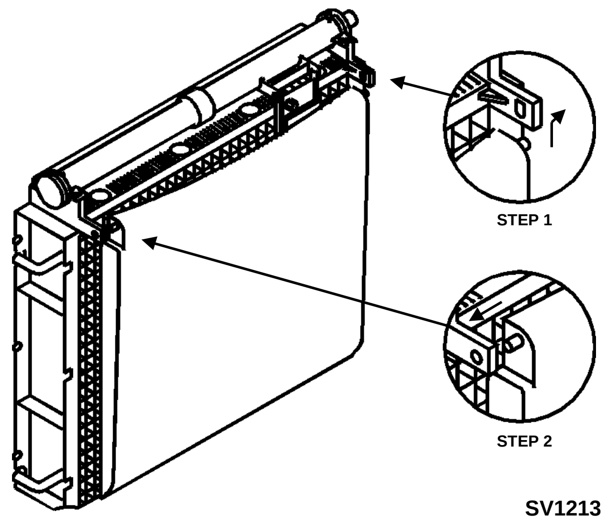


Float Valve Removal

3. Pull the float valve forward and off the mounting bracket.
4. Disconnect the water inlet tube from the float valve at the compression fitting.
5. Remove the filter screen and cap for cleaning.

WATER CURTAIN

1. Gently flex the curtain in the center and remove it from the right side.

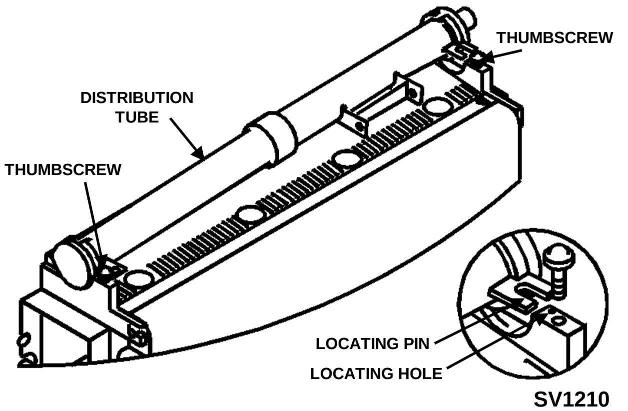


Water Curtain Removal

2. Slide the left pin out.

WATER DISTRIBUTION TUBE

1. Disconnect the water hose from the distribution tube.

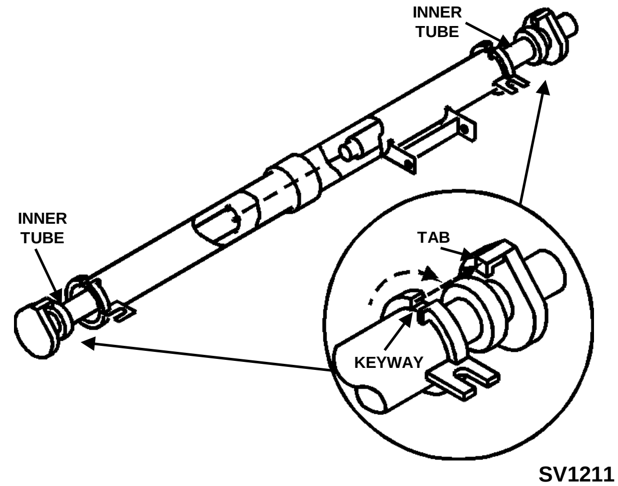


Water Distribution Tube Removal

2. Loosen the two thumbscrews which secure the distribution tube.
3. Lift the right side of the distribution tube up off the locating pin, then slide it back and to the right.

> **CAUTION**
> Do not force this removal. Be sure the locating pin is clear of the hole before sliding the distribution tube out.

4. Disassemble for cleaning.



Water Distribution Tube Disassembly

A. Twist both of the inner tube ends until the tabs line up with the keyways.
B. Pull the inner tube ends outward.

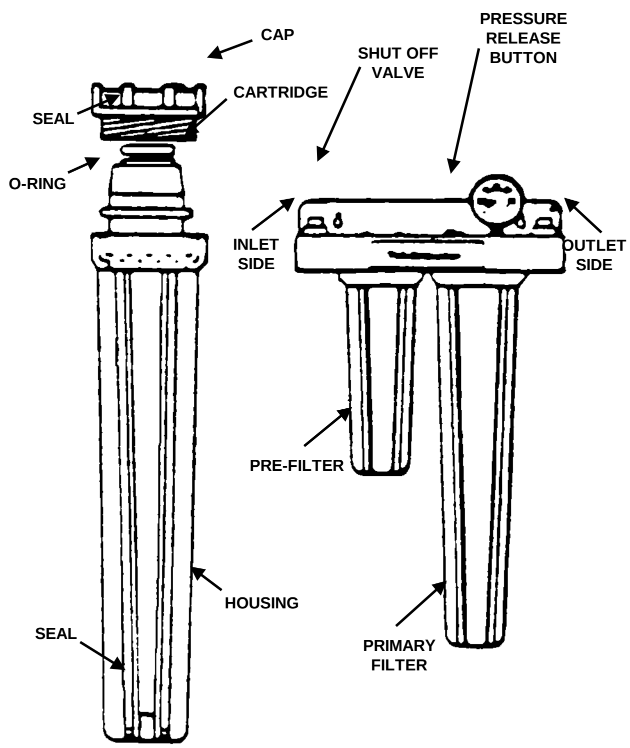
Water Treatment/Filtration

Local water conditions may require the installation of a water treatment system to inhibit scale formation, filter out sediment, and remove chlorine taste and odor. Consult your local distributor for information on Manitowoc's full line of Tri-Liminator filtration systems.

FILTER REPLACEMENT PROCEDURE

Tri-Liminator systems include a pre-filter and a primary filter. For maximum filtration efficiency, replace the primary filter cartridge every six months. If the filter gauge reading drops below 20 psig prior to six months usage, replace the pre-filter first.

1. Turn off the water supply at the inlet shutoff valve.



Typical Tri-Liminator Water Filtration System

2. Depress the pressure release button to relieve the pressure.
3. Unscrew the housing from the cap.
4. Remove the used filter cartridge from the housing and discard it.
5. Remove the O-ring from the housing groove. Wipe the housing groove and the O-ring clean.
6. Lubricate the O-ring with petroleum jelly.
7. Press the O-ring into the housing groove.
8. Insert a new filter cartridge into the housing. Make sure it slips down over the housing standpipe.
9. Screw the housing on to the cap and carefully hand-tighten it.

> ⚠ **CAUTION**
> Hand-tighten only. Do not overtighten. Do not use a spanner wrench.

10. Repeat steps 3-9 for each filter housing.
11. Turn on the water supply to allow the housing and filter to slowly fill with water.
12. Depress the pressure release button to release trapped air from the housing.
13. Check for leaks.

Removal from Service/Winterization

GENERAL

Special precautions must be taken if the ice machine is to be removed from service for an extended period of time or exposed to ambient temperatures of 32°F or below.

> **⚠ CAUTION**
>
> If water is allowed to remain in the ice machine in freezing temperatures, severe damage to some components could result. Damage of this nature is not covered by the warranty.

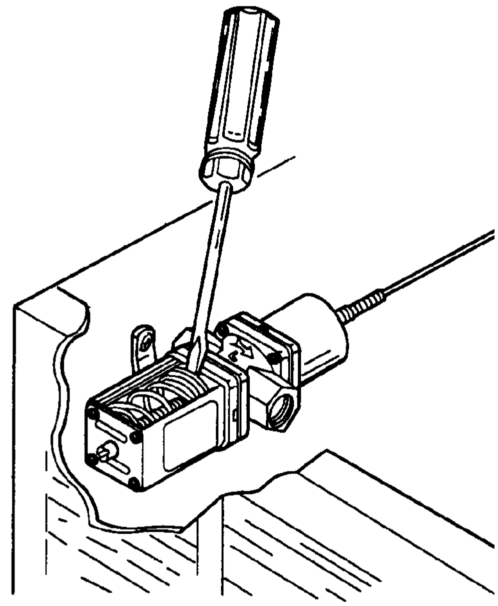
Follow the applicable procedure below.

SELF-CONTAINED AIR-COOLED ICE MACHINES

1. Disconnect the electric power at the circuit breaker or the electric service switch.
2. Turn off the water supply.
3. Remove the water from the water trough.
4. Disconnect and drain the incoming ice-making water line at the rear of the ice machine.
5. Blow compressed air in both the incoming water and the drain openings in the rear of the ice machine until no more water comes out of the float valve or the drain.
6. Make sure water is not trapped in any of the water lines, drain lines, distribution tubes, etc.

WATER-COOLED ICE MACHINES

1. Perform steps 1-6 under “Self-Contained Air-Cooled Ice Machines.”
2. Disconnect the incoming water and drain lines from the water-cooled condenser.
3. Insert a large screwdriver between the bottom spring coils of the water regulating valve. Pry upward to open the valve.



Pry Open the Water Regulating Valve

4. Hold the valve open and blow compressed air through the condenser until no water remains.

REMOTE ICE MACHINES

1. Move the ICE/OFF/CLEAN switch to OFF.
2. “Frontseat” (shut off) the receiver service valves. Hang a tag on the switch as a reminder to open the valves before restarting.
3. Perform steps 1-6 under “Self-Contained Air-Cooled Ice Machines.”

AUCS™ ACCESSORY

Refer to the AuCS™ Accessory manual for winterization of the AuCS™ Accessory.

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Section 4 Basic Ice Machine Sequence of Operation

Self-Contained Air- and Water-Cooled

J200/J250/J320/J420/J450/J600/J800/J1000/J1300/J1800

INITIAL START-UP OR START-UP AFTER AUTOMATIC SHUT-OFF

1. Water Purge

Before the compressor starts, the water pump and water dump solenoid are energized for 45 seconds, to completely purge the ice machine of old water. This feature ensures that the ice making cycle starts with fresh water.

The hot gas valve(s) is also energized during water purge, although it stays on for an additional 5 seconds (50 seconds total on time) during the initial refrigeration system start-up.

2. Refrigeration System Start-Up

The compressor starts after the 45 second water purge, and it remains on throughout the entire Freeze and Harvest Sequences. The hot gas valve(s) remains on for 5 seconds during initial compressor start-up and then shuts off.

At the same time the compressor starts, the fan condenser motor (air-cooled models) is supplied with power throughout the entire Freeze and Harvest Sequences. The fan motor is wired through a fan cycle pressure control, therefore it may cycle on and off. (The compressor and condenser fan motor are wired through the contactor. As a result, anytime the contactor coil is energized, the compressor and fan motor are supplied with power.)

FREEZE SEQUENCE

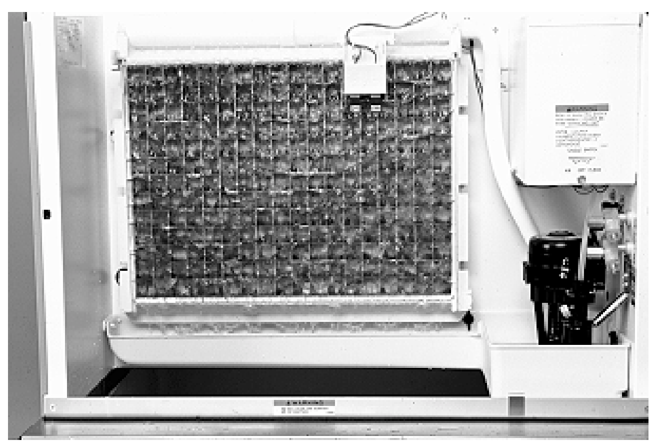
3. Prechill

The compressor is on for 30 seconds prior to water flow, to prechill the evaporator.

4. Freeze

The water pump restarts after the 30 second prechill. An even flow of water is directed across the evaporator and into each cube cell, where it freezes.

When sufficient ice has formed, the water flow (not the ice) contacts the ice thickness probe. After approximately 7 seconds of continual water contact, the harvest sequence is initiated. The ice machine cannot initiate a harvest sequence until a 6 minute freeze lock has been surpassed.



Freeze Sequence (Typical J450 Shown)

Continued on next page...

HARVEST SEQUENCE

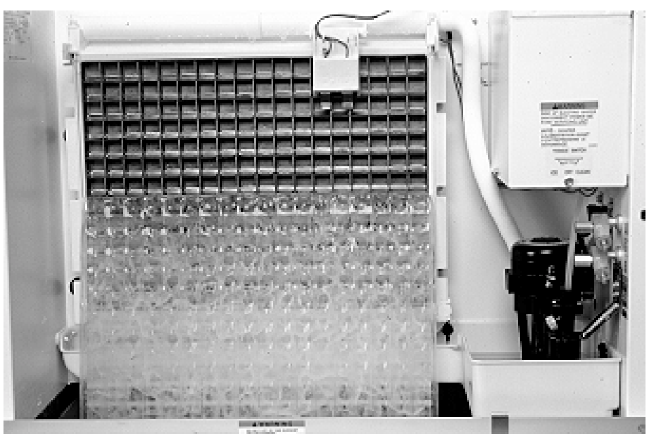
5. Water Purge

The water pump continues to run and the water dump valve energizes for 45 seconds, to purge the water in the sump trough. After the 45 second water purge, the water pump and dump valve de-energize. The hot gas valve(s) also opens at the beginning of the water purge, to divert hot refrigerant gas into the evaporator.

New style circuit boards have an adjustable water purge in the harvest cycle. This permits a 0 (off), 15, 30 or 45 second purge cycle.

6. Harvest

The hot gas valve(s) remains open and the refrigerant gas warms the evaporator causing the cubes to slide, as a sheet, off the evaporator and into the storage bin. The sliding sheet of cubes swings the water curtain out, opening the bin switch. The momentary opening and re-closing of the bin switch terminates the harvest sequence and returns the ice machine to the freeze sequence (Step 3 - 4.)



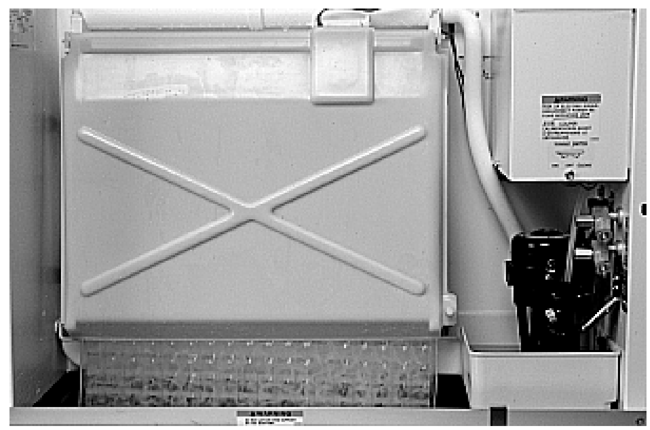
Harvest Sequence (Typical J450 Shown)

AUTOMATIC SHUT-OFF

7. Automatic Shut-Off

When the storage bin is full at the end of a harvest sequence, the sheet of cubes fails to clear the water curtain and will hold it open. After the water curtain is held open for 7 seconds, the ice machine shuts off. The ice machine remains off for 3 minutes before it can automatically restart.

The ice machine remains off until enough ice has been removed from the storage bin to allow the ice to fall clear of the water curtain. As the water curtain swings back to the operating position, the bin switch re-closes and the ice machine restarts (steps 1 - 2), provided the 3 minute delay period is complete.



Automatic Shut-Off (Typical J450 Shown)

Remote

J450/J600/J800/J1000/J1300/J1800

INITIAL START-UP OR START-UP AFTER AUTOMATIC SHUT-OFF

1. Water Purge

Before the compressor starts, the water pump and water dump solenoid are energized for 45 seconds, to completely purge the ice machine of old water. This feature ensures that the ice making cycle starts with fresh water.

The hot gas and harvest pressure regulating (HPR) solenoid valves also energize during water purge, although they stay on for an additional 5 seconds (50 seconds total on time) during the initial refrigeration system start-up.

2. Refrigeration System Start-Up

The compressor and liquid line solenoid valve energize after the 45 second water purge and remain on throughout the entire Freeze and Harvest Sequences. The hot gas valve and HPR solenoid valves remain on for 5 seconds during initial compressor start-up and then shut off.

The remote condenser fan motor starts at the same time the compressor starts and remain on throughout the entire Freeze and Harvest Sequences. (The compressor and condenser fan motor are wired through the contactor, therefore, anytime the contactor coil is energized, the compressor and fan motor are on.)

FREEZE SEQUENCE

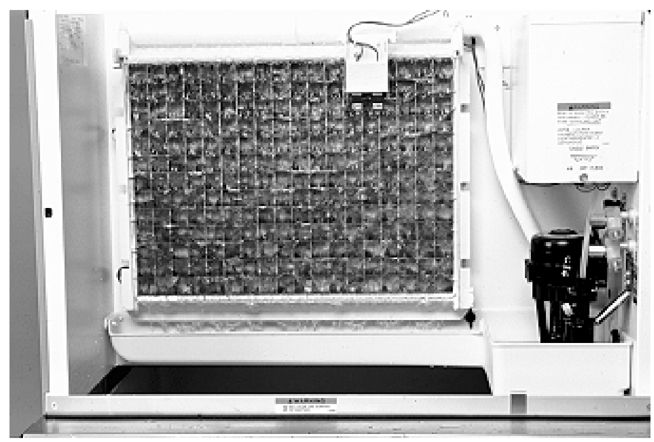
3. Prechill

The compressor is on for 30 seconds prior to water flow, to prechill the evaporator.

4. Freeze

The water pump restarts after the 30 second prechill. An even flow of water is directed across the evaporator and into each cube cell, where it freezes.

When sufficient ice has formed, the water flow (not the ice) contacts the ice thickness probe. After approximately 7 seconds of continual water contact, the harvest sequence is initiated. The ice machine cannot initiate a harvest sequence until a 6 minute freeze lock has been surpassed.



Freeze Sequence (Typical J450 Shown)

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HARVEST SEQUENCE

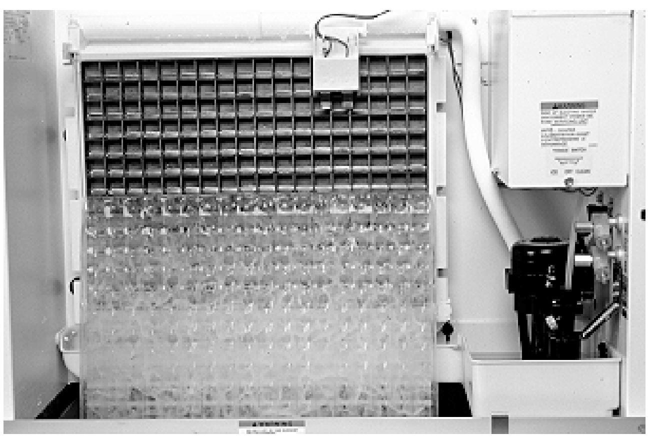
5. Water Purge

The water pump continues to run and the water dump valve energizes for 45 seconds, to purge the water in the sump trough. After the 45 second water purge, the water pump and dump valve de-energize. The hot gas valve(s) and HPR solenoid valve also open at the beginning of the water purge.

New style circuit boards have an adjustable water purge in the harvest cycle. This permits a 0 (off), 15, 30 or 45 second purge cycle.

6. Harvest

The HPR valve and the hot gas valve(s) remain open and the refrigerant gas warms the evaporator causing the cubes to slide, as a sheet, off the evaporator and into the storage bin. The sliding sheet of cubes swings the water curtain out, opening the bin switch. The momentary opening and re-closing of the bin switch terminates the harvest sequence and returns the ice machine to the freeze sequence (Step 3 - 4.)



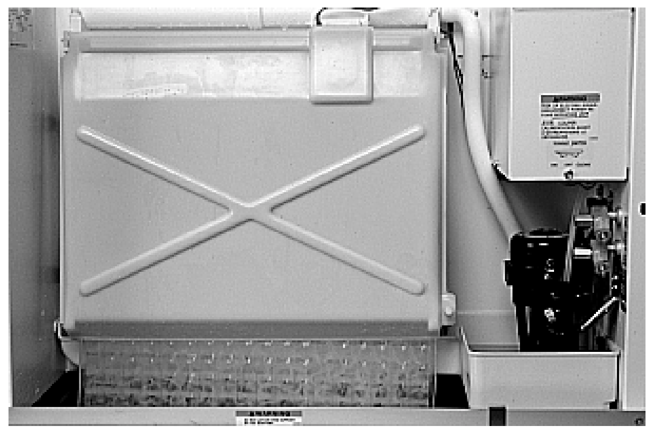
Harvest Sequence (Typical J450 Shown)

AUTOMATIC SHUT-OFF

7. Automatic Shut-Off

When the storage bin is full at the end of a harvest sequence, the sheet of cubes fails to clear the water curtain and will hold it open. After the water curtain is held open for 7 seconds, the ice machine shuts off. The ice machine remains off for 3 minutes before it can automatically restart.

The ice machine remains off until enough ice has been removed from the storage bin to allow the ice to drop clear of the water curtain. As the water curtain swings back to the operating position, the bin switch re-closes and the ice machine restarts (steps 1 - 2) provided the 3 minute delay period is complete.



Automatic Shut-Off (Typical J450 Shown)

Section 5

Water System Ice Making Sequence of Operation

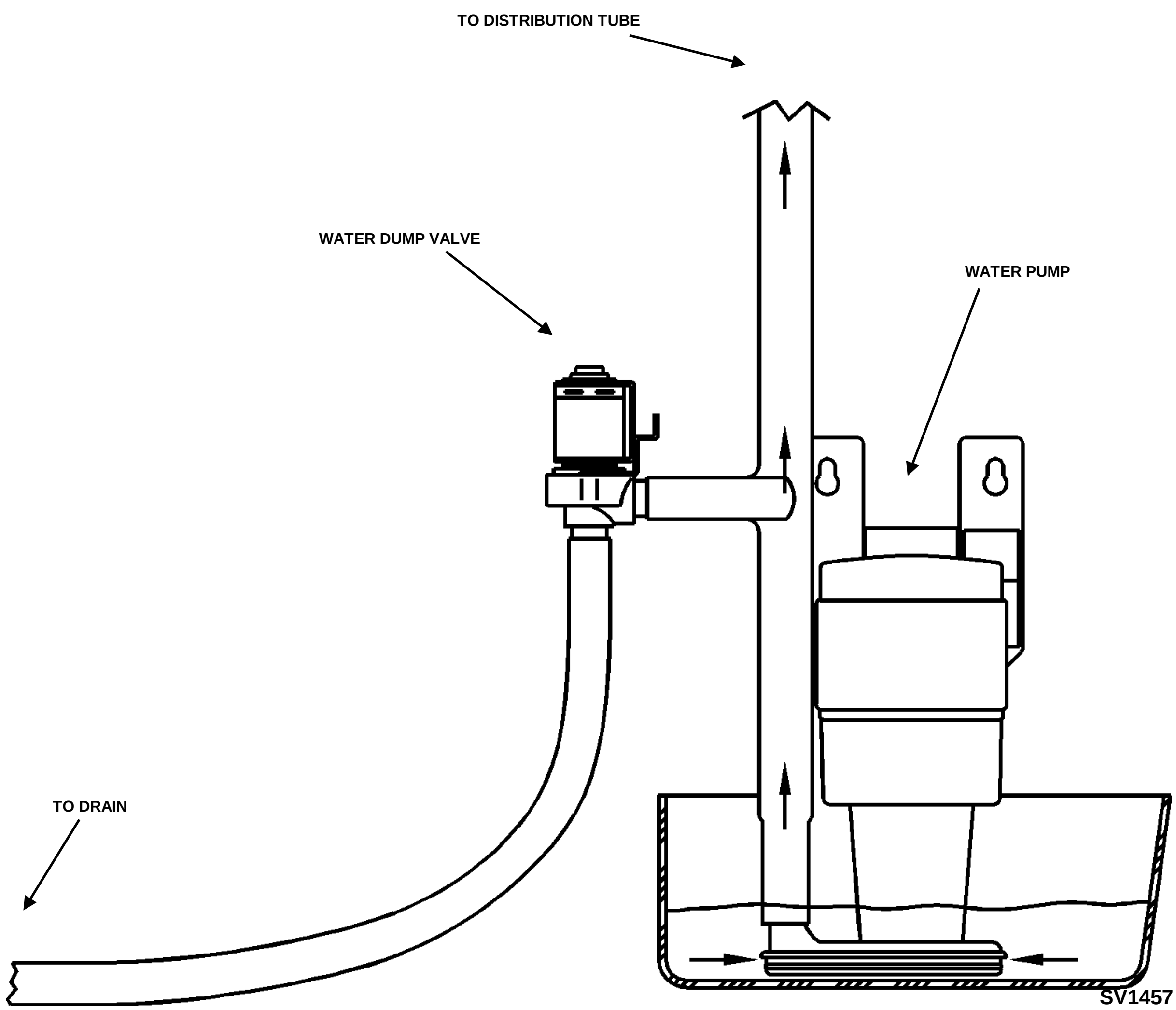
NOTE: The sequence of operation is the same for self-contained and remote models.

INITIAL START-UP OR START-UP AFTER AUTOMATIC SHUT-OFF

1. Before the ice machine starts, the water pump and water dump solenoid are energized for 45 seconds to purge old water from the water trough. This ensures that the ice-making cycle starts with fresh water.

FREEZE CYCLE

2. To pre-chill the evaporator, there is no water flow over the evaporator for the first 30 seconds of the freeze cycle.
3. The water pump starts after the 30-second pre-chill. An even flow of water is directed across the evaporator and into each cube cell.



Water Flow Over the Evaporator

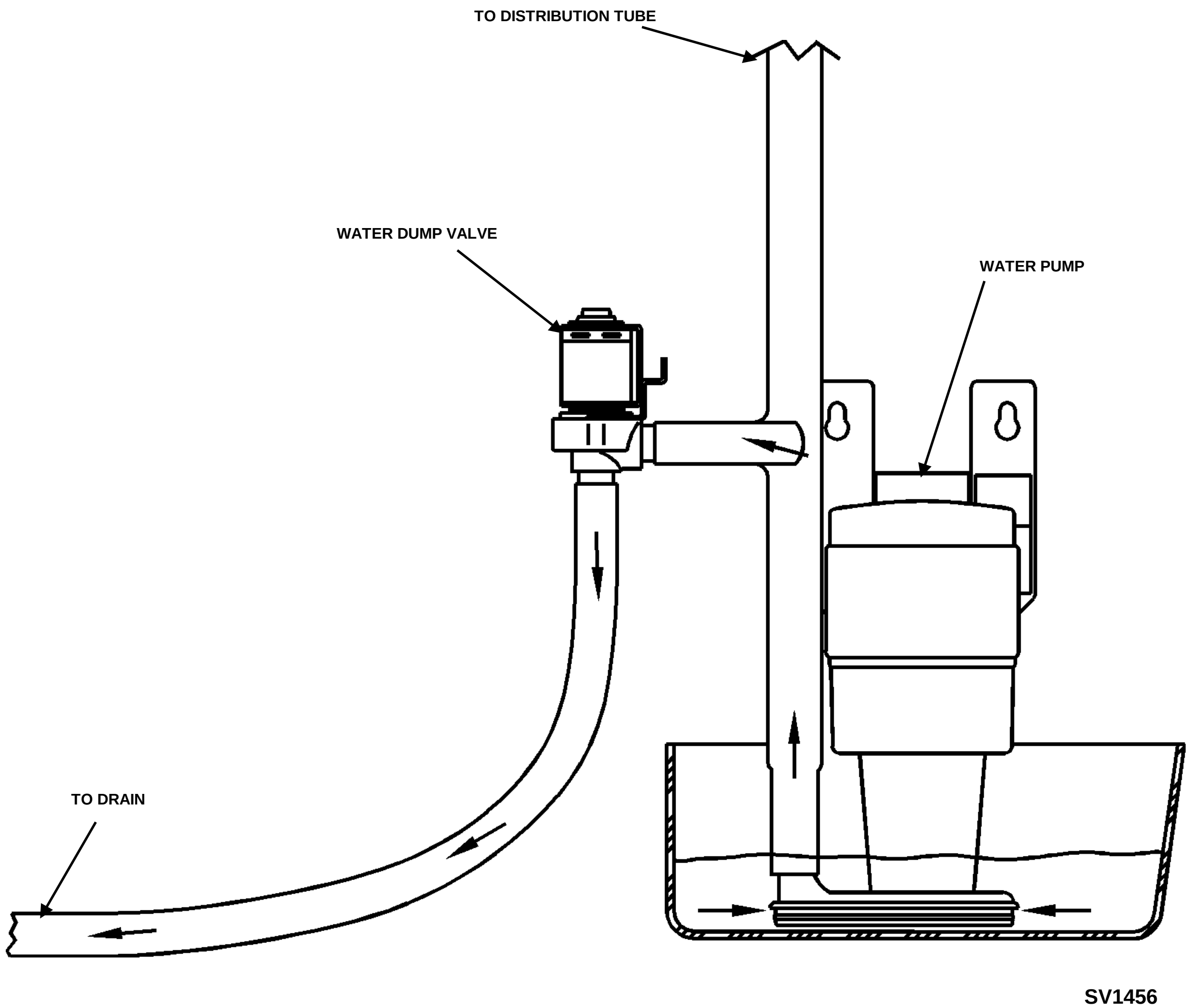
HARVEST CYCLE

4. The water pump and water dump solenoid are energized for 45 seconds to purge the water from the water trough.
5. After the 45-second purge, the water pump and water dump valve de-energize.

NOTE: New style control boards have an adjustable water purge in the harvest cycle. This permits a 0 (off), 15, 30 or 45 second purge cycle.

AUTOMATIC SHUT-OFF

There is no water flow during an automatic shut-off.



Water Flow Down the Drain

Section 6 Electrical System

Energized Parts Charts

SELF-CONTAINED AIR- AND WATER-COOLED MODELS

Ice Making Sequence Of Operation	Control Board Relays				Contactor		Length Of Time
	1	2	3	4	4A	4B	
	Water Pump	Hot Gas Valve	Water Dump Valve	Contactor Coil	Compressor	Condenser Fan Motor	
Start-Up[1] 1. Water Purge	On	On	On	Off	Off	Off	45 Seconds
2. Refrigeration System Start-Up	Off	On	Off	On	On	May Cycle On/Off	5 Seconds
Freeze Sequence 3. Pre-Chill	Off	Off	Off	On	On	May Cycle On/Off	30 Seconds
4. Freeze	On	Off	Off	On	On	May Cycle On/Off	Until 7 sec. water contact with ice thickness probe
Harvest Sequence 5. Water Purge	On	On	On	On	On	May Cycle On/Off	Factory-set at 45 Seconds
6. Harvest	Off	On	Off	On	On	May Cycle On/Off	Bin switch activation
7. **Automatic Shut-Off**	Off	Off	Off	Off	Off	Off	Until bin switch re-closes

[1]Initial Start-Up or Start-Up After Automatic Shut-Off

Condenser Fan Motor
The fan motor is wired through a fan cycle pressure control, therefore, it may cycle on and off.

Harvest Water Purge
New style circuit boards have an adjustable water purge in the havest cycle. This permits a 0 (off), 15, 30 or 45 second purge cycle.

Auto Shut-Off
The ice machine remains off for 3 minutes before it can automatically restart. The ice machine restarts (steps 1-2) immediately after the delay period, if the bin switch re-closes prior to 3 minutes.

Safety Timers
The control board has the following non-adjustable safety timers:

<u>FREEZE SEQUENCE</u>

- The ice machine is locked into the freeze cycle for the first 6 minutes, not allowing the ice thickness probe to initiate a harvest sequence.
- The maximum freeze time is 60 minutes, at which time the control board automatically initiates a harvest sequence (steps 5-6).

<u>HARVEST SEQUENCE</u>

- The maximum harvest time is 3-1/2 minutes, at which time the control board automatically terminates the harvest sequence. If the bin switch is open, the ice machine will go to automatic shut-off (step7). If the bin switch is closed, the ice machine will go to the freeze sequence (steps 3-4).

REMOTE MODELS

Ice Making Sequence Of Operation	Control Board Relays				Contactor		Length Of Time
	1	2	3	4	4A	4B	
	Water Pump	a. Hot Gas Valve b. HPR Solenoid	Water Dump Valve	a. Contactor Coil b. Liquid Line Solenoid	Compressor	Condenser Fan Motor	
Start-Up[1] **1. Water Purge**	On	On	On	Off	Off	Off	45 Seconds
2. Refrigeration System Start-Up	Off	On	Off	On	On	On	5 Seconds
Freeze Sequence **3. Pre-Chill**	Off	Off	Off	On	On	On	30 Seconds
4. Freeze	On	Off	Off	On	On	On	Until 7 sec. water contact with ice thickness probe
Harvest Sequence **5. Water Purge**	On	On	On	On	On	On	Factory-set at 45 Seconds
6. Harvest	Off	On	Off	On	On	On	Bin switch activation
7. Automatic Shut-Off	Off	Off	Off	Off	Off	Off	Until bin switch re-closes

[1]Initial Start-Up or Start-Up After Automatic Shut-Off

Auto Shut-Off
The ice machine remains off for 3 minutes before it can automatically restart. The ice machine restarts (steps 1-2) immediately after the delay period, if the bin switch re-closes prior to 3 minutes.

Harvest Water Purge
New style circuit boards have an adjustable water purge in the havest cycle. This permits a 0 (off), 15, 30 or 45 second purge cycle.

Safety Timers
The control board has the following non-adjustable safety timers:

<u>FREEZE SEQUENCE</u>

- The ice machine is locked into the freeze cycle for the first 6 minutes, not allowing the ice thickness probe to initiate a harvest sequence.
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<u>HARVEST SEQUENCE</u>

- The maximum harvest time is 3-1/2 minutes, at which time the control board automatically terminates the harvest sequence. If the bin switch is open, the ice machine will go to automatic shut-off (step7). If the bin switch is closed, the ice machine will go to the freeze sequence (steps 3-4).

Wiring Diagram Sequence of Operation

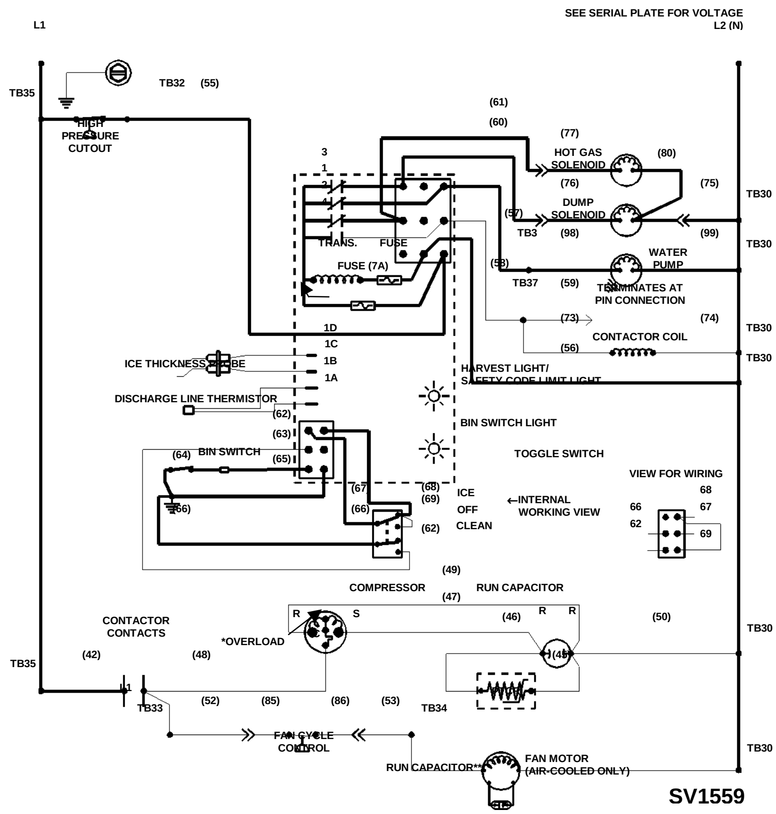
SELF-CONTAINED MODELS

Initial Start-Up or Start-Up After Automatic Shut-Off

1. WATER PURGE

Before the compressor starts, the water pump and water dump solenoid are energized for 45 seconds to purge old water from the ice machine. This ensures that the ice-making cycle starts with fresh water.

The hot gas valve(s) is also energized during the water purge. In the case of an initial refrigeration start-up, it stays on for an additional 5 seconds (50 seconds total).



(Old Style Control Board Shown)

Self-Contained Models

1. Water Purge (45 Seconds)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Closed
Water Pump	ON
#2	Closed
Hot Gas Solenoid	ON
#3	Closed
Water Dump Valve	ON
#4	Open
Contactor Coil	OFF
Compressor	OFF
Condenser Fan Motor	OFF
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

Initial Start-Up Or Start-Up After Automatic Shut-Off (cont.)

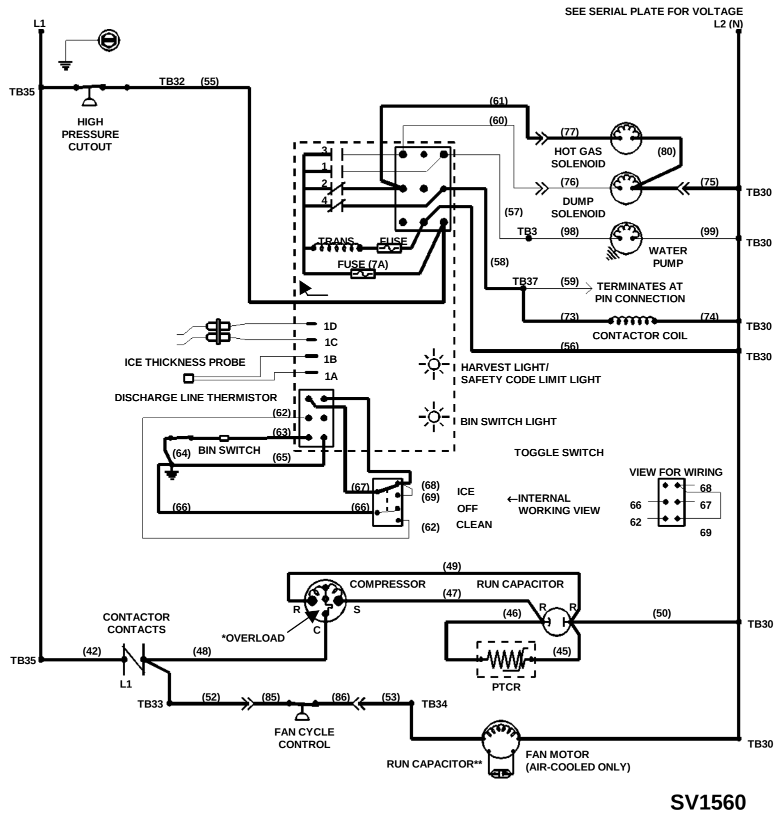
2. REFRIGERATION SYSTEM START-UP

The compressor starts after the 45-second water purge, and it remains on throughout the Freeze and Harvest cycles.

The hot gas valve(s) remains on for the first 5 seconds of the initial compressor start-up.

At the same time the compressor starts, the condenser fan motor (air-cooled models) is supplied with power. It continues to be supplied with power throughout the Freeze and Harvest cycles.

The fan motor is wired through a fan cycle pressure control, and may cycle on and off. (The compressor and the condenser fan motor are wired through the contactor. Any time the contactor coil is energized, these components are supplied with power.)



(Old Style Control Board Shown)

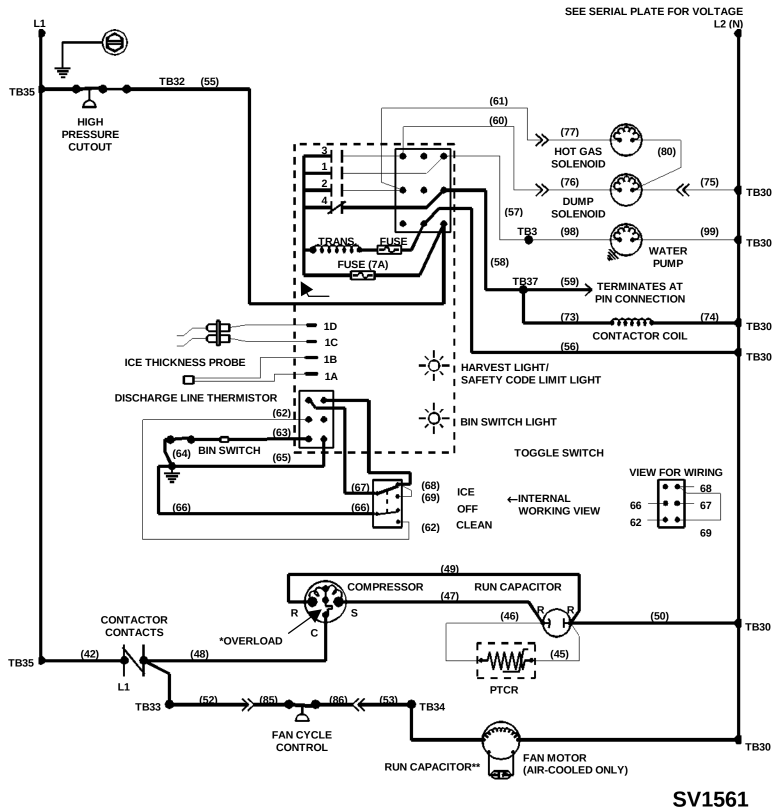
Self-Contained Models

2. Refrigeration System Start-Up (5 Seconds)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Open
Water Pump	OFF
#2	Closed
Hot Gas Solenoid	ON
#3	Open
Water Dump Valve	OFF
#4	Closed
Contactor Coil	ON
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

Freeze Sequence

3. PRE-CHILL

To pre-chill the evaporator, the compressor runs for 30 seconds prior to water flow.



(Old Style Control Board Shown)

Self-Contained Models

3. Pre-Chill (30 Seconds)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Open
Water Pump	OFF
#2	Open
Hot Gas Solenoid	OFF
#3	Open
Water Dump Valve	OFF
#4	Closed
Contactor Coil	ON
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

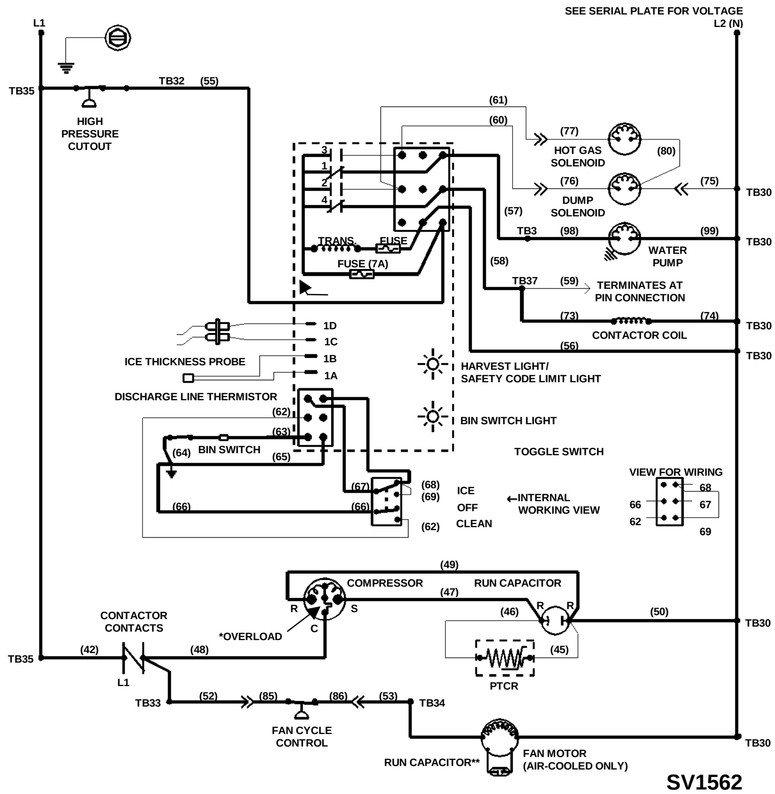
Freeze Sequence (cont.)

4. FREEZE

The water pump starts after the 30-second pre-chill. An even flow of water is directed across the evaporator and into each cube cell, where it freezes.

When sufficient ice has formed, the water flow (not the ice) contacts the ice thickness probes. After approximately 7 seconds of continual contact, a harvest cycle is initiated.

NOTE: The ice machine cannot initiate a harvest cycle until a 6-minute freeze lock has expired.



(Old Style Control Board Shown)

Self-Contained Models

4. Freeze (Until 7 Seconds of Water Contact with Ice Thickness Probe)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Closed
Water Pump	ON
#2	Open
Hot Gas Solenoid	OFF
#3	Open
Water Dump Valve	OFF
#4	Closed
Contactor Coil	ON
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

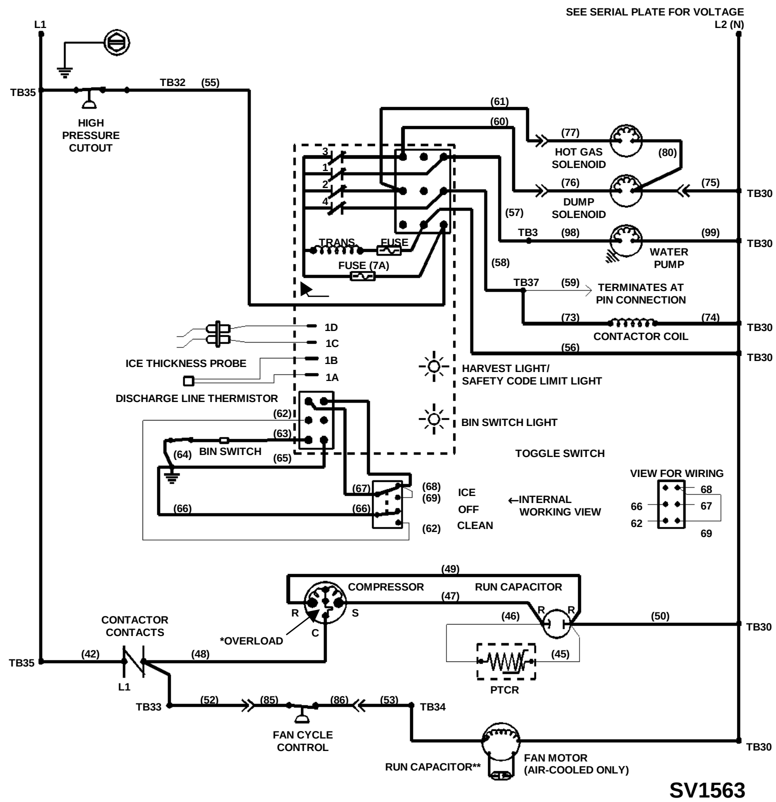
Harvest Sequence

5. WATER PURGE

The water pump continues to run as the water dump valve energizes for 45 seconds to purge the water from the water trough.

The hot gas valve(s) opens at the beginning of the water purge. Hot refrigerant gas is diverted into the evaporator throughout the 45-second water purge.

After the 45-second water purge, the water pump and dump valve de-energize. New style control boards have an adjustable water purge. This permits a 0 (off), 15, 30 or 45 second water purge.



(Old Style Control Board Shown)

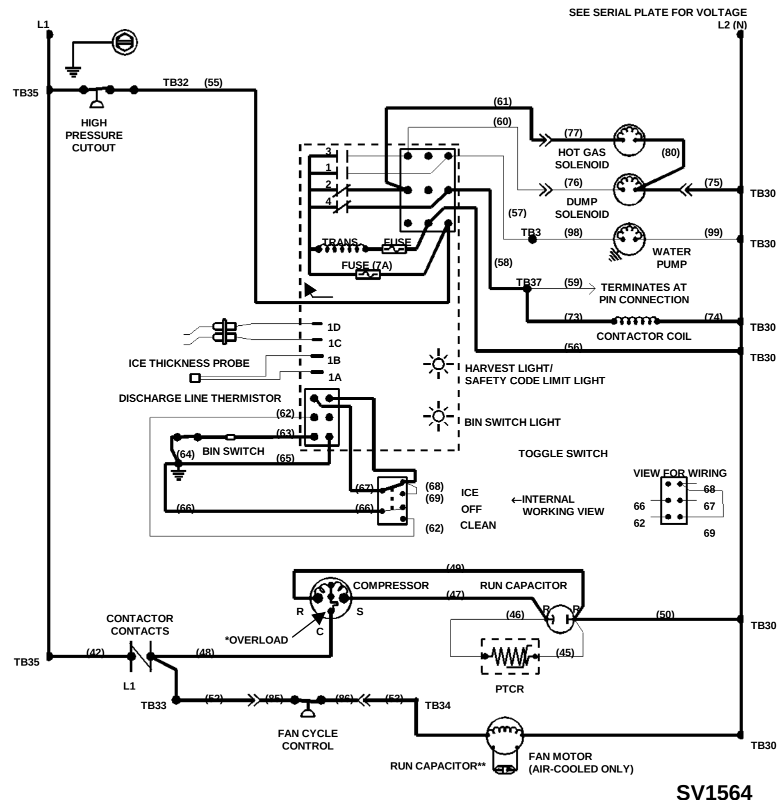
Self-Contained Models

5. Water Purge (45 Seconds)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Closed
Water Pump	ON
#2	Closed
Hot Gas Solenoid	ON
#3	Closed
Water Dump Valve	ON
#4	Closed
Contactor Coil	ON
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

Harvest Sequence (cont.)

6. HARVEST
The hot gas valve(s) remains open, allowing refrigerant gas to warm the evaporator. This causes the cubes to slide, as a sheet, off the evaporator and into the storage bin.

The sliding sheet of cubes swings the water curtain out, opening the bin switch. This momentary opening and closing of the bin switch terminates the Harvest Cycle and returns the ice machine to the Freeze Cycle (steps 3-4).



(Old Style Control Board Shown)

Self-Contained Models

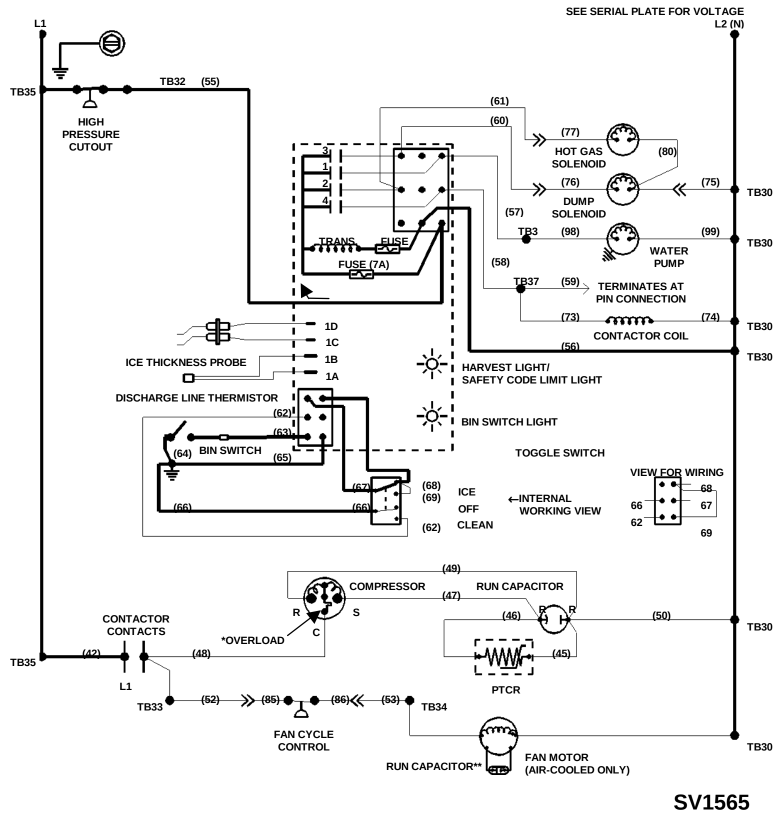
6. Harvest (Until Bin Switch Activation)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Open
Water Pump	OFF
#2	Closed
Hot Gas Solenoid	ON
#3	Open
Water Dump Valve	OFF
#4	Closed
Contactor Coil	ON
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

7. Automatic Shut-Off

If the storage bin is full at the end of a harvest cycle, the sheet of cubes fails to clear the water curtain and holds it open. After the water curtain is held open for 7 seconds, the ice machine shuts off.

The ice machine remains off until enough ice is removed from the storage bin to allow the sheet of cubes to drop clear of the water curtain. As the water curtain swings back to the operating position, the bin switch closes and the ice machine restarts (steps 1-2).

NOTE: The ice machine must remain off for 3 minutes before it can automatically restart.



(Old Style Control Board Shown)

Self-Contained Models

7. Automatic Shut-Off (Until Bin Switch Closes)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Open
Water Pump	OFF
#2	Open
Hot Gas Solenoid	OFF
#3	Open
Water Dump Valve	OFF
#4	Open
Contactor Coil	OFF
Compressor	OFF
Condenser Fan Motor	OFF
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

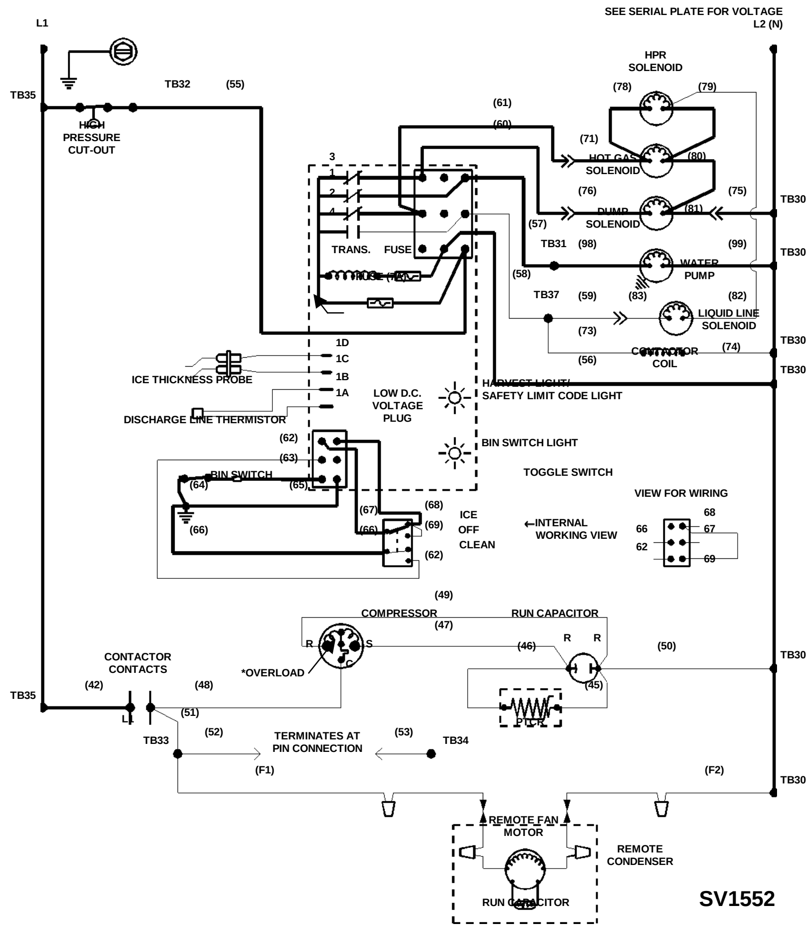
REMOTE MODELS

Initial Start-Up Or Start-Up After Automatic Shut-Off

1. WATER PURGE

Before the compressor starts, the water pump and water dump solenoid are energized for 45 seconds to purge old water from the ice machine. This ensures that the ice-making cycle starts with fresh water.

The hot gas valve and harvest pressure regulating (HPR) solenoid valve are also energized during the water purge. In the case of an initial refrigeration start-up, they stay on for an additional 5 seconds (50 seconds total).



(Old Style Control Board Shown)

Remote Models

1. Water Purge (45 Seconds)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Closed
Water Pump	ON
#2	Closed
Hot Gas Solenoid	ON
Harvest Pressure Regulating (HPR) Solenoid	ON
#3	Closed
Water Dump Valve	ON
#4	Open
Contactor Coil	OFF
Liquid Line Solenoid	De-Energized
Compressor	OFF
Condenser Fan Motor	OFF
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

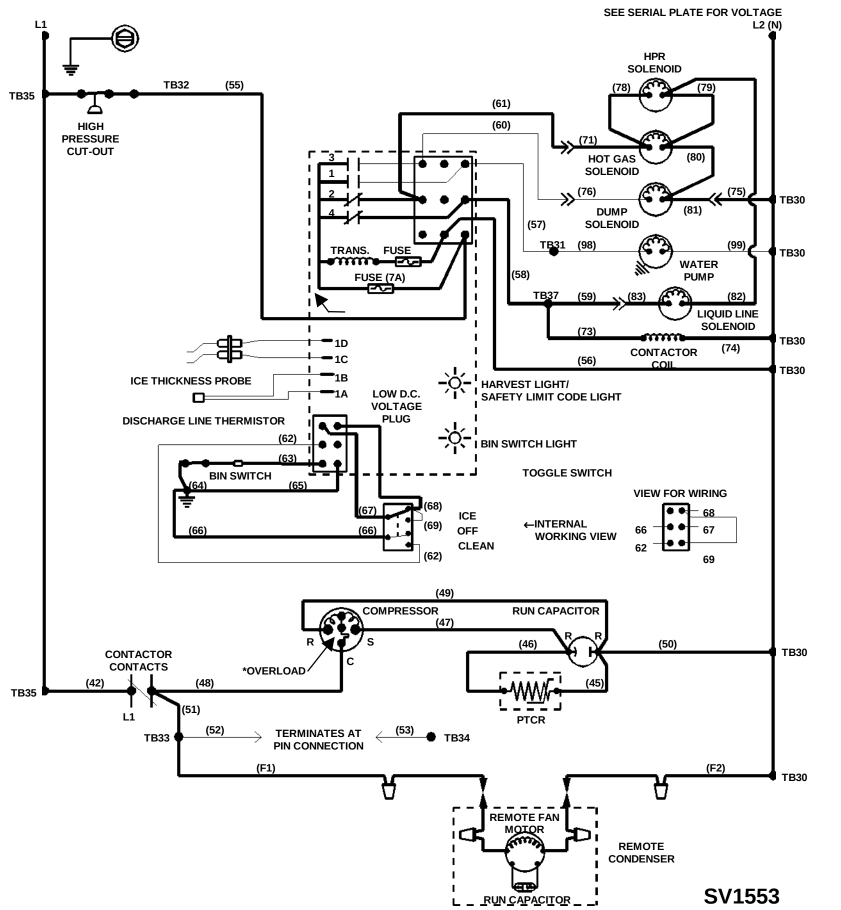
Initial Start-Up Or Start-Up After Automatic Shut-Off (cont.)

2. REFRIGERATION SYSTEM START-UP

The compressor, remote condenser fan motor and liquid line solenoid valve energize after the 45-second water purge, and remain on throughout the Freeze and Harvest cycles.

The hot gas valve and harvest pressure regulating (HPR) solenoid valve remain on for the first 5 seconds of the initial compressor start-up.

(The compressor and the condenser fan motor are wired through the contactor. Any time the contactor coil is energized, these components are supplied with power.)



(Old Style Control Board Shown)

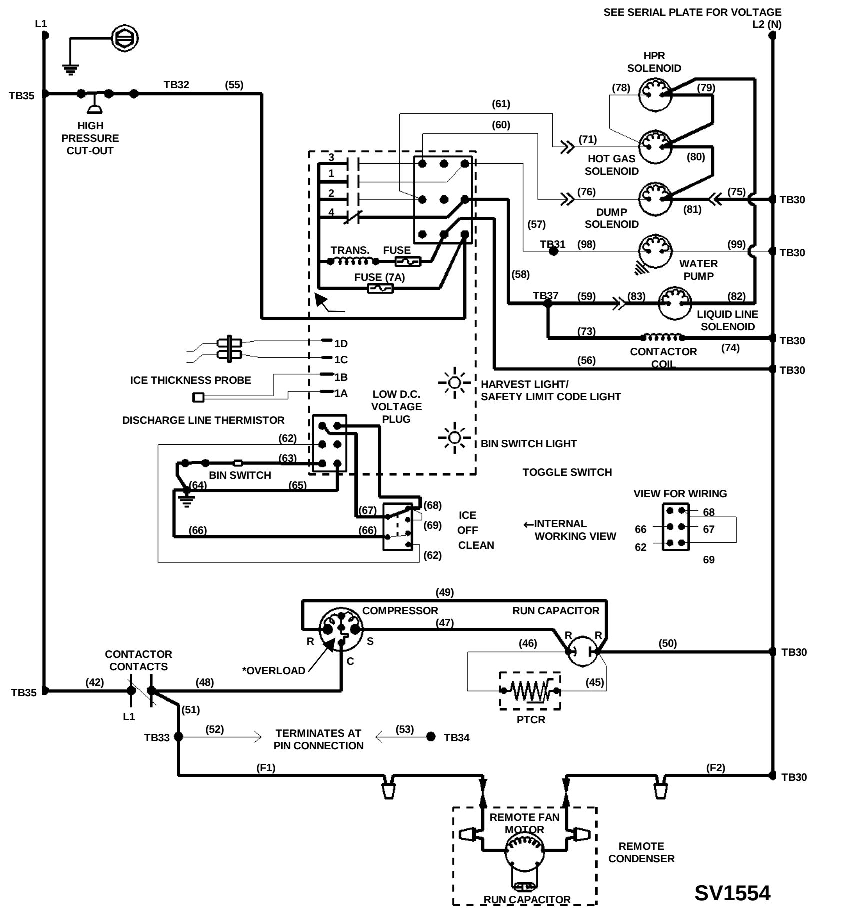
Remote Models

2. Refrigeration System Start-Up (5 Seconds)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Open
Water Pump	OFF
#2	Closed
Hot Gas Solenoid	ON
Harvest Pressure Regulating (HPR) Solenoid	ON
#3	Open
Water Dump Valve	OFF
#4	Closed
Contactor Coil	ON
Liquid Line Solenoid	Energized
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

Freeze Sequence

3. PRE-CHILL

To pre-chill the evaporator, the compressor runs for 30 seconds prior to water flow.



(Old Style Control Board Shown)

Remote Models

3. Pre-Chill (30 Seconds)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Open
Water Pump	OFF
#2	Open
Hot Gas Solenoid	OFF
Harvest Pressure Regulating (HPR) Solenoid	OFF
#3	Open
Water Dump Valve	OFF
#4	Closed
Contactor Coil	ON
Liquid Line Solenoid	Energized
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

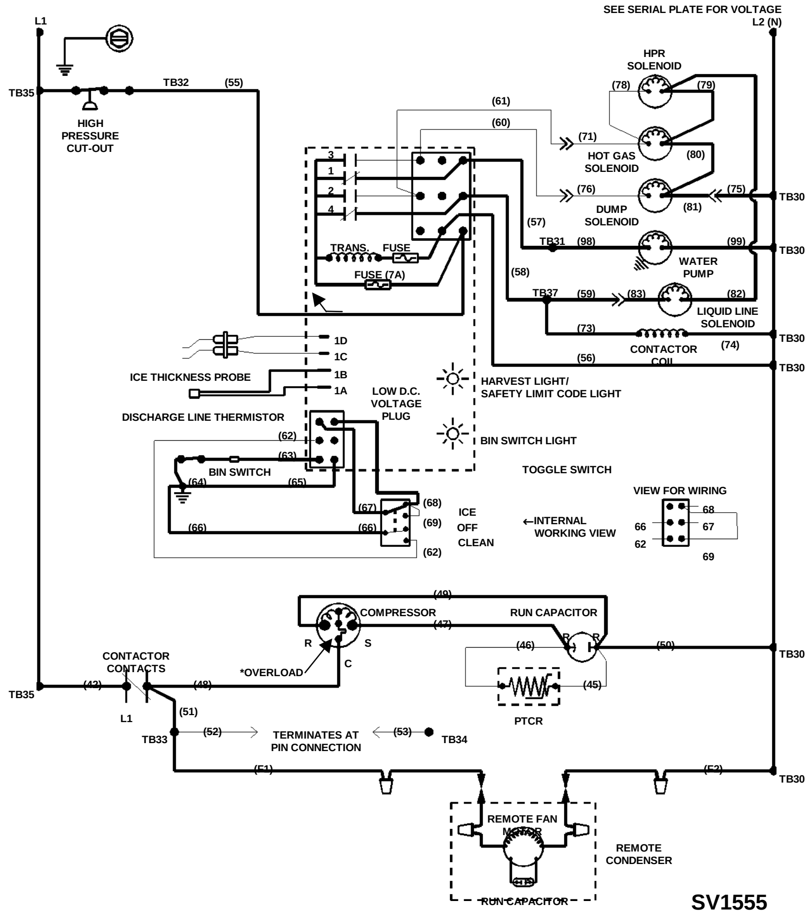
Freeze Sequence (cont.)

4. FREEZE

The water pump starts after the 30-second pre-chill. An even flow of water is directed across the evaporator and into each cube cell, where it freezes.

When sufficient ice has formed, the water flow (not the ice) contacts the ice thickness probes. After approximately 7 seconds of continual contact, a harvest cycle is initiated.

NOTE: The ice machine cannot initiate a harvest cycle until a 6-minute freeze lock has expired.



(Old Style Control Board Shown)

Remote Models

4. Freeze (Until 7 Seconds of Water Contact with Ice Thickness Probe)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Closed
Water Pump	ON
#2	Open
Hot Gas Solenoid	OFF
Harvest Pressure Regulating (HPR) Solenoid	OFF
#3	Open
Water Dump Valve	OFF
#4	Closed
Contactor Coil	ON
Liquid Line Solenoid	Energized
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

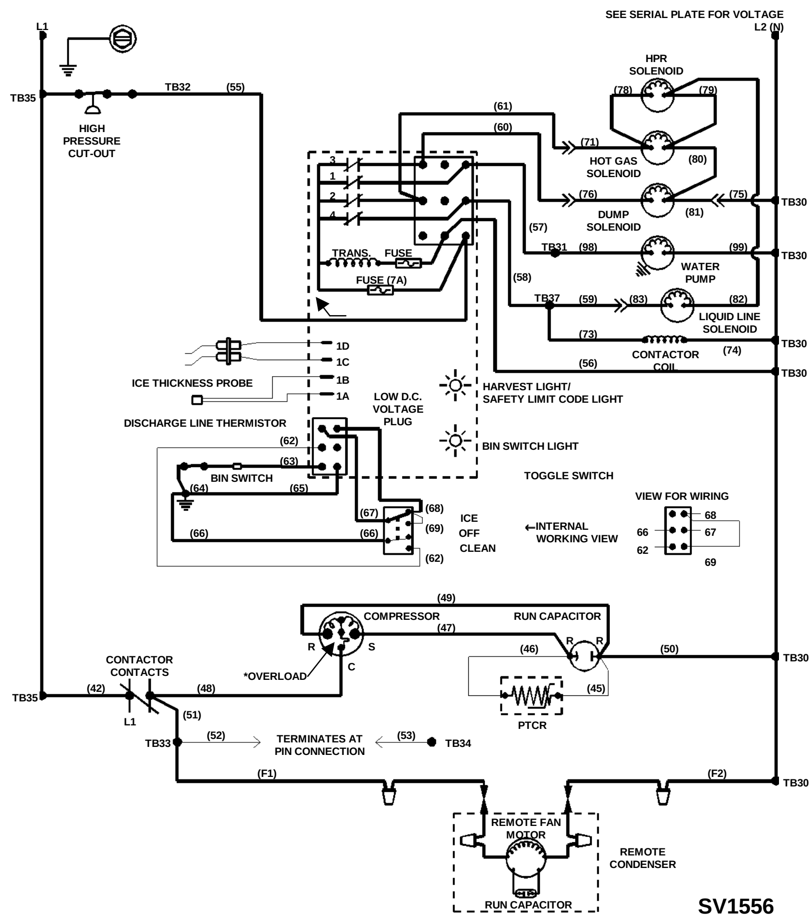
Harvest Sequence

5. WATER PURGE

The water pump continues to run as the water dump valve energizes for 45 seconds to purge the water from the water trough.

The hot gas valve(s) and HPR solenoid valve open at the beginning of the water purge. Hot refrigerant gas is diverted into the evaporator throughout the 45-second water purge.

After the 45-second water purge, the water pump and dump valve de-energize. New style control boards have an adjustable water purge. This permits a 0 (off), 15, 30 or 45 second water purge.



(Old Style Control Board Shown)

Remote Models

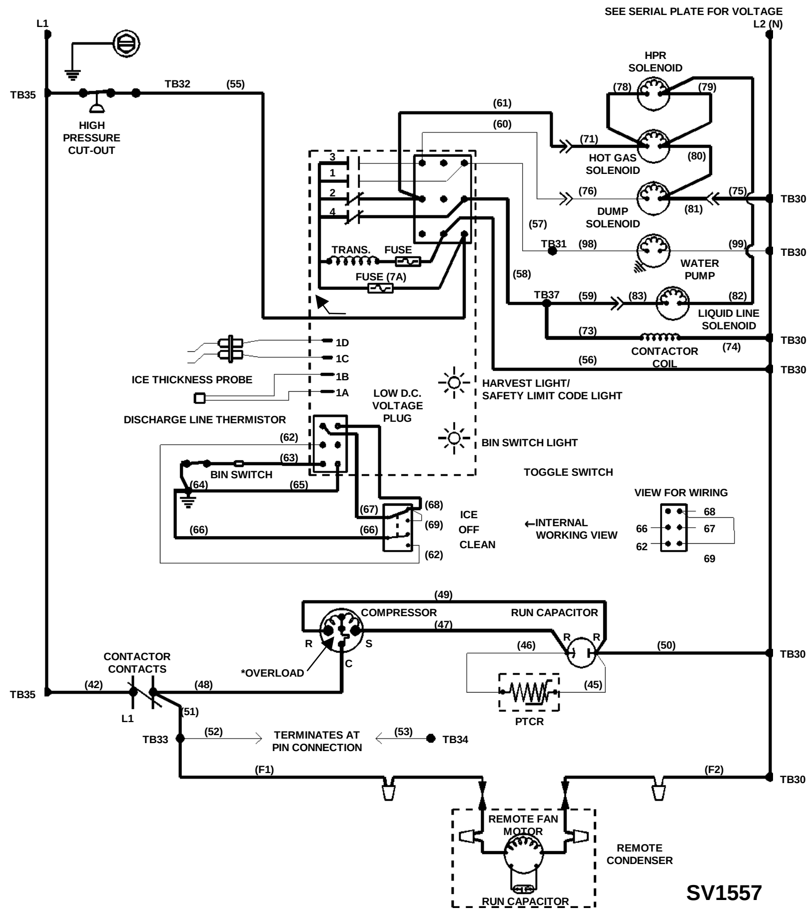
5. Water Purge (45 Seconds)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Closed
Water Pump	ON
#2	Closed
Hot Gas Solenoid	ON
Harvest Pressure Regulating (HPR) Solenoid	ON
#3	Closed
Water Dump Valve	ON
#4	Closed
Contactor Coil	ON
Liquid Line Solenoid	Energized
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

Harvest Sequence (cont.)

6. HARVEST

The hot gas valve(s) and HPR solenoid valve remain open, allowing refrigerant gas to warm the evaporator. This causes the cubes to slide, as a sheet, off the evaporator and into the storage bin.

The sliding sheet of cubes swings the water curtain out, opening the bin switch. This momentary opening and closing of the bin switch terminates the Harvest Cycle and returns the ice machine to the Freeze Cycle (steps 3-4).



(Old Style Control Board Shown)

Remote Models

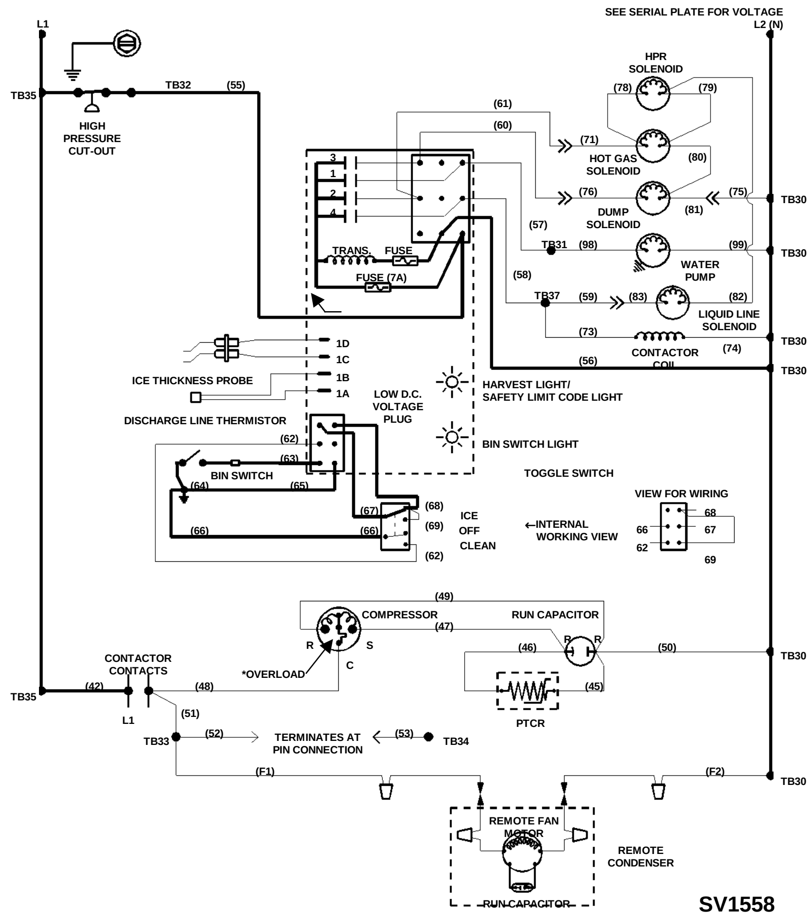
6. Harvest (Until Bin Switch Activation)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Open
Water Pump	OFF
#2	Closed
Hot Gas Solenoid	ON
Harvest Pressure Regulating (HPR) Solenoid	ON
#3	Open
Water Dump Valve	OFF
#4	Closed
Contactor Coil	ON
Liquid Line Solenoid	Energized
Compressor	ON
Condenser Fan Motor	ON
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

7. Automatic Shut-Off

If the storage bin is full at the end of a harvest cycle, the sheet of cubes fails to clear the water curtain and holds it open. After the water curtain is held open for 7 seconds, the ice machine shuts off.

The ice machine remains off until enough ice is removed from the storage bin to allow the sheet of cubes to drop clear of the water curtain. As the water curtain swings back to the operating position, the bin switch closes and the ice machine restarts.

NOTE: The ice machine must remain off for 3 minutes before it can automatically restart.



(Old Style Control Board Shown)

Remote Models

7. Automatic Shut-Off (Until Bin Switch Closes)	
Toggle Switch	ICE
Bin Switch	Closed
Control Board Relays	
#1	Open
Water Pump	OFF
#2	Open
Hot Gas Solenoid	OFF
Harvest Pressure Regulating (HPR) Solenoid	OFF
#3	Open
Water Dump Valve	OFF
#4	Open
Contactor Coil	OFF
Liquid Line Solenoid	De-Energized
Compressor	OFF
Condenser Fan Motor	OFF
Safety Controls (Which could stop ice machine operation)	
High Pressure Cut-Out	Closed
Main Fuse (On Control Board)	Closed
Transformer Fuse (On Control Board)	Closed
Thermistor Operation	OK

Wiring Diagrams

The following pages contain electrical wiring diagrams. Be sure you are referring to the correct diagram for the ice machine which you are servicing.

WARNING
Always disconnect power before working on electrical circuitry.

WIRING DIAGRAM LEGEND

The following symbols are used on all of the wiring diagrams:

***** Internal Compressor Overload
(Some models have external compressor overloads)

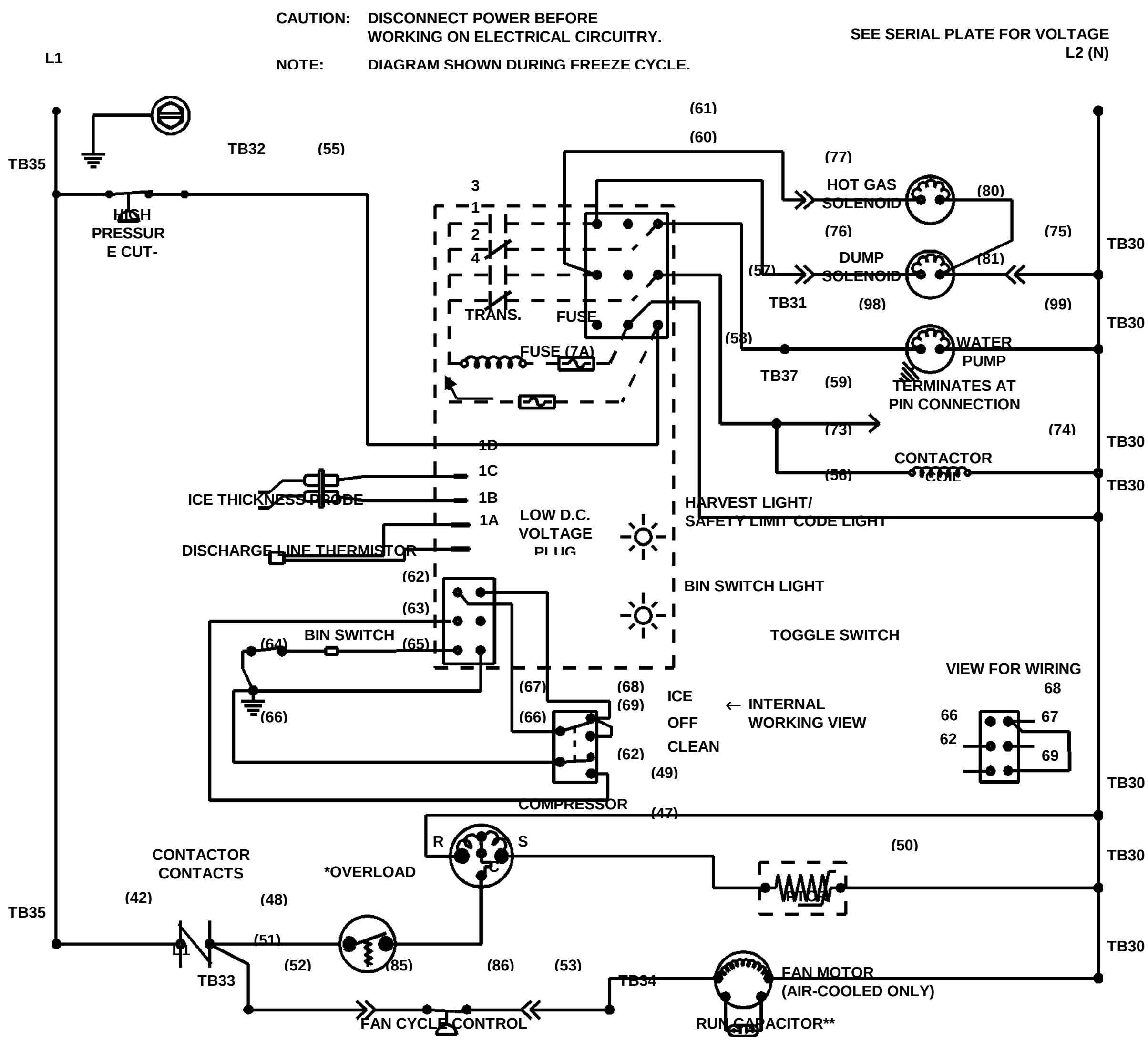
****** Fan Motor Run Capacitor
(Some models do not incorporate fan motor run capacitor)

TB Terminal Board Connection
(Terminal board numbers are printed on the actual terminal board)

( ) Wire Number Designation
(The number is marked at each end of the wire)

—>>— Multi-Pin Connection
(Electrical Box Side) —>>— (Compressor Compartment Side)

OLD STYLE SELF-CONTAINED - *J200/J250/J320 - 1 PHASE*



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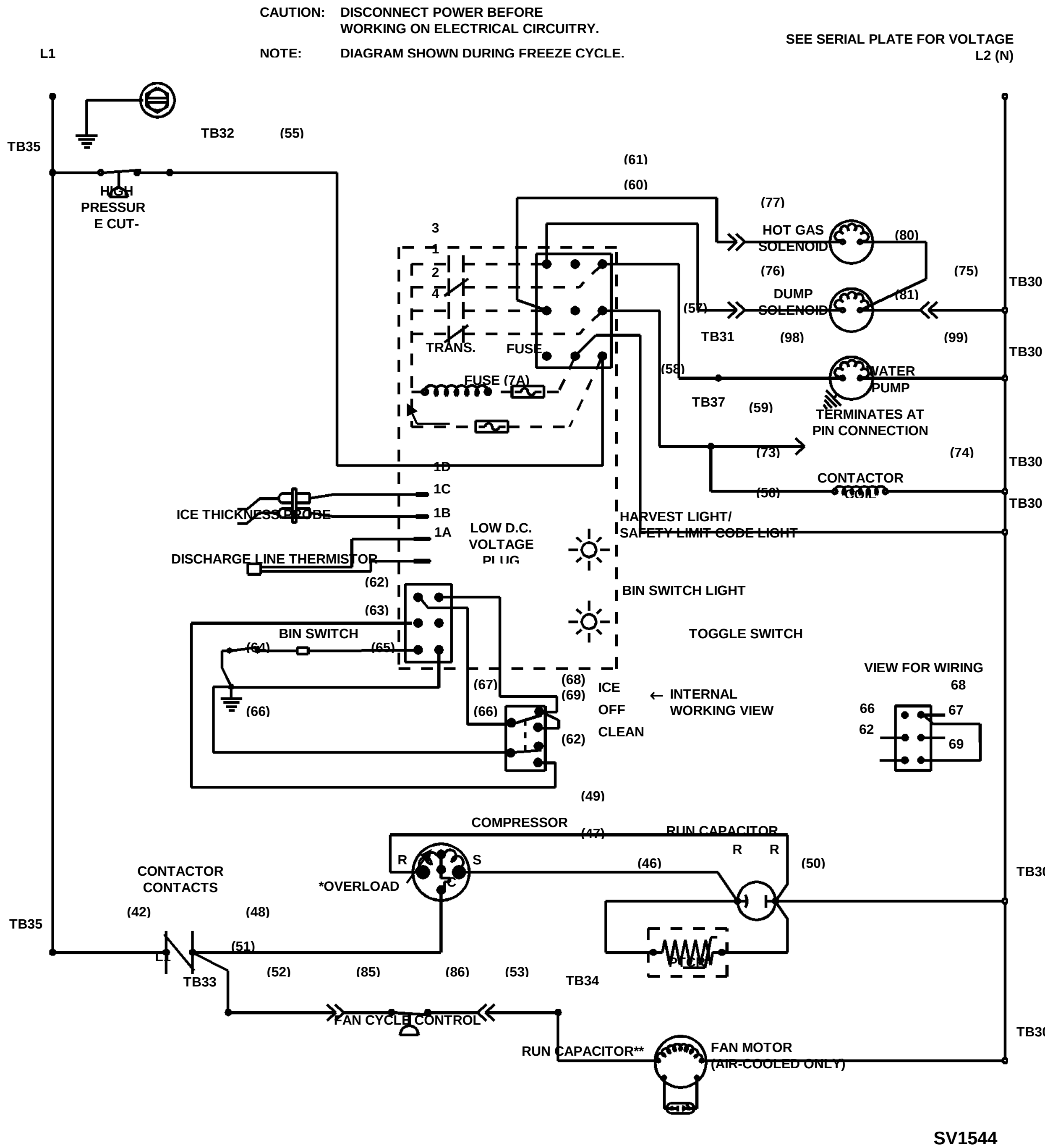
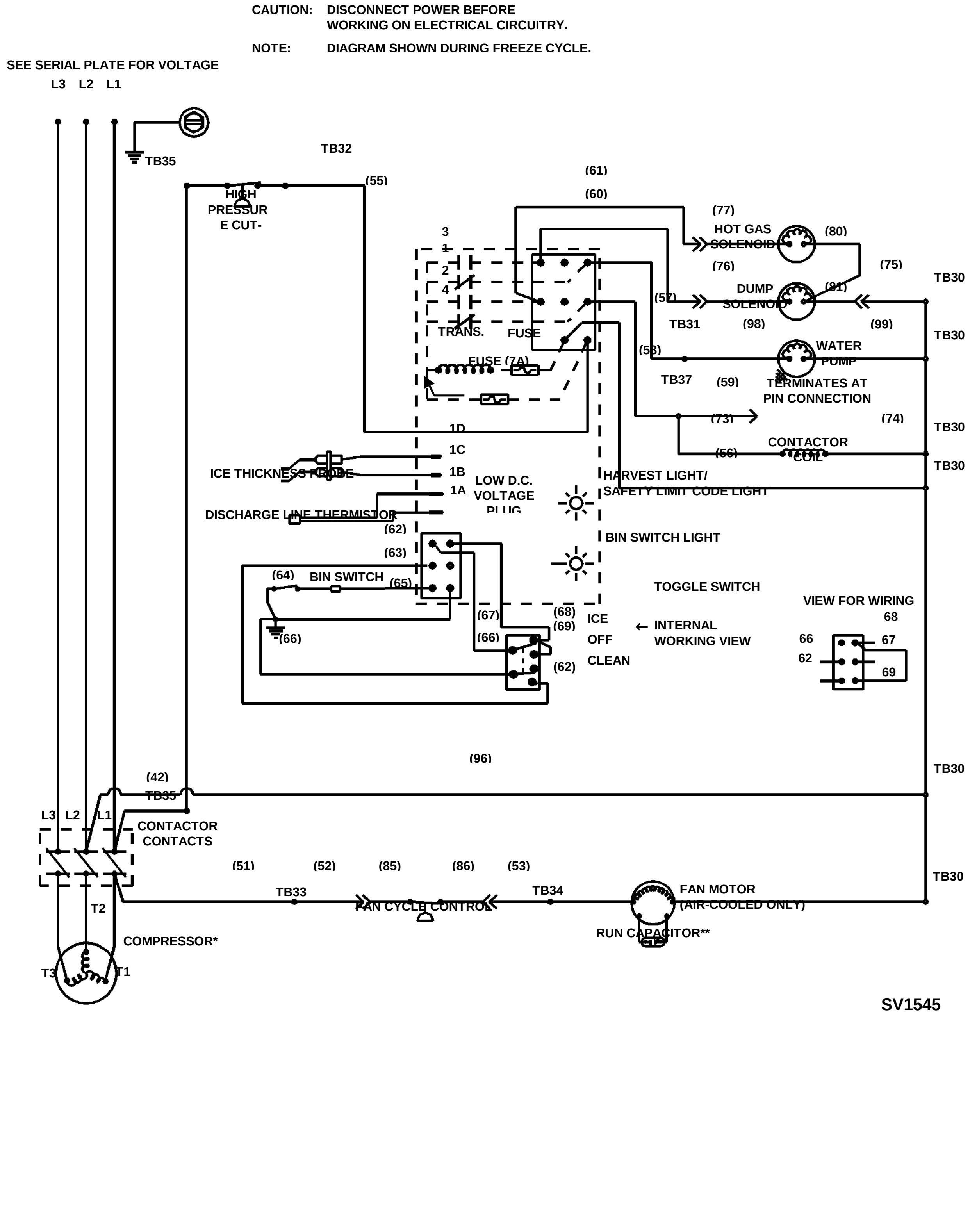
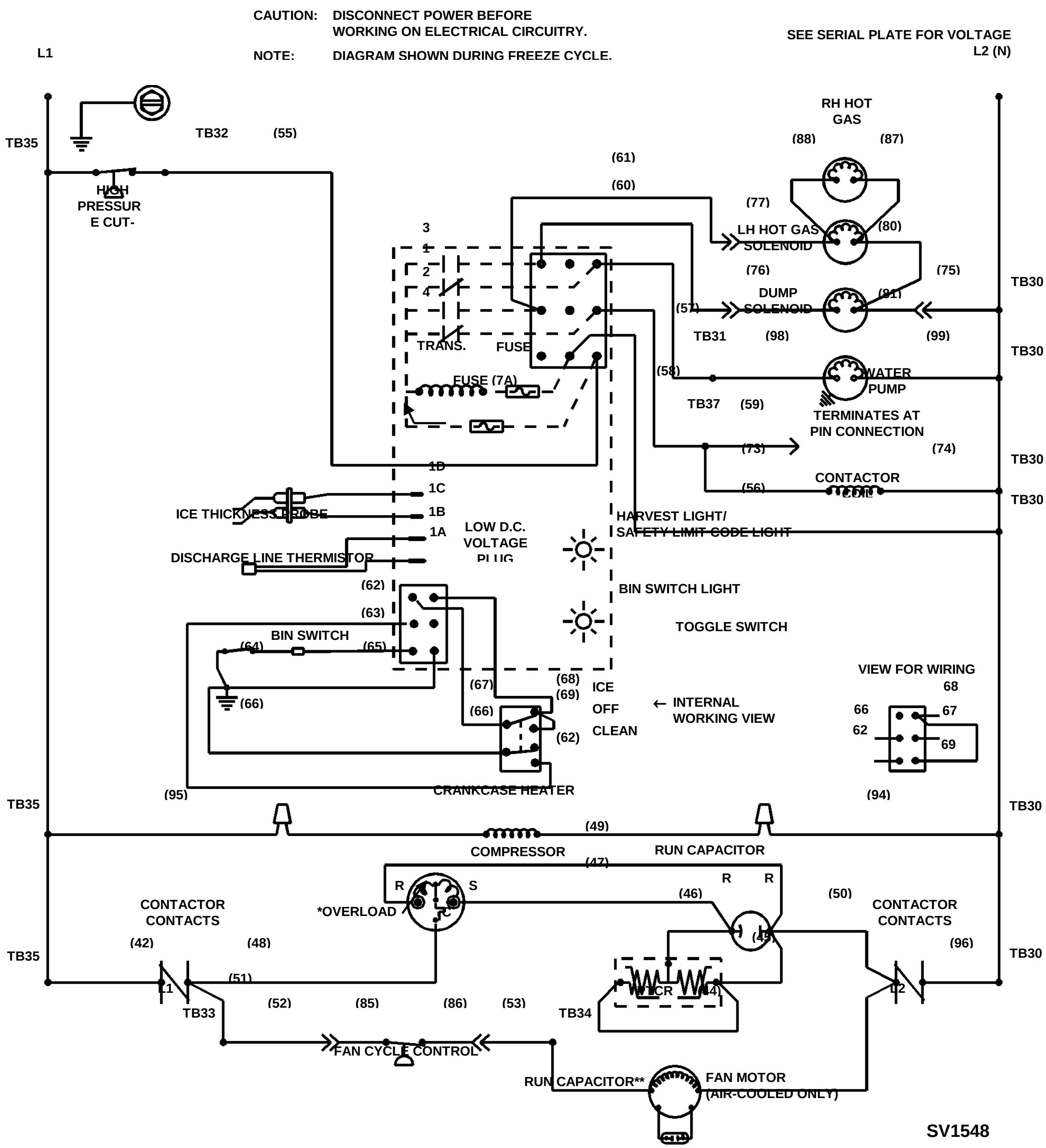
*OLD STYLE SELF-CONTAINED - **J420/J450/J600/J800/J1000 - 1 PHASE***



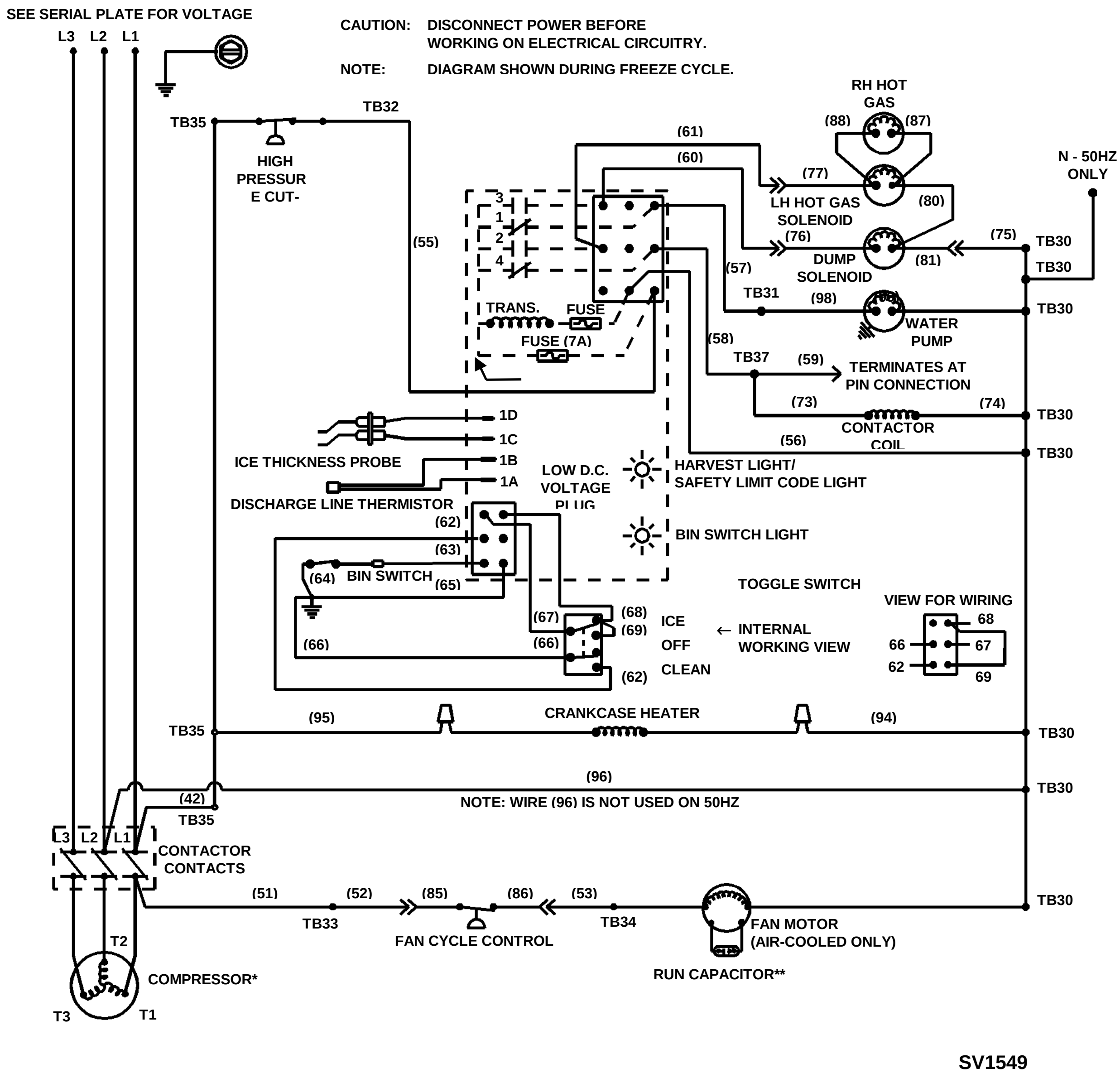
OLD STYLE SELF-CONTAINED - J800/J1000 - 3 PHASE



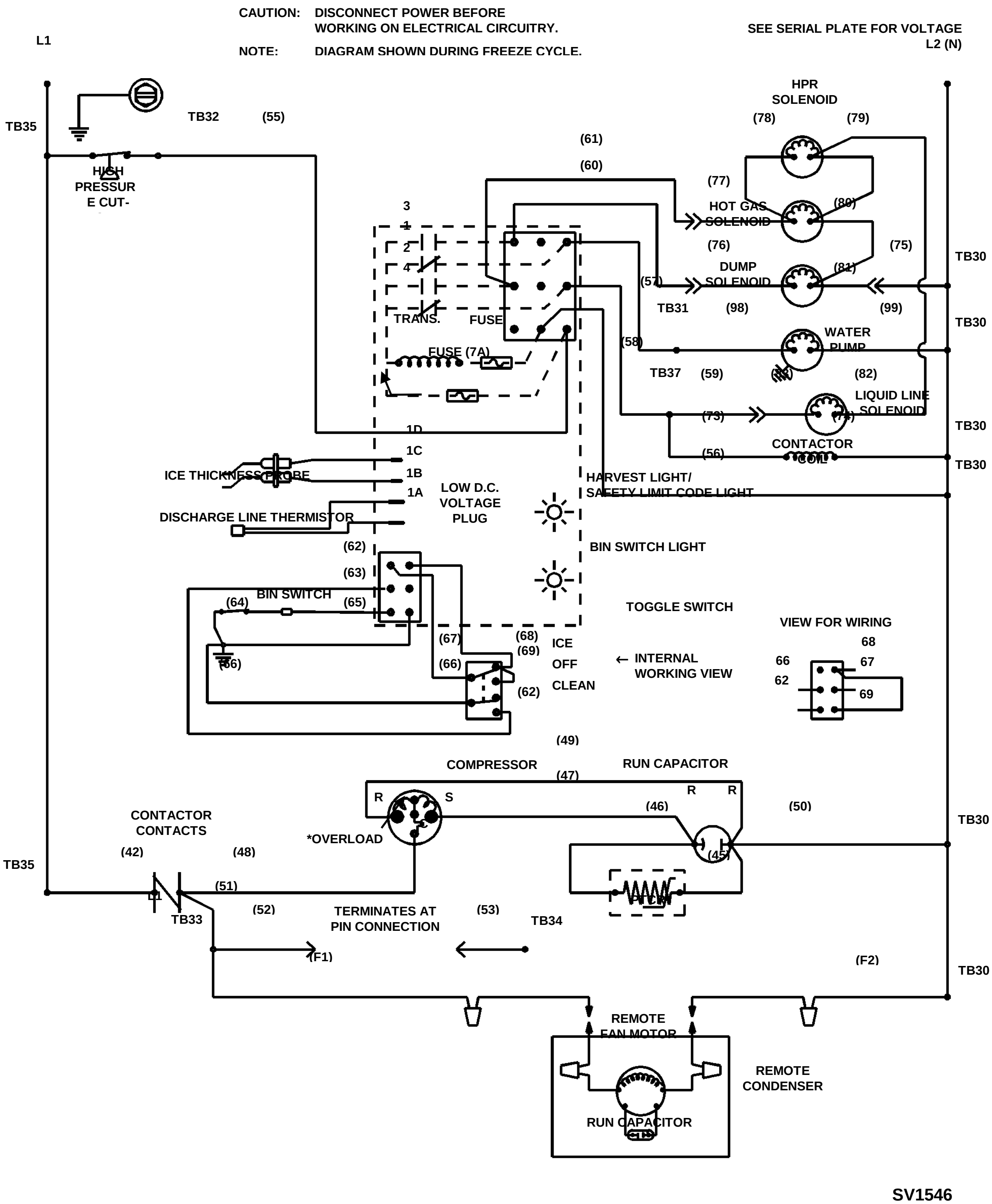
OLD STYLE SELF-CONTAINED - J1300/J1800 - 1 PHASE



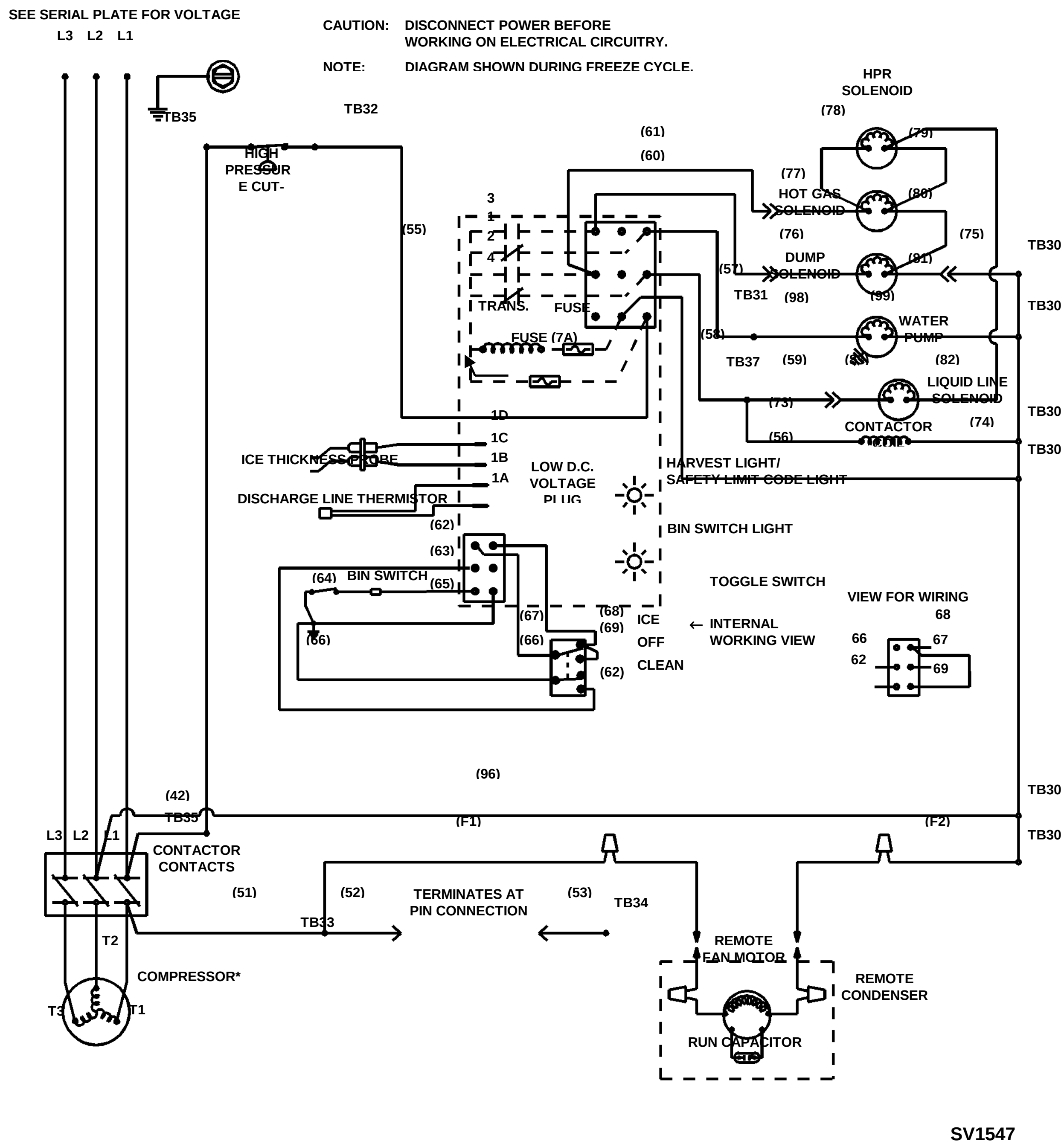
OLD STYLE SELF-CONTAINED - J1300/J1800 - 3 PHASE



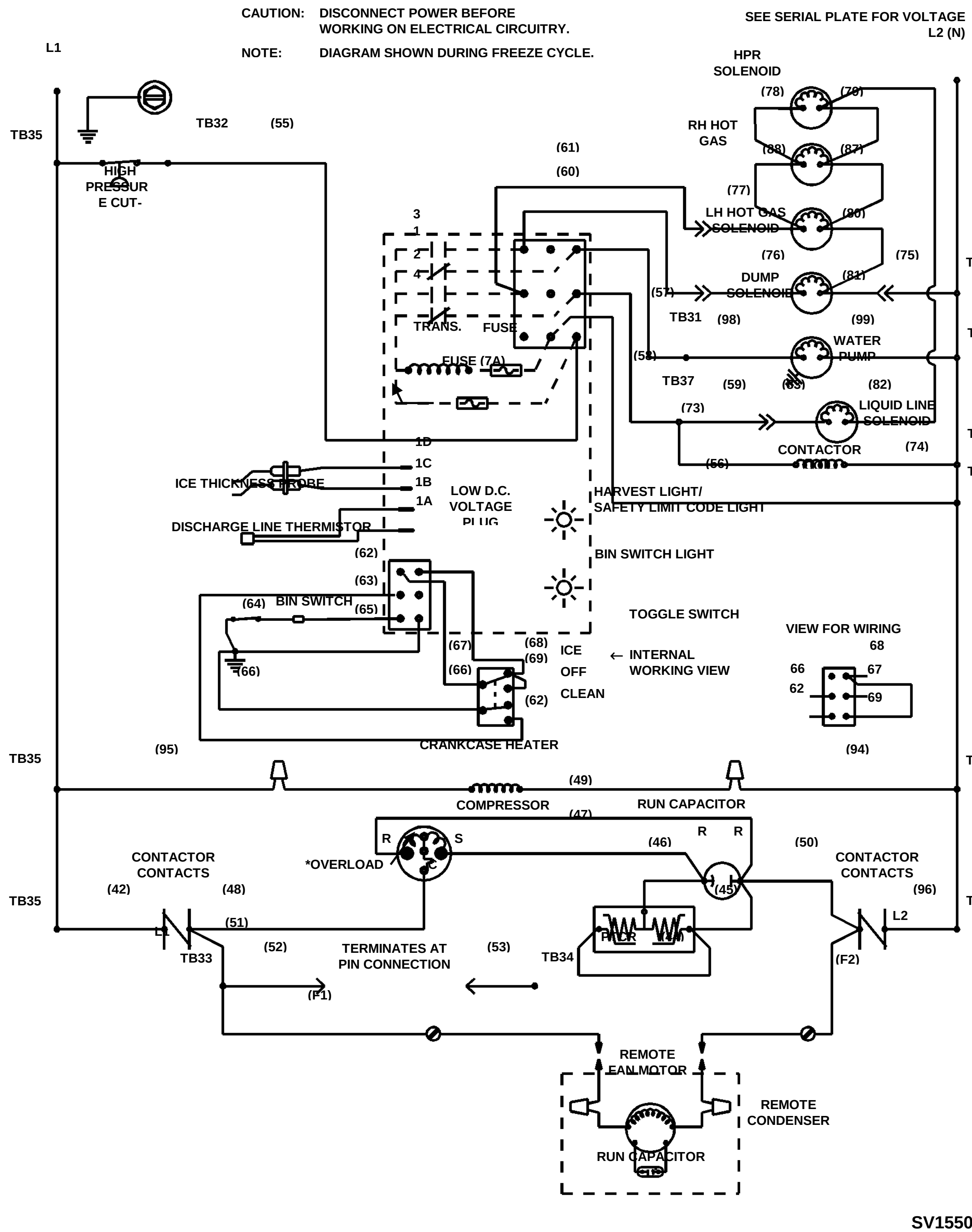
OLD STYLE REMOTE - ***J450/J600/J800/J1000 - 1 PHASE***



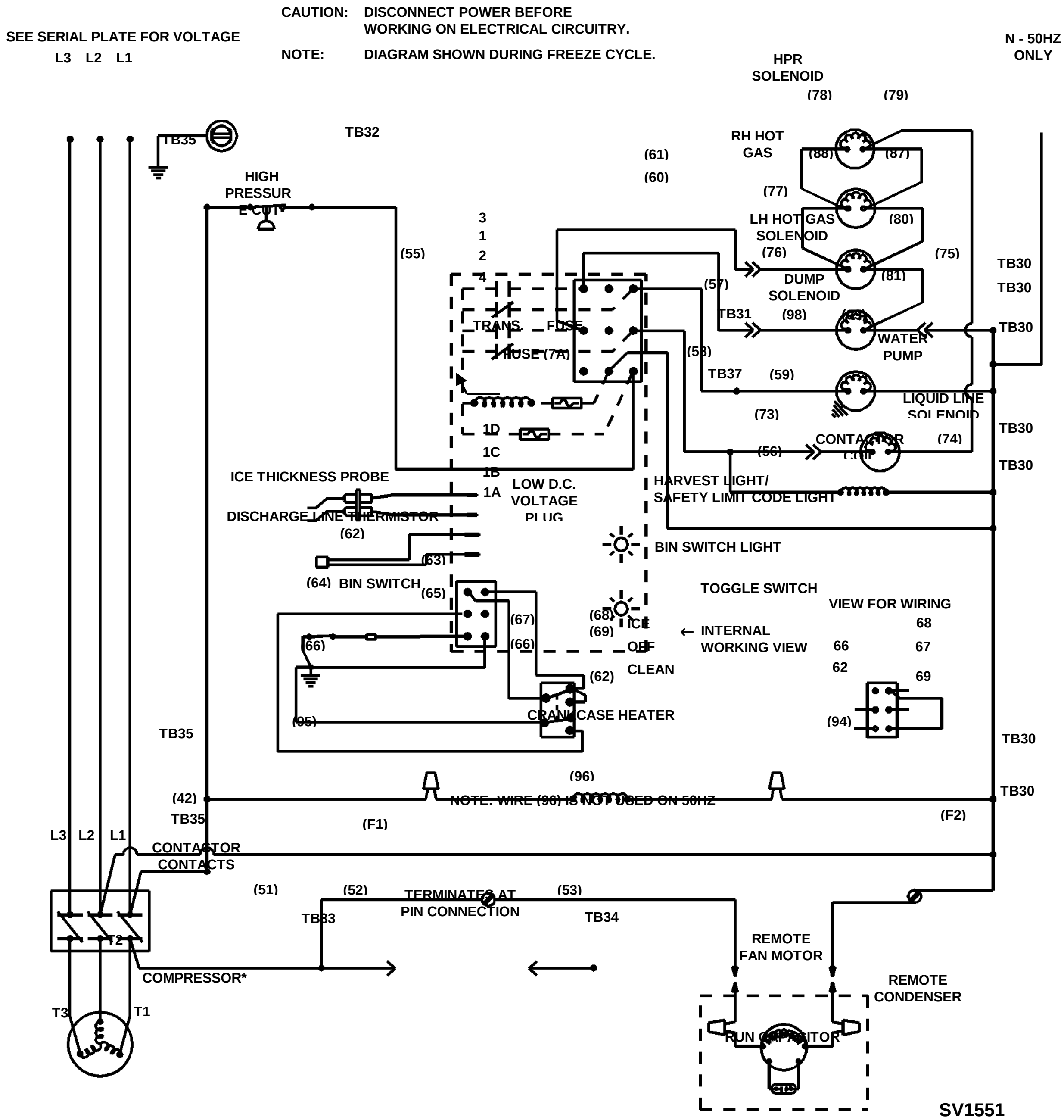
*OLD STYLE REMOTE - **J800/J1000 - 3 PHASE***



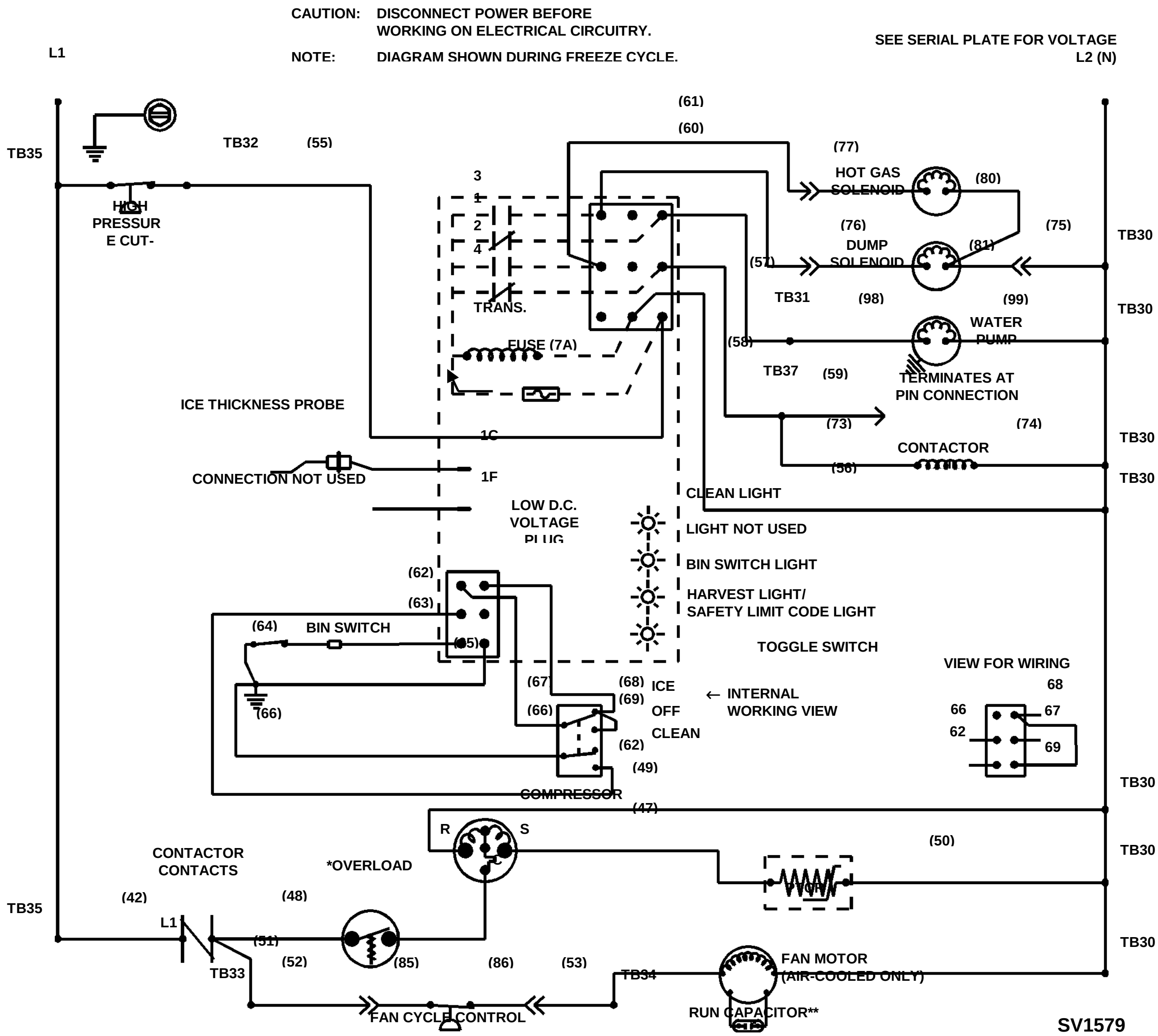
*OLD STYLE REMOTE - **J1300/J1800 - 1 PHASE***



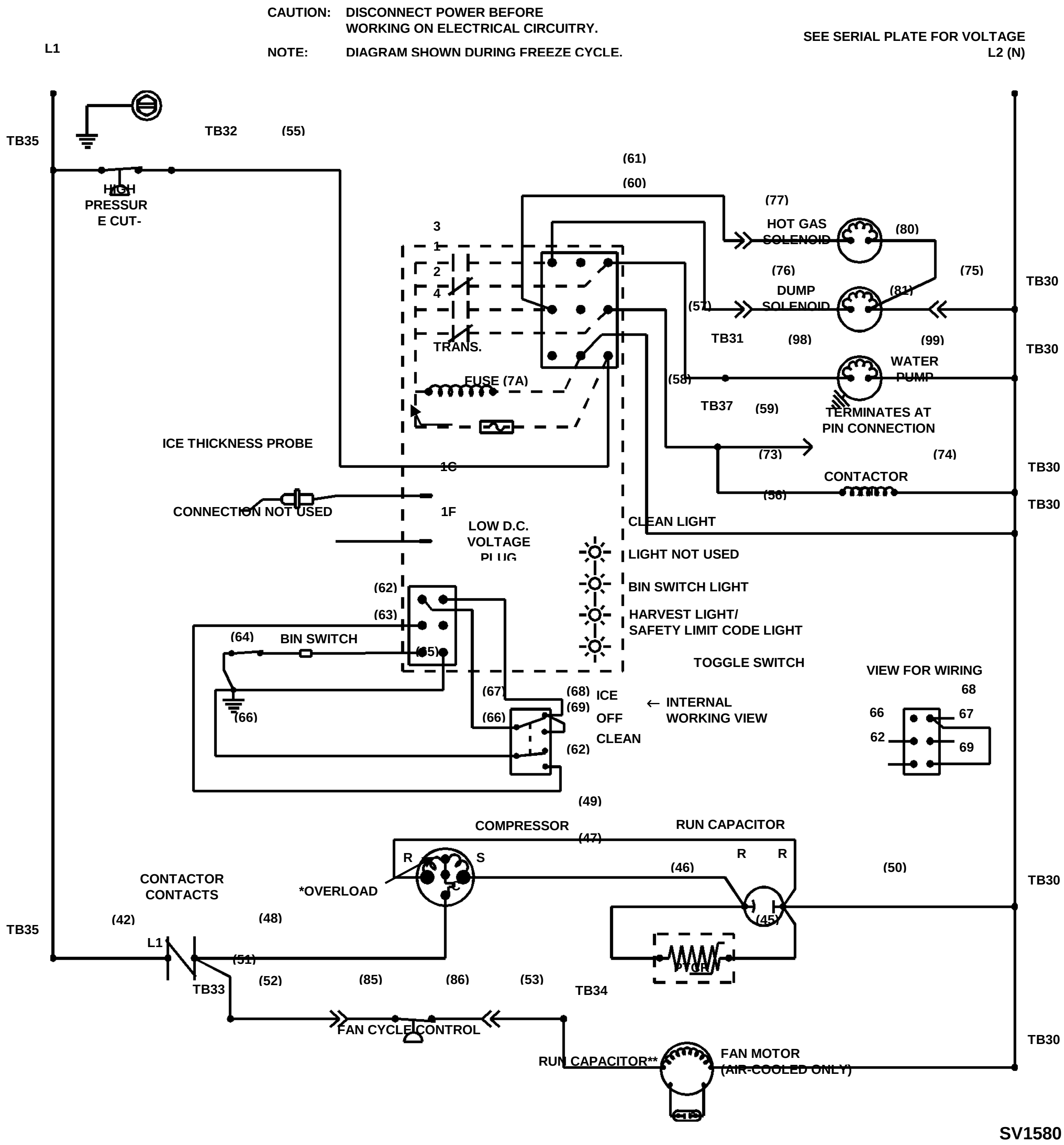
OLD STYLE REMOTE - J1300/J1800 - 3 PHASE



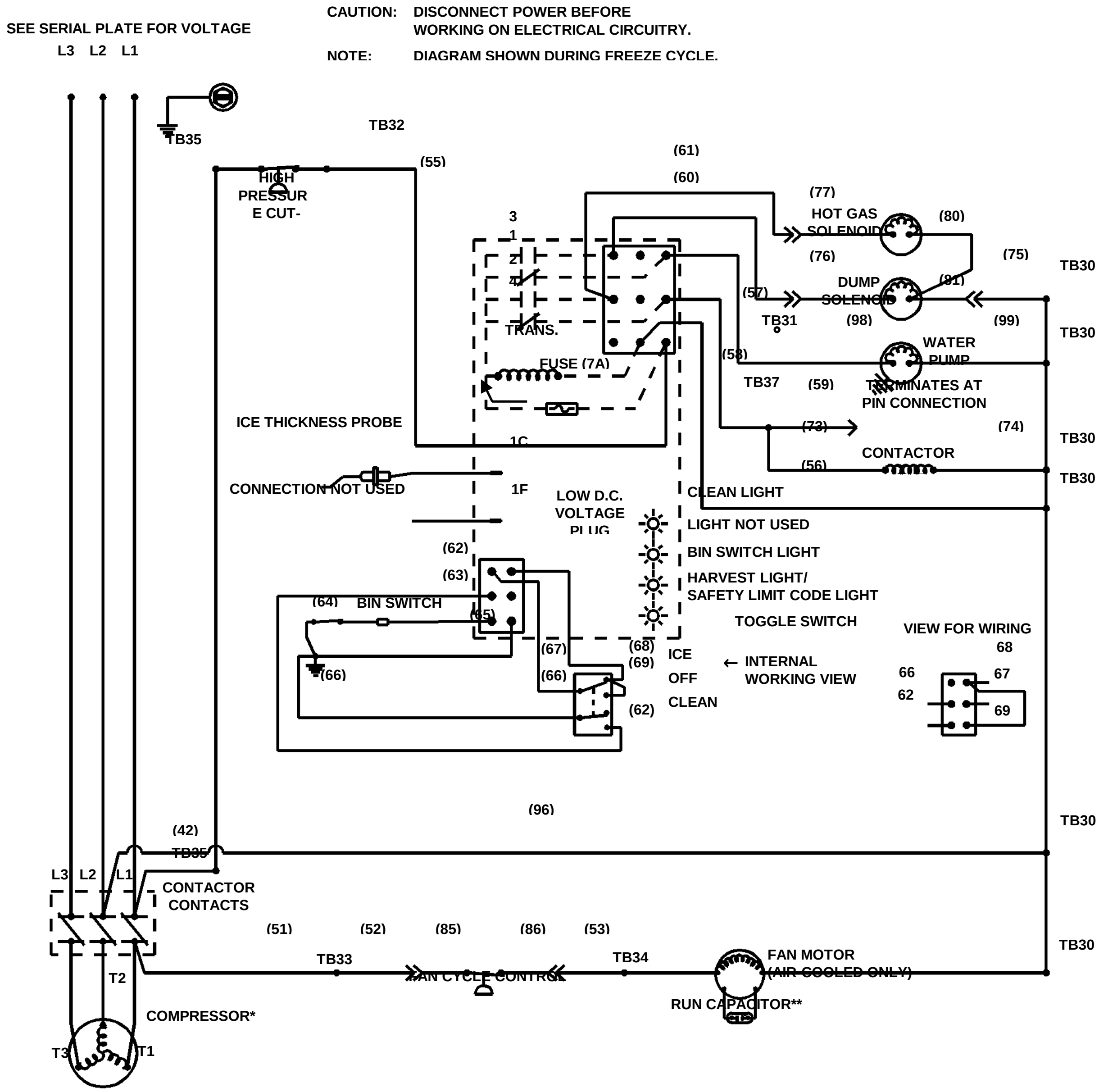
NEW STYLE SELF-CONTAINED - *J200/J250/J320 - 1 PHASE*



*NEW STYLE SELF-CONTAINED - **J420/J450/J600/J800/J1000 - 1 PHASE***

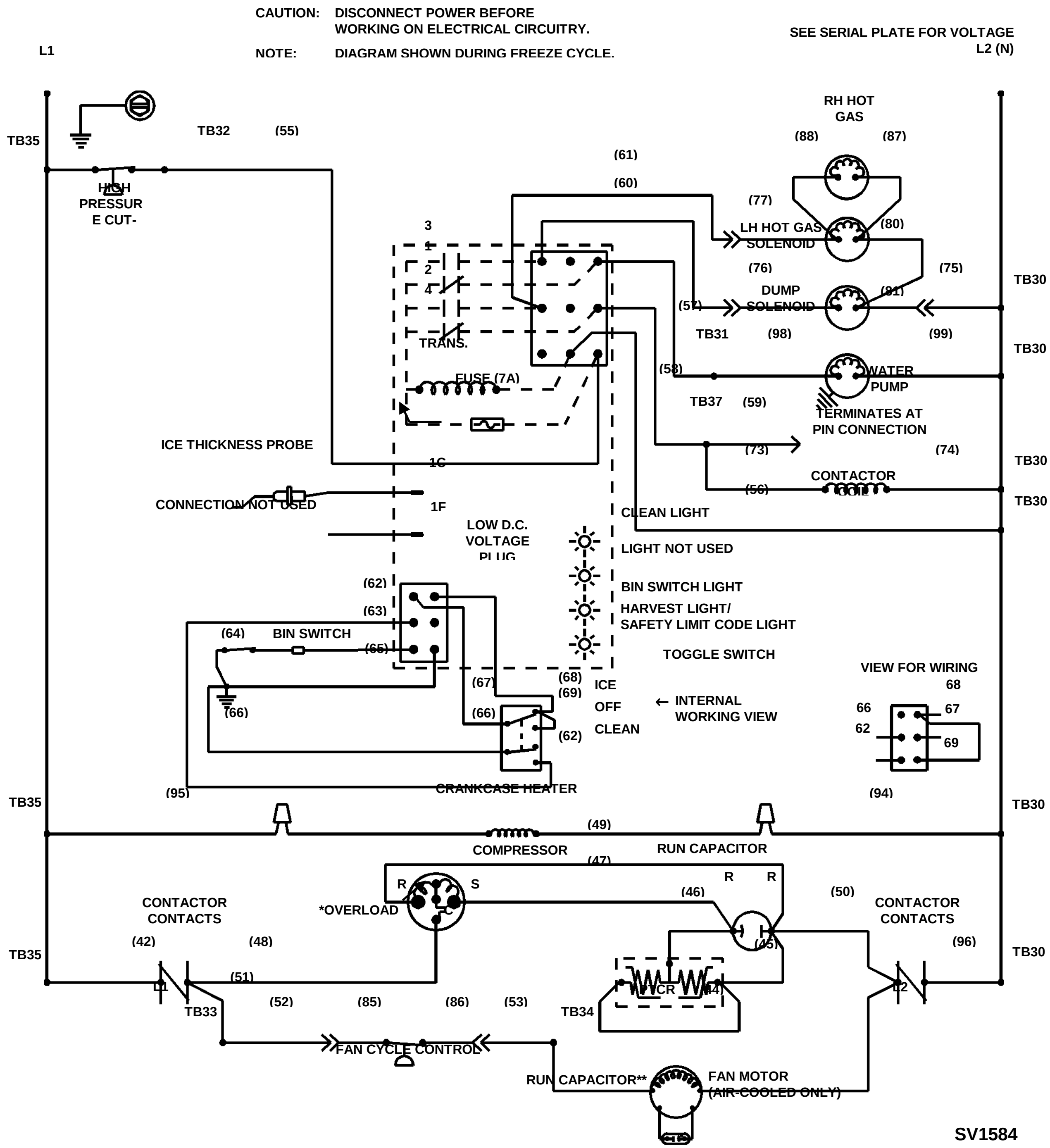


NEW STYLE SELF-CONTAINED - J800/J1000 - 3 PHASE

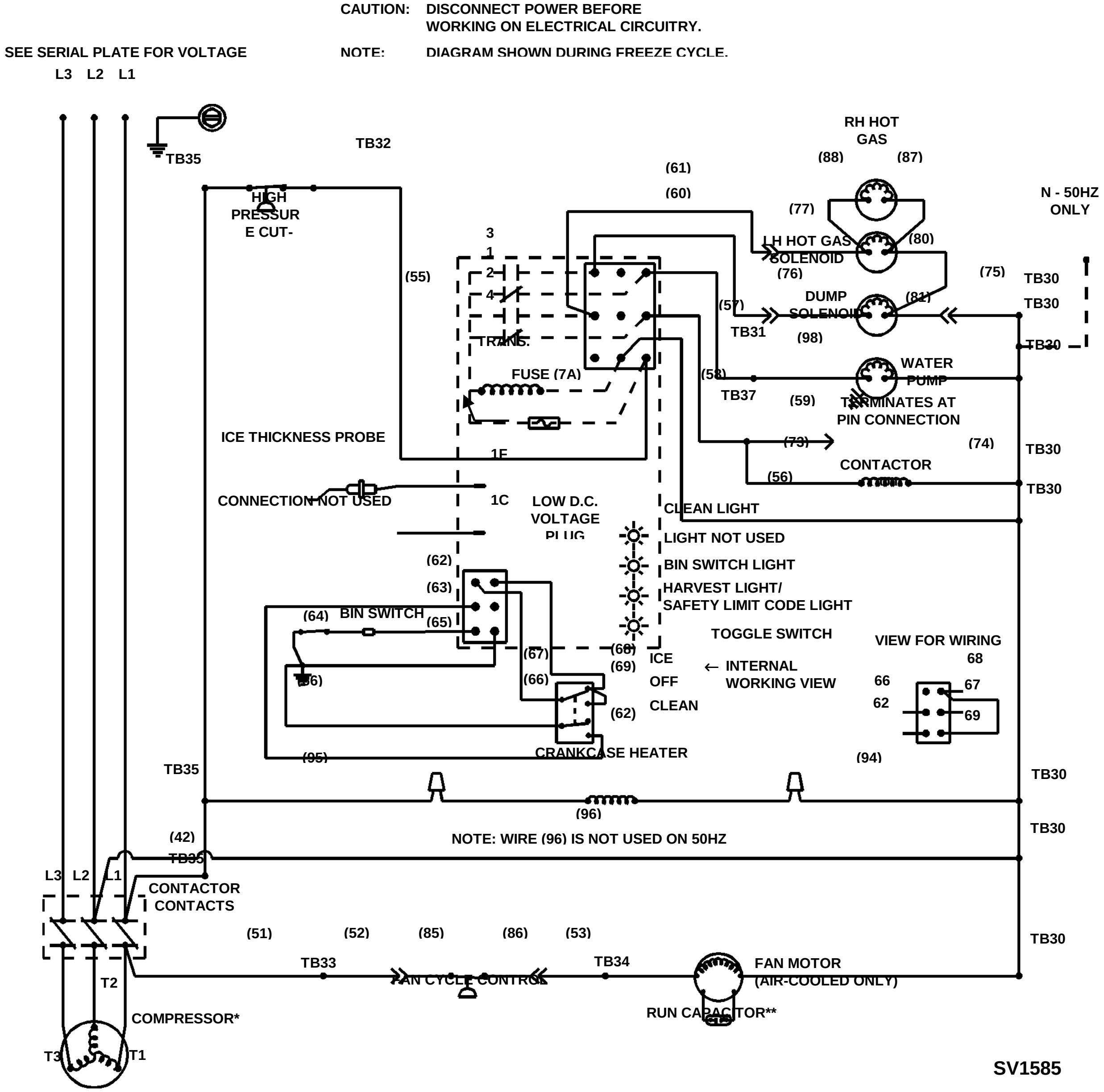


SV1581

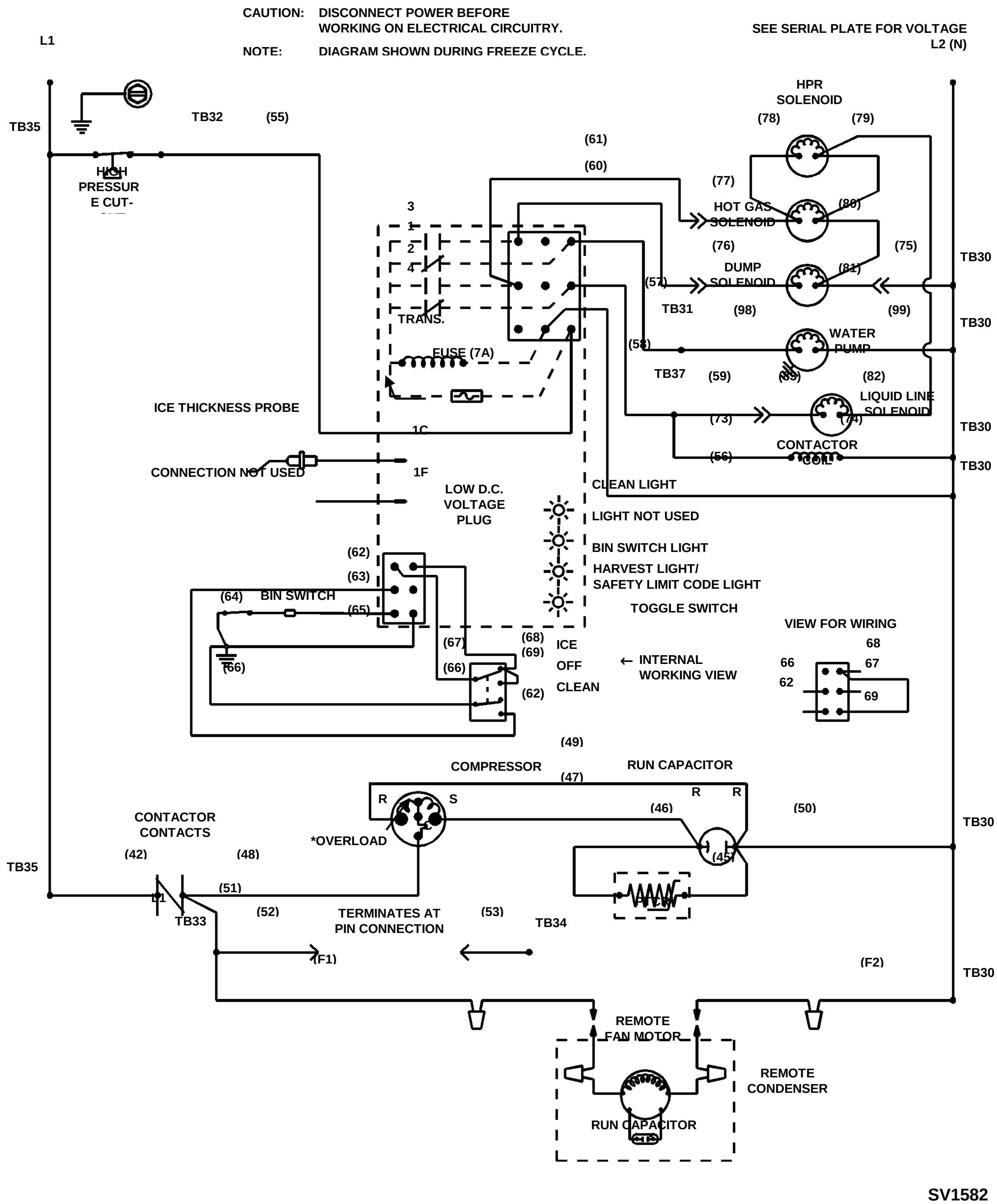
NEW STYLE SELF-CONTAINED - J1300/J1800 - 1 PHASE



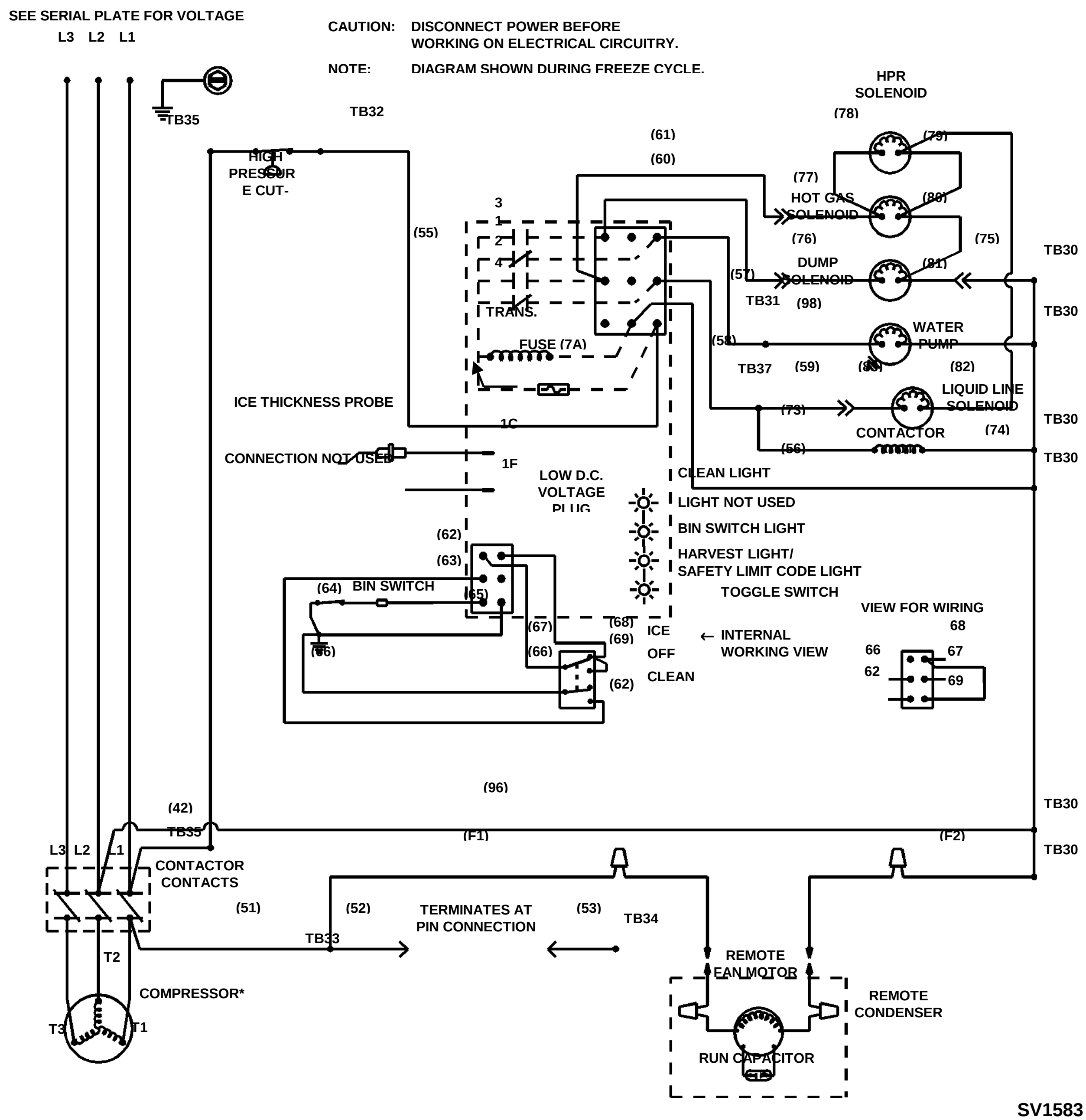
NEW STYLE SELF-CONTAINED - J1300/J1800 - 3 PHASE



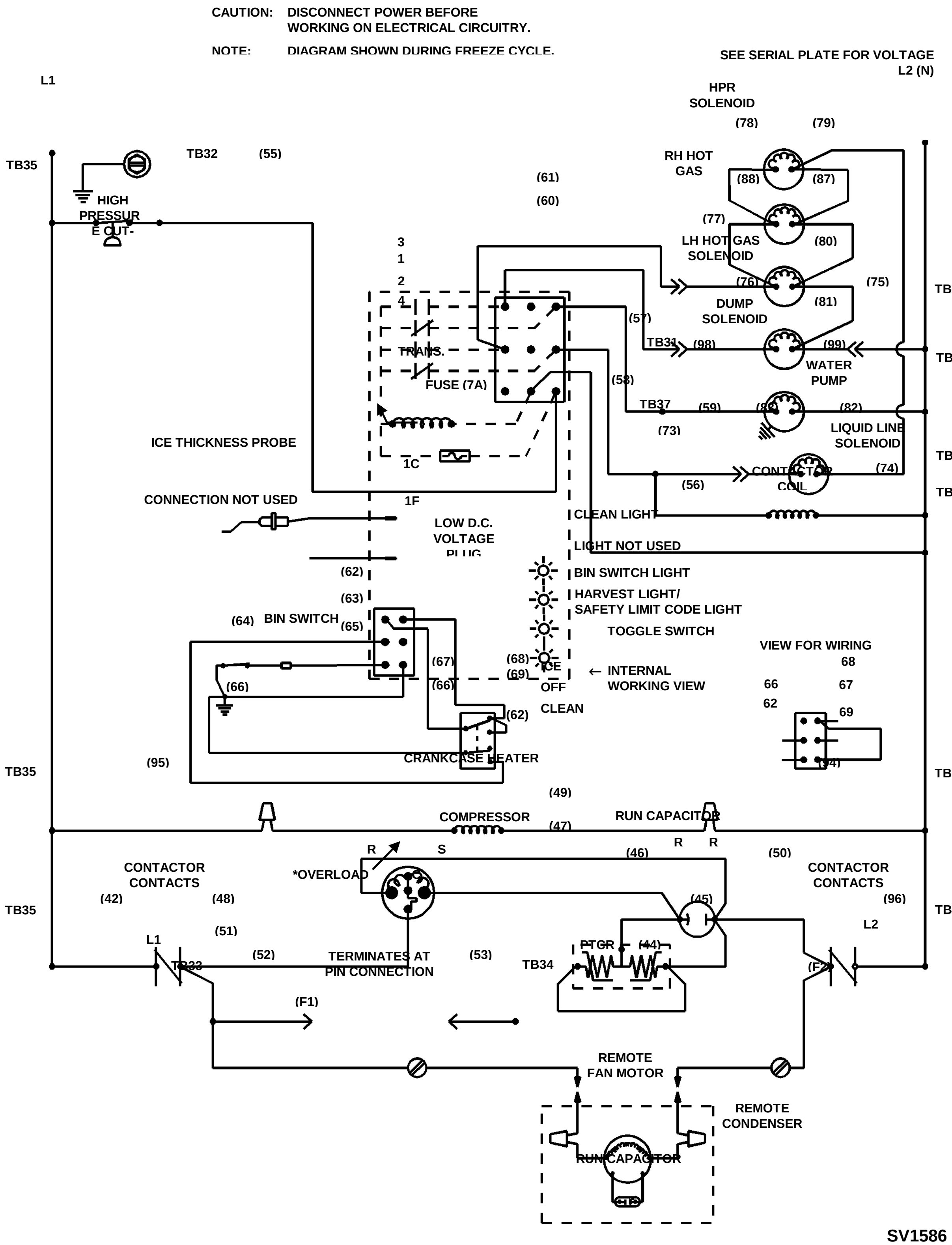
NEW STYLE REMOTE - *J450/J600/J800/J1000 - 1 PHASE*



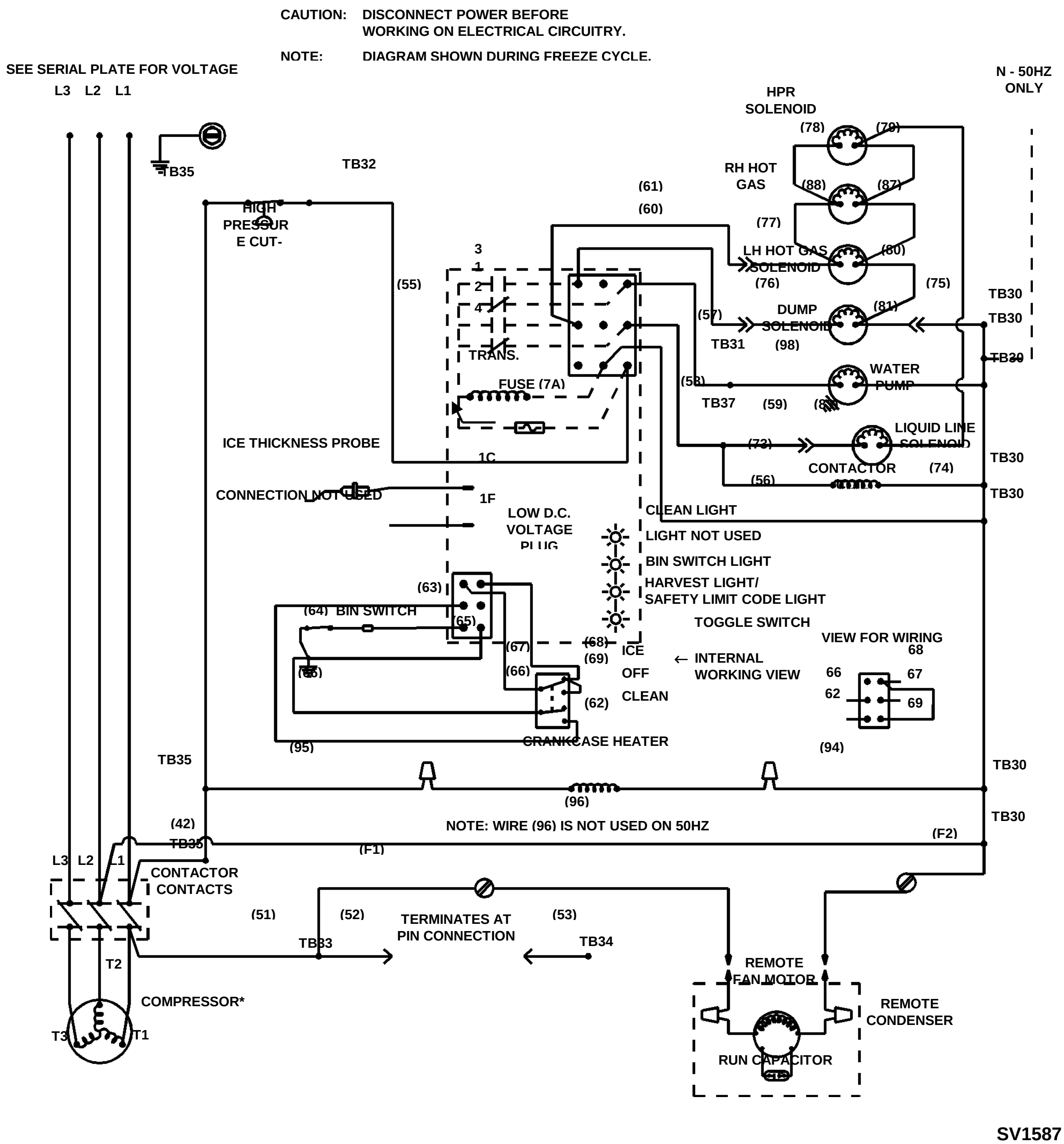
*NEW STYLE REMOTE - **J800/J1000 - 3 PHASE***



NEW STYLE REMOTE - J1300/J1800 - 1 PHASE



*NEW STYLE REMOTE - **J1300/J1800 - 3 PHASE***



Component Specifications and Diagnostics

FUSES

Function
The control board fuse(s) stops ice machine operation if electrical components fail causing high amp draw.

Specifications

Fuse	Specifications
Main Fuse	250 Volt, 7 Amp
Transformer Fuse[1]	250 Volt, 60 Hz, .125 Amp 250 Volt, 50 Hz, .100 Amp

[1] The transformer fuse is not used on new style dual voltage control boards.

Check Procedure

> **⚠ WARNING**
> High (line) voltage is applied to the control board (terminals #55 and #56) at all times. Removing control board fuses or moving the toggle switch to OFF will not remove the power supplied to the control board.

1. If the bin switch light is on with the water curtain closed, both fuses are good.

> **⚠ WARNING**
> Disconnect electrical power to the entire ice machine before proceeding.

2. Remove the fuse. Check the resistance across the fuse with an ohm meter.

Reading	Result
Open (OL)	Replace fuse
Closed (O)	Fuse is good

BIN SWITCH

Function
Bin switch operation is controlled by movement of the water curtain. The bin switch has two main functions:

1. Terminating the harvest cycle and returning the ice machine to the freeze cycle.

This occurs when the bin switch is opened and closed again within 7 seconds during the harvest cycle.

2. Automatic ice machine shut-off.

If the storage bin is full at the end of a harvest cycle, the sheet of cubes fails to clear the water curtain and holds it open. After the water curtain is held open for 7 seconds, the ice machine shuts off.

The ice machine remains off until enough ice is removed from the storage bin to allow the sheet of cubes to drop clear of the water curtain. As the water curtain swings back to the operating position, the bin switch closes and the ice machine restarts.

> **Important**
> The water curtain must be ON (bin switch closed) to start ice making.

Specifications
The bin switch is a magnetically operated reed switch. The magnet is attached to the lower right corner of the water curtain. The switch is attached to the evaporator mounting bracket.

The bin switch is connected to a varying D.C. voltage circuit. (Voltage does not remain constant.)

NOTE: Because of a wide variation in D.C. voltage, it is not recommended that a voltmeter be used to check bin switch operation.

Check Procedure

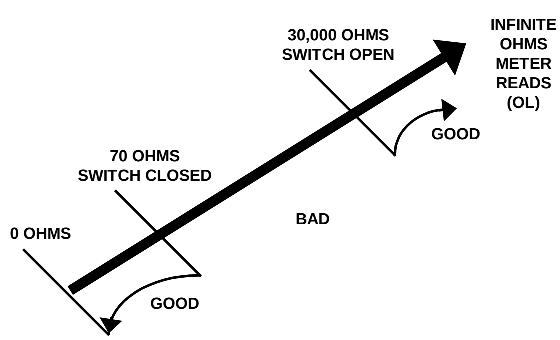
1. Set the toggle switch to OFF.
2. Watch the bin switch light on the control board.
3. Move the water curtain toward the evaporator. The bin switch must close. The bin switch light “on” indicates the bin switch has closed properly.
4. Move the water curtain away from the evaporator. The bin switch must open. The bin switch light “off” indicates the bin switch has opened properly.

Ohm Test

1. Disconnect the bin switch wires to isolate the bin switch from the control board.
2. Connect an ohmmeter to the disconnected bin switch wires. Set the ohmmeter to the 10,000 ohm scale.
3. Cycle the bin switch by opening and closing the water curtain.
4. With the bin switch open: Resistance readings of more than 30,000 ohms indicate a correctly operating bin switch.
5. With the bin switch closed: Resistance readings of less than 70 ohms indicates a correctly operating bin switch.

Important

Any reading between 70 and 30,000 ohms, regardless of curtain position, indicates a defective bin switch



Bin Switch Resistance Readings

Water Curtain Removal **Notes**

The water curtain must be on (bin switch closed) to start ice making. While a freeze cycle is in progress, the water curtain can be removed and installed at any time without interfering with the electrical control sequence.

If the ice machine goes into harvest sequence while the water curtain is removed, one of the following will happen:

- Water curtain remains off
  When the harvest cycle time reaches 3.5 minutes and the bin switch is not closed, the ice machine stops as though the bin were full.

- Water curtain is put back on
  If the bin switch closes prior to reaching the 3.5 minute point, the ice machine immediately returns to another freeze sequence prechill.

COMPRESSOR ELECTRICAL DIAGNOSTICS

The compressor will not start or will trip repeatedly on overload.

Check Resistance (Ohm) Values

NOTE: Compressor windings can have very low ohm values. Use a properly calibrated meter.

Perform the resistance test after the compressor cools. The compressor dome should be cool enough to touch (below 120°F/49°C) to assure that the overload is closed and the resistance readings will be accurate.

SINGLE PHASE COMPRESSORS

1. Disconnect power from the cuber and remove the wires from the compressor terminals.
2. The resistance values must be within published guidelines for the compressor. The resistance values between C and S and between C and R, when added together, should equal the resistance value between S and R.
3. If the overload is open, there will be a resistance reading between S and R, and open readings between C and S and between C and R. Allow the compressor to cool, then check the readings again.

THREE PHASE COMPRESSORS

1. Disconnect power from the cuber and remove the wires from the compressor terminals.
2. The resistance values must be within published guidelines for the compressor. The resistance values between L1 and L2, between L2 and L3, and between L3 and L1 should all be equal.
3. If the overload is open, there will be open readings between L1 and L2, between L2 and L3, and between L3 and L1. Allow the compressor to cool, then check the readings again.

Check Motor Windings to Ground

Check continuity between all three terminals and the compressor shell or copper refrigeration line.

NOTE: Scrape the metal surface to get good contact.

If continuity is present, the compressor windings are grounded and the compressor should be replaced.

Determine if the Compressor is Seized

Check the amp draw while the compressor is trying to start.

COMPRESSOR DRAWING LOCKED ROTOR

The two likely causes of this are:

- Defective starting component
- Mechanically seized compressor

To determine which you have:

1. Install high and low side gauges.
2. Try to start the compressor.
3. Watch the pressures closely.
   A. If the pressures do not move, the compressor is seized. Replace the compressor.
   B. If the pressures move, the compressor is turning slowly and is not seized. Check the capacitors and start relay.

COMPRESSOR DRAWING HIGH AMPS

The continuous amperage draw on start-up should not be near the maximum fuse size indicated on the serial tag.

The voltage when the compressor is trying to start must be within ±10% of the nameplate voltage.

Diagnosing Capacitors

- If the compressor attempts to start, or hums and trips the overload protector, check the starting components before replacing the compressor.
- Visual evidence of capacitor failure can include a bulged terminal end or a ruptured membrane. Do not assume a capacitor is good if no visual evidence is present.
- A good test is to install a known good substitute capacitor.
- Use a capacitor tester when checking a suspect capacitor. Clip the bleed resistor off the capacitor terminals before testing.

Diagnosing PTCR's

See "PTCR Diagnostics" on the next page.

PTCR DIAGNOSTICS

What is a PTCR?
A PTCR (or Positive Temperature Coefficient Resistor) is made from high-purity, semi-conducting ceramics.

A PTCR is useful because of its resistance versus temperature characteristic. The PTCR has a low resistance over a wide (low) temperature range, but upon reaching a certain higher temperature, its resistance greatly increases, virtually stopping current flow. When the source of heat is removed, the PTCR returns to its initial base resistance.

In severe duty cycles, it can be used to repeatedly switch (virtually stop) large currents at line voltages.

PTCR’s have been used for many years in millions of HVAC applications. In place of using the conventional start relay/start capacitor, a simple PTCR provides the starting torque assistance to PSC (Permanent Split Capacitor) single-phase compressors, which can equalize pressures before starting.

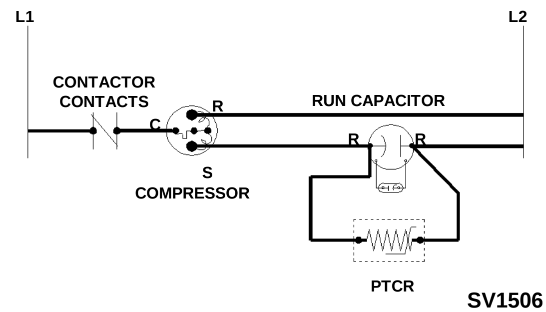
Compressor Start Sequence
PTCR’s provide additional starting torque by increasing the current in the auxiliary (start) winding during starting. The PTCR is wired across the run capacitor (in series with the start winding).

1. It is important for the refrigerant discharge and suction pressures to be somewhat equalized prior to the compressor starting. To assure equalization of pressures the hot gas valve (and HPR valve on remotes) will energize for 45 seconds prior to compressor starting. The hot gas valve (and HPR valve on remotes) remains on for an additional 5 seconds while the compressor is starting.
2. When starting the compressor, the contactor closes and the PTCR, which is at a low resistance value, allows high starting current to flow in the start winding.
3. The current passing through the PTCR causes it to rapidly heat up, and after approximately .25-1 second it abruptly “switches” to a very high resistance, virtually stopping current flow through it.
4. At this point the motor is up to speed and all current going through the start winding will now pass through the run capacitor.
5. The PTCR remains hot and at a high resistance as long as voltage remains on the circuit.
6. It is important to provide time between compressor restarts to allow the PTCR to cool down to near its initial temperature (low resistance). When the contactor opens to stop the compressor, the PTCR cools down to its initial low resistance and is again ready to provide starting torque assistance. To assure the PTCR has cooled down, during an automatic shut-off, the J model ice machines have a built-in 3-minute off time before it can restart.

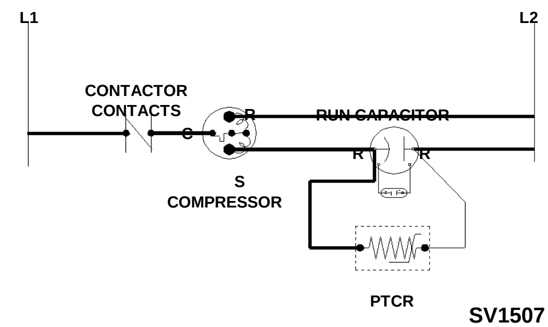
J-Model Automatic Shut-Off and Restart

When the storage bin is full at the end of a harvest cycle, the sheet of cubes fails to clear the water curtain and will hold it open. After the water curtain is held open for 7 seconds, the ice machine shuts off. To assure the PTCR has cooled, the ice machine remains off for 3 minutes before it can automatically restart.

The ice machine remains off until enough ice has been removed from the storage bin to allow the ice to fall clear of the water curtain. As the water curtain swings back to operating position, the bin switch closes and the ice machine restarts, provided the three-minute delay period is complete.



During Start-Up (First .25 - 1.0 Seconds)



After Start-Up
(Current Flows Through Run Capacitor)

Troubleshooting PTCR's

WHY A GOOD PTCR MAY FAIL
TO START THE COMPRESSOR

The PTCR must be cooled before attempting to start the compressor, otherwise the high starting torque may not last long enough.

For example, if the PTCR is properly cooled, say 60°F (15.6°C) when the compressor starts, it will take .25 to 1.0 seconds before its temperature reaches 260°F (126.6°C), and current flow is stopped.

If the PTCR is still warm, say 160°F (71.1°C) when the compressor starts, it will take only .125 to .50 seconds before its temperature reaches 260°F (126.6°C), and current flow is stopped. This decreased time may be insufficient to start the compressor.

A good PTCR may be too hot to operate properly at start-up because:

- The ice machine's 3-minute delay has been overridden. Opening and closing the service disconnect or cycling the toggle switch from OFF to ICE will override the delay period.
- The control box temperature is too high. Though rare, very high air temperatures (intense sunlight, etc.) can greatly increase the temperature of the control box and its contents. This may require a longer off time to allow the PTCR to cool.
- The compressor has short-cycled, or the compressor overload has opened. Move the toggle switch to OFF and allow the compressor and PTCR to cool.

There are other problems that may cause compressor start-up failure with a good PTCR in a new, properly wired ice machine.

- The voltage at the compressor during start-up is too low.

Manitowoc ice machines are rated at ±10% of nameplate voltage at compressor start-up. (Ex: An ice machine rated at 208-230 should have a compressor start-up voltage between 187 and 253 volts.)

- The compressor discharge and suction pressures are not matched closely enough or equalized.

  These two pressures must be somewhat equalized before attempting to start the compressor. The hot gas valve (and HPR valve on remotes) energizes for 45 seconds before the compressor starts, and remains on 5 seconds after the compressor starts. Make sure this is occurring before assuming that the PTCR is bad.

CHECKING THE PTCR

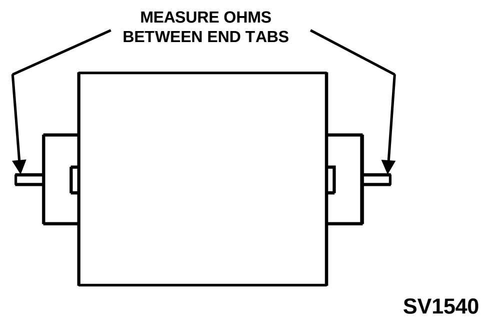
> **⚠ WARNING**
> Disconnect electrical power to the entire ice machine at the building electrical disconnect box before proceeding.

1. Visually inspect the PTCR. Check for signs of physical damage.

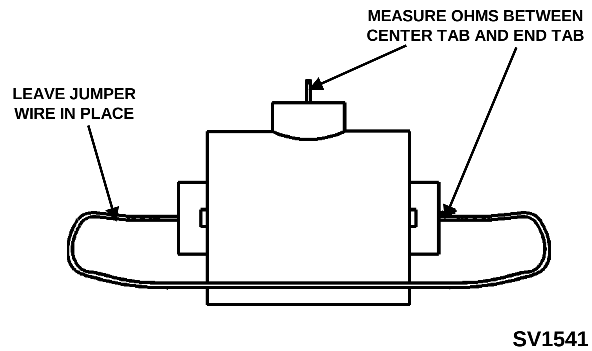
NOTE: The PTCR case temperature may reach 210°F (100°C) while the compressor is running. This is normal. Do not change a PTCR just because it is hot.

2. Wait at least 10 minutes for the PTCR to cool to room temperature.
3. Remove the PTCR from the ice machine.
4. Measure the resistance of the PTCR as shown below. If the resistance falls outside of the acceptable range, replace it.

Model	Manitowoc Part Number	Cera-Mite Part Number	Room Temperature Resistance
J200 J250 J320 J420 J450	8505003	305C20	22-50 Ohms
J600 J800 J1000	8504993	305C19	18-40 Ohms
J1300 J1800	8504913	305C9	8-22 Ohms



Manitowoc PTCR's 8505003 & 8504993



Manitowoc PTCR 8504913

DISCHARGE LINE THERMISTOR

NOTE: The discharge line thermistor is not used on later production J-model ice machines. The part has been removed due to the redundancy of safety limits 3 and 4. Any fault that would stop the ice machine on safety limit 3 or 4 would also stop the ice machine on safety limit 1 or 2.

As an example, consider an expansion valve that is overfeeding refrigerant, causing low discharge line temperatures in the harvest cycle. This would stop the ice machine on safety limit 3. But, due to decreased harvest temperatures, the ice machine will stop on safety limit 2 (harvest cycle exceeds 3.5 minutes) with safety limit 3 removed.

When replacing an old style control board with a new style control board, the thermistor will no longer be used.

Function

The discharge line thermistor senses the compressor discharge line temperature. This is used in conjunction with the control board safety limits to stop the ice machine if the discharge line temperature falls below 85°F (29.4°C) or rises above 255°F (123.9°C).

Specifications

100,000 Ohms ±2% at 77°F (25°C)

> ⚠ **CAUTION**
> Use only Manitowoc thermistors.

Check Procedure

Thermistors generally fail because of moisture or physical damage. Manitowoc J-Model discharge line thermistors are encased in a specially-designed, moisture sealed aluminum block. This eliminates physical damage and moisture concerns.

Verify that the thermistor resistance is accurate and corresponding to the high and low temperature ranges.

1. Disconnect the thermistor from terminals 1A and 1B on the control board.
2. Connect the ohm meter to the isolated thermistor wire leads.
3. Acquire a temperature meter capable of taking readings on curved copper lines. Attach the sensing device to the compressor discharge line next to the thermistor aluminum block.

> **Important**
> Do not simply “insert” the sensing device under the insulation. It must be attached to and reading the actual temperature of the copper line.

4. With the ice machine running, verify that the temperature of the discharge line corresponds to the thermistor resistance reading as stated in the chart on the next page.

Check the thermistor at high temperatures (during the freeze cycle) and at low temperatures (during the harvest cycle). It is normal for the compressor discharge line temperature to rise during the freeze cycle and drop during the harvest cycle.

NOTE: If the ice machine is inoperable, remove the thermistor and place it (for a short time) in an ice water bath, and then in a boiling water bath, to verify its accuracy. See the chart on the next page.

5. **If the thermistor would fail closed**, the ice machine would stop on safety limit #4 15 seconds after contact #4 on the control board closes (compressor starts).
6. **If the thermistor would fail open**, the ice machine would start and run through two normal freeze and harvest sequences. During the third harvest sequence, the ice machine would stop on safety limit #3.

Temperature/Resistance Chart

As the temperature rises at the thermistor block, the resistance drops.

> **Important**
> If the ohm meter reads "OL", check the scale setting on the meter before assuming the thermistor is bad.

Temperature of Thermistor °F	Temperature of Thermistor °C	Resistance K ohms (x 1000)
32° (ice water bath)	0°	376.7 - 283.6
50° - 60°	10.0° - 15.6°	198.9 - 153.1
60° - 70°	15.6° - 21.1°	153.1 - 118.8
70° - 80°	21.1° - 26.7°	118.8 - 92.9
80° - 90°	26.7° - 32.2°	92.9 - 73.3
90° - 100°	32.2° - 37.8°	73.3 - 58.2
100° - 110°	37.8° - 43.3°	58.2 - 46.6
110° - 120°	43.3° - 48.9°	46.6 - 37.5
120° - 130°	48.9° - 54.4°	37.5 - 30.5
130° - 140°	54.4° - 60.0°	30.5 - 24.9
140° - 150°	60.0° - 65.6°	24.9 - 20.4
150° - 160°	65.6° - 71.1°	20.4 - 16.8
160° - 170°	71.1° - 76.7°	16.8 - 14.0
170° - 180°	76.7° - 82.2°	14.0 - 11.7
180° - 190°	82.2° - 87.8°	11.7 - 9.8
190° - 200°	87.8° - 93.3°	9.8 - 8.2
200° - 210°	93.3° - 98.9°	8.2 - 7.0
212° (boiling water bath)	100°	7.3 - 6.2
220° - 230°	104.4° - 110.0°	5.9 - 5.1
230° - 240°	110.0° - 115.6°	5.1 - 4.3
240° - 250°	115.6° - 121.1°	4.3 - 3.7
250° - 260°	121.1° - 126.7°	3.7 - 3.3

ICE/OFF/CLEAN TOGGLE SWITCH

Function

The switch is used to place the ice machine in ICE, OFF or CLEAN mode of operation.

Specifications

Double-pole, double-throw switch. The switch is connected into a varying low D.C. voltage circuit.

Check Procedure

NOTE: Because of a wide variation in D.C. voltage, it is not recommended that a volt meter be used to check toggle switch operation.

1. Inspect the toggle switch for correct wiring.
2. Isolate the toggle switch by disconnecting all wires from the switch, or by disconnecting the Molex connector and removing wire #69 from the toggle switch.
3. Check across the toggle switch terminals using a calibrated ohm meter. Note where the wire numbers are connected to the switch terminals, or refer to the wiring diagram to take proper readings.

Switch Setting	Terminals	Ohm Reading
ICE	66-62	Open
	67-68	Closed
	67-69	Open
CLEAN	66-62	Closed
	67-68	Open
	67-69	Closed
OFF	66-62	Open
	67-68	Open
	67-69	Open

4. Replace the toggle switch if ohm readings do not match all three switch settings.

CONTROL BOARD RELAYS

Function
The control board relays energize and de-energize system components.

Specifications
Relays are not field replaceable. Old and new style control boards use four control board relays. New style control boards have a fifth relay which is not used.

Check Procedure
To increase relay life, there is a capacitor and a resistor mounted across the relay contacts to reducing arcing. Keep this in mind when measuring voltage through open relay contacts.

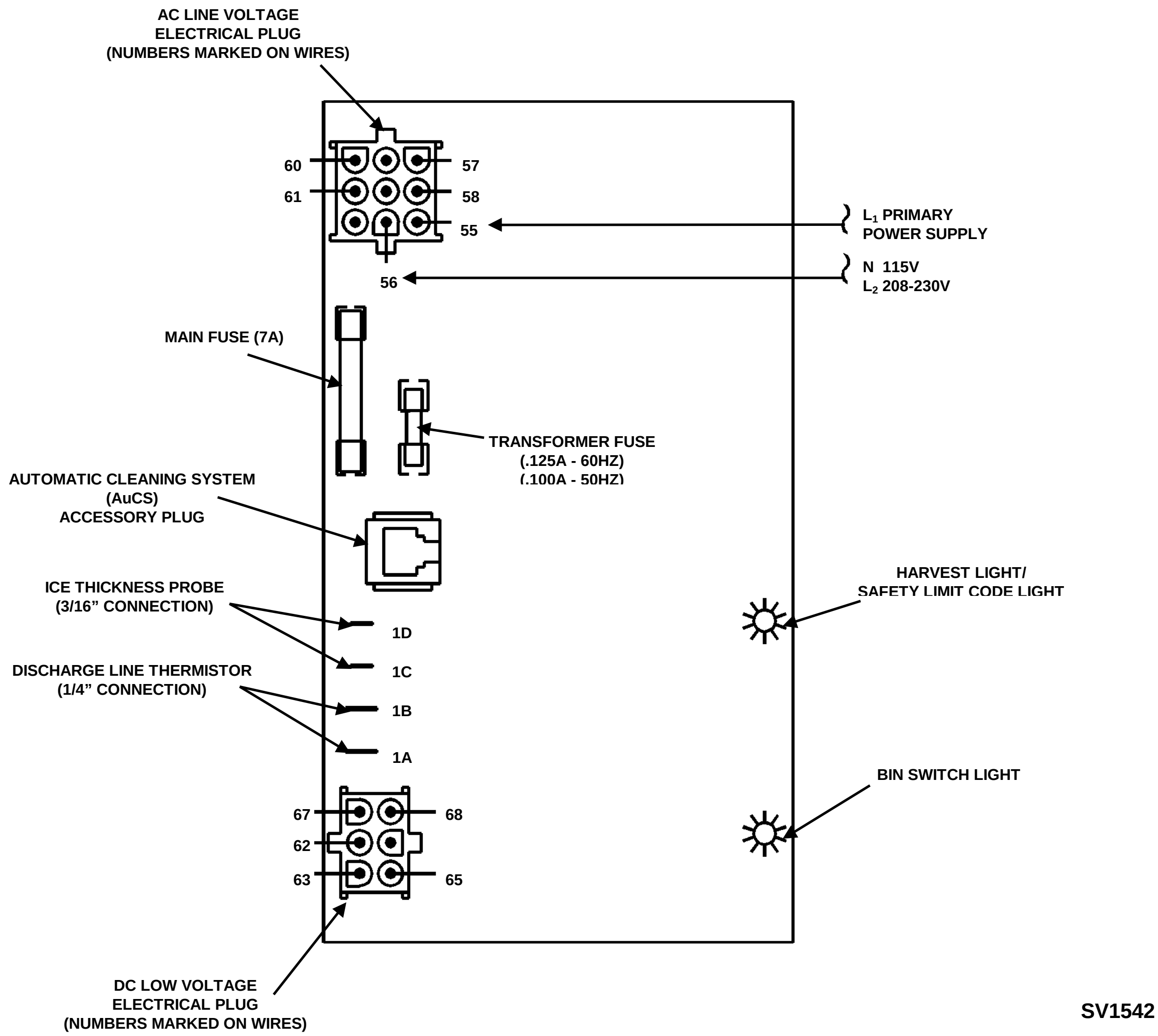
When measuring voltage through open contacts with a component disconnected from the relay, the current flows through the capacitor and resistor. This results in a “line voltage” reading. The current through the capacitor and resistor is milliamps. Always measure voltage with the component connected to the relay contacts which result in a “0” reading when the contacts are open.

For example, a service technician turns the toggle switch OFF (relay contact open) and unplugs the water pump (component disconnected). The service technician places the voltmeter leads into the water pump plug (taking voltage through open contacts with the component disconnected). He reads 208 volts (“line voltage” for the model being worked on).

The service technician mistakenly replaces the control board, thinking that the relay is stuck closed. Actually, there is nothing wrong with the relay, as the technician was reading milliamp current flow through the capacitor and resistor.

Remember to leave components connected to the relays when taking voltage measurements. Otherwise, the reading will always be “line voltage”, whether the relay contacts are open or closed.

ELECTRONIC CONTROL BOARD (OLD STYLE)



Old Style Control Board

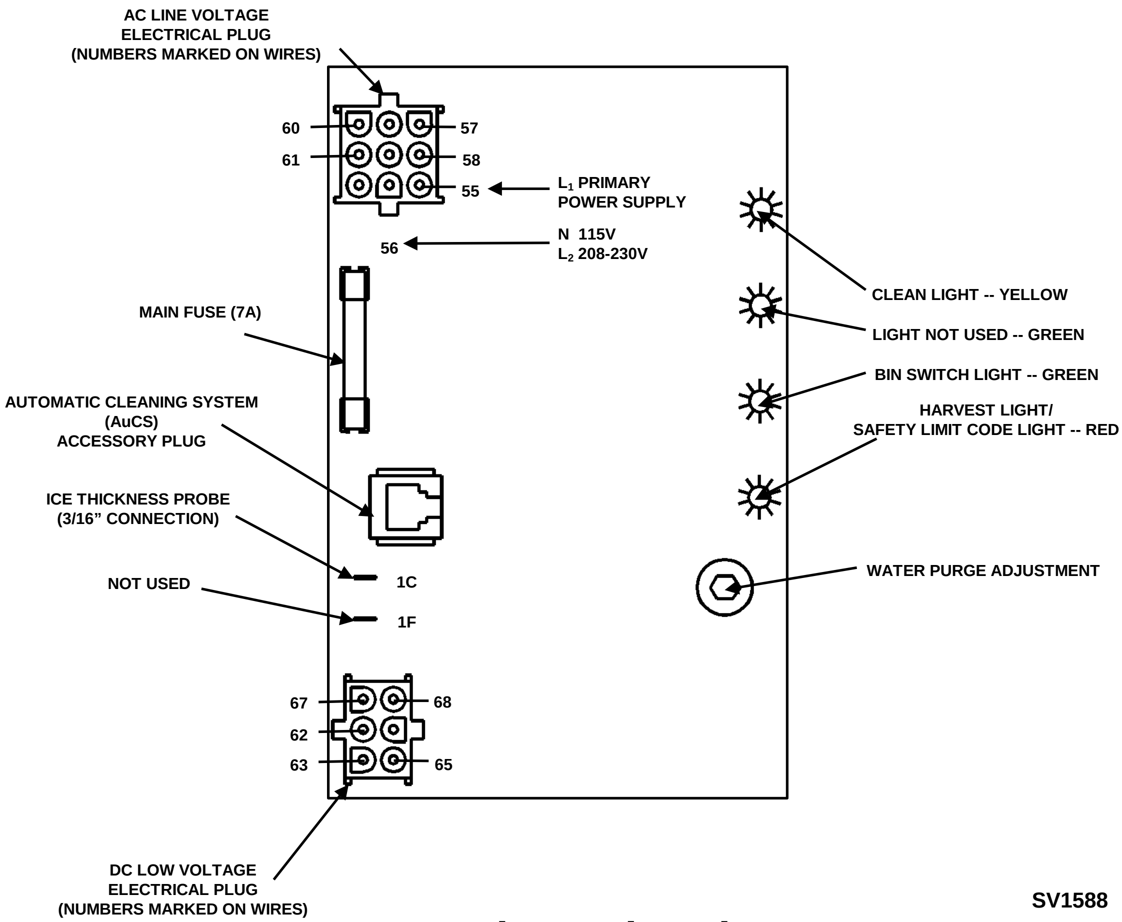
General
The control board controls all electrical components, including the ice machine sequence of operation. Prior to diagnosing, you must understand how the control board functions, and what it is supposed to do.

Refer to wiring diagrams and ice machine sequence of operation sections for details, including:

- Initial Start-Up or
Start-Up After Automatic Shut-Off
- Freeze Sequence
- Harvest Sequence
- Automatic Shut-Off
- Self-Cleaning

Refer to pages 6-48 and 6-49 for additional control board information.

ELECTRONIC CONTROL BOARD (NEW STYLE)



New Style Control Board

New Style Control Board Improvements

- A dual voltage transformer means only one control board for both 115V and 208-230V use.
- One 7-amp fuse - no separate transformer fuse.
- A single ice thickness probe provides improved ice thickness control by eliminating the possibility of scale or slime bridging the probes, causing premature harvests.
- A yellow "Clean" light energizes when a SeCS™ or AuCS™ cycle is in progress.

> **⚠ CAUTION**
> J model control boards that have only terminal 1C (no terminal 1D on board), must use the new single probe ice thickness control

- An adjustable harvest cycle water purge can be set to 15, 30 or 45 seconds. This will not affect clean cycle purge time.

> **⚠ CAUTION**
> This control is factory-set to 45 seconds. A reduced setting will increase cleaning frequency.

- Safety limits 3 and 4 have been eliminated; no thermistor is required.
- Exact control board replacement when replacing an old style control board with a new style control board. Electrical sequence of operation is identical to the old style control board.

Control Board

HARVEST INITIATION
(ICE THICKNESS PROBE)
Manitowoc's patented solid state electronic sensing circuit assures consistent ice formation. It does not rely on the refrigeration system (pressure), the temperature of the evaporator, or timers.

The ice machine must be in the freeze cycle six minutes prior to harvest cycle initiation. See "Freeze Time Lock-In Feature" for details.

As the ice forms on the evaporator, water (not ice) will contact the ice thickness probe. After the water completes this circuit for six to ten continuous seconds, a harvest sequence is initiated.

L.E.D. Lights

BIN SWITCH LIGHT
The light is on when the bin switch (water curtain) is closed, and off when the bin switch is open.

This light functions any time power is supplied to the ice machine, even when the toggle switch is in the OFF or CLEAN position. This indicates the primary power supply (line voltage) at the control board is functioning, without having to take a voltage reading.

HARVEST/SAFETY LIMIT LIGHT
This light's primary function is to be on as water contacts the ice thickness probe during the freeze cycle and remain on throughout the entire harvest cycle. The light will flicker as water splashes on the probes.

The light's secondary function is to continuously flash when the ice machine is shut off on a safety limit, and to indicate which safety limit shut off the ice machine.

CLEAN LIGHT
This light is only on the new style control board. It is on whenever a SeCS™ or AuCS™ (cleaning) cycle is in progress.

Freeze Time Lock-In Feature
This feature prevents the ice machine from short cycling in and out of harvest.

The control board locks the ice machine in the freeze cycle for six minutes. If water contacts the ice thickness probe during these six minutes, the harvest light will come on (to indicate that water is in contact with the probes), but the ice machine will stay in the freeze cycle. After the six minutes are up, a harvest sequence is initiated.

To allow the service technician to initiate a harvest cycle without delay, this feature is not used on the first cycle after moving the toggle switch OFF and back to ICE.

Water Curtain Removal

The water curtain must be on (bin switch closed) to start ice making. The water curtain can be removed and installed at any time during a freeze cycle without interfering with the electrical control sequence.

If the ice machine goes into a harvest sequence while the water curtain is removed, one of the following will happen:

- Water curtain remains off
  When the harvest cycle time reaches 3.5 minutes and the bin switch is not closed, the ice machine stops as though the bin were full.

- Water curtain is put back on
  If the bin switch closes prior to reaching the 3.5 minute point, the ice machine immediately returns to another freeze sequence prechill.

Fuses

The main fuse stops ice machine operation if electrical components fail cauing high amp draw.

The old style circuit board has an additional fuse. The transformer fuse protects the primary of the transformer only.

SAFETY LIMITS

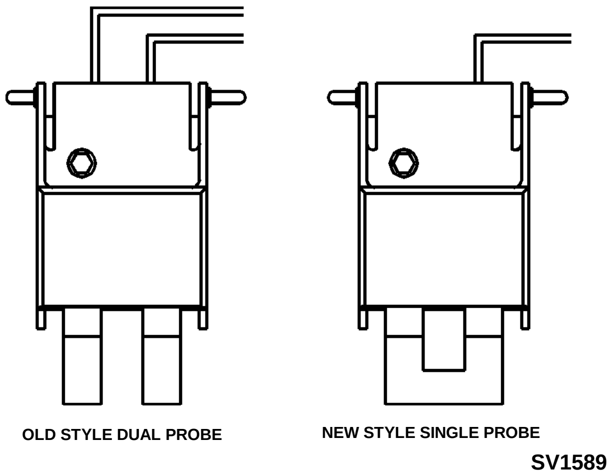
In addition to standard safety controls, such as the high pressure cut-out, the control board has built-in safety limits. Old style control boards have four safety limits, while new style control boards have two.

These safety limits protect the ice machine from major component failures. For more information, see “Safety Limits” in Section 7.

Ice Thickness Probe (Harvest Initiation)

GENERAL

The ice thickness probe has been changed from a dual probe to a single probe. This eliminates the possibility of scale or slime forming between the probes and causing a premature harvest cycle.



Ice Thickness Probes

HOW THE PROBE WORKS

Manitowoc's patented electronic sensing circuit does not rely on refrigerant pressure, evaporator temperature, water levels or timers to produce consistent ice formation.

As ice forms on the evaporator, water (not ice) contacts the ice thickness probe. After the water completes this circuit across the probe continuously for 6-10 seconds, a harvest cycle is initiated.

Since original production, a harvest cycle could be initiated one of two ways:

- Completing the circuit (shorting) across terminals 1C and 1D on the control board
- Completing the circuit (shorting) from terminal 1C on the control board to a cabinet ground anywhere in the ice machine

The improved, single probe design uses this second method.

FREEZE TIME LOCK-IN FEATURE

Since original production, the ice machine control system has incorporated a freeze time lock-in feature. This prevents the ice machine from short cycling in and out of harvest.

The control board locks the ice machine in the freeze cycle for six minutes. If water contacts the ice thickness probe during these six minutes, the harvest light will come on (to indicate that water is in contact with the probe), but the ice machine will stay in the freeze cycle. After the six minutes are up, a harvest cycle is initiated. This is important to remember when performing diagnostic procedures on the ice thickness control circuitry.

To allow the service technician to initiate a harvest cycle without delay, this feature is not used on the first cycle after moving the toggle switch OFF and back to ICE.

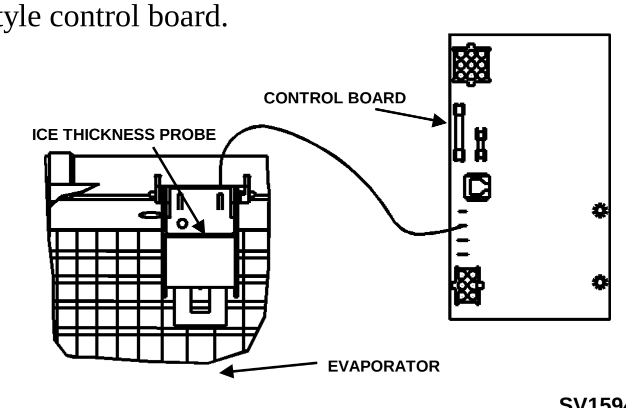
MAXIMUM FREEZE TIME

Since original production, The control system has included a built-in safety which will automatically cycle the ice machine into harvest after 60 minutes in the freeze cycle.

INSTALLATION OF NEW PROBE ON OLD STYLE CONTROL BOARD

1. Remove the old probe from the mounting bracket.
2. Snap the new probe into the mounting bracket.
3. Connect the single wire on the probe to terminal 1C on the control board.

NOTE: No wire is attached to terminal 1D on the old style control board.

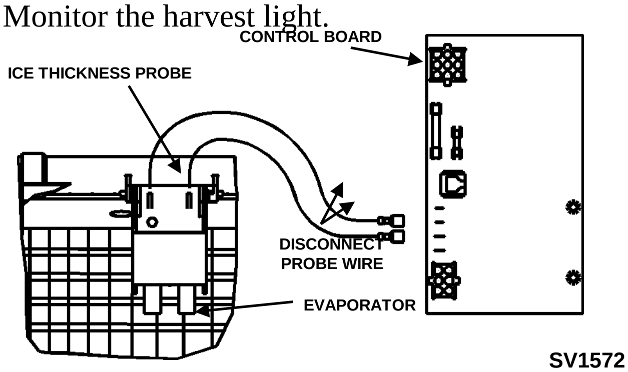


Installing New Ice Thickness Probe

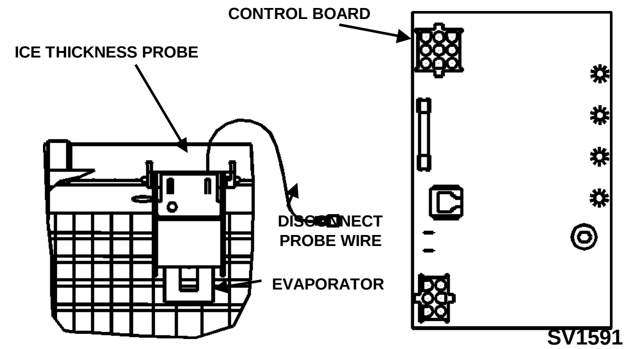
DIAGNOSING PROBE CONTROL CIRCUITRY

Ice Machine Cycles Into Harvest Before Water Contact with Probe

1. Disconnect the ice thickness probe from the control board.
2. Bypass the freeze time lock-in feature by moving the ICE/OFF /CLEAN switch to OFF and back to ICE.
3. Wait about 1.5 minutes for water to begin flowing over the evaporator.
4. Monitor the harvest light.



Dual Probe

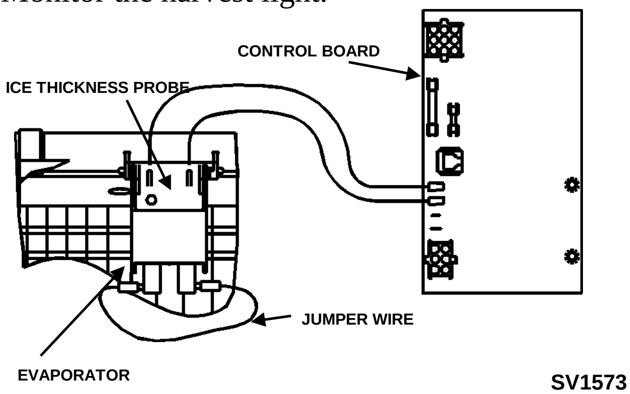


Single Probe

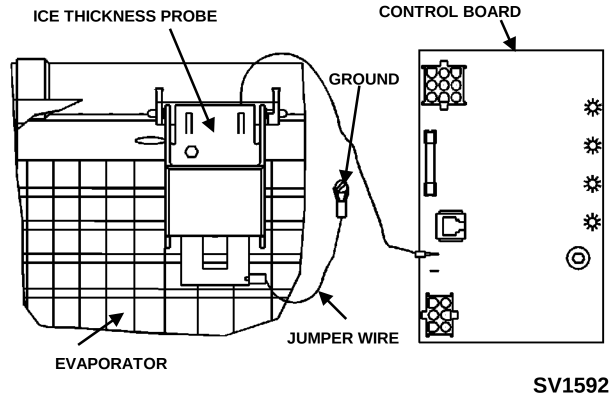
Monitoring of Harvest Light	Correction
The harvest light stays off and the ice machine remains in the freeze sequence.	The ice thickness probe is causing the malfunction.
The harvest light comes on, and 6-10 seconds later, ice machine cycles from freeze to harvest.	The control board is causing the malfunction.

Ice Machine Does Not Cycle Into Harvest When Water Contacts Probe

1. Bypass the freeze time lock-in feature by moving the ICE/OFF/CLEAN switch to OFF and back to ICE.
2. Clip the leads of a jumper wire onto the ice thickness probe to try to initiate a harvest cycle.
3. Monitor the harvest light.



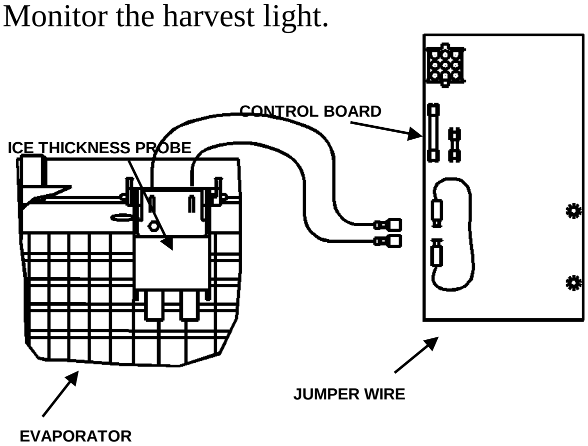
Dual Probe



Single Probe

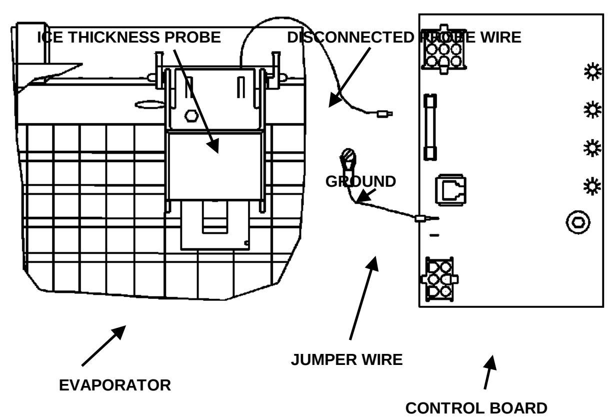
Monitoring of Harvest Light	Correction
The harvest light comes on, and 6-10 seconds later, ice machine cycles from freeze to harvest.	The control circuitry is functioning properly. Do not change any parts.
The harvest light comes on but the ice machine stays in the freeze sequence.	The control circuitry is functioning properly. The ice machine is in a six-minute freeze time lock-in.
The harvest light does not come on.	Proceed to Step 4, below.

4. Disconnect the ice thickness probe from the control board.
5. Clip the jumper wire leads to terminal 1C on the control board and ground to try to initiate a harvest cycle.
6. Monitor the harvest light.



Dual Probe

SV1574



Single Probe

SV1593

Monitoring of Harvest Light	Correction
The harvest light comes on, and 6-10 seconds later, ice machine cycles from freeze to harvest.	The ice thickness probe is causing the malfunction.
The harvest light comes on but the ice machine stays in the freeze sequence.	The control circuitry is functioning properly. The ice machine is in a six-minute freeze time lock-in.
The harvest light does not come on.	The control board is causing the malfunction.

Diagnosing Ice Machine That Will Not Run

WARNING

High (line) voltage is applied to the control board (terminals #55 and #56) at all times. Removing control board fuses or moving the toggle switch to OFF will not remove the power supplied to the control board.

Step	Check	Notes
1	Verify primary voltage supply to ice machine.	Verify that the fuse or circuit breaker is closed.
2	Verify the high pressure cut-out is closed.	The H.P.C.O. is closed if primary power voltage is present at terminals #55 and #56 on the control board.
3	Verify main and transformer (if applicable) control board fuses are OK.	If the bin switch light functions, the fuses are OK.
4	Verify the bin switch functions properly.	A defective bin switch can falsely indicate a full bin of ice.
5	Verify ICE/OFF/CLEAN toggle switch functions properly.	A defective toggle switch may keep the ice machine in the OFF mode.
6	Verify low DC voltage is properly grounded.	Loose DC wire connections may intermittently stop the ice machine.
7	Replace the control board.	Be sure Steps 1-6 were followed thoroughly. Intermittent problems are not usually related to the control board.

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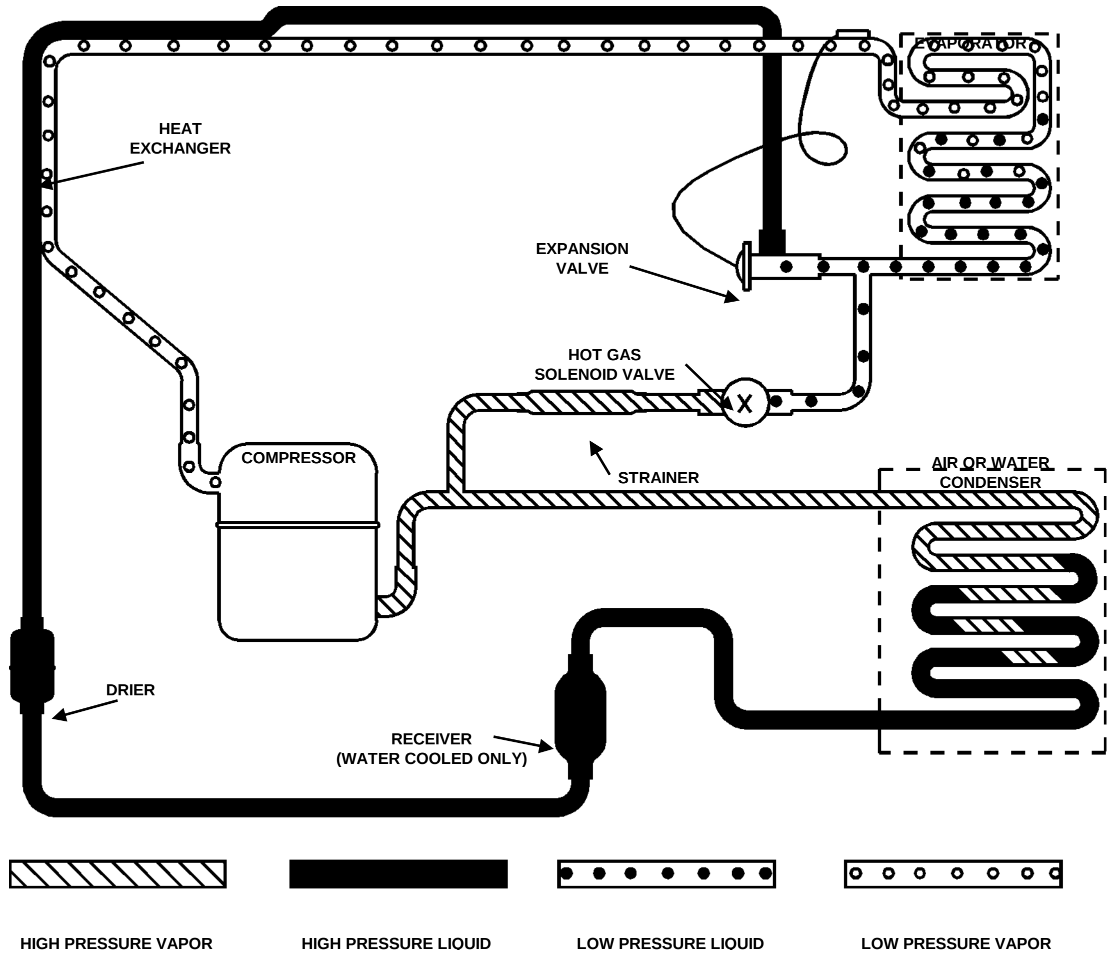
Section 7

Refrigeration System

Sequence of Operation

SELF-CONTAINED AIR OR WATER-COOLED MODELS



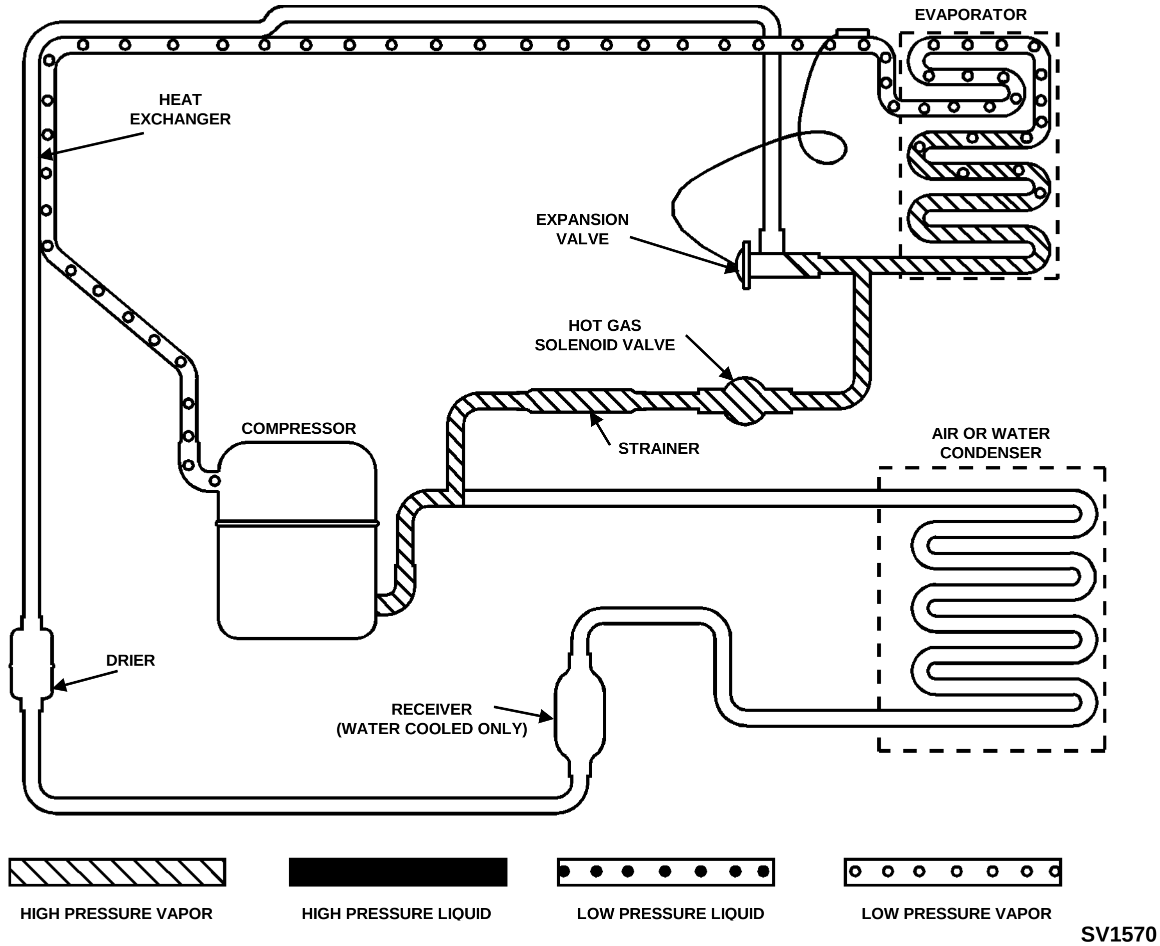
Self-Contained Prechill and Freeze Cycle (Models J250/J320/J420/J450/J600/J800/J1000)

Prechill Refrigeration Sequence

No water flows over the evaporator during the prechill. The refrigerant absorbs heat (picked up during the harvest cycle) from the evaporator. The suction pressure decreases during the prechill.

Freeze Cycle Refrigeration Sequence

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

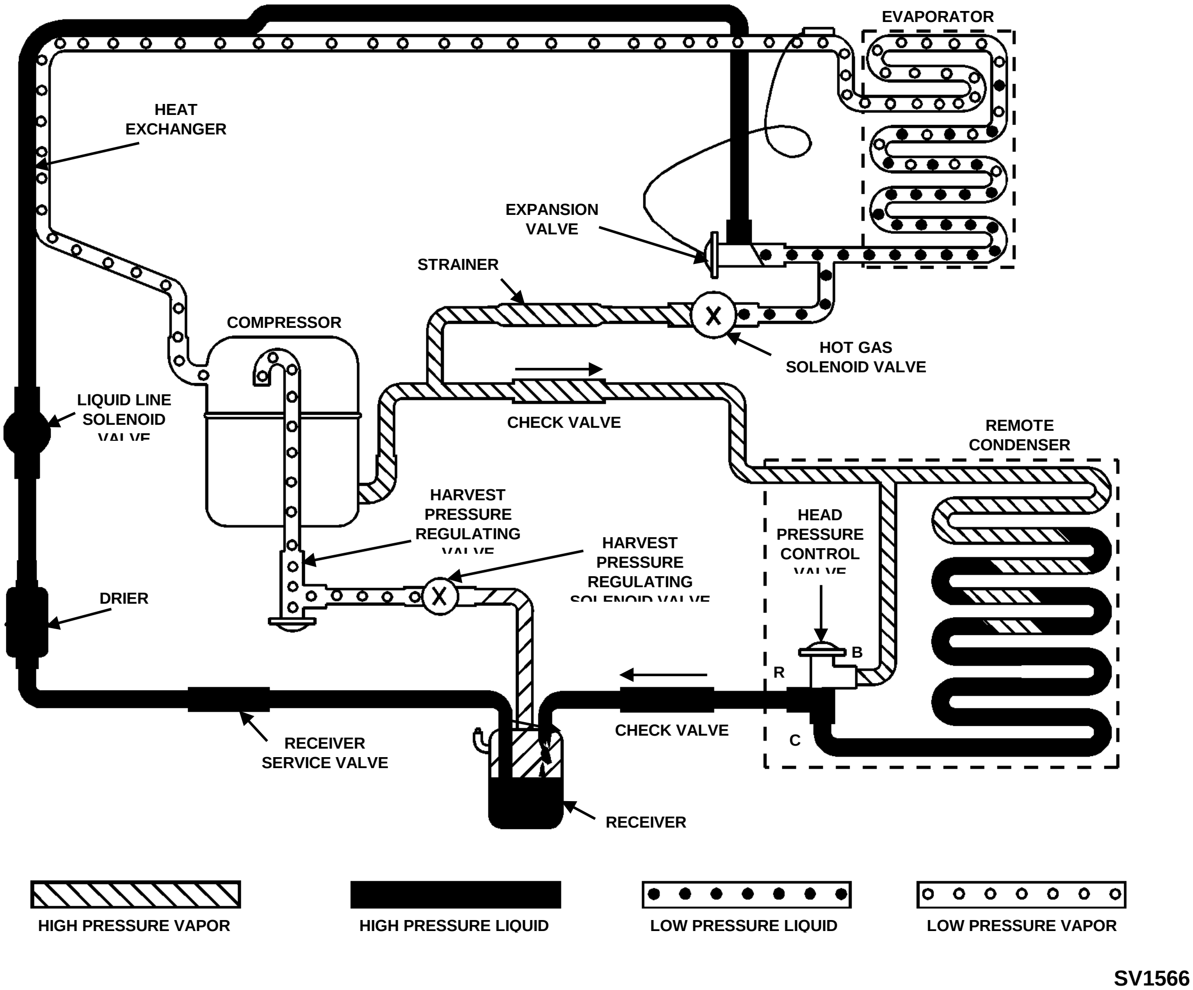


Self-Contained Harvest Cycle (Models J250/J320/J420/J450/J600/J800/J1000)

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 (along with the proper system refrigerant charge) assures proper heat transfer, without the refrigerant condensing and slugging the compressor.

REMOTE MODELS



Remote Pre-Chill and Freeze Cycle (Models J450/J600/J800/J1000)

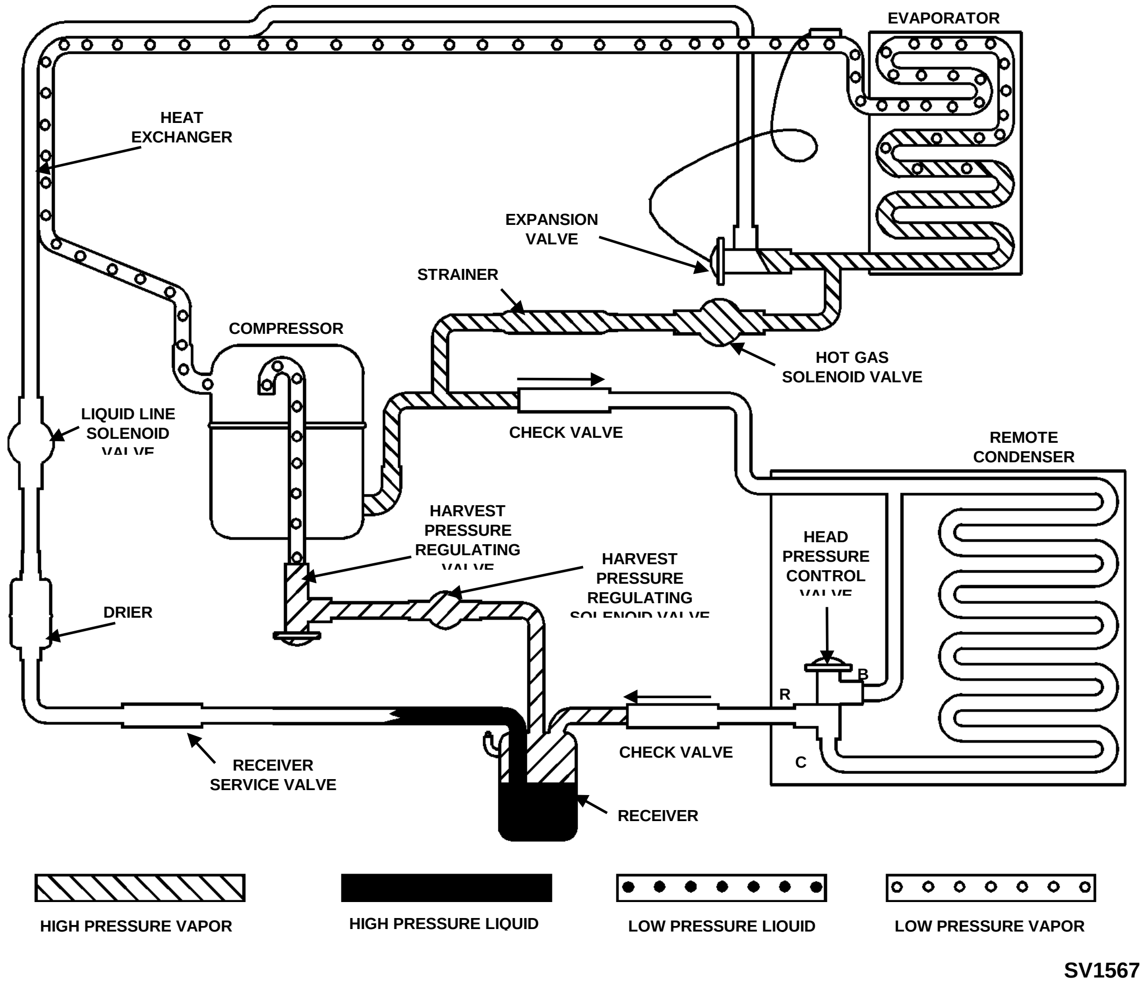
Prechill Refrigeration Sequence

No water flows over the evaporator during the prechill. The refrigerant absorbs heat (picked up during the harvest cycle) from the evaporators. The suction pressure decreases during the prechill.

Freeze Cycle Refrigeration Sequence

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

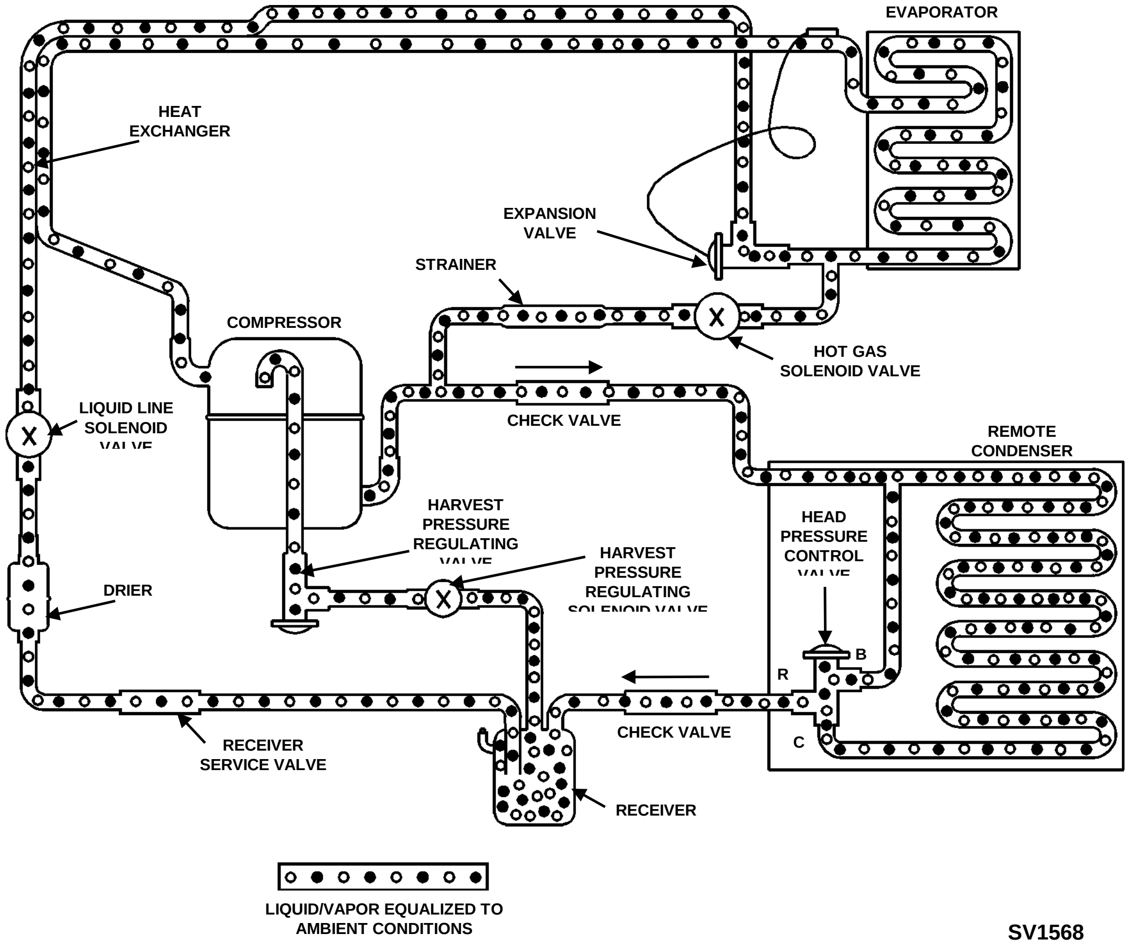
The headmaster control valve maintains discharge pressure in cold ambient temperatures. (See "Headmaster Control Valve" on page 7-28.)



Remote Harvest Cycle (Models J450/J600/J800/J1000)

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 hot gas into the evaporator. This specific hot gas valve sizing, along with the harvest pressure regulating (H.P.R.) system, assures proper heat transfer, without the hot gas condensing to liquid and slugging the compressor.

The harvest pressure regulating (H.P.R.) valve helps maintain the suction pressure during the harvest cycle. (See “H.P.R. System” on page 7-26.)



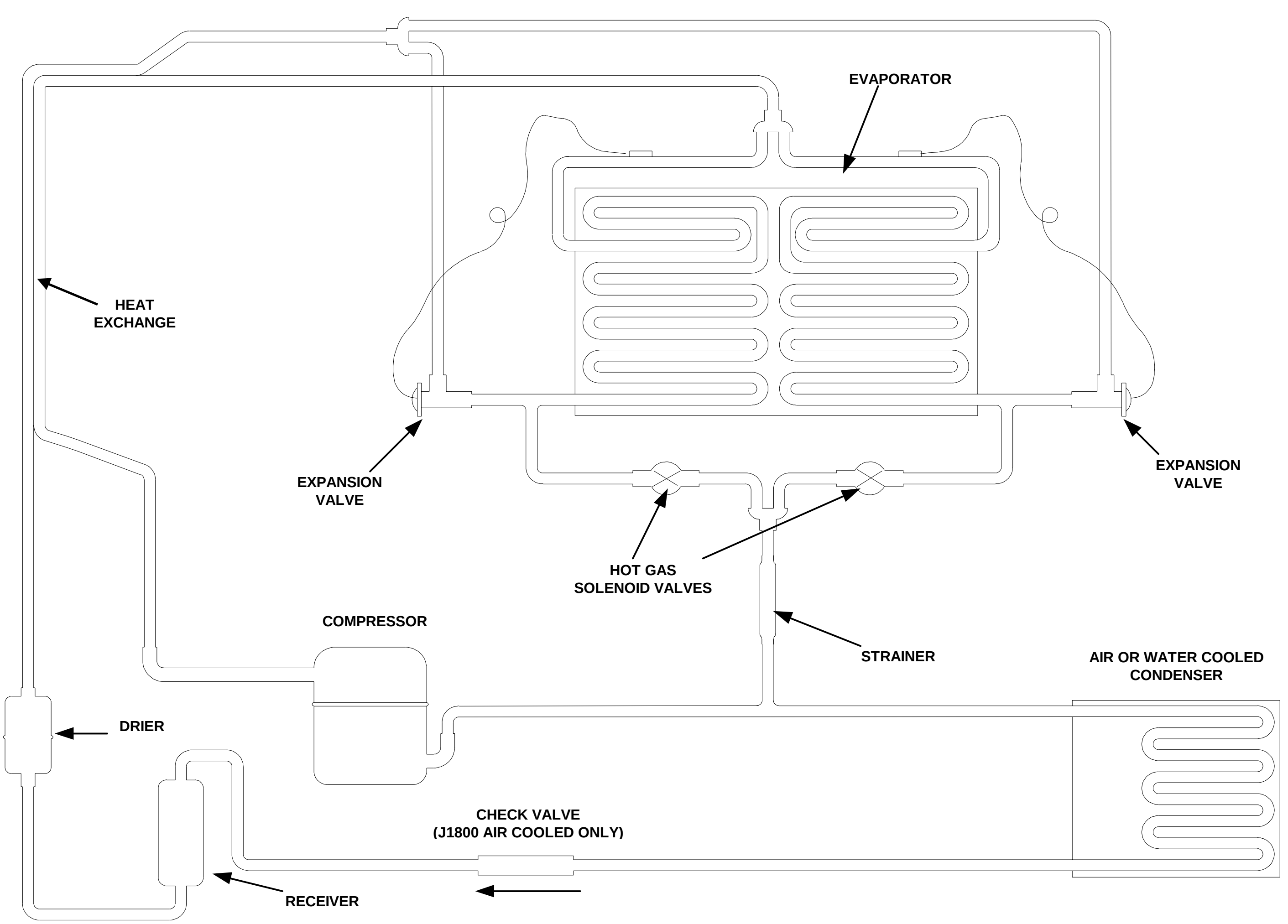
Remote Automatic Shut-Off (Models J450/J600/J800/J1000)

Automatic Shut-Off

The compressor and liquid line solenoid valve are de-energized simultaneously when the contactor contacts open.

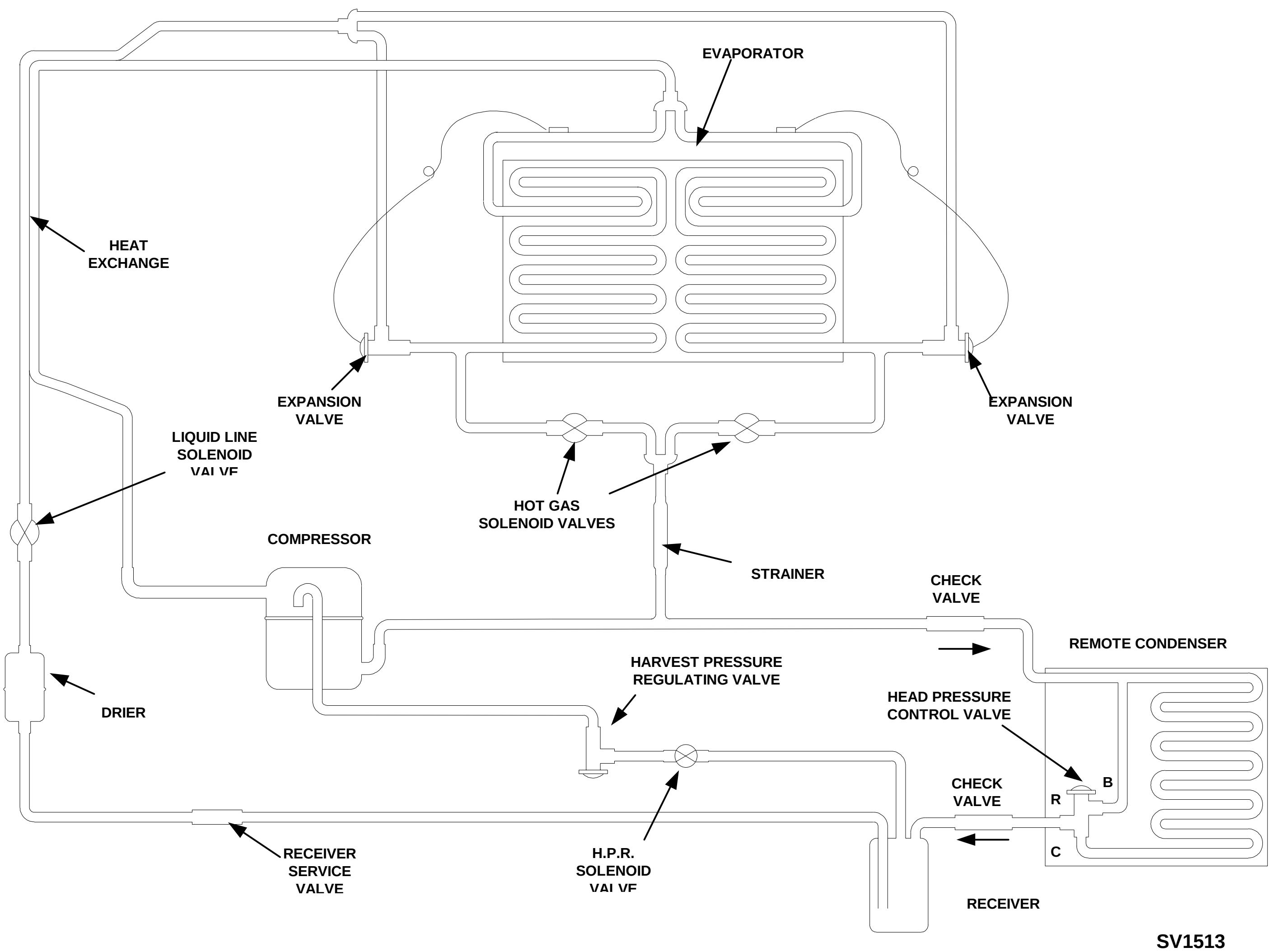
During the off cycle, the check valve prevents refrigerant from migrating back into the high side, and the liquid line solenoid prevents refrigerant from migrating back into the low side. This protects the compressor from refrigerant migration during the off cycle, preventing refrigerant slugging upon start-up.

J1300/J1800 REFRIGERATION TUBING SCHEMATICS



J1300/J1800 Self-Contained Air- or Water-Cooled Models

NOTE: The refrigeration sequence for self-contained dual expansion valve ice machines is identical to self-contained single expansion valve ice machines. See pages 7-1 and 7-2 for sequence of operation.



J1300/J1800 Remote Models

NOTE: The refrigeration sequence for remote dual expansion valve ice machines is identical to remote single expansion valve ice machines. See pages 7-3, 7-4 and 7-5 for sequence of operation.

Operational Analysis (Diagnostics)

GENERAL

When analyzing the refrigeration system, it is important to understand that different refrigeration component malfunctions may cause very similar symptoms.

Also, many external factors can make good refrigeration components appear bad. These factors can include improper installation, or water system malfunctions such as hot incoming water supply or water loss.

The following two examples illustrate how similar symptoms can result in a misdiagnosis.

1. An expansion valve bulb that is not securely fastened to the suction line and/or not insulated will cause a good expansion valve to flood. If a service technician fails to check for proper expansion valve bulb mounting, he may replace the expansion valve in error.

The ice machine now functions normally. The technician erroneously thinks that the problem was properly diagnosed and corrected by replacing the expansion valve. Actually, the problem (loose bulb) was corrected when the technician properly mounted the bulb of the replacement expansion valve.

The service technician's failure to check the expansion valve bulb for proper mounting (an external check) resulted in a misdiagnosis and the needless replacement of a good expansion valve.

2. An ice machine that is low on charge may cause a good expansion valve to starve. If a service technician fails to verify the system charge, he may replace the expansion valve in error.

During the replacement procedure, recovery, evacuation and recharging are performed correctly. The ice machine now functions normally. The technician erroneously thinks that the problem was properly diagnosed and corrected by replacing the expansion valve.

The service technician's failure to check the ice machine for a low charge condition resulted in a misdiagnosis and the needless replacement of a good expansion valve.

When analyzing the refrigeration system, use a Refrigeration System Operational Analysis Table. This table, along with detailed checklists and references, will help prevent replacing good refrigeration components due to external problems.

BEFORE BEGINNING SERVICE

Ice machines may experience operational problems only during certain times of the day or night. A machine may function properly while it is being serviced, but malfunctions later. Information provided by the user can help the technician start in the right direction, and may be a determining factor in the final diagnosis.

Ask these questions before beginning service:

- When does the ice machine malfunction? (night, day, all the time, only during the freeze cycle, etc.)
- When do you notice low ice production? (one day a week, every day, on weekends, etc.)
- Can you describe exactly what the ice machine seems to be doing?
- Has anyone been working on the ice machine?
- Is anything (such as boxes) usually stored near or on the ice machine which could obstruct airflow around the machine?
- During "store shutdown," is the circuit breaker, water supply or air temperature altered?
- Is there any reason why incoming water pressure might rise or drop substantially?

ICE PRODUCTION CHECK

The amount of ice a machine produces directly relates to the operating water and air temperatures. This means an ice machine in a 70°F (21.2°C) room with 50°F (10.0°C) water produces more ice than the same model ice machine in a 90°F (32.2°C) room with 70°F (21.2°C) water.

1. Determine the ice machine operating conditions:
   Air temp. entering condenser: ____°
   Air temp. around ice machine: ____°
   Water temp. entering float valve: ____°
2. Refer to the appropriate 24 Hour Ice Production Chart. (These charts begin on page 7-31.) Use the operating conditions determined in Step 1 to find the published 24 ice production: ______
3. Perform an actual ice production check. Use the formula below.

1.	________ Freeze Time	+	________ Harvest Time	=	________ Total Cycle Time
2.	1440 Minutes in 24 Hours	÷	________ Total Cycle Time	=	________ Cycles Per Day
3.	________ Weight of One Harvest	x	________ Cycles Per Day	=	________ Actual 24 Hour Ice Production

Important

- Times are in minutes.

Example: 1 min., 15 sec. converts to 1.25 min.
(15 seconds ÷ 60 seconds = .25 minutes)

- Weights are in pounds.

Example: 2 lb., 6 oz. converts to 2.375 lb.
(6 oz. ÷16 oz. = .375 lb.)

- Weighing the ice is the only 100% accurate check. However, if the ice pattern is normal and the 1/8" thickness is maintained, the ice slab weights listed with the 24 Hour Ice Production Charts may be used.

4. Compare the results of Step 3 with Step 2. Ice production is normal when these numbers match closely. If they do not match closely, determine if:
   - another ice machine is required.
   - more storage capacity is required.
   - relocating the existing equipment to lower the load conditions is required.

Contact the local Manitowoc distributor for information on available options and accessories.

INSTALLATION/VISUAL INSPECTION CHECKLIST

Possible Problem	Corrective Action
Ice machine is not level	Level the ice machine
Improper clearance around top, sides and/or back of ice machine	Reinstall according to the Installation Manual
Air-cooled condenser filter is dirty	Clean the condenser filter and/or condenser
Ice machine is not on an independent electrical circuit	Reinstall according to the Installation Manual
Water filtration is plugged (if used)	Install a new water filter
Water drains are not run separately and/or are not vented	Run and vent drains according to the Installation Manual
Remote condenser line set is improperly installed	Reinstall according to the Installation Manual

WATER SYSTEM CHECKLIST

A water-related problem often causes the same symptoms as a refrigeration system component malfunction.

Example: A water dump valve leaking during the freeze cycle, a system low on charge, and a starving TXV have similar symptoms.

Water system problems must be identified and eliminated prior to replacing refrigeration components.

Possible Problem	Corrective Action
Water area (evaporator) is dirty	Clean as needed
Water inlet pressure not between 20 and 80 psi	Install a water regulator valve or increase the water pressure
Incoming water temperature is not between 35°F (1.7°C) and 90°F (32.2°C).	If too hot, check the hot water line check valves in other store equipment
Water filtration is plugged (if used)	Install a new water filter
Water dump valve leaking during the freeze cycle	Clean/replace dump valve as needed
Vent tube is not installed on water outlet drain	See Installation Instructions
Hoses, fittings, etc., are leaking water	Repair/replace as needed
Float valve is stuck open or out of adjustment	Adjust/replace as needed
Water is spraying out of the sump trough area	Stop the water spray
Uneven water flow across the evaporator	Clean the ice machine
Water is freezing behind the evaporator	Correct the water flow
Plastic extrusions and gaskets are not secured to the evaporator	Remount/replace as needed
Water does not flow over the evaporator (not trickle) immediately after the prechill	Adjust/replace float valve as needed

ICE FORMATION PATTERN

Evaporator ice formation pattern analysis is helpful in ice machine diagnostics.

Analyzing the ice formation pattern alone cannot diagnose an ice machine malfunction. However, when this analysis is used along with Manitowoc's Refrigeration System Operational Analysis Table, it can help diagnose an ice machine malfunction.

Improper ice formation can be caused by any number of problems.

Example: An ice formation that is "extremely thin on top" could be caused by a hot water supply, a dump valve leaking water, a faulty float valve, a low refrigerant charge, etc.

Important
Keep the water curtain in place while checking the ice formation pattern to ensure no water is lost.

1. Normal Ice Formation

Ice forms across the entire evaporator surface.

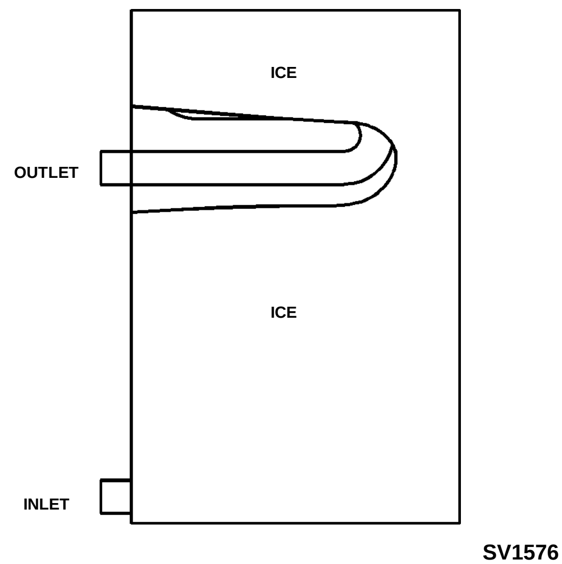
At the beginning of the freeze cycle, it may appear that more ice is forming on the bottom of the evaporator than on the top. At the end of the freeze cycle, ice formation on the top will be close to, or just a bit thinner than, ice formation on the bottom. The dimples in the cubes at the top of the evaporator may be more pronounced than those on the bottom. This is normal.

The ice thickness probe must be set to maintain the ice bridge thickness at approximately 1/8". If ice forms uniformly across the evaporator surface, but does not reach 1/8" in the proper amount of time, this is still considered normal.

2. Extremely Thin at Evaporator Outlet

There is no ice, or a considerable lack of ice formation on the top of the evaporator (tubing outlet).

Examples: No ice at all on the top of the evaporator, but ice forms on the bottom half of the evaporator. Or, the ice at the top of the evaporator reaches 1/8" to initiate a harvest, but the bottom of the evaporator already has 1/2" to 1" of ice formation.

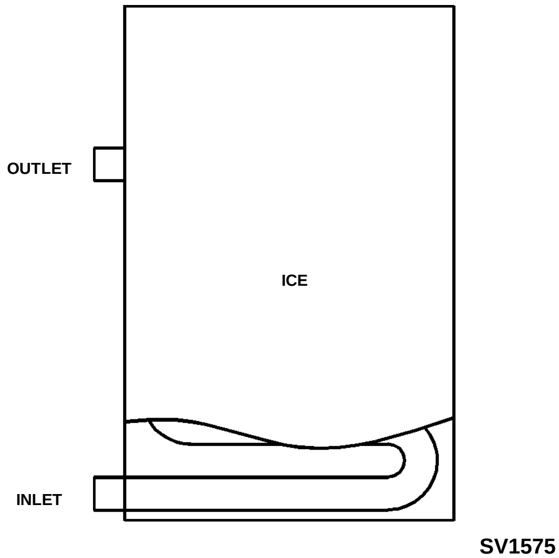


Extremely Thin Ice Formation at Evaporator Outlet

3. Extremely Thin at Evaporator Inlet

There is no ice, or a considerable lack of ice formation on the bottom of the evaporator (tubing inlet).

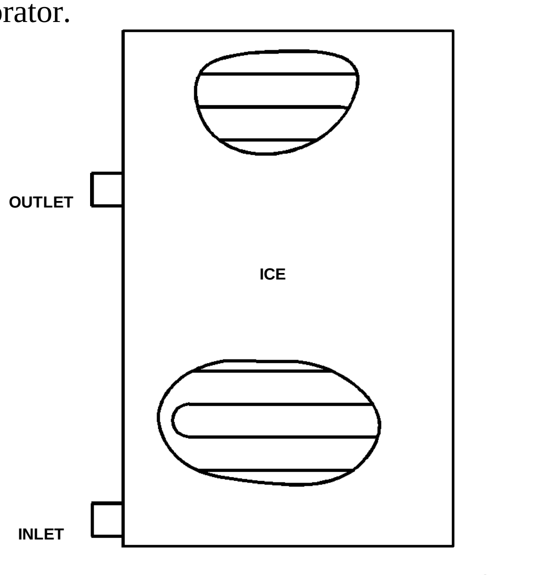
Examples: The ice at the top of the evaporator reaches 1/8” to initiate a harvest, but there is no ice formation at all on the bottom of the evaporator.



Extremely Thin Ice Formation at Evaporator Inlet

4. Spotty Ice Formation

There are small sections on the evaporator where there is no ice formation. This could be a single corner, or a single spot in the middle of the evaporator. This is generally caused by loss of heat transfer from the tubing on the back side of the evaporator.

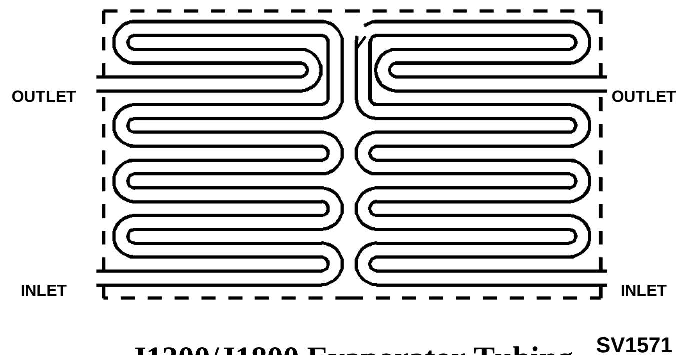


Spotty Ice Formation

5. No Ice Formation

The ice machine operates for an extended period, but there is no ice formation at all on the evaporator.

> **Important**
>
> The J1300 and J1800 model machines have left and right expansion valves and separate evaporator circuits. These circuits operate independently from each other. Therefore, one may operate properly while the other is malfunctioning.
>
> Example: If the left expansion valve is starving, it may not affect the ice formation pattern on the entire right side of the evaporator.



J1300/J1800 Evaporator Tubing

SAFETY LIMITS

General

In addition to standard safety controls, such as high pressure cut-out, the control board has four built in safety limit controls which protect the ice machine from major component failures. New style control boards have two safety limit controls.

Safety Limit #1: If the freeze time reaches 60 minutes, the control board automatically initiates a harvest cycle. If three consecutive 60-minute freeze cycles occur, the ice machine stops.

Safety Limit #2: If the harvest time reaches 3.5 minutes, the control board automatically returns the ice machine to the freeze cycle. If three consecutive 3.5 minute harvest cycles occur, the ice machine stops.

Safety Limit #3:if the compressor discharge line temperature falls below 85°F/29.4C for three consecutive harvest cycles, the ice machine stops.

Safety limit #4: If the compressor discharge line temperature reaches 255°F/123.8°C for 15 continuos seconds during a freeze or harvest cycle the ice machine stops.

Determining which safety limit stopped the ice machine

When a safety limit condition causes the ice machine to stop, the harvest light on the control board continually flashes on and off. Use the following procedures to determine which safety limit has stopped the ice machine.

Step 1 Move the toggle switch to off.

Step 2 Move the toggle switch back to ice.

Step 3 Watch the harvest light. It will flash one to four times, corresponding to safety limits 1-4, to indicate which safety limit stopped the ice machine.

After safety limit indication, the ice machine will restart and run until a safety limit is exceeded again.

Analyzing Why Safety Limits May Stop the Ice Machine

According to the refrigeration industry, a high percentage of compressors fail as a result of external causes. These can include: flooding or starving expansion valves, dirty condensers, water loss to the ice machine, etc. The safety limits protect the ice machine (primarily the compressor) from external failures by stopping ice machine operation before major component damage occurs.

The safety limit system is similar to a high pressure cut-out control. It stops the ice machine, but does not tell what is wrong. The service technician must analyze the system to determine what caused the high pressure cut-out, or a particular safety limit, to stop the ice machine.

The safety limits are designed to stop the ice machine prior to major component failures, most often a minor problem or something external to the ice machine. This may be difficult to diagnose, as many external problems occur intermittently.Example: An ice machine stops intermittently on safety limit #1 (long freeze times). The problem could be a low ambient temperature at night, a water pressure drop, the water is turned off one night a week, etc.

When a high pressure cut-out or a safety limit stops the ice machine, they are doing what they are supposed to do. That is, stopping the ice machine before a major component failure occurs.

Refrigeration and electrical component failures may also trip a safety limit. Eliminate all electrical components and external causes first. If it appears that the refrigeration system is causing the problem, use Manitowoc’s Refrigeration System Operational Analysis Table, along with detailed charts, checklists, and other references to determine the cause.

The following checklists are designed to assist the service technician in analysis. However, because there are many possible external problems, do not limit your diagnosis to only the items listed.

Safety Limit #1

Freeze time exceeds 60 minutes for 3 consecutive freeze cycles.

Possible Cause	Check/Correct
Improper installation	• See "Installation/Visual Inspection Checklist" on page 7-10
Water system	• Low water pressure (20 psi min.) • High water pressure (80 psi max.) • High water temperature (90°F/32.2°C max.) • Clogged water distribution tube • Dirty/defective float valve • Dirty/defective water dump valve • Defective water pump
Electrical system	• Ice thickness probe out of adjustment • Harvest cycle not initiated electrically • Contactor not energizing • Compressor electrically non-operational
Restricted condenser air flow (air-cooled models)	• High inlet air temperature (110°F/43.3°C max.) • Condenser discharge air recirculation • Dirty condenser filter • Dirty condenser fins • Defective fan cycling control • Defective fan motor
Restricted condenser water flow (water-cooled models)	• Low water pressure (20 psi min.) • High water temperature (90°F/32.2°C max.) • Dirty condenser • Dirty/defective water regulating valve • Water regulating valve out of adjustment
Refrigeration system	• Non-Manitowoc components • Improper refrigerant charge • Defective head pressure control (remotes) • Defective hot gas valve • Defective compressor • TXV starving or flooding (check bulb mounting) • Non-condensibles in refrigeration system • Plugged or restricted high side refrigerant lines or component

NOTE: Because there are many possible external problems, do not limit your diagnosis to only the items listed in this chart.

NOTE: This chart reflects the removal of safety limits #3 and #4 from new style control boards.

Safety Limit Notes

- A continuos run of 100 harvests automatically erases the safety limit code.
- The control board will store and indicate only one safety limit - the last one exceeded.
- If the toggle switch is moved to the **off** position and then back to the **on** position prior to reaching the 100-harvest point, the last safety exceeded will be indicated.
- If the harvest light did not flash prior to the ice machine restarting, then the ice machine did not stop because it exceeded a safety.

Safety Limit #2

Harvest time exceeds 3.5 minutes for 3 consecutive harvest cycles.

Possible Cause	Check/Correct
Improper installation	• See "Installation/Visual Inspection Checklist" on page 7-10
Water system	• Water area (evaporator) dirty • Dirty/defective water dump valve • Vent tube not installed on water outlet drain • Water freezing behind evaporator • Plastic extrusions and gaskets not securely mounted to the evaporator • Low water pressure (20 psi min.) • Loss of water from sump area • Clogged water distribution tube • Dirty/defective float valve • Defective water pump
Electrical system	• Ice thickness probe out of adjustment • Ice thickness probe dirty • Bin switch defective • Premature harvest
Refrigeration system	• Non-Manitowoc components • Water regulating valve dirty/defective • Improper refrigerant charge • Defective head pressure control valve (remotes) • Defective harvest pressure control (HPR) valve (remotes) • Defective hot gas valve • TXV flooding (check bulb mounting) • Defective fan cycling control

NOTE: Because there are many possible external problems, do not limit your diagnosis to only the items listed in this chart.

NOTE: This chart reflects the removal of safety limits #3 and #4 from new style control boards.

Safety Limit #3

Compressor discharge temperature fell below 85°F/29.4°C for 3 consecutive harvest cycles.

Possible Cause	Check/Correct
Improper installation	• See “Installation/Visual Inspection Checklist” on page 7-10
Ice thickness probe	• Check thickness setting
Water system - insufficient water flow over evaporator	• Low water pressure (20 psi min.) • Loss of water from sump area • Clogged water distribution tube • Dirty/defective float valve • Dirty/defective water dump valve • Defective water pump
Refrigeration system	• Non-Manitowoc components • Defective head pressure control valve (remotes) • Defective harvest pressure control (HPR) valve (remotes) • Defective fan cycle control • Improper refrigerant charge • Defective hot gas valve • TXV flooding (check bulb mounting)
Thermistor	• Defective thermistor

Safety Limit #4

Compressor discharge temperature exceeded 255°F/123.8°C for 15 continuous seconds.

Possible Cause	Check/Correct
Improper installation	• See “Installation/Visual Inspection Checklist” on page 7-10
Restricted condenser air flow (air-cooled models)	• High inlet air temperature (110°F/43.3°C max.) • Condenser air recirculation discharge • Dirty condenser filter • Dirty condenser fins • Defective fan cycling control • Defective fan motor
Restricted condenser water flow (water-cooled models)	• Low water pressure (20 psi min.) • High water temperature (90°F/32.2°C max.) • Dirty condenser • Dirty/defective water regulating valve • Water regulating valve out of adjustment
Refrigeration system	• Non-Manitowoc components • Defective head pressure control valve (remotes) • Improper refrigerant charge • Non-condensibles in refrigeration system • High side refrigerant lines/component restricted or plugged • TXV starving (check bulb mounting) • Defective compressor
Thermistor	• Defective thermistor

NOTE: Because there are many possible external problems, do not limit your diagnosis to only the items listed in these charts.

NOTE: Safety Limits #3 and #4 are not used on later production J-model ice machines. Any fault that would stop the ice machine on safety limit #3 or #4 would also stop the ice machine on safety limit #1 or #2.

HOT GAS VALVE TEMPERATURE CHECK

General

A hot gas valve requires a critical orifice size. This meters the amount of hot gas flowing into the evaporator during the harvest cycle. If the orifice is even slightly too large or too small, long harvest cycles will result.

A too-large orifice causes refrigerant to condense to liquid in the evaporator during the harvest cycle. This liquid will cause compressor damage. A too-small orifice does not allow enough hot gas into the evaporator. This causes low suction pressure, and insufficient heat for a harvest cycle.

Normally, a defective hot gas valve can be rebuilt. Refer to the Parts Manual for proper valve application and rebuild kits. If replacement is necessary, Use only “original” Manitowoc replacement parts.

Hot Gas Valve Analysis

Symptoms of a hot gas valve remaining partially open during the freeze cycle can be similar to symptoms of either an expansion valve or compressor problem. The best way to diagnose a hot gas valve is by using Manitowoc’s Ice Machine Refrigeration System Operational Analysis Table.

Use the following procedure and table to help determine if a hot gas valve is remaining partially open during the freeze cycle.

1. Wait five minutes into the freeze cycle.
2. Feel the inlet of the hot gas valves.

Important

Feeling the hot gas valve outlet or across the hot gas valve itself will not work for this comparison.

The hot gas valve outlet is on the suction side (cool refrigerant). It may be cool enough to touch even if the valve is leaking.

3. Feel the compressor discharge line.

WARNING

The inlet of the hot gas valve and the compressor discharge line could be hot enough to burn your hand. Just touch them momentarily.

4. Compare the temperature of the inlet of the hot gas valves to the temperature of the compressor discharge line.

Findings	Comments
The inlet of the hot gas valve is cool enough to touch and the compressor discharge line is hot.	This is normal as the discharge line should always be too hot to touch and the hot gas valve inlet, although too hot to touch during harvest, should be cool enough to touch after 5 minutes into the freeze cycle.
The inlet of the hot gas valve is hot and approaches the temperature of a hot compressor discharge line.	This is an indication something is wrong, as the hot gas valve inlet did not cool down during the freeze cycle. If the compressor dome is also entirely hot, the problem is not a hot gas valve leaking, but rather something causing the compressor (and the entire ice machine) to get hot.
Both the inlet of the hot gas valve and the compressor discharge line are cool enough to touch.	This is an indication something is wrong, causing the compressor discharge line to be cool to the touch. This is not caused by a hot gas valve leaking.

SINGLE EXPANSION VALVE ICE MACHINES COMPARING EVAPORATOR INLET AND OUTLET TEMPERATURES

NOTE: This procedure will not work on the dual expansion valve J1300 and J1800 ice machines.

The temperatures of the suction lines entering and leaving the evaporator alone cannot diagnose an ice machine. However, comparing these temperatures during the freeze cycle, along with using Manitowoc's Refrigeration System Operational Analysis Table, can help diagnose an ice machine malfunction.

The actual temperatures entering and leaving the evaporator vary by model, and change throughout the freeze cycle. This makes documenting the "normal" inlet and outlet temperature readings difficult. The key to the diagnosis lies in the difference between the two temperatures five minutes into the freeze cycle. These temperatures must be within 7° of each other.

Use this procedure to document freeze cycle inlet and outlet temperatures.

1. Use a quality temperature meter, capable of taking temperature readings on curved copper lines.
2. Attach the temperature meter sensing device to the copper lines entering and leaving the evaporator.

Important
Do not simply insert the sensing device under the insulation. It must be attached to and reading the actual temperature of the copper line.

3. Wait five minutes into the freeze cycle.
4. Record the temperatures below and determine the difference between them.
5. Use this with other information gathered on the Refrigeration System Operational Analysis Table to determine the ice machine malfunction.

________________	________________
Inlet Temperature	**Outlet Temperature**

____
Difference
Must be within 7°
5 min into freeze cycle

ANALYZING DISCHARGE PRESSURE DURING FREEZE OR HARVEST CYCLE

Procedure

1. Determine the ice machine operating conditions:
   Air temp. entering condenser ______
   Air temp. around ice machine ______
   Water temp. entering float valve ______

2. Refer to Operating Pressure Chart for ice machine being checked. (These charts begin on page 7-31.)

   Use the operating conditions determined in Step 1 to find the published normal discharge pressures.

   Freeze Cycle ______ Harvest Cycle ______

3. Perform an actual discharge pressure check.

	Freeze Cycle PSIG	Harvest Cycle PSIG
Beginning of Cycle	________	________
Middle of Cycle	________	________
End of Cycle	________	________

4. Compare the actual discharge pressure (Step 3) with the published discharge pressure (Step 2).

   The discharge pressure is normal when the actual pressure falls within the published pressure range for the ice machine's operating conditions.

Freeze Cycle Discharge Pressure High Checklist

Possible Cause	Check/Correct
Improper installation	• See "Installation/Visual Inspection Checklist" on page 7-10
Restricted condenser air flow (air-cooled models)	• High inlet air temperature (110°F/43.3°C max.) • Condenser discharge air recirculation • Dirty condenser filter • Dirty condenser fins • Defective fan cycling control • Defective fan motor
Restricted condenser water flow (water-cooled models)	• Low water pressure (20 psi min.) • High inlet water temperature (90°F/32.2°C max.) • Dirty condenser • Dirty/defective water regulating valve • Water regulating valve out of adjustment
Improper refrigerant charge	• Overcharged • Non-condensibles in system • Wrong type of refrigerant
Other	• Non-Manitowoc components in system • High side refrigerant lines/component restricted (before mid-condenser) • Defective head pressure control valve (remote models)

Freeze Cycle Discharge Pressure Low Checklist

Possible Cause	Check/Correct
Improper installation	• See "Installation/Visual Inspection Checklist" on page 7-10
Improper refrigerant charge	• Undercharged • Wrong type of refrigerant
Water regulating valve (water-cooled condensers)	• Out of adjustment • Defective
Other	• Non-Manitowoc components in system • Defective head pressure control valve (remote models) • Defective fan cycle control

NOTE: Do not limit your diagnosis to only the items listed in the checklists.

ANALYZING SUCTION PRESSURE DURING FREEZE CYCLE

The suction pressure gradually drops throughout the freeze cycle. The actual suction pressure (and drop rate) changes as the air and water temperatures entering the ice machine change. This affects freeze cycle times.

To analyze and identify the proper suction pressure drop throughout the freeze cycle, compare the published suction pressure to the published freeze cycle time. “Operating Pressure” and “Freeze Cycle Time” charts can be found later in this section.

NOTE: Analyze discharge pressure before analyzing suction pressure. High or low discharge pressure may be causing high or low suction pressure.

Procedure

<table>
<tr><th>Step</th><th colspan="4">Example Using JY604A Model Ice Machine</th></tr>
<tr><td>1. Determine the ice machine operating conditions.</td><td colspan="4">Air temp. entering condenser: 90°F/32.2°C
Air temp. around ice machine: 80°F/26.7°C
Water temp. entering float valve: 70°F/21.1°C</td></tr>
<tr><td>2A. Refer to “Cycle Time” and “Operating Pressure” charts for ice machine model being checked. Using operating conditions from Step 1, determine published freeze cycle time and published freeze cycle suction pressure.</td><td colspan="2">Published freeze cycle time:
10.6 - 12.5 minutes</td><td colspan="2">Published freeze cycle suction pressure:
52-23 PSIG</td></tr>
<tr><td>2B. Compare the published freeze cycle time and published freeze cycle suction pressure. Develop a chart.</td><td colspan="4">Published Freeze Cycle Time (minutes)
1 2 4 6 8 10 12
52 48 43 38 33 28 23
Published Freeze Cycle Suction Pressure (psig)</td></tr>
<tr><td>3. Perform an actual suction pressure check at the beginning, middle and end of the freeze cycle. Note the times at which the readings are taken.</td><td colspan="4">Beginning of freeze cycle: 48 PSIG at 4 minutes
Middle of freeze cycle: 42 PSIG at 8 minutes
End of freeze cycle: 28 PSIG at 12 minutes</td></tr>
<tr><td rowspan="2">4. Compare the actual freeze cycle suction pressure (Step 3) to the published freeze cycle time and pressure comparison (Step 2B). Determine if the suction pressure is high, low or acceptable.</td><td>Time Into Freeze Cycle</td><td>Published Pressure</td><td>Actual Pressure</td><td>Result</td></tr>
<tr><td>4 minutes
8 minutes
12 minutes</td><td>43 PSIG
33 PSIG
23 PSIG</td><td>48 PSIG
42 PSIG
28 PSIG</td><td>High
High
High</td></tr>
</table>

Freeze Cycle Suction Pressure High Checklist

Possible Cause	Check/Correct
Improper installation	• See “Installation/Visual Inspection Checklist” on page 7-10
Discharge pressure	• Discharge pressure is too high, and is affecting low side (See “Freeze Cycle Discharge Pressure High Checklist” on page 7-19)
Improper refrigerant charge	• Overcharged • Wrong type of refrigerant
Other	• Non-Manitowoc components in system • H.P.R. solenoid leaking • Hot gas valve stuck open • TXV flooding (check bulb mounting) • Defective compressor

Freeze Cycle Suction Pressure Low Checklist

Possible Cause	Check/Correct
Improper installation	• See “Installation/Visual Inspection Checklist” on page 7-10
Discharge pressure	• Discharge pressure is too low, and is affecting low side (See “Freeze Cycle Discharge Pressure Low Checklist” on page 7-19)
Improper refrigerant charge	• Undercharged • Wrong type of refrigerant
Other	• Non-Manitowoc components in system • Improper water supply over evaporator (See “Water System Checklist” on page 7-10) • Loss of heat transfer from tubing on back side of evaporator • Restricted/plugged liquid line drier • Restricted/plugged tubing in suction side of refrigeration system • TXV starving (check bulb mounting)

NOTE: Do not limit your diagnosis to only the items listed in the checklists.

HOW TO USE THE REFRIGERATION SYSTEM OPERATIONAL ANALYSIS TABLES

General

These tables must be used with charts, checklists and other references to eliminate refrigeration components not listed on the tables and external items and problems which can cause good refrigeration components to appear defective.

The tables list five different defects that may affect the ice machine's operation.

NOTE: There are only four columns listed across the top. A low-on-charge ice machine and a starving expansion valve have very similar characteristics and are listed under the same column.

NOTE: Before starting, see "Before Beginning Service" on page 7-9 for a few questions to ask when talking to the ice machine owner.

Procedure

Step1 Complete the "Operation Analysis" column.

Read down the left "Operational Analysis" column. Perform all procedures and check all information listed. Each item in this column has supporting reference material to help analyze each step.

While analyzing each item separately, you may find an "external problem" causing a good refrigerant component to appear bad. Correct problems as they are found.

If the operational problem is found, it is not necessary to complete the remaining procedures.

Step 2 Enter check marks (3) in the small boxes.

Each time the actual findings of an item in the "Operational Analysis" column matches the published findings on the table, enter a check mark.

Example: Freeze cycle suction pressure is determined to be low. Enter a check mark in the "low" box.

Step 3 Add the check marks listed under each column.

Add the number of check marks listed in each of the four columns. When completed, there will be four separate totals.

Note the column number with the highest total and proceed to "Final Analysis" on the next page.

NOTE: If two columns have matching high numbers, a procedure was not performed properly and/or supporting material was not analyzed correctly.

Final Analysis
Before totaling the four columns, be sure to analyze all detailed charts, checklists, and other references to eliminate external causes which may make a good refrigerant component appear bad.

The column with the highest number of check marks identifies the refrigeration problem. Refer to the appropriate heading below.

<u>COLUMN 1 - HOT GAS VALVE LEAKING</u>
Normally, a leaking hot gas valve can be repaired with a rebuild kit instead of changing the entire valve. Rebuild or replace the valve as required.

<u>COLUMN 2 - LOW ON CHARGE/ TXV STARVING</u>
Normally, a starving expansion valve only affects the freeze cycle pressures, not the harvest cycle pressures. A low refrigerant charge normally affects both pressures.

Verify the ice machine is not low on charge before replacing an expansion valve. To verify:

1. Add refrigerant charge in 2 to 4 oz. increments as a diagnostic procedure to verify a low charge. If the problem is corrected, the ice machine is low on charge. Find the refrigerant leak.

The ice machine must operate with the nameplate charge. If the leak cannot be found, proper refrigerant procedures must still be followed Change the liquid line drier. Then, evacuate and weigh in the proper charge.

2. If the problem is not corrected by adding charge, the expansion valve is faulty.

On dual expansion valve ice machines, change only the TXV that is starving. If both TXV’s are starving, they are probably good, and are being affected by some other malfunction, such as low charge.

<u>COLUMN 3 - TXV FLOODING</u>
A loose or improperly mounted expansion valve bulb causes the expansion valve to flood. Check bulb mounting, insulation, etc., before changing the valve.

On dual expansion valve machines, the service technician should be able to tell which TXV is flooding by analyzing ice formation patterns. Change only the flooding expansion valve.

<u>COLUMN 4 - COMPRESSOR</u>
Replace the compressor and start components.

To receive warranty credit, the compressor ports must be properly sealed by crimping and soldering them closed. Old start components must be returned with the faulty compressor.

Manitowoc® J Model Single Expansion Valve
Refrigeration System Operational Analysis Table

This table must be used with charts, checklists and other references to eliminate refrigeration components not listed on the table and external items and problems which can cause good refrigeration components to appear defective.

Operational Analysis (listed below)	1	2	3	4
Ice Production	Published 24 hour ice production: ______ Calculated (actual) ice production: ______ NOTE: The ice machine is operating properly if the ice production and the ice formation pattern is normal.			
Installation and Water System	Installation and/or water-related problems can simulate a refrigerant component malfunction. Refer to "Installation/Visual Inspection Checklist" and "Water System Checklist" and correct all problems before proceeding.			
Ice Formation Pattern ______ ______ NOTE: It is normal for the "dimples" in the ice cubes on the top of the evaporator to be more pronounced than the dimples" in the ice cubes on the bottom of the evaporator.	1. Ice formation is extremely thin on top of evaporator -or- 2. No ice formation on entire evaporator ❑	1. Ice formation is extremely thin on top of evaporator -or- 2. No ice formation on entire evaporator ❑	1. Ice formation is normal -or- 2. Ice formation is extremely thin on bottom of evaporator -or- 3. No ice formation on entire evaporator ❑	1. Ice formation is normal -or- 2. No ice formation on entire evaporator ❑
Safety Limits Refer to "Safety Limits" to eliminate problems and/or components not listed on this table.	Stops on safety limit: **1** ❑	Stops on safety limit: **1** or **4** ❑	Stops on safety limit: **1** or **2** or **3** ❑	Stops on safety limit: **1** or **4** ❑
Wait five minutes into the freeze cycle. Compare **compressor discharge line temp.** to **hot gas valve inlet temp.** **Compressor** _____° **Hot Gas Inlet** _____°	Inlet of hot gas valve is **HOT** -and- approaches the temperature of a **HOT** compressor discharge line ❑	Inlet of hot gas valve is **COOL** enough to hold hand on -and- compressor discharge line is **HOT** ❑	Inlet of hot gas valve is **COOL** enough to hold hand on -and- compressor discharge line is **COOL** enough to hold hand on ❑	Inlet of hot gas valve is **COOL** enough to hold hand on -and- compressor discharge line is **HOT** ❑
Wait five minutes into the freeze cycle. Compare **inlet** to **outlet of evaporator** temp. **Inlet** ____° **Outlet** ____° **Difference** ____°	Inlet and outlet **WITHIN 7°F** of each other ❑	Inlet and outlet **NOT within 7°F** of each other -and- Inlet is **colder** than outlet ❑	1. Inlet and outlet **WITHIN 7°F** of each other -or- 2. Inlet and outlet **NOT within 7°F** of each other -and- Inlet is **warmer** than outlet ❑	Inlet and outlet **WITHIN 7°F** of each other ❑
Freeze cycle DISCHARGE pressure _____ _____ _____ **1 minute into cycle** **Middle** **End**	If discharge pressure is **High** or **Low**, refer to a freeze cycle high (or low) discharge pressure checklist to eliminate problems/components not listed on this table before proceeding.			
Freeze cycle SUCTION pressure _____ _____ _____ **1 minute into cycle** **Middle** **End**	If suction pressure is **High** or **Low**, refer to a freeze cycle high (or low) suction pressure checklist to eliminate problems/components not listed on this table before proceeding. Suction pressure is: **HIGH** ❑	Suction pressure is: **LOW** ❑	Suction pressure is: **HIGH** ❑	Suction pressure is: **HIGH** ❑
Miscellaneous Enter items in proper boxes.	❑	❑	❑	❑
Final Analysis Total the number of boxes checked in each column.	Column 1 Total: __ **Hot Gas Valve Leaking**	Column 2 Total: __ **Low on Charge** -OR- **TXV Starving**	Column 3 Total: __ **TXV Flooding**	Column 4 Total: __ **Compressor**

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Manitowoc® J Model Dual Expansion Valve
Refrigeration System Operational Analysis Table

This table must be used with charts, checklists and other references to eliminate refrigeration components not listed on the table and external items/problems which can cause good refrigeration components to appear defective.

Operational Analysis (listed below)	**1**	**2**	**3**	**4**
Ice Production	Published 24 hour ice production: ______ Calculated (actual) ice production: ______ NOTE: The ice machine is operating properly if the ice production and the ice formation pattern is normal.			
Installation and Water System	Installation and/or water-related problems can simulate a refrigerant component malfunction. Refer to "Installation/Visual Inspection Checklist" and "Water System Checklist" and correct all problems before proceeding.			
Ice Formation Pattern Left Side: ______ ______ Right Side: ______ ______ NOTE: It is normal for the "dimples" in the ice cubes on the top of the evaporator to be more pronounced than the dimples" in the ice cubes on the bottom of the evaporator.	1. Ice formation is extremely thin on top of evaporator -or- 2. No ice formation on entire evaporator ❑	1. Ice formation is extremely thin on top of evaporator -or- 2. No ice formation on entire evaporator ❑	1. Ice formation is normal -or- 2. Ice formation is extremely thin on bottom of evaporator -or- 3. No ice formation on entire evaporator ❑	1. Ice formation is normal -or- 2. No ice formation on entire evaporator ❑
Safety Limits Refer to "Safety Limits" to eliminate problems and/or components not listed on this table.	Stops on safety limit: **1** ❑	Stops on safety limit: **1** or **4** ❑	Stops on safety limit: **1** or **2** or **3** ❑	Stops on safety limit: **1** or **4** ❑
Wait five minutes into the freeze cycle. Compare **compressor discharge line temp.** to **hot gas valve inlet temps.** **Compressor** _____° **Left Hot Gas Inlet** _____° **Right Hot Gas Inlet** _____°	Inlet of one hot gas valve is **HOT** -and- approaches the temperature of a **HOT** compressor discharge line ❑	Inlet of both hot gas valves are **COOL** enough to hold hand on -and- compressor discharge line is **HOT** ❑	Inlet of both hot gas valves are **COOL** enough to hold hand on -and- compressor discharge line is **COOL** enough to hold hand on ❑	Inlet of both hot gas valves are **COOL** enough to hold hand on -and- compressor discharge line is **HOT** ❑
Freeze cycle DISCHARGE pressure ____ ____ ____ **1 minute into cycle** **Middle** **End**	If discharge pressure is **High** or **Low**, refer to a freeze cycle high (or low) discharge pressure checklist to eliminate problems/components not listed on this table before proceeding.			
Freeze cycle SUCTION pressure ____ ____ ____ **1 minute into cycle** **Middle** **End**	If suction pressure is **High** or **Low**, refer to a freeze cycle high (or low) suction pressure checklist to eliminate problems/components not listed on this table before proceeding. Suction pressure is: **HIGH** ❑	Suction pressure is: **LOW** ❑	Suction pressure is: **HIGH** ❑	Suction pressure is: **HIGH** ❑
Miscellaneous Enter items in proper boxes.	❑	❑	❑	❑
Final Analysis Total the number of boxes checked in each column.	Column 1 Total: __ **Hot Gas Valve Leaking**	Column 2 Total: __ **Low on Charge** -OR- **TXV Starving**	Column 3 Total: __ **TXV Flooding**	Column 4 Total: __ **Compressor**

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REMOTES ONLY

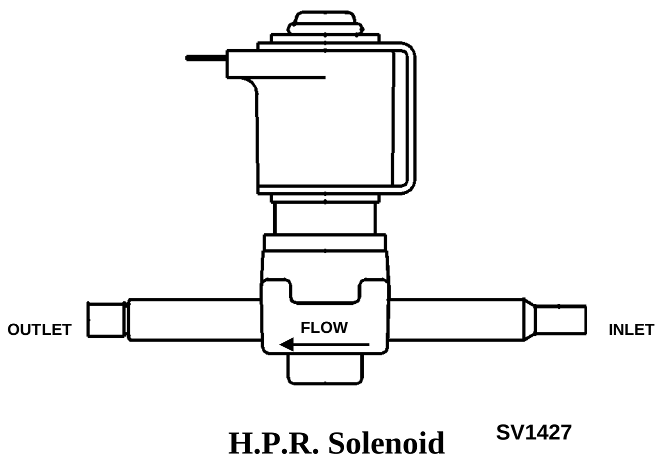
Harvest Pressure Regulating (H.P.R.) System

<u>GENERAL</u>

The harvest pressure regulating (H.P.R.) system includes:

1. Harvest pressure regulating solenoid valve (H.P.R. solenoid)

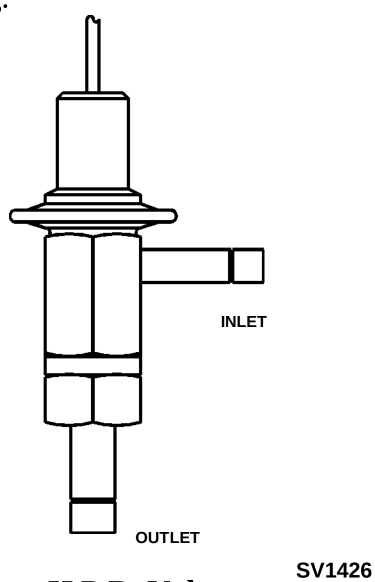
This is an electrically operated valve which opens when energized, and closes when de-energized.



H.P.R. Solenoid

2. Harvest pressure regulating valve (H.P.R. valve)

This is a non-adjustable pressure regulating valve which modulates open and closed, based on the refrigerant pressure at the outlet of the valve. The valve closes completely and stops refrigerant flow when the pressure at the outlet rises above the valve setting.



H.P.R. Valve

<u>FREEZE CYCLE</u>

The H.P.R. system is not used during the freeze cycle. The H.P.R. solenoid is closed (de-energized), preventing refrigerant flow into the H.P.R. valve.

<u>HARVEST CYCLE</u>

During the harvest cycle, the check valve in the discharge line prevents refrigerant in the remote condenser and receiver from backfeeding into the evaporator and condensing to liquid.

The H.P.R. solenoid is opened (energized) during the harvest cycle, allowing refrigerant gas from the top of the receiver to flow into the H.P.R. valve. The H.P.R. valve modulates open and closed, raising the suction pressure high enough to sustain heat for the harvest cycle, without allowing refrigerant to condense to liquid in the evaporator.

In general, harvest cycle suction pressure rises, then stabilizes in the range of 75-100 psig (517-758 kPA).

Exact pressures vary from model to model. These can be found in the "Operational Refrigeration Pressures" charts, beginning on page 7-31.

H.P.R. SYSTEM FAILURE CHART

Symptoms		Possible Causes
Freeze Cycle	The ice machine functions properly. (The H.P.R. solenoid is closed, preventing refrigerant flow into the H.P.R. valve.)	H.P.R. solenoid remains closed -or- H.P.R. valve remains closed
Harvest Cycle	The discharge pressure is low or normal and the suction pressure is low, which causes extended harvest times. The ice machine usually continues to run, although with extended harvest times, ice production decreases. If the harvest time exceeds 3.5 minutes for three consecutive cycles, the control boards stops ice machine operation on Safety Limit #2. Low discharge pressure during the freeze cycle causes the H.P.R. valve to appear as though it is not feeding properly during the harvest cycle. Verify/correct discharge pressure during the freeze cycle PRIOR TO assuming the H.P.R. valve is faulty.	
Freeze Cycle	The discharge pressure is normal and the suction pressure is slightly high or normal.	Solenoid leaks or remains open
Harvest Cycle	The discharge pressure is slightly low or normal and the suction pressure is slightly low or normal. NOTE: The liquid line solenoid closes when the ice machine shuts off. The discharge pressure should remain higher than the suction pressure. If the discharge and suction pressures equalize immediately, a solenoid valve (H.P.R., liquid line or hot gas valve) is most likely leaking.	

Headmaster Control Valve

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

OPERATION

The R404A headmaster control valve has a non-adjustable setting of 225 PSIG.

At ambient temperatures of approximately 70°F (21.1°C) or above, refrigerant flows through the valve from the condenser to the receiver inlet. At temperatures below this (or at higher temperatures if it is raining), 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

1. Determine the air temperature entering the remote condenser.
2. Determine if the head pressure is high or low in relationship to the outside temperature. (Refer to the proper “Operational Pressure Chart” later in this section.) If the air temperature is below 70°F (21.1°C), the head pressure should be modulating about 225 PSIG.
3. Determine the temperature of the liquid line entering the receiver by feeling it. This line is normally warm; “body temperature.”
4. Using the information gathered, refer to the chart below.

NOTE: A headmaster that will not bypass, will function properly with condenser air temperatures of approximately 70°F (21.1°C) or above. When the temperature drops below 70°F (21.1°C), the headmaster fails to bypass and the ice machine malfunctions. Lower ambient conditions can be simulated by rinsing the condenser with cool water during the freeze cycle.

Symptom	Probable Cause	Corrective Measure
Valve not maintaining pressures	Non-approved valve	Install a Manitowoc Headmaster control valve with proper setting
Discharge pressure extremely high; Liquid line entering receiver feels hot	Valve stuck in bypass	Replace valve
Discharge pressure low; Liquid line entering receiver feels extremely cold	Valve not bypassing	Replace valve
Discharge pressure low; Liquid line entering receiver feels warm to hot	Ice machine low on charge	See “Low on Charge Verification” on next page

LOW ON CHARGE VERIFICATION

The remote ice machine requires more refrigerant charge at lower ambient temperatures than at higher temperatures. A low on charge ice machine may function properly during the day, and then malfunction at night. Check this possibility.

If you cannot verify that 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 let the ice machine continue to run. To assure operation in all ambient conditions, the refrigerant leak must be found and repaired, the liquid line drier must be changed, and the ice machine must be evacuated and properly recharged.
3. If the ice machine does not start to operate properly after adding charge, replace the headmaster.

FAN CYCLE CONTROL VS. HEADMASTER

A fan cycle control cannot be used in place of a headmaster. The fan cycle control is not capable of bypassing the condenser coil and keeping the liquid line temperature and pressure up.

This is very apparent when it rains or the outside temperature drops. When it rains or the outside temperature drops, the fan begins to cycle on and off. At first, everything appears normal. But, as it continues raining or getting colder, the fan cycle control can only turn the fan off. All the refrigerant must continue to flow through the condenser coil, being cooled by the rain or low outside temperature.

This causes excessive sub-cooling of the refrigerant. As a result, the liquid line temperature and pressure are not maintained for proper operation.

Pressure Control Specifications and Diagnostics

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

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

The fan cycle control closes on an increase, and opens on a decrease in discharge pressure.

Specifications

Model	Cut-In (Close)	Cut-Out (Open)
J200 J250 J320 J420 J450 J600	250 psig ±5	200 psig ±5
J800 J1000 J1300 J1800	275 psig ±5	225 psig ±5

Check Procedure
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 the fan cycle control, leaving wires attached.
4. Refer to chart below.

At:	Reading Should Be:	Fan Should Be:
above cut-in	0 volts	running
below cut-out	line voltage	off

HIGH PRESSURE CUTOUT
(HPCO) CONTROL

Function
Stops the ice machine if subjected to excessive high-side pressure.

The HPCO control is normally closed, and opens on a rise in discharge pressure.

Specifications
Cut-out: 450 psig ±10
Cut-in: Manual (below 300 psig to reset)

Check Procedure
1. Set ICE/OFF/CLEAN switch to OFF, and reset HPCO if tripped.
2. Connect manifold gauges.
3. Hook voltmeter in parallel across the HPCO, leaving wires attached.
4. On water-cooled models, close the water service valve to the water condenser inlet. On self-contained air-cooled and remote models, disconnect the fan motor.
5. Set ICE/OFF/CLEAN switch to ICE.
6. No water or air flowing through the condenser will cause the HPCO control to open because of excessive pressure. Watch the pressure gauge and record the cut-out pressure.

WARNING
If discharge pressure exceeds 460 psig and the HPCO control does not cut out, set ICE/OFF/CLEAN switch to OFF to stop ice machine operation.

Replace the HPCO control if it:
- Will not reset (below 300 psig)
- Does not open at the specified cut-out point

Cycle Time/24 Hour Ice Production/Refrigerant Pressure Charts

J200 SERIES
SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	11.5-13.5	13.8-16.1	15.2-17.8	1-2.5
80/26.7	12.6-14.7	15.2-17.8	17.5-20.4	
90/32.2	14.5-16.9	17.0-19.8	19.8-23.0	
100/37.8	17.0-19.8	20.5-23.8	23.6-27.4	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	270	230	210
80/26.7	250	210	185
90/32.2	220	190	165
100/37.8	190	160	140

[1]Based on average ice slab weight of 2.44 - 2.81 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	190-260	60-28	120-190	85-110
70/21.1	190-260	60-28	120-190	85-110
80/26.7	210-270	65-28	160-190	90-110
90/32.2	240-290	70-30	190-210	100-120
100/37.8	270-330	70-35	220-240	120-140
110/43.3	310-390	90-40	250-270	120-150

[1]Suction pressure drops gradually throughout the freeze cycle

J200 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	11.8-13.8	14.5-16.9	17.0-19.8	1-2.5
80/26.7	12.0-14.1	14.5-16.9	17.0-19.8	
90/32.2	12.6-14.7	15.2-17.8	18.2-21.0	
100/37.8	12.6-14.7	15.2-17.8	18.2-21.0	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	265	220	190
80/26.7	260	220	190
90/32.2	250	210	180
100/37.8	250	210	180

[1]Based on average ice slab weight of 2.44 - 2.81 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	230	430	2230

[1]Water regulating valve set to maintain 230 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	225-240	60-28	170-200	90-110
70/21.1	225-240	60-28	170-200	90-110
80/26.7	225-240	60-28	175-205	90-110
90/32.2	225-245	65-28	175-205	90-115
100/37.8	225-245	70-30	180-210	90-115
110/43.3	225-250	75-30	185-215	90-120

[1]Suction pressure drops gradually throughout the freeze cycle

J250 SERIES SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	12.0-14.1	13.8-16.1	16.1-18.7	1-2.5
80/26.7	13.1-15.4	15.2-17.8	17.0-19.8	
90/32.2	14.5-16.9	18.2-21.0	20.5-23.8	
100/37.8	17.5-20.4	21.2-24.6	23.6-27.4	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	260	230	200
80/26.7	240	210	190
90/32.2	220	180	160
100/37.8	185	155	140

[1]Based on average ice slab weight of 2.44 - 2.81 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	200-250	70-28	160-180	80-100
70/21.1	210-280	70-28	160-180	80-100
80/26.7	230-300	75-28	170-200	90-110
90/32.2	270-340	80-30	190-200	95-115
100/37.8	310-380	85-34	220-250	120-140
110/43.3	340-430	90-38	250-280	130-150

[1]Suction pressure drops gradually throughout the freeze cycle

J250 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	11.0-13.0	13.8-16.1	16.1-18.7	1-2.5
80/26.7	11.0-13.0	13.8-16.1	16.1-18.7	
90/32.2	11.5-13.5	14.5-16.9	17.0-19.8	
100/37.8	11.5-13.5	14.5-16.9	17.0-19.8	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	280	230	200
80/26.7	280	230	200
90/32.2	270	220	190
100/37.8	270	220	190

[1]Based on average ice slab weight of 2.44 - 2.81 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	250	510	2400

[1]Water regulating valve set to maintain 225 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	220-240	60-28	170-200	80-100
70/21.1	220-240	60-28	170-200	85-105
80/26.7	220-240	62-30	175-205	85-105
90/32.2	220-240	65-32	180-210	90-110
100/37.8	220-240	65-32	180-210	90-110
110/43.3	220-260	65-32	210-230	90-115

[1]Suction pressure drops gradually throughout the freeze cycle

J320 SERIES SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	11.7-13.4	13.1-14.9	14.7-16.8	1-2.5
80/26.7	13.6-15.5	15.1-17.2	17.7-20.2	
90/32.2	16.1-18.4	18.6-21.2	21.9-25.0	
100/37.8	19.6-22.3	23.3-26.5	26.6-30.3	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	320	290	260
80/26.7	280	250	220
90/32.2	240	210	180
100/37.8	200	170	150

[1]Based on average ice slab weight of 2.93 - 3.31 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	200-250	50-36	150-180	75-90
70/21.1	200-250	50-36	160-190	80-100
80/26.7	220-280	50-36	170-200	90-110
90/32.2	230-320	52-38	180-220	90-120
100/37.8	270-360	54-40	200-250	95-140
110/43.3	280-380	56-42	210-260	95-150

[1]Suction pressure drops gradually throughout the freeze cycle

J320 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	11.9-13.6	13.8-15.8	16.1-18.4	1-2.5
80/26.7	12.1-13.9	14.4-16.5	16.5-18.8	
90/32.2	12.6-14.4	15.0-17.1	17.3-19.7	
100/37.8	13.1-14.9	15.1-17.2	17.7-20.2	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	315	275	240
80/26.7	310	265	235
90/32.2	300	255	225
100/37.8	290	250	220

[1]Based on average ice slab weight of 2.93 - 3.31 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	280	460	2300

[1]Water regulating valve set to maintain 230 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	225-235	50-36	160-180	80-110
70/21.1	225-235	50-36	170-190	85-115
80/26.7	225-240	50-36	170-200	85-115
90/32.2	225-250	50-36	170-210	90-120
100/37.8	225-260	50-36	170-210	90-120
110/43.3	225-265	50-36	175-215	95-125

[1]Suction pressure drops gradually throughout the freeze cycle

J420/450 SERIES
SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	9.5-11.2	10.9-12.8	12.3-14.4	1-2.5
80/26.7	10.4-12.2	12.0-14.1	13.7-16.0	
90/32.2	12.0-14.0	14.1-16.5	16.5-19.2	
100/37.8	13.3-15.6	16.0-18.6	18.3-21.3	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	540	480	430
80/26.7	500	440	390
90/32.2	440	380	330
100/37.8	400	340	300

[1]Based on average ice slab weight of 4.12 - 4.75 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle Discharge Pressure PSIG	Freeze Cycle Suction Pressure PSIG	Harvest Cycle Discharge Pressure PSIG	Harvest Cycle Suction Pressure PSIG
50/10.0	195-240	45-30	150-170	75-90
70/21.1	205-260	47-33	165-180	80-100
80/26.7	230-265	50-35	165-185	80-100
90/32.2	260-290	55-36	190-210	90-110
100/37.8	290-340	60-38	215-235	105-125
110/43.3	330-395	75-40	235-255	125-140

[1]Suction pressure drops gradually throughout the freeze cycle

J420/450 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	9.9-11.7	11.4-13.4	13.3-15.6	1-2.5
80/26.7	10.1-11.9	11.7-13.7	13.7-16.0	
90/32.2	10.4-12.2	12.0-14.1	14.1-16.5	
100/37.8	10.6-12.5	12.3-14.4	14.5-17.0	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	520	460	400
80/26.7	510	450	390
90/32.2	500	440	380
100/37.8	490	430	370

[1]Based on average ice slab weight of 4.12 - 4.75 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	400	740	2400

[1]Water regulating valve set to maintain 240 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle Discharge Pressure PSIG	Freeze Cycle Suction Pressure PSIG	Harvest Cycle Discharge Pressure PSIG	Harvest Cycle Suction Pressure PSIG
50/10.0	235-245	50-35	165-180	85-100
70/21.1	235-245	50-35	165-180	85-100
80/26.7	235-245	50-35	165-180	85-100
90/32.2	235-245	52-35	165-180	85-100
100/37.8	235-245	52-35	165-185	85-100
110/43.3	240-250	55-36	165-185	85-100

[1]Suction pressure drops gradually throughout the freeze cycle

J450 SERIES REMOTE

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
-20/-28.9 to 70/21.1	10.9-12.8	12.6-14.8	14.1-16.5	1-2.5
80/26.7	11.1-13.1	13.0-15.2	14.5-17.0	
90/32.2	11.4-13.4	13.3-15.6	15.0-17.5	
100/37.8	12.6-14.8	15.0-17.5	17.0-19.9	
110/43.3	14.1-16.5	17.1-19.9	19.0-22.1	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
-20/-28.9 to 70/21.1	480	420	380
80/26.7	470	410	370
90/32.2	460	400	360
100/37.8	420	360	320
110/43.3	380	320	290

[1]Based on average ice slab weight of 4.12 - 4.75 lb.
[2]Regular cube derate is 7%
[3]Ratings with JC0495 condenser, dice or half-dice cubes

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-28.9 to 50/10.0	220-245	50-30	175-190	85-100
70/21.1	230-250	50-31	175-190	85-100
80/26.7	240-260	52-32	180-195	85-100
90/32.2	245-270	54-32	185-200	85-100
100/37.8	280-310	57-32	190-205	90-105
110/43.3	290-325	64-39	190-205	95-110

[1]Suction pressure drops gradually throughout the freeze cycle

J600 SERIES SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	8.1-9.5	9.5-11.2	10.9-12.8	1-2.5
80/26.7	8.4-9.9	9.7-11.4	11.2-13.1	
90/32.2	9.3-10.9	10.6-12.5	12.3-14.4	
100/37.8	10.6-12.5	12.3-14.4	14.5-17.0	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	620	540	480
80/26.7	600	530	470
90/32.2	550	490	430
100/37.8	490	430	370

[1]Based on average ice slab weight of 4.12 - 4.75 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	195-260	42-22	155-180	75-95
70/21.1	220-290	44-22	160-185	85-100
80/26.7	220-305	52-22	160-190	90-110
90/32.2	250-325	52-23	175-195	95-115
100/37.8	280-355	54-30	195-210	95-125
110/43.3	300-385	56-32	200-225	100-135

[1]Suction pressure drops gradually throughout the freeze cycle

J600 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	8.1-9.5	9.2-10.8	11.7-13.7	1-2.5
80/26.7	8.2-9.7	9.4-11.1	12.0-14.1	
90/32.2	8.4-9.9	9.6-11.3	12.3-14.4	
100/37.8	8.6-10.1	9.8-11.5	12.6-14.8	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	620	555	450
80/26.7	610	545	440
90/32.2	600	535	430
100/37.8	590	525	420

[1]Based on average ice slab weight of 4.12 - 4.75 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	550	1000	4600

[1]Water regulating valve set to maintain 230 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	225-235	46-25	140-184	80-102
70/21.1	225-235	46-26	148-184	82-104
80/26.7	225-235	48-26	154-186	86-108
90/32.2	225-240	48-26	154-190	86-108
100/37.8	225-245	50-28	162-194	86-112
110/43.3	225-250	52-28	165-200	86-115

[1]Suction pressure drops gradually throughout the freeze cycle

J600 SERIES REMOTE

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
-20/-28.9 to 70/21.1	8.2-9.7	9.9-11.7	12.0-14.1	1-2.5
80/26.7	8.3-9.8	10.0-11.8	12.1-14.2	
90/32.2	8.4-9.9	10.2-11.9	12.3-14.4	
100/37.8	8.9-10.5	10.9-12.8	12.6-14.8	
110/43.3	9.9-11.7	12.0-14.1	14.1-16.5	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
-20/-28.9 to 70/21.1	610	520	440
80/26.7	605	515	435
90/32.2	600	510	430
100/37.8	570	480	420
110/43.3	520	440	380

[1]Based on average ice slab weight of 4.12 - 4.75 lb.
[2]Regular cube derate is 7%
[3]Ratings with JC0895 condenser, dice or half-dice cubes

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-28.9 to 50/10.0	220-250	42-26	152-170	75-90
70/21.1	245-260	44-26	155-172	82-94
80/26.7	245-265	46-26	156-174	82-95
90/32.2	250-265	48-26	157-174	84-96
100/37.8	265-295	52-26	158-176	84-98
110/43.3	300-335	52-28	158-176	84-102

[1]Suction pressure drops gradually throughout the freeze cycle

J800 SERIES SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	8.8-10.2	10.3-11.9	11.9-13.6	1-2.5
80/26.7	9.4-10.8	11.0-12.7	12.5-14.4	
90/32.2	10.5-11.5	11.6-13.3	13.3-15.2	
100/37.8	11.6-13.4	13.6-15.5	15.0-17.2	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	800	700	620
80/26.7	760	660	590
90/32.2	720	630	560
100/37.8	630	550	500

[1]Based on average ice slab weight of 5.75 - 6.50 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle Discharge Pressure PSIG	Freeze Cycle Suction Pressure PSIG	Harvest Cycle Discharge Pressure PSIG	Harvest Cycle Suction Pressure PSIG
50/10.0	220-240	31-18	135-180	65-90
70/21.1	220-240	32-18	140-180	70-90
80/26.7	225-260	36-20	140-180	70-95
90/32.2	260-295	38-22	150-200	80-100
100/37.8	300-330	40-24	210-225	80-100
110/43.3	320-360	44-26	210-240	85-120

[1]Suction pressure drops gradually throughout the freeze cycle

J800 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	8.8-10.2	9.7-11.1	11.9-13.6	1-2.5
80/26.7	9.1-10.5	10.5-11.5	12.3-14.1	
90/32.2	9.4-10.8	10.3-11.9	12.8-14.6	
100/37.8	9.7-11.1	10.7-12.3	13.3-15.2	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	800	740	620
80/26.7	780	720	600
90/32.2	760	700	580
100/37.8	740	680	560

[1]Based on average ice slab weight of 5.75 - 6.50 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	610	1300	6700

[1]Water regulating valve set to maintain 230 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle Discharge Pressure PSIG	Freeze Cycle Suction Pressure PSIG	Harvest Cycle Discharge Pressure PSIG	Harvest Cycle Suction Pressure PSIG
50/10.0	225-235	33-20	160-185	65-85
70/21.1	225-235	34-20	165-185	70-85
80/26.7	225-235	34-20	165-185	70-85
90/32.2	225-235	36-22	165-185	70-85
100/37.8	225-235	36-22	165-185	70-85
110/43.3	225-240	38-24	170-190	75-90

[1]Suction pressure drops gradually throughout the freeze cycle

J800 SERIES REMOTE

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
-20/-28.9 to 70/21.1	8.8-10.2	10.3-11.9	12.1-13.8	1-2.5
80/26.7	8.9-10.3	10.4-12.0	12.2-14.0	
90/32.2	9.0-10.3	10.5-12.1	12.3-14.1	
100/37.8	9.7-11.1	11.4-13.1	13.6-15.5	
110/43.3	10.9-12.5	13.6-15.5	15.0-17.2	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
-20/-28.9 to 70/21.1	800	700	610
80/26.7	795	695	605
90/32.2	790	690	600
100/37.8	740	640	550
110/43.3	670	550	500

[1]Based on average ice slab weight of 5.75 - 6.50 lb.
[2]Regular cube derate is 7%
[3]Ratings with JC0895 condenser, dice or half-dice cubes

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-28.9 to 50/10.0	220-250	30-22	180-200	65-90
70/21.1	230-250	32-22	190-200	70-90
80/26.7	240-260	33-22	190-205	70-90
90/32.2	255-265	34-22	195-205	70-90
100/37.8	275-295	38-24	200-210	70-90
110/43.3	280-320	40-26	200-225	75-100

[1]Suction pressure drops gradually throughout the freeze cycle

J1000 SERIES SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	8.8-9.5	10.1-10.9	11.2-12.0	1-2.5
80/26.7	9.1-9.8	10.5-11.3	11.6-12.5	
90/32.2	9.7-10.4	11.2-12.0	12.5-13.4	
100/37.8	10.6-11.4	12.5-13.4	14.0-15.0	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	1080	960	880
80/26.7	1050	930	850
90/32.2	1000	880	800
100/37.8	920	800	720

[1]Based on average ice slab weight of 7.75 - 8.25 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	220-240	38-18	135-180	65-90
70/21.1	220-240	40-18	140-180	70-90
80/26.7	225-260	42-20	140-180	70-95
90/32.2	260-295	42-22	150-200	80-100
100/37.8	300-330	42-24	210-225	80-100
110/43.3	320-360	44-24	210-240	85-120

[1]Suction pressure drops gradually throughout the freeze cycle

J1000 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	8.8-9.5	10.1-10.9	11.3-12.2	**1-2.5**
80/26.7	8.9-9.6	10.2-11.0	11.5-12.3	
90/32.2	8.9-9.6	10.2-11.0	11.5-12.3	
100/37.8	9.0-9.7	10.4-11.1	11.6-12.5	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	1080	960	870
80/26.7	1070	950	860
90/32.2	1070	950	860
100/37.8	1060	940	850

[1]Based on average ice slab weight of 7.75 - 8.25 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	840	1650	6600

[1]Water regulating valve set to maintain 230 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	225-235	36-18	160-185	65-85
70/21.1	225-235	38-18	165-185	70-85
80/26.7	225-235	40-18	165-185	70-85
90/32.2	225-235	40-20	165-185	70-85
100/37.8	225-235	40-20	165-185	70-85
110/43.3	225-240	40-20	170-190	75-90

[1]Suction pressure drops gradually throughout the freeze cycle

J1000 SERIES REMOTE

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
-20/-28.9 to 70/21.1	9.1-9.8	10.6-11.4	11.8-12.6	**1-2.5**
80/26.7	9.3-10.0	10.4-11.6	12.0-12.8	
90/32.2	9.4-10.2	10.8-11.7	12.1-13.0	
100/37.8	10.0-10.8	11.6-12.5	13.0-13.9	
110/43.3	10.8-11.6	12.6-13.5	14.2-15.2	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
-20/-28.9 to 70/21.1	1050	920	840
80/26.7	1035	910	830
90/32.2	1020	900	820
100/37.8	970	850	770
110/43.3	910	790	710

[1]Based on average ice slab weight of 7.75 - 8.25 lb.
[2]Regular cube derate is 7%
[3]Ratings with JC1095 condenser, dice or half-dice cubes

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-28.9 to 50/10.0	220-250	40-22	180-200	65-90
70/21.1	230-250	40-22	190-200	70-90
80/26.7	240-260	42-22	190-205	70-90
90/32.2	255-265	44-22	195-205	70-90
100/37.8	275-295	44-24	200-210	70-90
110/43.3	280-320	46-26	200-225	75-100

[1]Suction pressure drops gradually throughout the freeze cycle

J1300 SERIES SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	8.8-9.8	10.2-11.4	11.5-12.8	1-2.5
80/26.7	9.1-10.1	10.5-11.7	12.0-13.3	
90/32.2	9.8-10.9	11.4-12.6	13.0-14.5	
100/37.8	10.8-12.0	12.8-14.2	14.9-16.5	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	1400	1230	1110
80/26.7	1360	1200	1070
90/32.2	1280	1120	990
100/37.8	1170	1010	880

[1]Based on average ice slab weight of 10.0 - 11.0 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle Discharge Pressure PSIG	Freeze Cycle Suction Pressure PSIG	Harvest Cycle Discharge Pressure PSIG	Harvest Cycle Suction Pressure PSIG
50/10.0	220-280	40-20	140-170	65-80
70/21.1	220-280	40-20	145-170	70-80
80/26.7	220-280	42-22	150-185	70-80
90/32.2	245-300	48-26	160-190	70-85
100/37.8	275-330	50-26	160-210	70-90
110/43.3	280-360	52-28	165-225	75-100

[1]Suction pressure drops gradually throughout the freeze cycle

J1300 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	8.5-9.5	9.5-10.6	11.1-12.4	1-2.5
80/26.7	8.6-9.7	9.7-10.8	11.4-12.6	
90/32.2	8.8-9.8	9.8-11.0	11.6-12.9	
100/37.8	8.9-10.0	10.0-11.2	11.8-13.2	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	1440	1310	1140
80/26.7	1420	1290	1120
90/32.2	1400	1270	1100
100/37.8	1380	1250	1080

[1]Based on average ice slab weight of 10.0 - 11.0 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	1150	2400	7700

[1]Water regulating valve set to maintain 240 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle Discharge Pressure PSIG	Freeze Cycle Suction Pressure PSIG	Harvest Cycle Discharge Pressure PSIG	Harvest Cycle Suction Pressure PSIG
50/10.0	235-245	40-18	150-180	70-80
70/21.1	235-245	40-18	150-180	70-80
80/26.7	235-245	40-20	150-180	70-80
90/32.2	235-250	42-20	150-180	70-80
100/37.8	235-255	44-20	150-180	70-80
110/43.3	240-265	46-20	150-180	70-80

[1]Suction pressure drops gradually throughout the freeze cycle

J1300 SERIES REMOTE

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
-20/-28.9 to 70/21.1	9.2-10.2	10.5-11.7	11.8-13.2	1-2.5
80/26.7	9.4-10.4	10.7-11.9	12.0-13.4	
90/32.2	9.5-10.6	10.9-12.2	12.2-13.6	
100/37.8	10.1-11.3	11.6-12.9	13.0-14.5	
110/43.3	11.0-12.3	12.8-14.2	14.5-16.1	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
-20/-28.9 to 70/21.1	1350	1200	1080
80/26.7	1325	1180	1066
90/32.2	1310	1160	1050
100/37.8	1240	1100	990
110/43.3	1150	1010	900

[1]Based on average ice slab weight of 10.0 - 11.0 lb.
[2]Regular cube derate is 7%
[3]Ratings with JC1395 condenser, dice or half-dice cubes

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-28.9 to 50/10.0	220-250	40-22	135-170	75-95
70/21.1	240-260	40-22	140-180	80-95
80/26.7	240-270	41-22	140-190	80-95
90/32.2	250-290	42-22	140-200	80-95
100/37.8	280-320	46-22	140-210	80-95
110/43.3	310-360	48-24	140-220	85-100

[1]Suction pressure drops gradually throughout the freeze cycle

J1800 SERIES SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time Water Temperature °F/°C			Harvest Time
	50/10.0	70/21.1	90/32.2	
70/21.1	9.0-10.0	10.1-11.3	11.4-12.6	1-2.5
80/26.7	9.5-10.5	10.8-11.9	12.1-13.2	
90/32.2	10.4-11.4	11.9-13.0	13.6-14.9	
100/37.8	11.9-13.0	13.8-15.2	15.6-17.1	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	1800	1620	1470
80/26.7	1720	1540	1400
90/32.2	1600	1420	1260
100/37.8	1420	1240	1110

[1]Based on average ice slab weight of 13.19 - 14.31 lb.
[2]Regular cube derate is 7%

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	220-280	40-20	155-190	60-80
70/21.1	220-280	40-20	160-190	65-80
80/26.7	230-290	42-20	160-190	65-80
90/32.2	260-320	44-22	185-205	70-90
100/37.8	300-360	46-24	210-225	75-100
110/43.3	320-400	48-26	215-240	80-100

[1]Suction pressure drops gradually throughout the freeze cycle

J1800 SERIES WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10.0	70/21.1	90/32.2	
70/21.1	8.8-9.7	10.1-11.1	11.9-13.1	**1-2.5**
80/26.7	8.9-9.9	10.2-11.2	12.1-13.2	
90/32.2	9.0-10.0	10.4-11.4	12.3-13.4	
100/37.8	9.2-10.1	10.6-11.6	12.5-13.7	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	1840	1640	1420
80/26.7	1820	1620	1400
90/32.2	1800	1600	1380
100/37.8	1780	1580	1360

[1]Based on average ice slab weight of 13.19- 14.31 lb.
[2]Regular cube derate is 7%

Condenser Water Consumption	90/32.2 Air Temperature Around Ice Machine		
	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
Gal/24 hours	1300	2400	7100

[1]Water regulating valve set to maintain 240 PSIG discharge pressure

Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	235-245	36-20	170-190	65-80
70/21.1	235-245	38-20	170-190	65-80
80/26.7	235-245	40-20	170-190	65-80
90/32.2	235-250	42-22	175-190	65-80
100/37.8	235-255	44-22	175-190	65-80
110/43.3	235-260	46-22	175-190	65-80

[1]Suction pressure drops gradually throughout the freeze cycle

J1800 SERIES REMOTE

NOTE: These characteristics may vary depending on operating conditions.

Cycle Times

Freeze Time + Harvest Time = Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10.0	70/21.1	90/32.2	
-20/-28.9 to 70/21.1	9.2-10.2	10.6-11.6	11.5-12.6	**1-2.5**
80/26.7	9.4-10.4	10.8-11.8	11.7-12.9	
90/32.2	9.7-10.7	11.2-12.2	12.1-13.2	
100/37.8	10.2-11.2	11.9-13.1	13.3-14.6	
110/43.3	11.0-12.1	12.9-14.2	14.9-16.3	

[1]Times in minutes

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
-20/-28.9 to 70/21.1	1770	1570	1470
80/26.7	1735	1545	1435
90/32.2	1700	1500	1400
100/37.8	1620	1420	1280
110/43.3	1520	1320	1160

[1]Based on average ice slab weight of 13.19- 14.31 lb.
[2]Regular cube derate is 7%
[3]Ratings with JC1895 condenser, dice or half-dice cubes

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-28.9 to 50/10.0	220-250	38-24	160-180	60-80
70/21.1	250-260	40-24	170-180	60-80
80/26.7	250-270	48-24	175-190	70-90
90/32.2	250-280	50-24	180-200	80-90
100/37.8	270-300	52-28	205-215	80-95
110/43.3	300-350	54-28	205-230	80-100

[1]Suction pressure drops gradually throughout the freeze cycle

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Refrigerant Recovery/Evacuation and Recharging

NORMAL SELF-CONTAINED MODEL PROCEDURES

Refrigerant Recovery/Evacuation

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

Important

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

Important

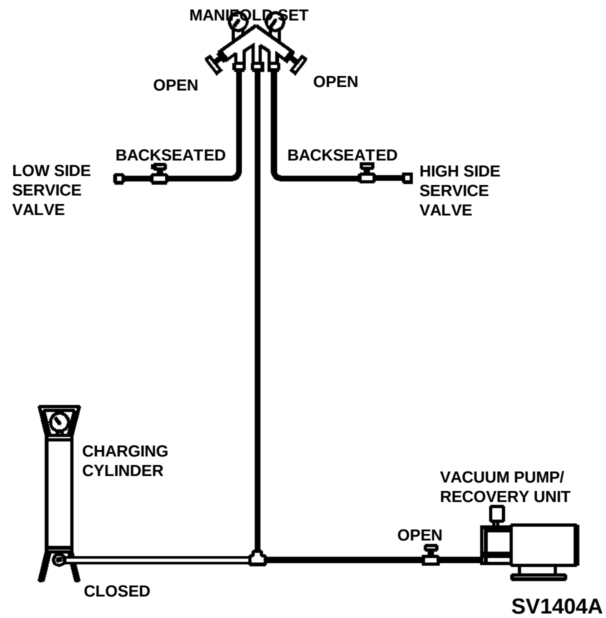
Replace the liquid line drier before evacuating and recharging. Use only a Manitowoc (O.E.M.) liquid line filter drier to prevent voiding the warranty.

CONNECTIONS

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

SELF-CONTAINED RECOVERY/EVACUATION

1. Place the toggle switch in the OFF position.
2. Install manifold gauges, charging cylinder/scale, and recovery unit or two-stage vacuum pump.



Recovery/Evacuation Connections

3. Open (backseat) the high and low side ice machine service valves, and open high and low side on manifold gauges.
4. Perform recovery or evacuation:
   - A. Recovery: Operate the recovery unit as directed by the manufacturer's instructions.
   - B. Evacuation prior to recharging: Pull the system down to 250 microns. Then, allow the pump to run for an additional half hour. Turn off the pump and perform a standing vacuum leak check.

NOTE: Check for leaks using a halide or electronic leak detector after charging the ice machine.

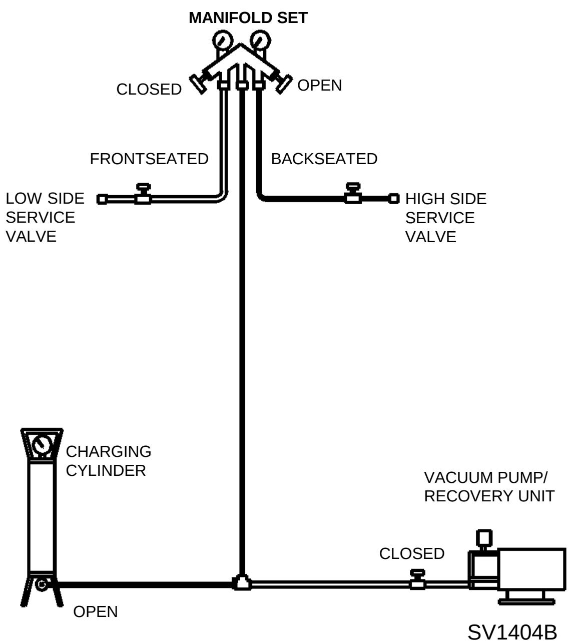
5. Follow the Charging Procedures on the next page.

Self-Contained Charging Procedures

Important

The charge is critical on all Manitowoc ice machines. Use a scale or a charging cylinder to ensure the proper charge is installed.

1. Be sure the toggle switch is in the OFF position.



Charging Connections

2. Close the vacuum pump valve, the low side service valve, and the low side manifold gauge valve.
3. Open the high side manifold gauge valve, and backseat the high side service valve.
4. Open the charging cylinder and add the proper refrigerant charge (shown on nameplate) through the discharge service valve.
5. Let the system “settle” for 2 to 3 minutes.
6. Place the toggle switch in the ICE position.
7. Close the high side on the manifold gauge set. Add any remaining vapor charge through the suction service valve (if necessary).

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

8. Make sure that all of the vapor in the charging hoses is drawn into the ice machine before disconnecting the charging hoses.
   A. Run the ice machine in freeze cycle.
   B. Close the high side service valve at the ice machine.
   C. Open the low side service valve at the ice machine.
   D. Open the high and low side valves on the manifold gauge set. Any refrigerant in the lines will be pulled into the low side of the system.
   E. Allow the pressures to equalize while the ice machine is in the freeze cycle.
   F. Close the low side service valve at the ice machine.
   G. Remove the hoses from the ice machine and install the caps.

NORMAL REMOTE MODEL PROCEDURES

Refrigerant Recovery/Evacuation

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

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

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

CONNECTIONS

> **Important**
> Recovery/evacuation of a remote system requires connections at four points for complete system evacuation. See the drawing on the following page.

Make these connections:

- Suction side of the compressor through the suction service valve.
- Discharge side of the compressor through the discharge service valve.
- Receiver outlet service valve, which evacuates the area between the check valve in the liquid line and the pump down solenoid.
- Access (Schraeder) valve on the discharge line quick-connect fitting, located on the outside of the compressor/evaporator compartment. This connection evacuates the condenser. Without it, the magnetic check valves would close when the pressure drops during evacuation, preventing complete evacuation of the condenser.

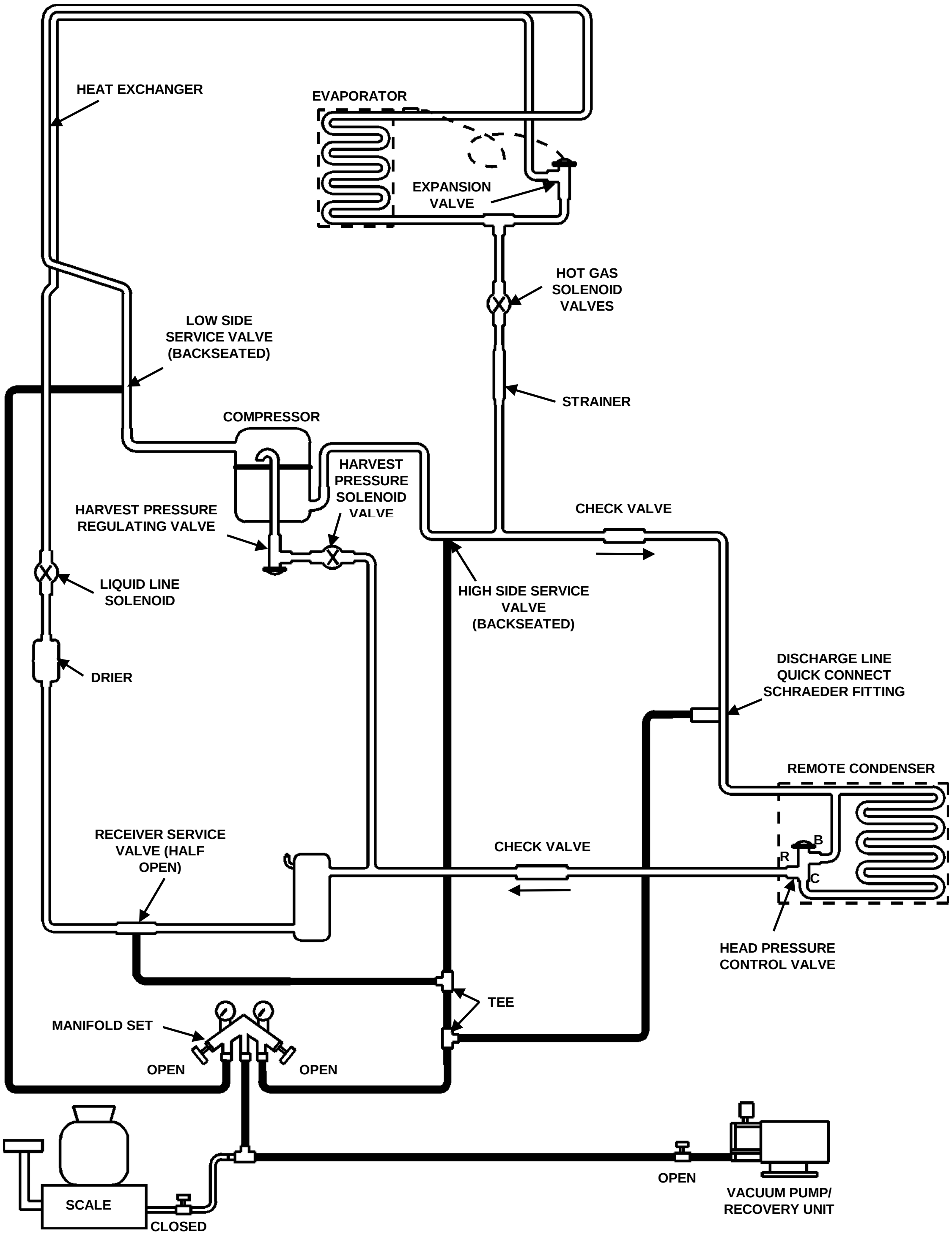
NOTE: Manitowoc recommends using an access valve core removal and installation tool on the discharge line quick-connect fitting. This permits access valve core removal. This allows for faster evacuation and charging, without removing the manifold gauge hose.

REMOTE RECOVERY/EVACUATION

1. Place the toggle switch in the OFF position.
2. Install manifold gauges, charging cylinder/scale, and recovery unit or two-stage vacuum pump.
3. Open (backseat) the high and low side ice machine service valves.
4. Open the receiver service valve halfway.
5. Open high and low side on the manifold gauge set.
6. Perform recovery or evacuation:
   A. Recovery: Operate the recovery unit as directed by the manufacturer's instructions.
   B. Evacuation prior to recharging: Pull the system down to 250 microns. Then, allow the pump to run for an additional hour. Turn off the pump and perform a standing vacuum leak check.

NOTE: Check for leaks using a halide or electronic leak detector after charging the ice machine.

7. Follow the Charging Procedures on page 7-48.



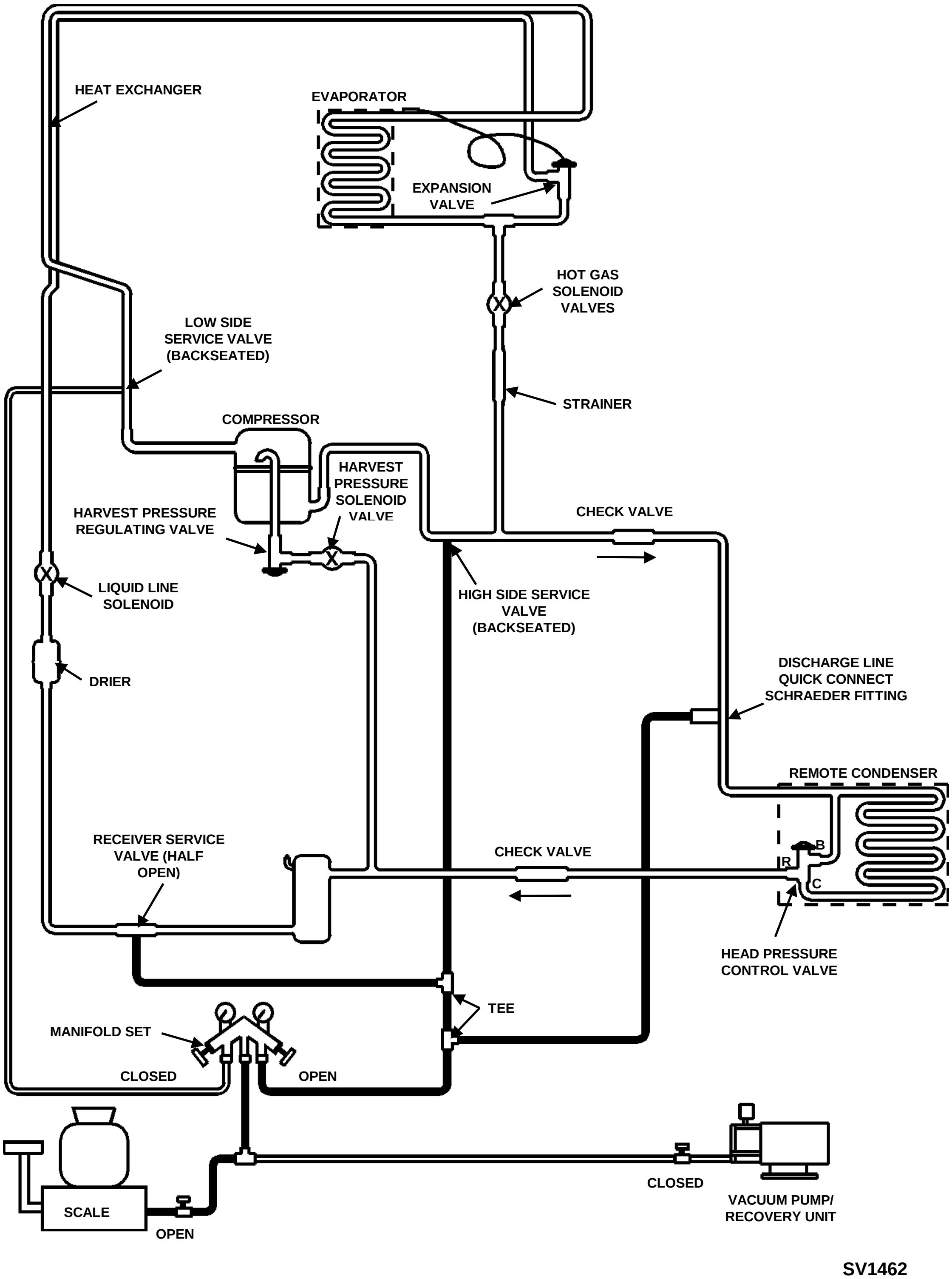
Recovery/Evacuation Connections

Remote Charging Procedures

1. Be sure the toggle switch is in the OFF position.
2. Close the vacuum pump valve, the low and high side service valves (frontseat), and the low side manifold gauge valve.
3. Open the charging cylinder and add the proper refrigerant charge (shown on nameplate) into the system high side (receiver outlet valve and discharge lines quick-connect fitting).
4. If the high side does not take the entire charge, close the high side on the manifold gauge set, and backseat (open) the low side service valve and receiver outlet service valve. Start the ice machine and add the remaining charge through the low side (in vapor form) until the machine is fully charged.
5. Ensure all vapor in charging hoses is drawn into the machine, then disconnect the manifold gauges.

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

6. Run the ice machine in freeze cycle.
7. Close the high side service valve at the ice machine.
8. Open the low side service valve at the ice machine.
9. Open the high and low side valves on the manifold gauge set. Any refrigerant in the lines will be pulled into the low side of the system.
10. Allow the pressures to equalize while the ice machine is in the freeze cycle.
11. Close the low side service valve at the ice machine.
12. Remove the hoses from the ice machine and install the caps.



Remote Charging Connections

SYSTEM CONTAMINATION CLEANUP

General

This section describes the basic requirements for restoring contaminated systems to reliable service.

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

Determining Severity Of Contamination

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

Inspection of the refrigerant usually provides the first indication of system contamination. Obvious moisture or an acrid odor in the refrigerant indicates contamination.

If either condition is found, or if contamination is suspected, use a Total Test Kit from Totaline or a similar diagnostic tool. These devices sample refrigerant, eliminating the need to take an oil sample. Follow the manufacturer's directions.

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

1. Remove the refrigerant charge from the ice machine.
2. Remove the compressor from the system.
3. Check the odor and appearance of the oil.
4. Inspect open suction and discharge lines at the compressor for burnout deposits.
5. If no signs of contamination are present, perform an acid oil test.

Check the chart below to determine the type of cleanup required.

Contamination/Cleanup Chart

Symptoms/Findings	Required Cleanup Procedure
No symptoms or suspicion of contamination	Normal evacuation/recharging procedure
Moisture/Air Contamination symptoms • Refrigeration system open to atmosphere for longer than 15 minutes • Refrigeration test kit and/or acid oil test shows contamination • Leak in water-cooled condenser • No burnout deposits in open compressor lines	Mild contamination cleanup procedure
Mild Compressor Burnout symptoms • Oil appears clean but smells acrid • Refrigeration test kit or acid oil test shows harmful acid content • No burnout deposits in open compressor lines	Mild contamination cleanup procedure
Severe Compressor Burnout symptoms • Oil is discolored, acidic, and smells acrid • Burnout deposits found in the compressor and lines, and in other components	Severe contamination cleanup procedure

Mild System Contamination Cleanup Procedure

1. Replace any failed components.
2. If the compressor is good, change the oil.
3. Replace the liquid line drier.

NOTE: If the contamination is from moisture, use heat lamps during evacuation. Position them at the compressor, condenser and evaporator prior to evacuation. Do not position heat lamps too close to plastic components, or they may melt or warp.

Important

Dry nitrogen is recommended for this procedure. This will prevent CFC release.

4. Follow the normal evacuation procedure, except replace the evacuation step with the following:
   A. Pull vacuum to 1000 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psi.
   B. Pull vacuum to 500 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psi.
   C. Change the vacuum pump oil.
   D. Pull vacuum to 250 microns. Run the vacuum pump for 1/2 hour on self-contained models, 1 hour on remotes.

NOTE: You may perform a standing vacuum test to make a preliminary leak check. You should use an electronic leak detector after system charging to be sure there is no leak.

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

Severe System Contamination Cleanup Procedure

1. Remove the refrigerant charge.
2. Remove the compressor.
3. Disassemble the hot gas solenoid valve. If burnout deposits are found inside the valve, install a rebuild kit, and replace the TXV and harvest pressure regulating valve.
4. Wipe away any burnout deposits from suction and discharge lines at compressor.
5. Sweep through the open system with dry nitrogen.

Important

Refrigerant sweeps are not recommended, as they release CFC's into the atmosphere.

7. Install a new compressor and new start components.
8. Install a suction line filter-drier with acid and moisture removal capability (P/N 89-3028-3). Place the filter drier as close to the compressor as possible.
9. Install an access valve at the inlet of the suction line drier.
10. Install a new liquid line drier.

Continued on next page...

11. Follow the normal evacuation procedure, except replace the evacuation step with the following:

Important

Dry nitrogen is recommended for this procedure. This will prevent CFC release.

A. Pull vacuum to 1000 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psi.
B. Change the vacuum pump oil.
C. Pull vacuum to 500 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psi.
D. Change the vacuum pump oil.
E. Pull vacuum to 250 microns. Run the vacuum pump for 1/2 hour on self-contained models, 1 hour on remotes.

NOTE: You may perform a standing vacuum test to make a preliminary leak check. You should use an electronic leak detector after system charging to be sure there is no leak.

12. Charge the system with the proper refrigerant to the nameplate charge.
13. Operate the ice machine for one hour. Then, check the pressure drop across the suction line filter-drier.
    A. If the pressure drop is less than 1 psi, the filter-drier should be adequate for complete cleanup.
    B. If the pressure drop exceeds 1 psi, change the suction line filter-drier and the liquid line drier. Repeat until the pressure drop is acceptable.
14. Operate the ice machine for 48-72 hours. Then, remove the suction line drier and change the liquid line drier.
15. Follow normal evacuation procedures.

REPLACING PRESSURE CONTROLS WITHOUT REMOVING REFRIGERANT CHARGE

This procedure reduces repair time and cost. Use it when any of the following components require replacement, and the refrigeration system is operational and leak-free.

- Fan cycle control (air-cooled only)
- Water regulating valve (water-cooled only)
- High pressure cut-out control
- High side service valve
- Low side service valve

Important

This is a required in-warranty repair procedure.

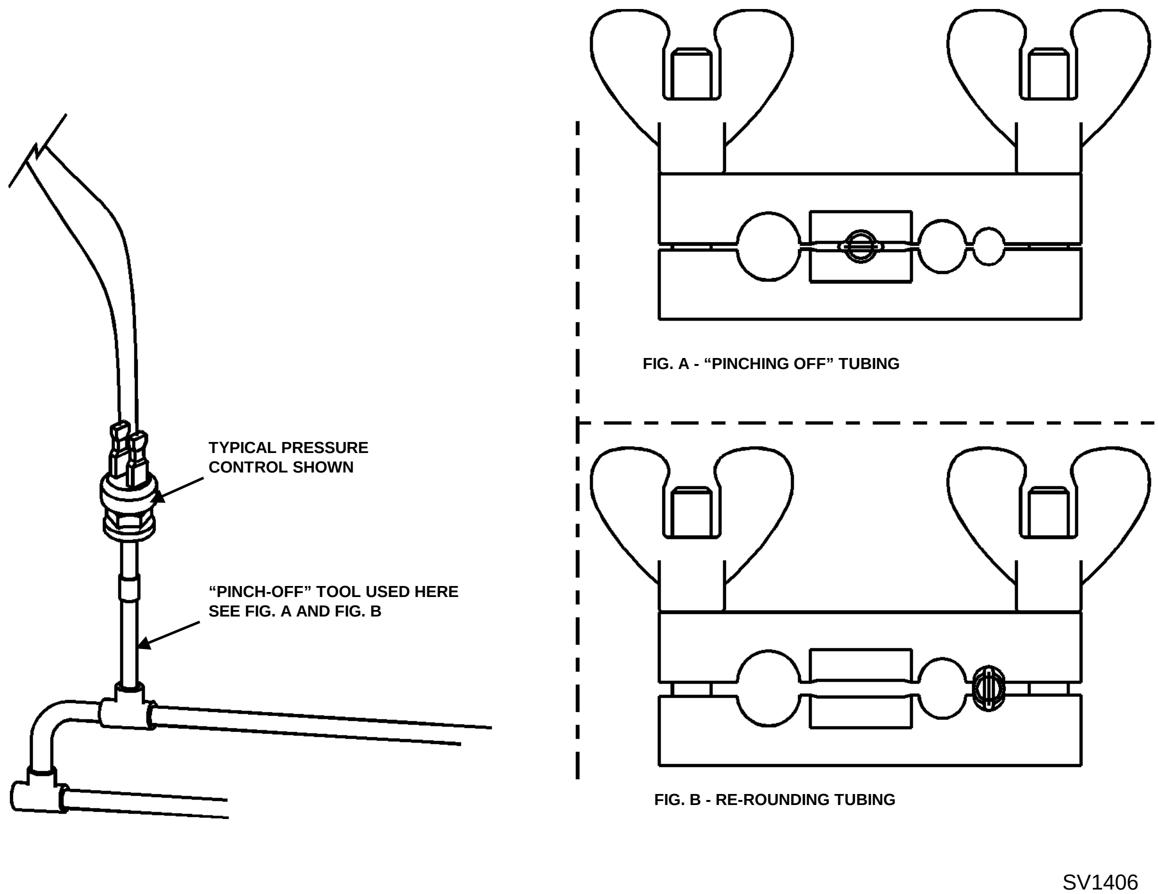
1. Disconnect power to the ice machine.
2. Follow all manufacturer’s instructions supplied with the pinch-off tool. Position the pinch-off tool around the tubing as far from the pressure control as feasible. (See the figure on next page.) Clamp down on the tubing until the pinch-off is complete.

⚠ WARNING

Do not unsolder a defective component. Cut it out of the system. Do not remove the pinch-off tool until the new component is securely in place.

3. Cut the tubing of the defective component with a small tubing cutter.
4. Solder the replacement component in place. Allow the solder joint to cool.
5. Remove the pinch-off tool.
6. Re-round the tubing. Position the flattened tubing in the proper hole in the pinch off tool. Tighten the wingnuts until the block is tight and the tubing is rounded. (See the drawing on next page.)

NOTE: The pressure controls will operate normally once the tubing is re-rounded. Tubing may not re-round 100%.



Using Pinch-Off Tool

FILTER-DRIERS

The filter-driers used on Manitowoc ice machines are manufactured to Manitowoc specifications.

The difference between Manitowoc driers and off-the-shelf driers is in filtration. Manitowoc driers have dirt-retaining filtration, with fiberglass filters on both the inlet and outlet ends. This is very important because ice machines have a back-flushing action which takes place during every harvest cycle.

These filter-driers have a very high moisture removal capability and a good acid removal capacity.

The size of the filter-drier is important. The refrigerant charge is critical. Using an improperly sized filter-drier will cause the ice machine to be improperly charged with refrigerant.

Listed below are the recommended O.E.M. field replacement driers:

Model	Drier Size	End Connection Size	Part Number
J200 J250 J320 J420 J450 J600	UK-032S	1/4	89-3022-9
J800 J1000 J1300 J1800	UK-083S	3/8	89-3026-9
Suction Filter[1]	UK-165S	5/8	89-3028-9

[1]Used when cleaning up severely contaminated systems

Important

Driers are covered as a warranty part. The drier must be replaced any time the system is opened for repairs.

TOTAL SYSTEM REFRIGERANT CHARGES

Important

Refer to the ice machine serial number tag to verify the system charge.

Series	Version	Charge
J200	Air-Cooled	18 oz.
	Water-Cooled	15 oz.
J250	Air-Cooled	18 oz.
	Water-Cooled	13 oz.
J320	Air-Cooled	20 oz.
	Water-Cooled	16 oz.
J420/J450	Air-Cooled	24 oz.
	Water-Cooled	22 oz.
	Remote	6 lb.
J600	Air-Cooled	32 oz.
	Water-Cooled	26 oz.
	Remote	8 lb.
J800	Air-Cooled	36 oz.
	Water-Cooled	31 oz.
	Remote	8 lb.
J1000	Air-Cooled	38 oz.
	Water-Cooled	34 oz.
	Remote	9.5 lb.
J1300	Air-Cooled	48 oz.
	Water-Cooled	50 oz.
	Remote	12.5 lb.
J1800	Air-Cooled	65 oz.
	Water-Cooled	52 oz.
	Remote	15 lb.

NOTE: All ice machines on this list are charged using R-404A refrigerant.

REFRIGERANT DEFINITIONS

Recover
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.

Recycle
To clean refrigerant for re-use 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 (see below) by means which may include distillation. A chemical analysis of the refrigerant is required after processing to be sure that product specifications are met. This term usually implies the use of processes and procedures available only at a reprocessing or manufacturing facility.

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

New Product Specifications
This means ARI Standard 700 (latest edition). Chemical analysis is required to assure that this standard is met.

REFRIGERANT RE-USE POLICY

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

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

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.

Manitowoc approves the use of:

New Refrigerant

- Must be of original nameplate type.

Reclaimed Refrigerant

- Must be of original nameplate type.
- Must meet ARI Standard 700 (latest edition) specifications.

Recovered or Recycled Refrigerant

- Must be recovered or recycled in accordance with current local, state and federal laws.
- Must be recovered from and re-used in the same Manitowoc product. Re-use of recovered or recycled refrigerant from other products is not approved.
- Recycling equipment must be certified to ARI Standard 740 (latest edition) and be maintained to consistently meet this standard.
- Recovered refrigerant must come from a "contaminant-free" system. To decide whether the system is contaminant free, consider:
  - Type(s) of previous failure(s)
  - Whether the system was cleaned, evacuated and recharged properly following failure(s)
  - Whether the system has been contaminated by this failure
  - Compressor motor burnouts and improper past service prevent refrigerant re-use.
  - Refer to "System Contamination Cleanup" to test for contamination.

"Substitute" or "Alternative" Refrigerant

- Must use only Manitowoc-approved alternative refrigerants.
- Must follow Manitowoc-published conversion procedures.

HFC REFRIGERANT QUESTIONS AND ANSWERS

Manitowoc uses R-404A and R-134A HFC refrigerants with ozone depletion potential (ODP) factors of zero (0.0). R-404A is used in ice machines and reach-in freezers and R-134A is used in reach-in refrigerators.

1. What compressor oil does Manitowoc require for use with HFC refrigerants?

Manitowoc products use Polyol Ester (POE) type compressor oil. It is the lubricant of choice among compressor manufacturers.

2. What are some of the characteristics of POE oils?

They are hygroscopic, which means they have the ability to absorb moisture. POE oils are 100 times more hygroscopic than mineral oils. Once moisture is absorbed into the oil, it is difficult to remove, even with heat and vacuum. POE oils are also excellent solvents, and tend to “solvent clean” everything inside the system, depositing material where it is not wanted.

3. What do these POE oil characteristics mean to me?

You must be more exacting in your procedures. Take utmost care to prevent moisture from entering the refrigeration system. Keep oil containers and compressors capped at all times to minimize moisture entry. Before removing the system charge to replace a faulty component, be sure you have all of the needed components at the site. Remove new system component plugs and caps just prior to brazing. Be prepared to connect a vacuum pump immediately after brazing.

4. Are there any special procedures required if a POE system is diagnosed with a refrigerant leak?

For systems found with positive refrigerant system pressure, no special procedures are required.

For systems found without any positive refrigerant pressure, assume that moisture has entered the POE oil. After the leak is found and repaired, the compressor oil must be changed. The compressor must be removed and at least 95% of the oil drained from the suction port of the compressor. Use a “measuring cup” to replace the old oil with exactly the same amount of new POE oil, such as Mobil EAL22A.

Remember, care must be taken to prevent moisture from getting into the refrigeration system during refrigeration repairs.

5. How do I leak-check a system containing HFC refrigerant?

Use equipment designed for HFC detection. Do not use equipment designed for CFC detection. Consult leak detection equipment manufacturers for their recommendations. Also, standard soap bubbles will work with HFC refrigerants.

6. Does Manitowoc use a special liquid line filter-drier with HFC refrigerants?

Yes. Manitowoc uses an ALCO “UK” series filter-drier for increased filtration and moisture removal. During a repair, Manitowoc recommends installing the drier just before hooking up a vacuum pump.

Continued on next page...

7. Is other special equipment required to service HFC refrigerants?

No. Standard refrigeration equipment such as gauges, hoses, recovery systems, vacuum pumps, etc., are generally compatible with HFC refrigerants. Consult your equipment manufacturer for specific recommendations for converting existing equipment to HFC usage. Once designated (and calibrated, if needed) for HFC use, this equipment should be used specifically with HFC refrigerants only.

8. Do I have to recover HFC refrigerants?

Yes. Like other refrigerants, government regulations require recovering HFC refrigerants.

9. Will R-404A or R-134A separate if there is a leak in the system?

No. Like R-502, the degree of separation is too small to detect.

10. How do I charge a system with HFC refrigerant?

The same as R-502. Manitowoc recommends charging only liquid refrigerant into the high side of the system.

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