Manitowoc

S Model Air Water Remote Ice Machines

Technician's Handbook



Part Number 8014793 6/18

Safety Notices

As you work on Manitowoc equipment, be sure to pay close attention to the safety notices in this handbook. Disregarding the notices may lead to serious injury and/or damage to the equipment.

Throughout this handbook, 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 equipment. Be sure to read the Caution statement before proceeding, and work carefully.

Procedural Notices

As you work on Manitowoc equipment, be sure to read the procedural notices in this handbook. These notices supply helpful information which may assist you as you work.

Throughout this handbook, 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.

Read These Before Proceeding:

⚠ Caution

Proper installation, care and maintenance are essential for maximum performance and trouble-free operation of your Manitowoc equipment. If you encounter problems not covered by this handbook, do not proceed, contact Manitowoc Foodservice. We will be happy to provide assistance.

Important

Routine adjustments and maintenance procedures outlined in this handbook are not covered by the warranty.

⚠ Warning

PERSONAL INJURY POTENTIAL

Do not operate equipment that has been misused, abused, neglected, damaged, or altered/modified from that of original manufactured specifications.

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

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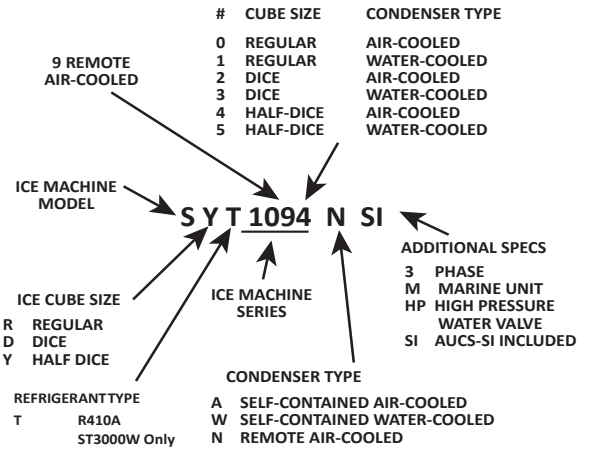
Model Numbers

This manual covers the following models:

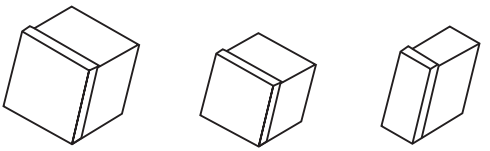
Self-Contained Air-Cooled	Self-Contained Water-Cooled	Remote
SD0302A SY0304A	SD0303W SY0305W	--- ---
SD0322A SY0324A	SD0323W SY0325W	--- ---
SR0420A SD0422A SY0424A	SR0421W SD0423W SY0425W	--- ---
SD0452A SY0454A	SD0453W SY0455W	--- ---
SR0500A SD0502A SY0504A	SR0501W SD0503W SY0505W	SD0592N SY0594N
SD0602A SY0604A	SD0603W SY0605W	SD0692N SY0694N
SR0850A SD0852A SY0854A	SR0851W SD0853W SY0855W	SR0890N SD0892N SY0894N
SR1000A SD1002A SY1004A	SR1001W SD1003W SY1005W	SR1090N SD1092N SY1094N
SD1202A SY1204A	SD1203W SY1205W	--- ---
SD1402A SY1404A	SD1403W SY1405W	SD1492N SY1494N
SR1600A SD1602A SY1604A	SR1601W SD1603W SY1605W	SR1690N SD1692N SY1694N
SR1800A SD1802A SY1804A	SR1801W SD1803W SY1805W	SR1890N SD1892N SY1894N
--- --- --- ---	SD3303W SD3303WHP SY3305W SY3305WHP	--- --- --- ---
--- ---	SDT3000W SYT3000W	--- ---

NOTE: Model numbers ending in 3 indicate a 3 phase unit. Example: SY1004A3.

HOW TO READ A MODEL NUMBER



Ice Cube Sizes



Regular	Dice	Half Dice
1-1/8" x 1-1/8" x 7/8"	7/8" x 7/8" x 7/8"	3/8" x 1-1/8" x 7/8"
2.86 x 2.86 x 2.22 cm	2.22 x 2.22 x2.22 cm	0.95 x 2.86 x 2.22 cm

⚠ Warning

Personal Injury Potential

Do not operate equipment that has been misused, abused, neglected, damaged, or altered/modified from that of original manufactured specifications.

⚠ Warning

All Manitowoc ice machines require the ice storage system (bin, dispenser, etc.) to incorporate an ice deflector.

48” wide S Model ice machines require adding Manitowoc Ice Deflector Kit K00349 when installing with non-Manitowoc ice storage systems.

30” wide S Model ice machines require adding Manitowoc Ice Deflector Kit K00347 when installing with non-Manitowoc ice storage systems.

Prior to using a non-Manitowoc ice storage system with other Manitowoc ice machines, contact the manufacturer to assure their ice deflector is compatible with Manitowoc ice machines.

Model/Serial Number Location

These numbers are required when requesting information from your local Manitowoc Distributor, service representative, or Manitowoc Ice, Inc. The model and serial number are listed on the OWNER WARRANTY REGISTRATION CARD. They are also listed on the MODEL/SERIAL NUMBER DECAL affixed to the ice machine.

Energy Efficient Ice Machine Serial Breaks

Some specifications have changed with our release of more Energy Efficient machines. The following machines have a serial break to indicate when they became more Energy Efficient.

Series Ice Machine	Serial Break/Manufacture Date for Energy Efficient Machines
S300	110704351
S420	110667970
S450	110670157
S500	110684316
S850	110683282
S1000	110697023
S1200	110707329
S1400W	Manufacture Date After 0711 (November 2007)
S1400W	Manufacture Date Between 0711 & 0905 (November 2007 & May 2009)
S1400A S1400W S1400N	Manufacture Date After 0905 (May 2009)
S1800A S1800W S1800N	Manufacture Date After 0910 (October 2009)
SYT3000W SDT3000W	Model number was changed to indicate refrigerant type change and energy efficiency increase.

Installation

⚠ Warning

PERSONAL INJURY POTENTIAL

Remove all ice machine panels before lifting and installing.

Location of Ice Machine

The location selected for the ice machine head section must meet the following criteria. If any of these criteria are not met, select another location.

- The location must be free of airborne and other contaminants.
- Self contained air and water cooled - The air temperature must be at least 35°F (1.6°C), but must not exceed 110°F (43.4°C).
- Remote air cooled - The air temperature must be at least -20°F (-29°C), but must not exceed 120°F (49°C)
- Ice Making Water Inlet - Water Pressure must be at least 20 psi (1.38 bar), but must not exceed 80 psi (5.52 bar).
- Condenser Water Inlet - Water Pressure must be at least 20 psi (1.38 bar), but must not exceed 150 psi (10.34 bar). S3300W-HP units allow water pressure up to 350 psig (24.13 bar).
- The location must not be near heat-generating equipment or in direct sunlight and protected from weather.
- The location must not obstruct air flow through or around the ice machine. Refer to chart below for clearance requirements.
- 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 “Removal from Service/Winterization”

Ice Machine Clearance Requirements

S300	Self-Contained Air-Cooled	Self-Contained Water-Cooled
Top/Sides	16" (40.6 cm)	8" (20.3 cm)
Back	5" (12.7 cm)	5" (12.7 cm)

S320/S450/S500/ S600/S850/S1000	Self-Contained Air-Cooled	Water-Cooled and Remote*
Top/Sides	8" (20.3 cm)	8" (20.3 cm)
Back	5" (12.7 cm)	5" (12.7 cm)

S420	Self-Contained Air-Cooled	Water-Cooled and Remote*
Top/Sides	12" (30.5 cm)	8" (20.3 cm)
Back	5" (12.7 cm)	5" (12.7 cm)

S1200	Self-Contained Air-Cooled	Water-Cooled and Remote*
Top	8" (20.3 cm)	8" (20.3 cm)
Sides	12" (30.5 cm)	8" (20.3 cm)
Back	5" (12.7 cm)	5" (12.7 cm)

S1400/S1600/ S1800	Self-Contained Air-Cooled	Water-Cooled and Remote*
Top/Sides	24" (61.0 cm)	8" (20.3 cm)
Back	12" (30.5 cm)	5" (12.7 cm)*

ST3000/S3300**	Water-Cooled
Top/Sides	8" (20.3 cm)
Back	24" (61.0 cm)

* There is no minimum clearance required for water-cooled or remote ice machines. This value is recommended for efficient operation and servicing only.

** ST3000/S3300 - 24" on all sides is recommended to allow access without moving the bin/ice machine.

Ice Machine Heat of Rejection

Series Ice Machine	Heat of Rejection	
	Air Conditioning*	Peak
S300	3,800	6,000
S320	3,800	6,000
S420/S450	7,000	9,600
S500	7,000	9,600
S600	9,000	13,900
S850	12,000	18,000
S1000	16,000	22,000
S1200	19,000	28,000
S1400	19,000	28,000
S1600	21,000	31,000
S1800	24,000	36,000
Energy Efficient Machines		
S300	5,000	6,000
S420/S450	5,900	6,900
S500	6,100	6,900
S850	13,000	16,000
S1000	17,700	21,000
S1200	20,700	24,500
S1400W	25,000	28,000
S1400A/ S1400N	23,500	27,000
S1800	31,000	36,000
ST3000 S3300	45,000	51,000

*BTU/Hour
Because the heat of rejection varies during the ice making cycle, the figure shown is an average.

REMOTE CONDENSER LINE SET INSTALLATION

Ice Machine	Remote Single Circuit Condenser	Line Set*
S500	JC0495	RT-20-R404A RT-35-R404A RT-50-R404A
S600 S800 S1000	JC0895	RT-20-R404A RT-35-R404A RT-50-R404A
S1400 S1600 S1800	JC1395	RL-20-R404A RL-35-R404A RL-50-R404A

*Line Set	Discharge Line	Liquid Line
RT	1/2" (1.27 cm)	5/16" (.79 cm)
RL	1/2" (1.27 cm)	3/8" (.95 cm)

Air Temperature Around the Condenser	
Minimum	Maximum
-20°F (-29°C)	120°F (49°C)

Important

Manitowoc remote systems are only approved and warranted as a complete new package. Warranty on the refrigeration system will be void if a new ice machine head section is connected to pre-existing (used) tubing or remote condensers or vice versa.

CALCULATING REMOTE CONDENSER INSTALLATION DISTANCES

NOTE: Manitowoc warrants only complete new and unused remote packages. Warranty on the refrigeration system will be void if a new ice machine head section is connected to existing (used) tubing or condensers.

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 120°F (49°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 calculated 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 ____ X 1.7 = _____Calculated Rise (35 ft. Max)

Step 2
Measured Drop ____ X 6.6 = _____Calculated Drop (15 ft. Max.)

Step 3
Measured Horizontal Distance = _____Horizontal (100 ft. Max.) Distance

Step 4
Total Calculated Distance = _____Total Calculated (150 ft. Max.) Distance

LENGTHENING OR REDUCING LINE SET LENGTHS

In most cases, by routing the line set properly, shortening will not be necessary. When shortening or lengthening is required, do so before connecting the line set to the ice machine or the remote condenser. This prevents the loss of refrigerant in the ice machine or condenser.

The quick connect fittings on the line sets are equipped with Schraeder valves. Use these valves to recover any vapor charge from the line set. When lengthening or shortening lines follow good refrigeration practices, purge with nitrogen and insulate all tubing. Do not change the tube sizes. Evacuate the lines and place about 5 oz (143g) of vapor refrigerant charge in each line.

CONNECTING A LINE SET

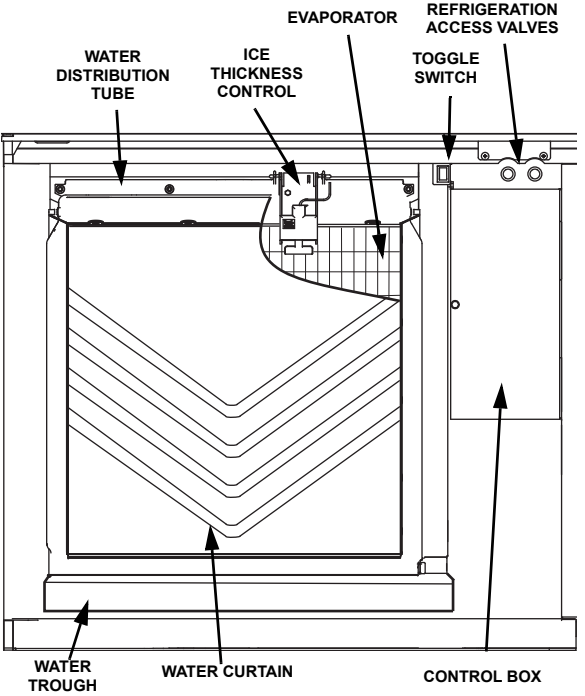
1. Remove the dust caps from the line set, condenser and ice machine.
2. Apply refrigeration oil to the threads on the quick disconnect couplers before connecting them to the condenser.
3. Carefully thread the female fitting to the condenser or ice machine by hand.
4. Tighten the couplings with a wrench until they bottom out.
5. Turn an additional 1/4 turn to ensure proper brass-to-brass seating. Torque to the following specifications:

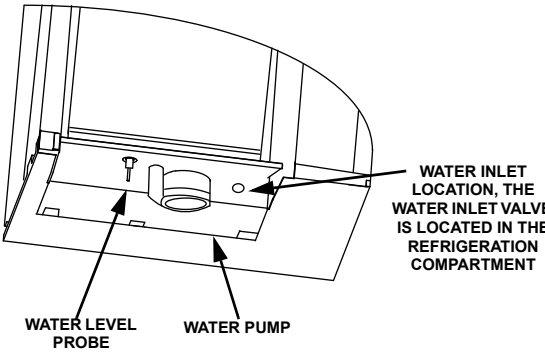
Liquid Line	Discharge Line
10-12 ft lb. (13.5-16.2 N•m)	35-45 ft lb. (47.5-61.0 N•m)

6. Check all fittings and valve caps for leaks.
7. Make sure Schraeder cores are seated and Schraeder caps are on and tight.

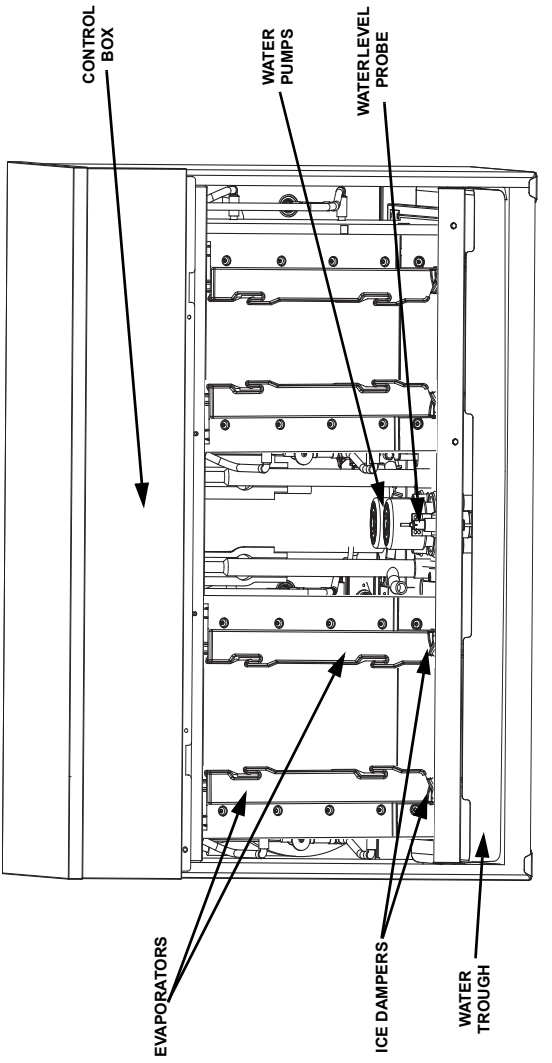
Component Identification

S Model Single Evaporator Models





S Model Quad Evaporator Models



Maintenance

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 water care professional to test the water quality and recommend appropriate water treatment. An extremely dirty ice machine must be taken apart for cleaning and sanitizing.

Manitowoc Ice Machine Cleaner and Sanitizer are the only products approved for use in Manitowoc ice machines.

This Manitowoc Ice Machine has two separate cleaning procedures.

Cleaning/Sanitizing Procedure

This procedure must be performed a minimum of once every six months.

- The ice machine and bin must be disassembled cleaned and sanitized
- All ice produced during the cleaning and sanitizing procedures must be discarded
- Removes mineral deposits from areas or surfaces that are in direct contact with water

Heavily Scaled Cleaning Procedure

Perform this procedure if you have some or all of these symptoms.

- Ice machine stops on Safety Shutdown
- Your water has a high concentration of minerals
- The ice machine has not been on a regular maintenance schedule.

Cleaning / Sanitizing Procedure

⚠ Caution

Use only Manitowoc approved Ice Machine Cleaner and Sanitizer for this application (Manitowoc Cleaner part number 9405463 and Manitowoc Sanitizer part number 9405653). 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.

CLEANING PROCEDURE

⚠ 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.

Ice machine cleaner is used to remove lime scale and mineral deposits. Ice machine sanitizer disinfects and removes algae and slime.

Step 1 Remove front door and top cover. This will allow easiest access for adding cleaning and sanitizing solutions.

Step 2 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 3 Remove all ice from the bin.

Step 4 Place the toggle switch in the CLEAN position. The water will flow through the water dump valve and down the drain. Wait until the water trough refills and water flows over the evaporator, then add the proper amount of ice machine cleaner.

Model	Amount of Cleaner
S300/S320/S420	3 ounces (90 ml)
S450/S500/S600/S850/ S1000/S1200	5 ounces (150 ml)
S1400/S1600/S1800	9 ounces (265 ml)
ST3000/S3300	16 ounces (475 ml)

Step 5 Wait until the clean cycle is complete (approximately *35 minutes*). then place the toggle switch in the OFF position and disconnect power to the ice machine (and dispenser when used).

NOTE: **ST3000/S3300 Only - 80 minutes*..

⚠ Warning

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

Step 6 Remove parts for cleaning.

Please refer to the proper parts removal for your ice machine.

Single Evaporator Ice Machines - page 26.

Quad Evaporator Ice Machines - page 27.

PARTS REMOVAL FOR CLEANING/SANITIZING

Single Evaporator Ice Machines

A. Remove the water curtain

- Gently flex the curtain in the center and remove it from the right side.
- Slide the left pin out.

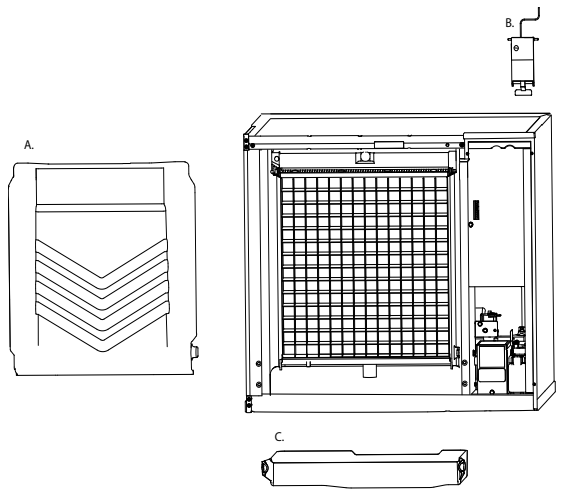
B. Remove the ice thickness probe

- Compress the hinge pin on the top of the ice thickness probe.
- Pivot the ice thickness probe to disengage one pin then the other. The ice thickness probe can be cleaned at this point without complete removal. If complete removal is desired, disconnect the ice thickness control wiring from the control board.

C. Remove the water trough

- Depress tabs on right and left side of the water trough.
- Allow front of water trough to drop as you pull forward to disengage the rear pins.

NOTE: Proceed to page 29, Step 7.



Quad Evaporator Ice Machines

A.Remove the water trough shield.

- Grasp the water trough shield in the center and the left end.
- Flex the water trough shield in the center and pull the left end forward until clear of the side wall. Repeat for the right end.
- Pull water trough shield forward to remove.

B. Remove Splash Shields.

- Grasp the top center of splash shields.
- Lift up and then out.

C. Remove ice thickness probe.

- Compress the hinge pin on the top of the ice thickness probe.
- Pivot the ice thickness probe to disengage one pin then the other. The ice thickness probe can be cleaned at this point without complete removal. If complete removal is desired, disconnect the ice thickness control wiring from the control board.

D. Remove the water pump assembly

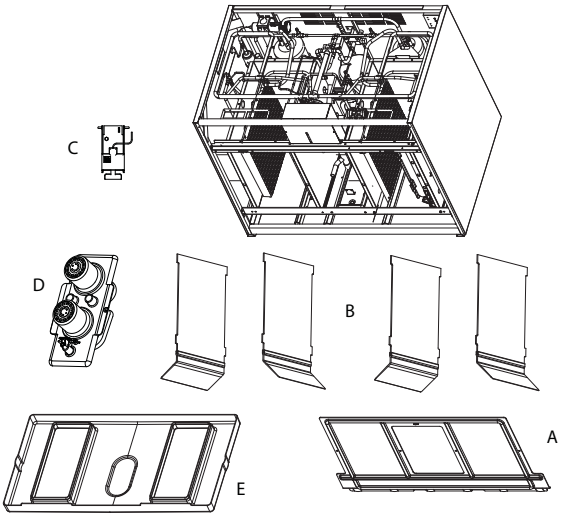
- Disconnect the vinyl distribution tube from both water pumps.
- Disconnect the water pump and water level probe electrical connections.
- Remove two thumbscrews and lift the water pump assembly out of the ice machine.

E. Remove the water trough.

- Depress the two tabs on the top of the water trough.
- Turn left and right ice dampers down to clear water trough.
- Pull forward on the water trough to remove.

NOTE: Proceed to page 29, Step 7.

Continued on next page …


C
D
B
A
E

Step 7 Mix a solution of cleaner and warm water. Depending upon the amount of mineral buildup, a larger quantity of solution may be required. Use the ratio in the table below to mix enough solution to thoroughly clean all parts.

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

Step 8 Use 1/2 of the cleaner/water mixture to clean all components. The cleaner solution will foam when it contacts lime scale and mineral deposits; once the foaming stops use a soft-bristle nylon brush, sponge or cloth (NOT a wire brush) to carefully clean the parts. Soak parts for 5 minutes (15 - 20 minutes for heavily scaled parts). Rinse all components with clean water.

Step 9 While components are soaking, use 1/2 of the cleaner/water solution to clean all foodzone surfaces of the ice machine and bin (or dispenser). Use a nylon brush or cloth to thoroughly clean the following ice machine areas:

- Side walls
- Base (area above water trough)
- Evaporator plastic parts - including top, bottom, and sides
- Bin or dispenser

Rinse all areas thoroughly with clean water.

Continued on next page …

Step 10 Mix a solution of sanitizer and warm water.

Solution Type	Water	Mixed With
Sanitizer	6 gal. (23 l)	4 oz (120 ml) sanitizer

Step 11 Use 1/2 of the sanitizer/water solution to sanitize all removed components. Use a spray bottle to liberally apply the solution to all surfaces of the removed parts or soak the removed parts in the sanitizer/water solution. Do not rinse parts after sanitizing.

Step 12 Use 1/2 of the sanitizer/water solution to sanitize all foodzone surfaces of the ice machine and bin (or dispenser). Use a spray bottle to liberally apply the solution. When sanitizing, pay particular attention to the following areas:

- Side walls
- Base (area above water trough)
- Evaporator plastic parts - including top, bottom and sides
- Bin or dispenser

Do not rinse the sanitized areas.

Step 13 Replace all removed components.

Step 14 Wait 30 minutes.

Step 15 Reapply power to the ice machine and place the toggle switch in the CLEAN position.

Step 16 Wait until the water trough refills and water flows over the evaporator (approximately 3 minutes). Add the proper amount of Manitowoc Ice Machine Sanitizer to the water trough by pouring between the water curtain/splash shields and evaporator..

Model	Amount of Sanitizer
S300/S320/S420	3 ounces (90 ml)
S450/S500/S600/S850/ S1000/S1200	3 ounces (90 ml)
S1400/S1600/S1800	6 ounces (180 ml)
ST3000/S3300	25 ounces (740 ml)

Step 17 Move the toggle switch to the ICE position and replace the front panel. The ice machine will automatically start ice making after the sanitize cycle is complete (approximately 35 minutes) ST3000/S3300 approximately 80 minutes.

Procedure to Clean Heavily Scaled Ice Machines

Ice machines that are heavily scaled or have not been cleaned on a regular basis will need to run this procedure.

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. The ice machine must be taken apart for cleaning and sanitizing.

⚠ Caution

Use only Manitowoc approved Ice Machine Cleaner and Sanitizer for this application (Manitowoc Cleaner part number 9405463 and Manitowoc Sanitizer part number 9405653). 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.

CLEANING PROCEDURE

⚠ 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.

Ice machine cleaner is used to remove lime scale and mineral deposits. Ice machine sanitizer disinfects and removes 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 Remove top cover. This will allow easiest access for adding cleaning and sanitizing solutions.

Step 3 Remove all ice from the bin.

Step 4 Place the toggle switch in the CLEAN position. The water will flow through the water dump valve and down the drain. Wait until the water trough refills and water flows over the evaporator, then add the proper amount of ice machine cleaner.

Model	Amount of Cleaner
S300/S320/S420	3 ounces (90 ml)
S450/S500/S600/S850/ S1000/S1200	5 ounces (150 ml)
S1400/S1600/S1800	9 ounces (265 ml)
ST3000/S3300	16 ounces (475 ml)

Continued on next page …

Step 5 Wait until the clean cycle is complete (approximately *35 minutes). then place the toggle switch in the OFF position and disconnect power to the ice machine (and dispenser when used)

NOTE: **ST3000/S3300 approximately 80 minutes*..

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

Step 6 Remove parts for cleaning.

Please refer to the proper parts removal for your ice machine.

Single Evaporator Ice Machines - page 35.

Quad Evaporator Ice Machines - page 38.

PARTS REMOVAL FOR CLEANING/SANITIZING

Single Evaporator Ice Machines

A. Remove the water curtain

- Gently flex the curtain in the center and remove it from the right side.
- Slide the left pin out.

B. Remove the ice thickness probe

- Compress the hinge pin on the top of the ice thickness probe.
- Pivot the ice thickness probe to disengage one pin then the other. The ice thickness probe can be cleaned at this point without complete removal. If complete removal is desired, disconnect the ice thickness control wiring from the control board.

C. Remove the water distribution tube

NOTE: Distribution tube thumbscrews are retained to prevent loss. Loosen thumbscrews but do not pull thumbscrews out of distribution tube.

- Loosen the two outer screws (do not remove screws completely they are retained to prevent loss) and pull forward on the distribution tube to release from slip joint.
- Disassemble distribution tube by loosening the two (2) middle thumbscrews and dividing the distribution tube into two pieces.

D. Remove the water trough

- Depress tabs on right and left side of the water trough.
- Allow front of water trough to drop as you pull forward to disengage the rear pins.

E. Remove the water level probe

- Pull the water level probe straight down to disengage.
- Lower the water level probe until the wiring connector is visible.
- Disconnect the wire lead from the water level probe.
- Remove the water level probe from the ice machine.

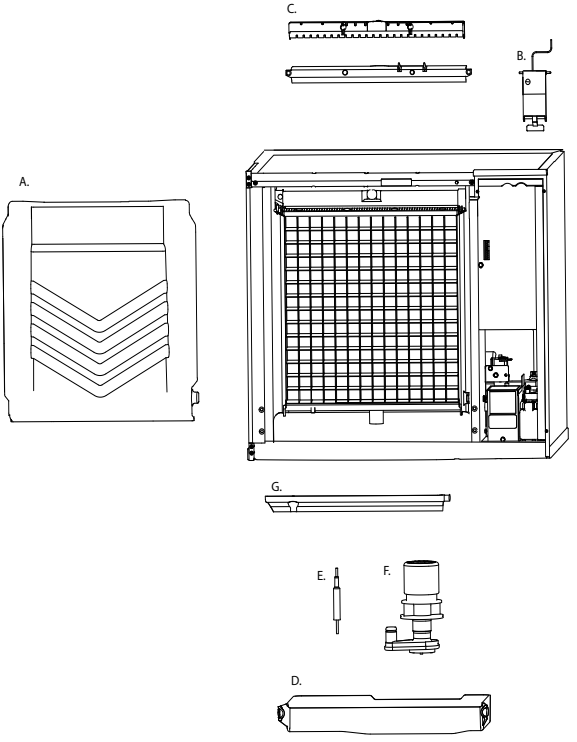
F. Remove the water pump.

- Grasp pump and pull straight down on pump assembly until water pump disengages and electrical connector is visible.
- Disconnect the electrical connector.
- Remove the water pump assembly from ice machine.
- Do not soak the water pump motor in cleaner or sanitizer solution.

G. Remove the evaporator tray or water diverter from the bottom of the evaporator.

- Loosen thumbscrew on left side of tray.
- Allow left side of tray to drop as you pull the tray to the left side. Continue until the outlet tube disengages from the right side.

NOTE: Proceed to page 41, Step 7.


C.
B.
A.
G.
E.
F.
D.

Quad Evaporator Ice Machines

A. Remove panels

- Remove both front panels
- Remove top panel

B. Remove front evaporator shield.

- Remove four quarter turn connectors
- Remove splash shield

C. Remove left and right evaporator top covers.

- Remove two thumbscrews from the front of each evaporator top cover.
- Lift front of cover, pull forward to remove.

D. Remove Splash Shields.

- Grasp the top center of splash shields.
- Lift up and then out.

NOTE: Each evaporator has a splash shield that must be removed - total of four splash shields.

E. Remove ice thickness probe.

- Compress the hinge pin on the top of the ice thickness probe.
- Pivot the ice thickness probe to disengage one pin then the other. The ice thickness probe can be cleaned at this point without complete removal. If complete removal is desired, disconnect the ice thickness control wiring from the control board.

F. Remove distribution tubes.

- Distribution tube thumbscrews are retained to prevent loss. Loosen thumbscrews but do not pull thumbscrews out of distribution tube.
- Loosen the two outer screws and pull forward on the distribution tube to release from slip joint.
- Disassemble distribution tube by loosening the two (2) middle thumbscrews and dividing the distribution tube into two pieces.

NOTE: Each evaporator has a distribution tube that must be removed - total of four distribution tubes.

G. Remove ice dampers.

- Grasp ice damper and apply pressure toward the back mounting bracket.
- Apply pressure to the front mounting bracket with thumb.
- Pull ice damper downward when the front ice damper pin disengages.

NOTE: Each evaporator has an ice damper that must be removed - total of four ice dampers.

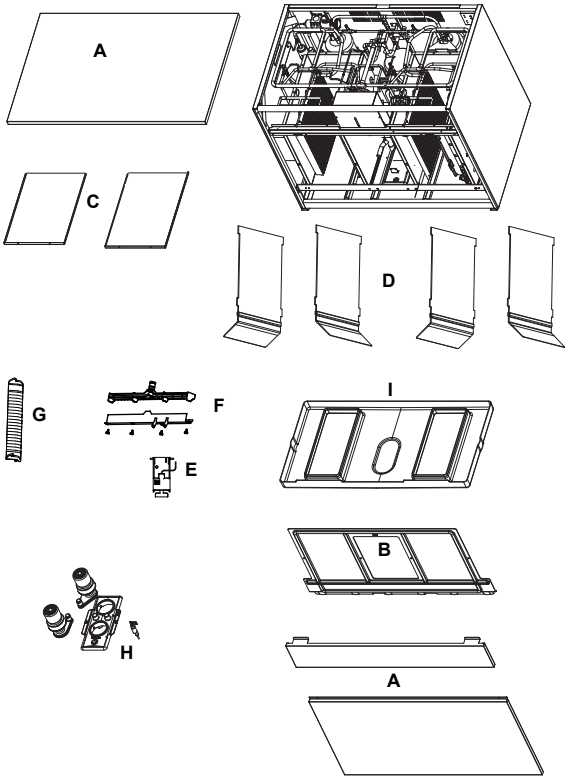
H. Remove the water pump assembly.

- Disconnect the vinyl distribution tube from both water pumps.
- Disconnect the water pump and water level probe electrical connections.
- After the wires are disconnected remove the two thumbscrews and lift the water pump assembly out of the ice machine.
- Remove the thumbscrews securing the water pumps (2 each pump) and remove water pumps. Do not immerse the water pump motor in cleaner or sanitizer solutions.
- Remove the water level probe from the assembly housing.

I. Remove the water trough.

- Pull forward on the water trough to remove.

NOTE: Proceed to page 41, Step 7.


A
C
D
G
F
E
I
B
H
A

Step 7 Mix a solution of cleaner and warm water. Depending upon the amount of mineral buildup, a larger quantity of solution may be required. Use the ratio in the table below to mix enough solution to thoroughly clean all parts.

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

Step 8 Use 1/2 of the cleaner/water mixture to clean all components. The cleaner solution will foam when it contacts lime scale and mineral deposits; once the foaming stops use a soft-bristle nylon brush, sponge or cloth (NOT a wire brush) to carefully clean the parts. Soak parts for 5 minutes (15 - 20 minutes for heavily scaled parts). Rinse all components with clean water.

Step 9 While components are soaking, use 1/2 of the cleaner/water solution to clean all foodzone surfaces of the ice machine and bin (or dispenser). Use a nylon brush or cloth to thoroughly clean the following ice machine areas:

- Side walls
- Base (area above water trough)
- Evaporator plastic parts - including top, bottom, and sides
- Bin or dispenser

Rinse all areas thoroughly with clean water.

Step 10 Mix a solution of sanitizer and warm water.

Solution Type	Water	Mixed With
Sanitizer	6 gal. (23 l)	4 oz (120 ml) sanitizer

Step 11 Use 1/2 of the sanitizer/water solution to sanitize all removed components. Use a cloth or sponge to liberally apply the solution to all surfaces of the removed parts or soak the removed parts in the sanitizer/water solution. Do not rinse parts after sanitizing.

Step 12 Use 1/2 of the sanitizer/water solution to sanitize all foodzone surfaces of the ice machine and bin (or dispenser). Use a cloth or sponge to liberally apply the solution. When sanitizing, pay particular attention to the following areas:

- Side walls
- Base (area above water trough)
- Evaporator plastic parts - including top, bottom and sides
- Bin or dispenser

Do not rinse the sanitized areas.

Step 13 Replace all removed components.

Step 14 Reapply power to the ice machine and place the toggle switch in the CLEAN position.

Step 15 Wait about two minutes or until water starts to flow over the evaporator. Add the proper amount of Manitowoc Ice Machine Sanitizer to the water trough by pouring between the water curtain/splash shields and evaporator.

Model	Amount of Sanitizer
S300/S320/S420	3 ounces (90 ml)
S450/S500/S600/S850/ S1000/S1200	3 ounces (90 ml)
S1400/S1600/S1800	6 ounces (180 ml)
ST3000/S3300	25 ounces (740 ml)

Step 16 The ice machine will stop after the sanitize cycle (approximately *35 minutes). Place the toggle switch in the OFF position and disconnect power to the ice machine.
**ST3000/S3300 approximately 80 minutes*

Step 17 Refer to step 6 and disassemble components. After dissembling proceed to step 18.

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

Step 18 Mix a solution of sanitizer and warm water.

Solution Type	Water	Mixed With
Sanitizer	6 gal. (23 l)	4 oz (120 ml) sanitizer

Step 19 Use 1/2 of the sanitizer/water solution to sanitize all removed components. Use a cloth or sponge to liberally apply the solution to all surfaces of the removed parts or soak the removed parts in the sanitizer/water solution. Do not rinse parts after sanitizing.

Step 20 Use 1/2 of the sanitizer/water solution to sanitize all foodzone surfaces of the ice machine and bin (or dispenser). Use a cloth or sponge to liberally apply the solution. When sanitizing, pay particular attention to the following areas:

- Side walls
- Base (area above water trough)
- Evaporator plastic parts - including top, bottom and sides
- Bin or dispenser

Do not rinse the sanitized areas.

Step 21 Install the removed parts, restore power and place the toggle switch in the ICE position.

Ice Thickness Probe & Water Level Probe

Clean the probes using the following procedure.

1. Mix a solution of Manitowoc ice machine cleaner and water (2 ounces of cleaner to 16 ounces of water) in a container.
2. Soak probes in container of cleaner/water solution while disassembling and cleaning water circuit components (soak probes for 10 minutes or longer).
3. Clean all probe surfaces including all plastic parts (do not use abrasives). Verify all cavities are clean. Thoroughly rinse probes (including cavity) with clean water, then dry completely. **Incomplete rinsing and drying of the ice thickness probe can cause premature harvest.**
4. Reinstall probes, then sanitize all ice machine and bin/dispenser interior surfaces.

Water Inlet Valve

The water inlet valve normally does not require removal for cleaning. Refer to “Water System Checklist” page 98, if you are troubleshooting water related problems.

1. When the ice machine is off, the water inlet valve must completely stop water flow into the machine. Watch for water flow.

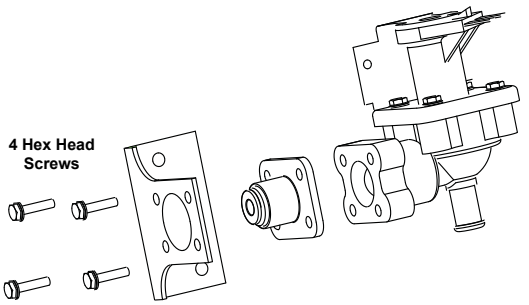
When the ice machine is on, the water inlet valve must allow the proper water flow through it. Set the toggle switch to ON. Watch for water flow into the ice machine. If the water flow is slow or only trickles into the ice machine, refer to water system checklist.

⚠ Warning

Disconnect the electric power to the ice machine and dispenser at the electric service switch box and turn off the water supply before proceeding.

Follow the procedure below to remove the water inlet valve.

1. Remove the 1/4” hex head screws.
2. Remove, clean, and install the filter screen.



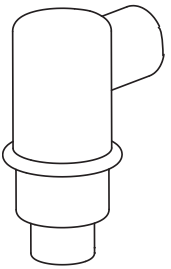
Water Dump Valve

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

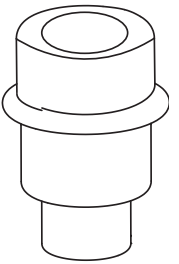
1. Locate the water dump valve.
2. Set the toggle switch to ICE.
3. While the ice machine is in the freeze mode, check the water trough to determine if the dump valve is leaking. If there is no or little water in the water trough (during the freeze cycle) the dump valve is leaking.
   A. If the dump valve is leaking, replace the dump valve.
   B. If the dump valve is not leaking, follow the “Ice Machine Cleaning Procedure”.

Drain Line Check Valve

The drain line check valve (not used on all models) should be inspected and cleaned, whenever the ice machine is cleaned.



CHECK VALVE ASSEMBLY



CHECK VALVE

1. Remove check valve and tube assembly.
   A. Tip assembly to right until tubing disengages.
   B. Lift up on assembly to remove.
2. Remove insulation from check valve assembly.
3. Remove vinyl tubing from top of check valve.
4. Soak in cleaner solution 10 minutes, and then flush with water to remove debris.

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 (0°C) 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.

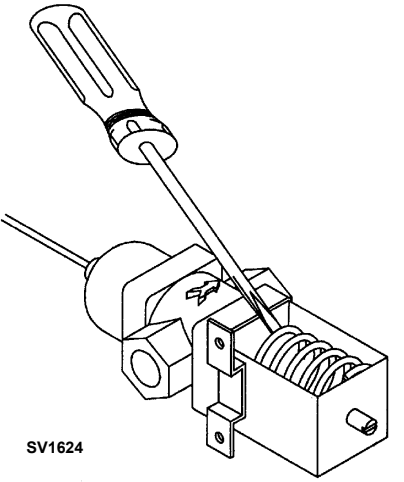
Follow the applicable procedure below.

SELF-CONTAINED AIR-COOLED ICE MACHINES

1. Move the ICE/OFF/CLEAN switch to OFF.
2. Disconnect the electric power at the circuit breaker or the electric service switch.
3. Turn off the water supply.
4. Remove the water from the water trough.
5. Disconnect and drain the incoming ice-making water line at the rear of the ice machine.
6. Energize the ice machine and wait one minute for the water inlet valve to open.
7. 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 water inlet lines or the drain.
8. 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 line 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.



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 valve. 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.”

Sequence of Operation

Self Contained Air or Water Cooled

SINGLE & QUAD EVAPORATOR MODELS

NOTE: The toggle switch must be in the ice position and the water curtain/ice dampers must be in place on the evaporator before the ice machine will start.

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

1. Water Purge

Before the refrigerant compressor starts, the water pump and water dump solenoid energize to purge the ice machine of old water. This feature ensures that the ice making cycle starts with fresh water.

Single evaporator models energize the harvest valve(s) and air compressor (when used) at the end of the water purge and they remain energized during refrigeration startup.

Energized Control Board Lights-

Single Evaporators = Left Bin (green)

Quad Evaporators = All Curtain Switches (green), Dump Valve (red), Water Pump (red)

2. Refrigeration System Start-Up

The compressor, condenser fan motor and water fill valve energize and 5 seconds later the harvest valve(s) and air compressor(s) de-energize.

The fan motor is wired through a fan cycle pressure control and will cycle on and off when the room temperatures is below 70°F (21°C) .

Energized Control Board Lights-

Single Evaporators = Left Bin (green)

Quad Evaporators = All Curtain Switches (green), Water Solenoid (red), Liquid Solenoid (red)

Freeze Sequence

3. Prechill

The compressor lowers the temperature of the evaporator(s) before the water pump is energized. The water fill valve will remain energized until water contacts the water level probe.

Energized Control Board Lights-

Single Evaporators = Left Bin (green)

Quad Evaporators = All Curtain Switches (green), Water Solenoid (red), Liquid Solenoid (red)

4. Freeze

The water pump(s) energizes and water flows over the evaporator. After water contacts the water level probe the water fill valve de-energizes. The water fill valve will cycle on and off one more time.

The freeze cycle continues until the six minute freeze lock expires and enough ice has formed to allow water to contact the ice thickness probe. After approximately 10 seconds of continual water contact, the harvest sequence is initiated.

NOTE: Freeze lock is bypassed after moving the toggle switch from OFF to ICE position for the first cycle only.

Energized Control Board Lights-

Single Evaporators = Left Bin (green), water probe (green), Harvest (red *when water contacts the ice thickness probe*)

Quad Evaporators = All Curtain Switches (green), Water Level (green), Water Solenoid (red), Liquid Solenoid (red), Water Pump (red), Harvest (red *when water contacts the ice thickness probe*)

Harvest Sequence

5. Water Purge

The air compressor (when used) and the harvest valve(s) open at the beginning of the water purge to divert hot refrigerant gas into the evaporator.

The water pump continues to run, and the water dump valve energizes to purge the water in the water trough.

Single evaporator models energize the water fill valve for the last 15 seconds of the water purge cycle.

Energized Control Board Lights-

Single Evaporators = Left Bin (green), Harvest (red)

Quad Evaporators = All Curtain Switches (green), Liquid Solenoid (red), Dump Valve (red), Water Pump (red), Harvest (red), All Harvest Valves (red)

6. Harvest

The air compressor (when used) remains energized and the harvest valve(s) remains open. The refrigerant gas warms the evaporator causing the cubes to slide, as a sheet, off the evaporator and into the storage bin.

Energized Control Board Lights-

Single Evaporators = Left Bin (green), Harvest (red)

Quad Evaporators = All Curtain Switches (green), Liquid Solenoid (red), Harvest (red), All Harvest Valves (red)

Single evaporator models - The sliding sheet of cubes opens the water curtain and bin switch.

The momentary opening and re-closing of the bin switch terminates the harvest sequence and return to the freeze sequence (Step 3 - 4.)

Quad evaporator models - The sliding sheet of cubes opens the ice damper and bin switch. The momentary opening and re-closing of the bin switch de-energized the harvest valve for the evaporator. When all of the bin switches have opened and closed the ice machine will terminate the harvest sequence and return to the freeze sequence (Step 3 - 4.)

Energized Control Board Lights (once ice drops)-

Single Evaporators = Left Bin (green *flashes once*)

Quad Evaporators = All Curtain Switches (green *flashes once*), Liquid Solenoid (red)

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/ice damper and will hold it open. After the water curtain/ice damper is held open for 30 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 or all of the ice dampers. As the water curtain/ice dampers swing back to the closed position, the bin switch re-closes and the ice machine restarts (steps 1 - 2), provided the 3 minute delay period is complete.

Energized Control Board Lights-

Single Evaporators = No Lights

Quad Evaporators = Depending on which damper is open, the closed dampers will be lit (green)

Safety Timers

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

- The ice machine is locked into the freeze cycle for 6 minutes before a harvest cycle can be initiated. Freeze lock is bypassed after moving the toggle switch from OFF to ICE position for the first cycle only.
- The maximum freeze time is 60 minutes at which time the control board automatically initiates a harvest sequence (steps 5 & 6).
- The maximum harvest time is 3.5 minutes for single evaporators and 7 minutes for Quad evaporator model. The control board automatically initiates a freeze sequence (steps 3 & 4) when these times are exceeded.

Safety Limits

Safety limits are stored and indicated by the control board after three cycles. The number of cycles required to stop the ice machine varies for each safety limit.

- Safety Limit 1 - If the freeze time reaches 60 minutes, the control board automatically initiates a harvest cycle. If 6 consecutive 60-minute freeze cycles occur, the ice machine stops
- Safety Limit 2 single evaporator models - If the harvest time reaches 3.5 minutes, the control board automatically returns the ice machine to the freeze cycle. If 500 consecutive 3.5 minute harvest cycles occur, the ice machine stops.
- Safety Limit 2 Quad evaporator models - If the harvest time reaches 7 minutes, the control board automatically returns the ice machine to the freeze cycle. If 500 consecutive 7 minute harvest cycles occur, the ice machine stops.
- Safety Limit 3 Quad evaporator models - If the low refrigerant pressure control opens, the ice machine shuts off and starts a 5 minute delay period. If 3 consecutive low pressure esvents occur the ice machine stops and flashes the safety/harvest light.

Use the following procedures to determine if the control board contains a safety limit indication.

1. Move the toggle switch to OFF.
2. Move the toggle switch back to ICE. Watch the safety limit/harvest lights on the control board. If a safety limit has been recorded, the corresponding light will flash once, twice or three times to indicate which safety limit stopped the ice machine.

Safety Limit Stand-By Mode (Quad Evaporators Only)

The first time a safety limit shut down occurs, (three consecutive long freeze or harvest cycles) the ice machine will turn off for 60 minutes (Stand-By Mode).

During the Stand-By Mode the harvest light will be flashing continuously and a safety limit indication can be viewed. After 60 minutes the ice machine will automatically restart to see if the problem re-occurs. If the same safety limit is reached a second time (three more consecutive long freeze or harvest cycles) the ice machine will initiate a safety limit shut down and remain off until it is manually restarted. During a safety limit shut down the harvest light will be flashing continuously.

Warm Water Rinse Cycle

Single evaporator models only - Closing the back of the evaporator allows ice to build up on the rear of the evaporator and the plastic evaporator frame parts. After 200 freeze/harvest cycles have been completed the control board will initiate a warm water rinse.

After the 200th harvest cycle ends:

- The Clean and Harvest LEDs energize to indicate the ice machine is in a warm water rinse.
- The compressor and harvest valve remain energized.
- The water pump energizes.
- The water inlet valve energizes until water contacts the water level probe.
- The compressor and harvest valve warm the water for 5 minutes, then de-energize.
- The water pump remains energized for an additional 5 minutes (10 minute total on time) then de-energizes.

NOTE: The warm water rinse cycle can be terminated by moving the toggle switch to the OFF position, then back to ICE.

Self Contained Air & Water-Cooled
Single Evaporator Model Energized Parts Chart

Ice Making Sequence of Operation	Water Pump	Harvest Valve(s)	Air Pump(s)*	Water Inlet Valve	Water Dump Valve	Contactor Coil	Compressor	Condenser Fan Motor	Length of Time
Start-Up 1. Water Purge	**On**	**On**	35 sec. **Off** 10 sec. **On**	**Off**	**On**	**Off**	**Off**	**Off**	*45 Seconds*
2. Refrigeration System Start-up	**Off**	**On**	**Off**	**On**	**Off**	**On**	**On**	May Cycle **On/Off**	*5 Seconds*
Freeze Sequence 3. Prechill	**Off**	**Off**	**Off**	May Cycle **On/Off** during pre-chill	**Off**	**On**	**On**	May Cycle **On/Off**	*Initial Start-Up is 60 Seconds* *30 Seconds thereafter*
4. Freeze	**On**	**Off**	**Off**	**Cycles Off then On one more time**	**Off**	**On**	**On**	May Cycle **On/Off**	*Unil 10 Sec. Water Contact w/Ice Thickness Probe*

Self Contained Air & Water-Cooled
Single Evaporator Model Energized Parts Chart (Continued)

Ice Making Sequence of Operation	Water Pump	Harvest Valve(s)	Air Pump(s)*	Water Inlet Valve	Water Dump Valve	Contactor Coil	Compressor	Condenser Fan Motor	Length of Time
Harvest Sequence 5. Water Purge	**On**	**On**	**On**	30 sec. **Off** 15 sec. **On**	**On**	**On**	**On**	May Cycle **On/Off**	*Factory Set at 45 Seconds*
6. Harvest	**Off**	**On**	**On**	**Off**	**Off**	**On**	**On**	May Cycle **On/Off**	*Bin Switch Activation*
7. Automatic Shut-Off	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	*Until Bin Switch Re-closes & 3 min. delay*

*** NOT USED ON ALL MODELS**

Self Contained Water-Cooled
Quad Evaporator Model Energized Parts Chart

Ice Making Sequence of Operation	Water Pumps	Harvest Valves	Air Pumps	Water Inlet Valve	Water Dump Valves	Contactor Coil	Compressor	Length of Time
Start-Up 1. Water Purge	**On**	**Off**	**Off**	**Off**	**On**	**Off**	**Off**	*Initial Start-Up is 45 Seconds* *30 Seconds thereafter*
2. Refrigeration System Start-up	**Off**	**Off**	**Off**	**On**	**Off**	**On**	**On**	*5 Seconds*
Freeze Sequence 3. Prechill	**Off**	**Off**	**Off**	May Cycle **On/Off** during pre-chill	**Off**	**On**	**On**	*30 Seconds thereafter*
4. Freeze	**On**	**Off**	**Off**	**Cycles Off then On up to two more times**	**Off**	**On**	**On**	*Unil 10 Sec. Water Contact w/Ice Thickness Probe*

Self Contained Water-Cooled
Quad Evaporator Model Energized Parts Chart (Continued)

Ice Making Sequence of Operation	Water Pumps	Harvest Valves	Air Pumps	Water Inlet Valve	Water Dump Valves	Contactor Coil	Compressor	Length of Time
Harvest Sequence 5. Water Purge	**On**	**On**	**On**	**On** *from 30-45 seconds*	**On**	**On**	**On**	*Factory Set at 30 Seconds*
6. Harvest	**Off**	**On**	**On**	**Off**	**Off**	**On**	**On**	*Bin Switch Activation*
7. Automatic Shut-Off	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	*Until Bin Switch Re-closes & 3 min. delay expires*

REMOTES

Single Evaporator Models

NOTE: The toggle switch must be in the ice position and the water curtain must be in place on the evaporator before the ice machine will start.

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 harvest valve 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.

When Used - The air pump energizes for the last 10 seconds of the cycle.

Energized Control Board Lights-

Left Bin (green)

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 water fill valve is energized at the same time as the compressor. It remains on until the water level sensor closes for 3 continuous seconds, or until a six-minute time period has expired. The harvest 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 remains on throughout the entire Freeze and Harvest Sequences.

Energized Control Board Lights-

Left Bin (green)

Freeze Sequence

3. Prechill

The compressor is on for 30 seconds (60 seconds initial cycle) prior to water flow, to prechill the evaporator.

Energized Control Board Lights-

Left Bin (green)

4. Freeze

The water pump restarts after the prechill. An even flow of water is directed across the evaporator and into each cube cell, where it freezes. The water fill valve will cycle on and then off one more time to refill the water trough.

When sufficient ice has formed, the water flow (not the ice) contacts the ice thickness probe. After approximately 10 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.

Energized Control Board Lights-

Left Bin (green), water probe (green), Harvest (red *when water contacts the ice thickness probe*)

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. The water fill valve energizes (turns on) and de-energizes (turns off) strictly by time. The water fill valve energizes for the last 15 seconds of the 45-second water purge. The water purge must be at the factory setting of 45 seconds for the fill valve to energize during the last 15 seconds of the Water Purge. If set at less than 45 seconds the water fill valve does not energize during the water purge.

After the 45 second water purge, the water fill valve, water pump and dump valve de-energize. (Refer to "Water Purge Adjustment") The harvest valve(s) and HPR solenoid valve also open at the beginning of the water purge.

Energized Control Board Lights-

Left Bin (green), Harvest (red)

6. Harvest

The HPR valve and the harvest 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.)

When Used - The air pump energizes after 35 seconds and remains energized throughout the entire harvest cycle. The air pump will automatically energize after 60 seconds when the harvest cycle time exceeded 75 seconds the previous cycle

Energized Control Board Lights-

Left Bin (green), Harvest (red) - when the ice drops the harvest light turns 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 30 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.

Energized Control Board Lights-

No Lights

Remote Air-Cooled
Single Evaporator Model Energized Parts Chart

Ice Making Sequence of Operation	Water Pump	Harvest Valve (Left) HPR Valve	Harvest Valve (Right) (When Used)	Air Comp. (When Used)	Water Inlet Valve	Water Dump Valve	Contactor Coil Liquid Line Solenoid	Compressor	Condenser Fan Motor	Length of Time
Initial Start-Up 1. Water Purge	**On**	**On**	**On**	**35 sec. Off 10 sec. On.**	**Off**	**On**	**Off**	**Off**	**Off**	*45 Seconds*
2. Refrigeration System Start-up	**Off**	**On**	**On**	**On**	**On**	**Off**	**On**	**On**	**On**	5 Seconds
Freeze Sequence 3. Prechill	**Off**	**Off**	**Off**	**Off**	**May Cycle On/Off during prechill**	**Off**	**On**	**On**	**On**	*Initial Start-Up is 60 Seconds* *30 Seconds thereafter*
4. Freeze	**On**	**Off**	**Off**	**Off**	**Cycles Off Then On one more time**	**Off**	**On**	**On**	**On**	*Unil 10 Sec. Water Contact w/Ice Thickness Probe*

Remote Air-Cooled
Single Evaporator Model Energized Parts Chart (Continued)

Ice Making Sequence of Operation	Water Pump	Harvest Valve (Left) HPR Valve	Harvest Valve (Right) (When Used)	Air Comp. (When Used)	Water Inlet Valve	Water Dump Valve	Contactor Coil Liquid Line Solenoid	Compressor	Condenser Fan Motor	Length of Time
Harvest Sequence 5. Water Purge	**On**	**On**	**On**	**On After 35 sec.**	**30 sec. Off** **15 sec. On**	**On**	**On**	**On**	**On**	*Factory Set at 45 Seconds*
6. Harvest	**Off**	**On**	**On**	**On**	**Off**	**Off**	**On**	**On**	**On**	*Bin Switch Activation*
7. Automatic Shut-Off	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	**Off**	*Until Bin Switch Re-closes & 3 min. delay*

Safety Limits

In addition to standard safety controls, the control board has built in safety limit controls which protect the ice machine from major component failures.

Use the following procedures to determine if the control board contains a safety limit indication.

1. Move the toggle switch to OFF.
2. Move the toggle switch back to ICE.
3. Watch the safety limit lights/harvest light on the control board. If a safety limit has been recorded, the corresponding light will flash once, twice or three times to indicate which safety limit stopped the ice machine.

Safety limits are stored and indicated by the control board after three cycles. The number of cycles required to stop the ice machine varies for each safety limit.

- **Safety Limit 1** ***all models*** - If the freeze time reaches 60 minutes, the control board automatically initiates a harvest cycle. If 6 consecutive 60-minute freeze cycles occur, the ice machine stops
- **Safety Limit 2** ***single evaporator models*** - If the harvest time reaches 3.5 minutes, the control board automatically returns the ice machine to the freeze cycle. If 500 consecutive 3.5 minute harvest cycles occur, the ice machine stops.
- **Safety Limit 2** ***quad evaporator models*** - If the harvest time reaches 7 minutes, the control board automatically returns the ice machine to the freeze cycle. If 500 consecutive 7 minute harvest cycles occur, the ice machine stops.
- **Safety Limit 3** ***quad evaporator models*** - If the low refrigerant pressure control opens, the ice machine shuts off and starts a 5 minute delay period. If 3 consecutive low pressure events occur the ice machine stops and flashes the harvest light.

QUAD EVAPORATOR MACHINES ONLY

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.

1. Move the toggle switch to OFF.
2. Move the toggle switch back to ICE.
3. Watch the harvest light. It will flash one or two times, corresponding to safety limits 1 and 2, 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.

When a safety limit condition is exceeded for 3 consecutive cycles the control board enters the limit to memory and the ice machine continues to run. Use the following procedure to determine if the control board contains a safety limit indication.

1. Move the toggle switch to OFF.
2. Move the toggle switch back to ICE.
3. Watch the harvest light. It will flash one or two times, corresponding to safety limits 1 and 2, to indicate which safety limit stopped the ice machine.

When a safety limit condition is exceeded (6 consecutive cycles for safety limit #1 or 500 cycles for safety limit #2) the ice machine stops, and the harvest light on the control board flashes on and off. Use the following procedure to determine which safety limit has stopped the ice machine.

1. Move the toggle switch to OFF.
2. Move the toggle switch back to ICE.
3. Watch the harvest light. It will flash one or two times, corresponding to safety limits 1 and 2, 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.

Safety Limit Stand-By Mode:

The first time a safety limit shut down occurs, (three consecutive long freeze or harvest cycles) the ice machine will turn off for 60 minutes (Stand-By Mode).

During the Stand-By Mode the harvest light will be flashing continuously and a safety limit indication can be viewed. After 60 minutes the ice machine will automatically restart to see if the problem re-occurs. If the same safety limit is reached a second time (three more consecutive long freeze or harvest cycles) the ice machine will initiate a safety limit shut down and remain off until it is manually restarted. During a safety limit shut down the harvest light will be flashing continuously.

ANALYZING WHY A SAFETY LIMIT STOPPED 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.

Refrigeration and electrical component failures will cause a safety limit trip. Eliminate all electrical components and external causes first. If it appears that the refrigeration system is causing the problem, use Manitowoc's Freeze Cycle 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

Water System

1. Water supply to machine is being interrupted
2. Water leaking down the drain during freeze (dump valve or water tracking into condensate tray)
3. Water tracking into bin
4. Uneven water flow over evaporator
5. Water pump not pumping

Electrical System

1. Improper voltage (low)
2. Ice thickness probe adjustment too thick
3. Water level probe open / dirty
4. Water inlet valve failure
5. Contactor failure
6. Compressor failure / start component failure page 134

Refrigeration System

1. Dirty condenser
2. Low on Refrigerant
3. Starving TXV
4. Head Pressure Control Valve stuck in Bypass
5. Harvest valve leaking through or stuck open
6. Inefficient compressor

SAFETY LIMIT #2

Water System

1. Ice thickness control probe is dirty causing a premature harvest with no ice on the plate. page 137
2. Dirty evaporator causing a long harvest and ice melt out. page 120

Electrical System

1. Ice thickness probe adjustment too close
2. Bin switch failed closed
3. Harvest valve not energizing
4. Quad Evaporator Only - Harvest pressure solenoid valve not energizing.

Refrigeration System

1. Non-Manitowoc components
2. Incorrect refrigerant charge
3. TXV flooding
4. Defective harvest valve
5. Defective fan cycle control - will not open (page 156)
6. Defective Head Pressure Control Valve - will not bypass (page 153)
7. Quad Evaporator Only - Harvest pressure solenoid valve not energizing.

SAFETY LIMIT #3

Water System

1. Water supply to machine is being interrupted
2. Water leaking down the drain during freeze (dump valve or water tracking into condensate tray)
3. Water tracking into bin
4. Uneven water flow over evaporator
5. Water pump not pumping

Electrical System

1. Water level probe prematurely satisfied
2. Water inlet valve failure
3. Water pump failure

Refrigeration System

1. Low on Refrigerant
2. Starving TXV

Control Board Testing

All replacement S Model control boards and ice machines with serial numbers larger than 110924847 have a control board that includes a diagnostic test cycle. The control board can be identified by the blue printed circuit board and a push button switch on the bottom left corner labeled “service mode”.

CONTROL BOARD TEST CYCLE

1. Place the toggle switch in the ice position.
2. Press and hold the test button for 5 seconds.
3. The control board memory is cleared.
   A. All safety limits are cleared
   B. Resets to factory default settings
   C. Calibration is cleared for ice thickness & water level probe.
4. The control board relays close at 1 second intervals and energize the corresponding control board light.
5. The relays remain closed and the lights remain energized for 3.5 minutes to allow time to test voltage at components.
6. After 3.5 minutes the ice machine automatically exits the test cycle.
7. An ice making cycle will automatically start (unless the toggle switch is moved to OFF).
8. Water level and ice thickness probe calibration are processed and stored in control board memory during the second ice making cycle.

The test cycle can be terminated at anytime by moving the toggle switch from ICE to OFF, or by disconnecting and reapplying line voltage to the ice machine.

Troubleshooting By Symptom

The troubleshooting procedures follow flow charts. There are four symptoms, the symptom that you are experiencing will determine which flow chart to use. The flow chart asks yes and no questions to determine the problem. The flow chart will direct you to a procedure to correct the problem. Traditional remote and self contained models use separate charts.

SYMPTOM #1

Ice Machine Stops Running
Toggle Switch is in the ICE position
or
Has a History of Shutting Down

- Refer to Ice Machine Stops Running Flow Chart (page 78)

SYMPTOM #2

Ice Machine has a Long Freeze Cycle.
Ice Formation is Thick
or
Thin Ice Fill on Top or Bottom of Evaporator
or
Low Production

Safety Limit #1 (possible)

- Refer to Freeze Cycle Refrigeration System Operational Analysis Table (page 94)

SYMPTOM #3

Ice Machine Will Not Harvest - Freeze Cycle is Normal and Ice Cubes are Not Melted After Harvest

Safety Limit #2 (possible)

- Refer to Refrigeration Harvest Flow Chart (page 116)

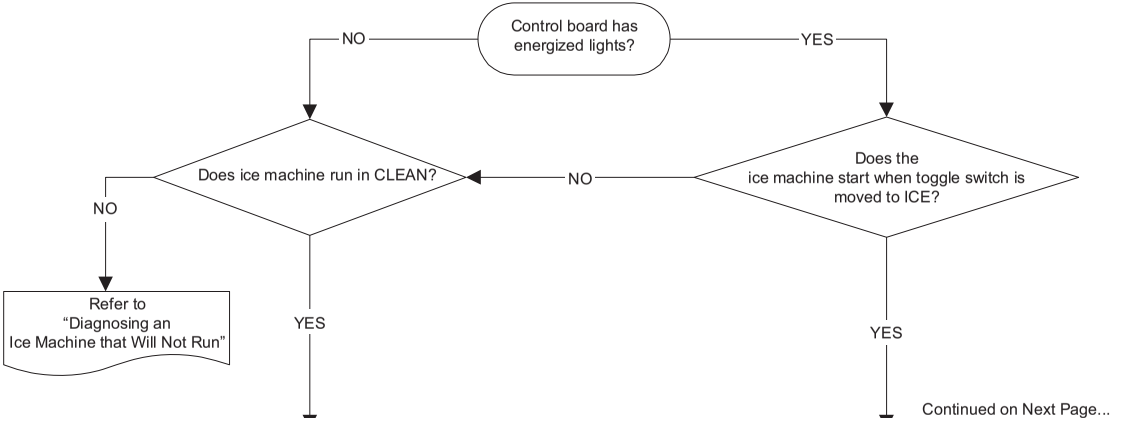
Symptom #4

Ice Machine Will Not Harvest - Freeze Cycle is Normal and Ice Cubes are Melted After Harvest

- Refer to Ice Melt out Flow Chart (page 120)

SYMPTOM #1 ICE MACHINE WILL NOT RUN

Ice Machine Stops Running or Has a History of Shutting Down



YES
Are
Water Curtain/Ice Dampers
in place?
NO
Install
Water Curtain/
Ice Dampers
YES
Are
Water Curtain/Ice Damper
magnets attached?
NO
Replace the Water Curtain/
Ice Dampers
YES
Refer to Bin
Switch Diagnostics
YES
Which light flashed immediately after
resetting the toggle switch?
SL1/
Harvest (once)
Refer to Safety Limit #1
Long Freeze Cycle
SL2/
Harvest (twice)
Refer to Safety Limit #2
Long Harvest Cycle
Harvest (3 times)
Refer to Safety Limit #3
Low Pressure
Run machine &
check for
Normal Operation

DIAGNOSING AN 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 fuse or moving the toggle switch to OFF will not remove the power supplied to the control board.

1. Verify primary voltage is supplied to ice machine and the fuse/circuit breaker is closed.
2. Verify the High Pressure cutout is closed. The HPCO is closed if primary power voltage is present at terminals #55 and #56 on the control board.
3. Verify control board fuse is okay. If the bin switch or water level probe light functions, the fuse is okay.
4. Verify all bin switches function 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 on a safety limit.
7. Replace the control board. Be sure steps 1-6 were followed thoroughly. Intermittent problems are not usually related to the control board.

COMPRESSOR ELECTRICAL DIAGNOSTICS

The compressor does 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 then remove the wires from the compressor terminals.
2. 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 and remove the wires from the compressor terminals.
2. 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. Scrape metal surface to get good contact. If continuity is present, the compressor windings are grounded and the compressor should be replaced.

COMPRESSOR DRAWING LOCKED ROTOR

To determine if the compressor is seized, check the amp draw while the compressor is trying to start.

The two likely causes of this are a defective starting component and a mechanically seized compressor.

To determine which you have:

1. Install high and low side gauge set.
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 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.

SYMPTOM #2 LOW PRODUCTION, LONG FREEZE

Ice Machine has a Long Freeze Cycle.

Ice Formation is Thick
or
Thin Ice Fill on Top or Bottom of Evaporator
or
Low Production

How to Use the Freeze Cycle Refrigeration System Operational Analysis Table

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: 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" for questions to ask when talking to the ice machine owner.

PROCEDURE

Step 1 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 (√).

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" column.

Step 3 Add the check marks listed under each of the four columns. Note the column number with the highest total and proceed to "Final Analysis."

NOTE: If two columns have matching high numbers, a procedure was not performed properly, supporting material was not analyzed correctly or the problem component is not covered by the analysis table.

SYMPTOM #2 - FREEZE CYCLE REFRIGERATION SYSTEM OPERATIONAL ANALYSIS TABLES

S MODELS SINGLE EXPANSION VALVE

Operational Analysis	1	2	3	4
Ice Production	Air-Temperature Entering Condenser_____ Water Temperature Entering Ice Machine_____ Published 24 hour ice production_____ Calculated (actual) ice production_____ NOTE: The ice machine is operating properly if the ice fill patterns is normal and ice production is within 10% of charted capacity.			
Installation and Water System	All installation and water related problems must be corrected before proceeding with chart.			
Ice Formation Pattern	Ice formation is extremely thin on outlet of evaporator -or- No ice formation on the entire evaporator	Ice formation is extremely thin on outlet of evaporator -or- No ice formation on entire evaporator	Ice formation normal -or- Ice formation is extremely thin on inlet of evaporator -or- No ice formation on entire evaporator	Ice formation normal -or- No ice formation on entire evaporator
Freeze Cycle Discharge Pressure _____ _____ _____ **1 minute Middle End into cycle**	If discharge pressure is High or Low refer to freeze cycle high or low discharge pressure problem checklist page 101 to eliminate problems and/or components not listed on this table before proceeding.			

S MODELS SINGLE EXPANSION VALVE

Operational Analysis	1	2	3	4
Freeze Cycle Suction Pressure	If suction pressure is High or Low refer to freeze cycle high or low suction pressure problem checklist page 104 to eliminate problems and/or components not listed on this table before proceeding.			
_____ _____ _____ 1 minute Middle End	Suction pressure is **High**	Suction pressure is **Low or Normal**	Suction pressure is **High**	Suction pressure is **High**
Wait 5 minutes into the freeze cycle. Compare temperatures of **evaporator inlet** and **evaporator outlet.** **Inlet _____° F (°C)** **Outlet _____ ° F (°C)** **Difference_____ ° F (°C)**	Inlet and outlet **within 7° F (4°C)** of each other	Inlet and outlet **not within 7° F (4°C)** of each other -and- Inlet is colder than outlet	Inlet and outlet **within 7°F (4°C)** of each other -or- Inlet and outlet **not within 7°F (4°C)** of each other -and- Inlet is warmer than outlet	Inlet and outlet **within 7°F (4°C)** of each other

S MODELS SINGLE EXPANSION VALVE

Operational Analysis	1	2	3	4
Wait 5 minutes into the freeze cycle. Compare temperatures of **compressor discharge line** and **harvest valve inlet.**	The harvest valve inlet is **Hot** -and- approaches the temperature of a **Hot** compressor discharge line.	The harvest valve inlet is **Cool** enough to hold hand on -and- the compressor discharge line is **Hot.**	The harvest valve inlet is **Cool** enough to hold hand on -and- the compressor discharge line is **Cool** enough to hold hand on.	The harvest valve inlet is **Cool** enough to hold hand on -and- the compressor discharge line is **Hot.**
Discharge Line Temperature Record freeze cycle discharge line temperature at the end of the freeze cycle _____**°F (°C)**	Discharge line temp. **150°F (65°C) or higher** at the end of the freeze cycle --- S850/S1000 Air & Water Only Discharge line temp. **140°F (60°C) or higher at the end of the freeze cycle**	Discharge line temp. **150°F (65°C) or higher** at the end of the freeze cycle --- S850/S1000 Air & Water Only Discharge line temp. **140°F (60°C) or higher** at the end of the freeze cycle	Discharge line temp. **less than 150°F (65°C)** at the end of the freeze cycle --- S850/S1000 Air & Water Only Discharge line temp. **less than 140°F (60°C)** at the end of the freeze cycle	Discharge line temp. **150°F (65°C) or higher at the end of the freeze cycle** --- S850/S1000 Air & Water Only Discharge line temp. **140°F (60°C) or higher** at the end of the freeze cycle
Final Analysis Enter total number of boxes checked in each column.	**Harvest Valve Leaking**	**Low On Charge -Or- TXV Starving**	**TXV Flooding**	**Compressor**

Freeze Cycle Refrigeration System Operational Analysis Tables

S MODELS DUAL EXPANSION VALVE

Operational Analysis	1	2	3	4
Ice Production	Air-Temperature Entering Condenser_____ Water Temperature Entering Ice Machine_____ Published 24 hour ice production_____ Calculated (actual) ice production_____ NOTE: The ice machine is operating properly if the ice fill patterns is normal and ice production is within 10% of charted capacity.			
Installation and Water System	All installation and water related problems must be corrected before proceeding with table.			
Ice Formation Pattern **Left Side_____** **Right Side_____**	Ice formation is extremely thin on outlet of evaporator -or- No ice formation on the one side of evaporator	Ice formation is extremely thin on outlet of one side of evaporator -or- No ice formation on entire evaporator	Ice formation normal -or- Ice formation is extremely thin at inlet of one side of evaporator -or- No ice formation on entire evaporator	Ice formation normal -or- No ice formation on entire evaporator
Freeze Cycle Discharge Pressure **_____ _____ _____** **1 minute Middle End into cycle**	If discharge pressure is High or Low refer to freeze cycle high or low discharge pressure problem checklist page 101 to eliminate problems and/or components not listed on this table before proceeding.			

S MODELS DUAL EXPANSION VALVE

Operational Analysis	1	2	3	4
Freeze Cycle Suction Pressure	If suction pressure is High or Low refer to freeze cycle high or low suction pressure problem checklist page 104 to eliminate problems and/or components not listed on this table before proceeding.			
_____ _____ _____ **1 minute Middle End**	Suction pressure is **High**	Suction pressure is **Low or Normal**	Suction pressure is **High**	Suction pressure is **High**
Wait 5 minutes into the freeze cycle. Compare temperatures of **compressor discharge line** and **both harvest valve inlets.**	The harvest valve inlet is **Hot** -and- approaches the temperature of a **Hot** compressor discharge line.	The harvest valve inlet is **Cool** enough to hold hand on -and- the compressor discharge line is **Hot.**	The harvest valve inlet is **Cool** enough to hold hand on -and- the compressor discharge line is **Cool** enough to hold hand on.	The harvest valve inlet is **Cool** enough to hold hand on -and- the compressor discharge line is **Hot.**

S MODELS DUAL EXPANSION VALVE

Operational Analysis	1	2	3	4
Discharge Line Temperature Record freeze cycle discharge line temperature at the end of the freeze cycle **_____°F (°C)**	Discharge line temp. **150°F (65°C) or higher at the end of the freeze cycle**	Discharge line temp. **150°F (65°C) or higher at the end of the freeze cycle**	Discharge line temp. **less than 150°F (65°C) at the end of the freeze cycle**	Discharge line temp. **150°F (65°C) or higher at the end of the freeze cycle**
Final Analysis Enter total number of boxes checked in each column.	**Harvest Valve Leaking**	**Low On Charge -Or- TXV Starving**	**TXV Flooding**	**Compressor**

Freeze Cycle Refrigeration System Operational Analysis Tables

S MODELS FOUR EXPANSION VALVES

Operational Analysis	1	2	3	4	5
Ice Production	Ambient Air-Temperature_____ Water Temperature Entering Ice Machine_____ Published 24 hour ice production_____ Calculated (actual) ice production_____ NOTE: The ice machine is operating properly if the ice fill patterns is normal and ice production is within 10% of charted capacity.				
Installation & Water System	All installation and water related problems must be corrected before proceeding with chart.				
Ice Formation Pattern Evaporators are numbered left to right viewed from the front of the ice machine Evaporator #1_____ Evaporator #2_____ Evaporator #3_____ Evaporator #4_____	Ice formation is normal	Ice formation is extremely thin on outlet of 1 or more evaporators -or- No ice formation on entire evaporator	Ice formation normal	Ice formation normal or No ice formation on entire evaporator	Ice formation is normal
Safety Limits Refer to "Analyzing Safety Limits" page 72 to eliminate all non refrigeration problems	Stops on Safety Limit: 2	Stops on Safety Limit: 1 or 2	Stops on Safety Limit: 2	Stops on Safety Limit: 1	Stops on Safety Limit: 2

S MODELS FOUR EXPANSION VALVES

Operational Analysis	1	2	3	4	5
Freeze Cycle Discharge Pressure _____ _____ _____ 1 minute Middle End	If discharge pressure is High or Low refer to freeze cycle high or low discharge pressure problem checklist page 101 and eliminate problems and/or components not listed on this table before proceeding.				
Freeze Cycle Suction Pressure _____ _____ _____ 1 minute Middle End	If suction pressure is High or Low refer to freeze cycle high or low suction pressure problem checklist page 104 and eliminate problems and/or components not listed on this table before proceeding.				
	Suction pressure is **High**	Suction pressure is **Normal or Low**	Suction pressure is **Normal or High**	Suction pressure is **High**	Suction pressure is **High**
Evaporator Outlet Temperature Comparison Attach and insulate temperature probes between evaporator outlet and 90° elbow	Evaporator outlet temperatures are **within 10°F of each other**	Evaporator outlet temperatures are **NOT within 10°F of each other** or **Within 10°F of each other and above 32°F**	Evaporator outlet temperatures are **NOT within 10°F of each other**	Evaporator outlet temperatures are **within 10°F of each other**	Evaporator outlet temperatures are **within 10°F of each other**

S MODELS FOUR EXPANSION VALVES

Operational Analysis	1	2	3	4	5
Harvest Valve Temperature Wait 5 minutes into the freeze cycle. Compare temperatures of **compressor discharge line** and **harvest valve inlets.**	One harvest valve inlet is **Hot** -and- approaches the temperature of a **Hot** compressor discharge line.	All harvest valve inlets are **Cool** enough to hold and the compressor discharge line is **Hot.**	All harvest valve inlets are **Cool** enough to hold and- the compressor discharge line is **Cool** enough to hold hand on.	All harvest valve inlets are **Cool** enough to hold and- the compressor discharge line is **Hot.**	All harvest valve inlets are **Cool** enough to hold and- the compressor discharge line is **Cool** enough to hold hand on.
Discharge Line Temperature Record freeze cycle discharge line temperature at the end of the freeze cycle _____**°F (°C)**	Discharge line temperature **150°F (65°C) or higher at the end of the freeze cycle**	Discharge line temperature **150°F (65°C) or higher at the end of the freeze cycle**	Discharge line temperature **less than 150°F (65°C) at the end of the freeze cycle or Compressor shell is frosted**	Discharge line temperature **150°F (65°C) or higher at the end of the freeze cycle**	Discharge line temperature **less than 150°F (65°C) at the end of the freeze cycle or Compressor shell is frosted**
Final Analysis Enter total number of boxes checked in each column.	**Harvest Valve Leaking**	**Low On Charge -Or- TXV Starving**	**TXV Flooding**	**Compressor**	**Harvest Pressure Valve Leaking**

FREEZE CYCLE REFRIGERATION SYSTEM OPERATIONAL ANALYSIS TABLE PROCEDURES

The following is the procedures for completing each step of the Freeze Cycle Refrigeration System Operational Analysis Tables. Each procedure must be performed exactly for the table to work correctly.

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?
- 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 a condensing unit with a 70°F (21°C) outdoor ambient temperature and 50°F (10°C) water produces more ice than the same model condensing unit with a 90°F (32°C) outdoor ambient temperature and 70°F (21°C) water.

1. Determine the ice machine operating conditions:

   Air temp entering condenser:____°

   Air temp around ice machine:____°

   Water temp entering sump trough:____°

2. Refer to the appropriate 24-Hour Ice Production Chart (starting on page 179). Use the operating conditions determined in step 1 to find published 24-Hour Ice Production:_____

- 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.)

3. Perform an ice production check using the formula below.

1.	_____ Freeze Time	+	_____ Harvest Time	=	_____ Total Cycle Time	
2.	1440 Minutes in 24 Hrs.	÷	_____ Total Cycle Time	=	_____ Cycles per Day	
3.	_____ Weight of One Harvest	×	_____ Cycles per Day	=	_____ Actual 24-Hour Production	

Weighing the ice is the only 100% accurate check. However, if the ice pattern is normal and the 1/8 in. 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 checks that are within 10% of the chart are considered normal. If they 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

Inadequate Clearances

- Check all clearances on sides, back and top.

Ice machine is not level

- Level the ice machine

Condenser is dirty

- Clean the condenser

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

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.

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

Water area (evaporator) is dirty

- Clean as needed

Water inlet pressure not between 20 and 80 psig (1-5 Bar, 138-552 kPa).

- Install water regulator or increase water pressure

Incoming water temperature is not between 35°F (2°C) and 90°F (32°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

Water fill valve is stuck open or closed

- Clean/replace as needed

Water is leaking out of the sump trough area

- Stop the water loss

Uneven water flow across the evaporator

- Clean the ice machine

Plastic extrusions and gaskets are not secured to the evaporator

- Remount/replace 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 Freeze Cycle Refrigeration System Operational Analysis Tables, it can help diagnose an ice machine malfunction.

Any number of problems can cause improper ice formation.

Important

Keep the water curtain/ice dampers 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 inlet of the evaporator than on the outlet. At the end of the Freeze cycle, ice formation at the outlet will be close to, or just a bit thinner than, ice formation at the inlet. The dimples in the cubes at the outlet of the evaporator may be more pronounced than those on the inlet. This is normal.

It is normal for ice thickness to vary up to 1/16" across the surface of the evaporator. The ice bridge thickness at the ice thickness control probe should be at least 1/8".

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

2. Extremely Thin at Evaporator Outlet

There is no ice, or a considerable lack of ice formation, at the outlet of the evaporator.

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

3. Extremely Thin at Evaporator Inlet

There is no ice, or a considerable lack of ice formation at the inlet of the evaporator. Examples: The ice at the outlet of the evaporator reaches 1/8 in. to initiate a harvest, but there is no ice formation at all on the inlet of the evaporator.

4. No Ice Formation

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

Analyzing Discharge Pressure in the Freeze Cycle

1. Determine the ice machine operating conditions:

   Air temp. entering condenser_____

   Air temp. around ice machine_____

   Water temp. entering sump trough_____

2. Refer to Operating Pressure table (starting on page 179) for ice machine being checked.

   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 (kPa)
1 Minute into the Freeze Cycle	_____
Middle of Freeze Cycle	_____
End of Freeze 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. It is normal for the discharge pressure to be higher at the beginning of the Freeze cycle (when load is greatest), then drop throughout the Freeze cycle.

FREEZE CYCLE DISCHARGE PRESSURE HIGH CHECKLIST

Improper Installation

- Refer to “Installation/Visual Inspection Checklist” (page 97)

Air Condenser

- Dirty condenser filter
- Dirty condenser fins
- High inlet air temperature (Self contained 110°F/ 43°C max. Remote 120°F/49°C max.).
- Condenser discharge air recirculation
- Defective fan cycling control (page 156)
- Defective fan motor
- Defective head pressure control valve {Remotes} (page 153)

Water Condenser

- Low water pressure [20 psig (138 kPa) min.]
- High inlet water temperature (90°F/32°C max.)
- Dirty condenser
- Dirty/Defective water regulating valve
- Water regulating valve out of adjustment

Other

- Overcharged
- Non-condensible (air) in system
- Wrong type of refrigerant
- Non-Manitowoc components in system
- High side refrigerant lines/component restricted

FREEZE CYCLE DISCHARGE PRESSURE LOW CHECKLIST

Improper Installation

- Refer to “Installation/Visual Inspection Checklist” (page 97)

Air Cooled Condensers

- Defective head pressure control valve, won’t bypass (page 153)
- Defective fan cycle control, stuck closed (page 156)

Water Cooled Condensers

- Water Regulating Valve out of adjustment
- Water Regulating Valve Defective

Other

- Undercharged
- Wrong type of refrigerant
- Non-Manitowoc components in system

Analyzing Suction Pressure

The suction pressure gradually drops throughout the Freeze cycle. The actual suction pressure (and drop rate) changes as the air and water temperature entering the ice machine changes. These variables also determine the 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.

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

Procedure
Step
1. Determine the ice machine operating conditions. *Temperature of air entering the condenser. Look up and determine the published suction pressure.
2. Perform an actual suction pressure check at the beginning, middle and end of the Freeze cycle. *Freeze cycle begins when the water pump starts
3. Compare the actual Freeze cycle suction pressure (step 2) to the published Freeze cycle pressure. Determine if the suction pressure is high, low or normal.

Suction Pressure High Checklist

Improper Installation

- Refer to “Installation/Visual Inspection Checklist” page 97

Discharge Pressure

- Discharge pressure is too high and is affecting low side – refer to “Freeze Cycle Discharge Pressure High Checklist” (page 102)

Improper Refrigerant Charge

- Overcharged (also see “Freeze Cycle Discharge Pressure High Checklist” page 102)
- Wrong type of refrigerant

Components

- Harvest valve leaking - continue the table
- Harvest pressure solenoid valve leaking - continue the table
- TXV flooding - continue the table
- Defective compressor - continue the table

Other

- Non-Manitowoc components in system

SUCTION PRESSURE LOW CHECKLIST

Improper Installation

- Refer to “Installation/Visual Inspection Checklist” (page 97)

Discharge Pressure

- Discharge pressure is too low and is affecting low side – refer to “Freeze Cycle Discharge Pressure High Checklist” (page 102)

Improper Refrigerant Charge

- Undercharged
- Wrong type of refrigerant

Other

- Non-Manitowoc components in system
- Improper water supply over evaporator – refer to “Water System Checklist” (page 98)
- Restricted/plugged liquid line drier
- Restricted/plugged tubing in suction side of refrigeration system
- TXV starving - continue the table

Single Expansion Valve Ice Machines Comparing Evaporator Inlet and Outlet Temperatures

NOTE: This procedure will not work on dual or Quad expansion valve 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 Freeze Cycle 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 should 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 evaporator inlet and outlet temperatures after 5 minutes into the freeze cycle. Determine the difference.
5. Record the information on the table.

Multiple Expansion Valve Ice Machines Comparing Evaporator Inlet and Outlet Temperatures

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 Freeze Cycle Refrigeration System Operational Analysis Table, can help diagnose an ice machine malfunction.

The temperature difference between evaporator outlets vary throughout the freeze cycle. Compare the evaporator outlet temperatures to each other during the last 60 seconds of the freeze cycle. The end of freeze cycle temperatures vary with ambient and water temperature, but the temperatures of all evaporators will always be within 10 degrees of each other in a correctly operating ice machine. 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. Estimate end of freeze cycle and take multiple readings to assure the comparison was taken in the last 60 seconds of the freeze cycle.
4. Record the temperatures and compare the difference.
5. Record the information on the table.

Harvest Valve Analysis

Symptoms of a harvest 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 harvest valve is by using Manitowoc's Ice Machine Freeze Cycle Refrigeration System Operational Analysis Table.

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

1. Wait five minutes into the freeze cycle.
2. Feel the inlet of the harvest valve(s).

Important

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

The harvest 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.
4. Compare the temperature of the inlet of the harvest valves to the temperature of the compressor discharge line.

⚠ Warning

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

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

5. Record your findings on the table.

Discharge Line Temperature Analysis

GENERAL

Knowing if the discharge line temperature is increasing, decreasing or remaining constant can be an important diagnostic tool. Compressor discharge line temperature on a normally operating ice machine steadily increases throughout the freeze cycle.

Ambient air temperatures affect the discharge line temperature.

Higher ambient air temperatures at the condenser and/or higher inlet water temperature = higher discharge line temperatures at the compressor.

Lower ambient air temperatures at the condenser and/or lower supply water temperature= lower discharge line temperatures at the compressor.

Regardless of ambient and water temperatures, the freeze cycle discharge line temperature will be higher than 150°F (66°C) [S850/S1000 Air & Water Machines Only - 140°F (60°C)] at the end of the freeze cycle.

PROCEDURE

Connect a temperature probe on the compressor discharge line with-in 6" of the compressor and **insulate**.

Observe the discharge line temperature for the last three minutes of the freeze cycle and record on the table.

Discharge Line Temperature Above 150°F (66°C) [S850/S1000 Air & Water Machines Only - 140°F (60°C)] At End Of Freeze Cycle:

Ice machines that are operating normally will have consistent minimum discharge line temperature of 150°F (66°C) [S850/S1000 Air & Water Machines Only - 140°F (60°C)].

Water Regulating Valve

Problem (Freeze Cycle)

Valve not maintaining discharge pressure.

- Valve incorrectly set, dirty or defective. Adjust valve to 240 psig, clean or replace valve.

Discharge pressure extremely high; Liquid line entering receiver feels hot.

- Water regulating valve incorrectly set or not opening. Verify Head Pressure Control Valve operation before changing water regulating valve.

Discharge pressure low, Liquid line entering receiver feels warm to hot.

- Ice machine low on charge. Verify Total System Refrigerant Charge page 177.

Final Analysis

The column with the highest number of check marks identifies the refrigeration problem.

COLUMN 1 - HARVEST VALVE LEAKING

Replace the valve as required.

COLUMN 2 - LOW CHARGE/TXV STARVING

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.

1. Add refrigerant charge to verify a low charge (air and water self-contained only). Do not add more than 30% of nameplate refrigerant charge. If the problem is corrected, the ice machine is low on charge.
   *Do not add charge to remotes. The symptoms of a remote low on charge will result in a safety limit #1 in cool ambient temperatures. Check the liquid line temperature at the ice machine. The liquid line will be hot with a normal or below normal head pressure in freeze when the ice machine is low on refrigerant.
2. 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.
3. If the problem is not corrected by adding charge, the expansion valve is faulty.

COLUMN 3 - TXV FLOODING

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, change both valves.

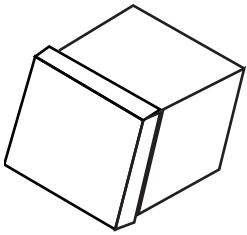
COLUMN 4 - COMPRESSOR

Replace the compressor. To receive warranty credit, the compressor ports must be properly sealed by crimping and soldering them closed.

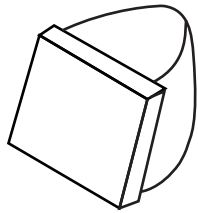
COLUMN 5 - HARVEST PRESSURE VALVE LEAKING (4 EVAPORATOR MODELS ONLY)

Replace the valve as required.

Harvest Problems



Normal Ice Cube



Melted Out Ice Cube

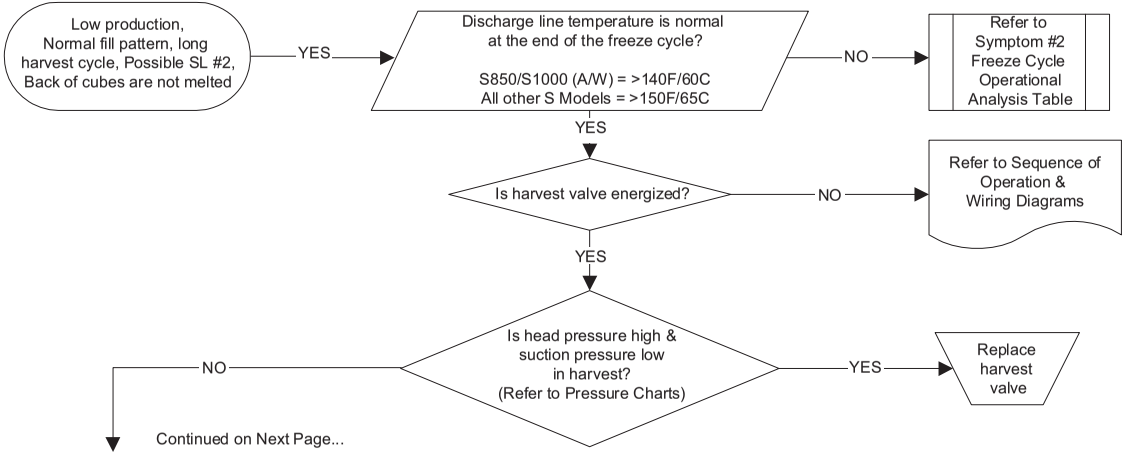
Definition of a harvest problem; At the end of a 3.5 minute harvest cycle the slab of ice is still contacting the evaporator. The slab of ice may or may not be removable by hand.

Harvest problems can be split into two categorizes.

- Melted sheet of cubes at the end of the harvest cycle. Ice can be removed rather easily by hand. The back of the cubes are misshapen and melted. This indicates something is on the evaporator preventing the ice slab from releasing. Follow the appropriate flow chart (in Troubleshooting) to determine the cause of the problem. A manual cleaning procedure must always be performed when this problem is encountered.
- Normal sheet of cubes at the end of the harvest cycle. Ice is difficult to remove from the evaporator by hand. Once removed the back of the cubes are square and show no signs of melting. This indicates a refrigeration problem. The source of the problem could be in the freeze or harvest cycle. Use the appropriate flow chart (in Troubleshooting) to determine the cause of the problem.

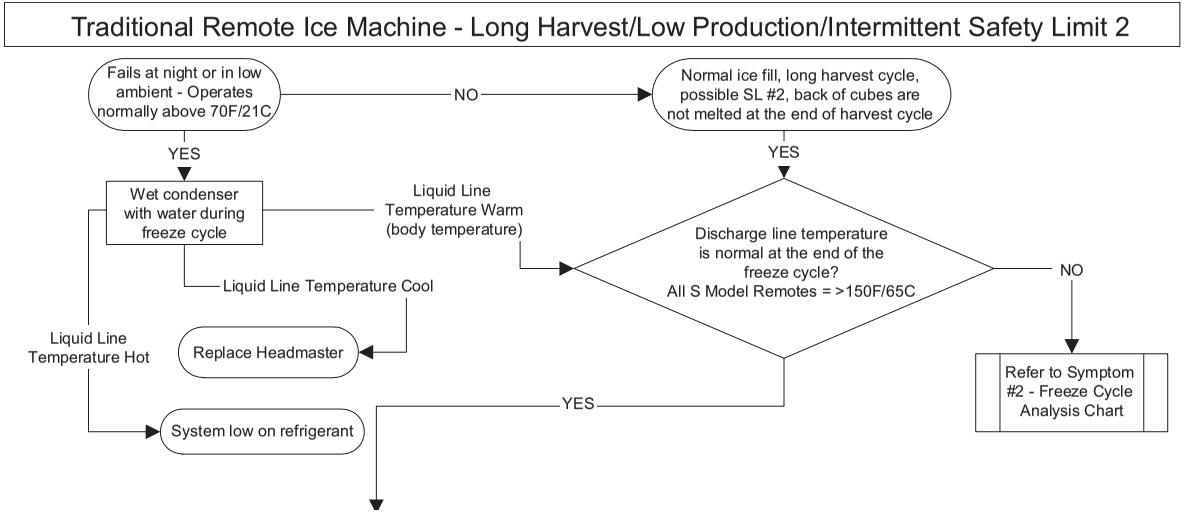
SYMPTOM #3 ICE WILL NOT HARVEST, CUBES ARE NOT MELTED

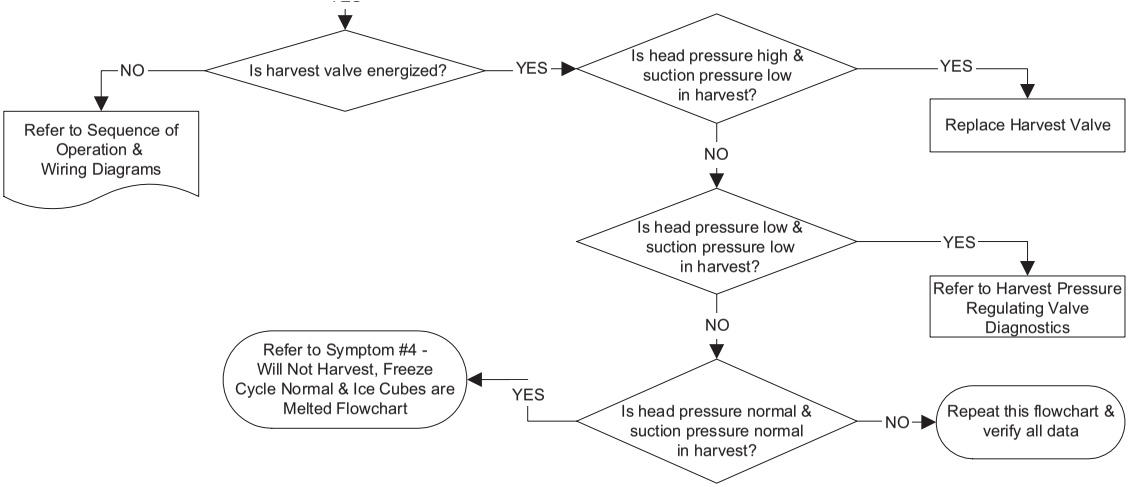
Ice Machine Will Not Harvest - Freeze Cycle is Normal and Ice Cubes are Not Melted After Harvest



Self Contained Air-cooled Condenser?
YES
NO
Fan cycling control operates correctly in freeze cycle?
YES
NO
Replace Fan Cycling Control
Fan cycling control opens below setpoint in harvest cycle?
YES
NO
Are you sure Discharge line temperature is normal?
Repeat this flowchart & verify all data
Self Contained Water-cooled Condenser?
YES
NO
Maintains correct pressure in freeze cycle?
YES
NO
Adjust or Replace Water Regulating Valve
Stops water flow 100% in harvest cycle?
YES
NO
Traditional Remote Air-cooled Condenser?
YES
Refer to Symptom #3 Traditional Remotes Only Chart

SYMPTOM #3 - TRADITIONAL REMOTES ONLY

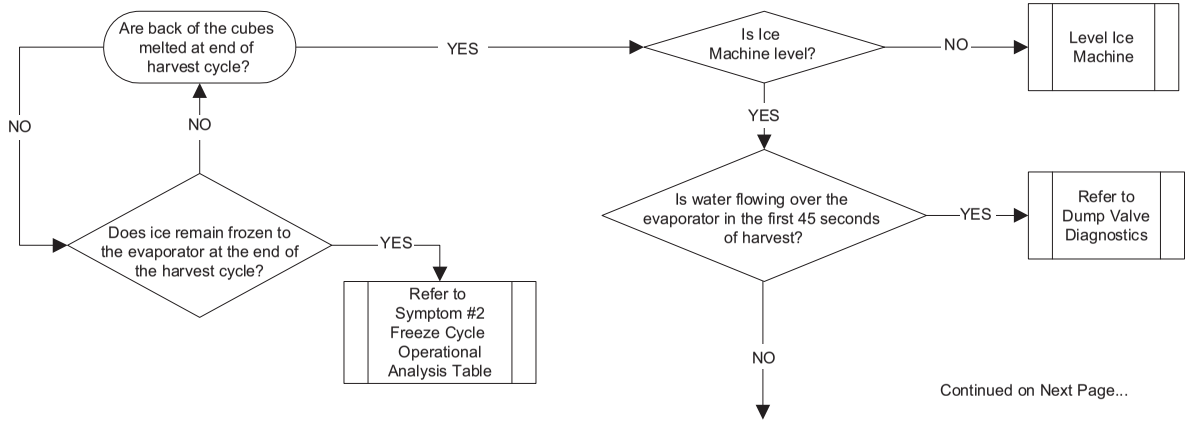




Single Evaporator Systems with Dual Harvest Valves: If one Harvest Vavle is open and the other is restricted / stuck closed you may have normal harvest pressures. Look for ice not melting on one side of the evaporator.

SYMPTOM #4 WILL NOT HARVEST, MELTED CUBES

Ice Machine Will Not Harvest - Freeze Cycle is Normal and Ice Cubes are Melted After Harvest



Continued on Next Page...

NO
Is the evaporator dirty?
(Dry evaporator first then check)
YES
Refer to Heavily Scaled
Cleaning Procedure
NO
Discharge line temperature is normal
at the end of the freeze cycle?
S850/S1000 (A/W) = >140F/60C
All other S Models = >150F/65C
NO
Refer to Symptom #2
Freeze Cycle Operational
Analysis Table
YES
Refer to Manual
Cleaning Procedure

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Component Check Procedures

Electrical Components

MAIN FUSE

FUNCTION

The control board fuse stops ice machine operation if electrical components fail, causing high amp draw.

SPECIFICATIONS

The main fuse is 250 Volt, 7 amp.

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

CHECK PROCEDURE

1. If the bin switch light is on with the water curtain/ ice dampers closed, the fuse is good.

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

2. Remove the fuse. Check for continuity across the fuse with an ohmmeter.

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

ICE/OFF/CLEAN TOGGLE SWITCH

FUNCTION

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

SPECIFICATIONS

Single-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 voltmeter be used to check toggle switch operation.

1. Inspect the toggle switch for correct wiring.
2. Isolate the toggle switch by disconnecting the Molex connector.
3. Check continuity across the toggle switch terminals. 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	1-6	Open
	1-2	Closed
	2-6	Open
CLEAN	1-6	Closed
	1-2	Open
	2-6	Open
OFF	1-6	Open
	1-2	Open
	2-6	Open

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

BIN SWITCH

FUNCTION

Movement of the water curtain/ice dampers control bin switch operation. 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 30 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/ice dampers and holds it open. After the water curtain/ice dampers are held open for 30 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/ice dampers. As the water curtain/ice dampers swing back to the operating position, the bin switch closes and the ice machine restarts, provide the 3-minute delay has expired.

Important

The water curtain/ice dampers 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/ice dampers. The switch is attached to the right bulkhead wall.

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.

SYMPTOMS

Bin Switch Fails Open

- The ice machine will not start with the toggle switch in the ice position, but runs normally with the toggle switch in the clean position.

Bin Switch Fails Closed

- Safety limit 2 is recorded in the control board memory and the harvest cycle continues after the ice opens and closes the water curtain/ice dampers (harvest cycle is 3.5 minutes for single evaporators and 7 minutes for Quad evaporator models).

DIAGNOSTIC AIDS:

- Always use the water curtain/ice dampers magnet to cycle the switch (a larger or smaller magnet will affect switch operation).
- Readings are affected by your test lead connection and VOM battery strength. Verify you have solid connections and a correctly functioning VOM before testing bin switch.
- Open the curtain/ice dampers for 3 seconds, then close the curtain/ice dampers for 3 seconds. This will allow your VOM display to settle.
- With the bin switch closed your meter reading should be 0 (0 to 10 is acceptable). With the curtain/ice dampers open the reading must be infinity (OL).

CONTINUITY 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.
3. Cycle the bin switch open and closed 25 times by opening and closing the water curtain/ice dampers. Watch for consistent readings each time the bin switch is cycled open and closed (bin switch failure could be erratic).

Water Curtain/Ice Damper 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.

CLEANING THE ICE THICKNESS OR WATER LEVEL PROBE

Clean the probes using the following procedure.

1. Mix a solution of Manitowoc ice machine cleaner and water (2 ounces of cleaner to 16 ounces of water) in a container.
2. Soak probes in container of cleaner/water solution while disassembling and cleaning water circuit components (soak probes for 10 minutes or longer).
3. Clean all probe surfaces including all plastic parts (do not use abrasives). Verify all cavities are clean. Thoroughly rinse probes (including cavity) with clean water, then dry completely. **Incomplete rinsing and drying of the ice thickness probe can cause premature harvest.**

Reinstall probes, then sanitize all ice machine and bin/dispenser interior surfaces.

WATER LEVEL CONTROL CIRCUITRY

The water level probe circuit can be monitored by watching the water level light. The water level light is on when water contacts the probe, and off when no water is in contact with the probe. The water level light functions any time power is applied to the ice machine, regardless of toggle switch position.

FREEZE CYCLE WATER LEVEL SETTING

During the Freeze cycle, the water level probe is set to maintain the proper water level above the water pump housing. The water level is not adjustable. If the water level is incorrect, check the water level probe position. Reposition or replace the probe as necessary.

WATER INLET VALVE SAFETY SHUT-OFF

In the event of a water level probe failure, this feature limits the water inlet valve to a six-minute on time. Regardless of the water level probe input, the control board automatically shuts off the water inlet valve if it remains on for 12 continuous minutes. This is important to remember when performing diagnostic procedures on the water level control circuitry.

FREEZE CYCLE CIRCUITRY

Manitowoc's electronic sensing circuit does not rely on float switches or timers to maintain consistent water level control. During the Freeze cycle, the water inlet valve energizes and de-energizes in conjunction with the water level probe located in the water trough.

During the first 45 seconds of the Freeze cycle:

- The water inlet valve is **ON** when there is no water in contact with the water level probe.
- The water inlet valve turns **OFF** after water contacts the water level probe for 3 continuous seconds.
- The water inlet valve will cycle ON and OFF as many times as needed to fill the water trough.

After 45 seconds into the Freeze cycle:

The water inlet valve will cycle ON, and then OFF one more time to refill the water trough. The water inlet valve is now OFF for the duration of the freeze cycle.

4.

Diagnosing Water Level Control Circuitry

PROBLEM: WATER TROUGH OVERFILLING DURING THE FREEZE CYCLE

Step 1 Start a new Freeze sequence by moving the ICE/OFF/CLEAN toggle switch to OFF and then back to ICE.(if water flows with the switch off, check the water inlet valve).

Important

This restart must be done prior to performing diagnostic procedures. This assures the ice machine is not in a Freeze cycle water inlet valve safety shut-off mode. You must complete the entire diagnostic procedure within 6 minutes of starting.

Step 2 Wait until the Freeze cycle starts (the Freeze cycle starts when the water pump energizes).

Step 3 Disconnect the water level probe from the control board, then connect a jumper from the control board terminal and any cabinet ground, & refer to chart on the next page.

Important

For the test to work properly you must wait until the Freeze cycle starts, prior to disconnecting the water level probe. If you restart the test, you must reconnect the water level probe, restart the ice machine (step 1), and then disconnect the water level probe after the compressor starts.

Step 3. Jumper Wire Connected from Control Board Terminal to Ground			
Is Water Flowing into the Water Trough?	**The Water Level Light Is:**	**The Water Inlet Valve Solenoid Coil Is:**	**Cause**
No	On	De-energized	The water level probe is causing the problem. Ohm, then clean or replace the water level probe.
Yes	Off	Energized	The control board is causing the problem.
Yes	On	De-energized	The water fill valve is causing the problem.

PROBLEM: WATER WILL NOT RUN INTO THE SUMP TROUGH DURING THE FREEZE CYCLE

Step 1 Verify water is supplied to the ice machine.Start a new Freeze sequence by moving the ICE/OFF/CLEAN toggle switch to OFF, then back to ICE.

Step 2 Wait until the freeze cycle starts (approximately 45 seconds, the freeze cycle starts when the compressor energizes).

Important

This restart must be done prior to performing diagnostic procedures. This assures the ice machine is not in a freeze cycle water inlet valve safety shut-off mode. You must complete the entire diagnostics within 6 minutes of starting.

Step 3 Disconnect the water level probe from the water level probe terminal on the control board.

Important

For the test to work properly you must wait until the Freeze cycle starts, prior to disconnecting the water level probe. If you restart the test, you must reconnect the water level probe, restart the ice machine (step 1), and then disconnect the water level probe after the compressor starts.

Step 3. Disconnect Probe from Control Board			
Is Water Flowing into the Water Trough?	**The Water Level Light Is:**	**The Water Inlet Valve Solenoid Coil Is:**	**Cause**
Yes	Off	Energized	The water level probe is causing the problem. Clean or replace the water level probe.
No	Off	Energized	The water inlet valve is causing the problem.
No	On or Off	De-energized	The control board is causing the problem.

ICE THICKNESS PROBE (HARVEST INITIATION)

HOW THE PROBE WORKS

Manitowoc's 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.

ICE PROBE 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 probe.

FREEZE TIME LOCK-IN FEATURE

The ice machine control system incorporates 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 ice probe or 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

The control system includes a built-in safety which will automatically cycle the ice machine into harvest after 60 minutes in the freeze cycle.

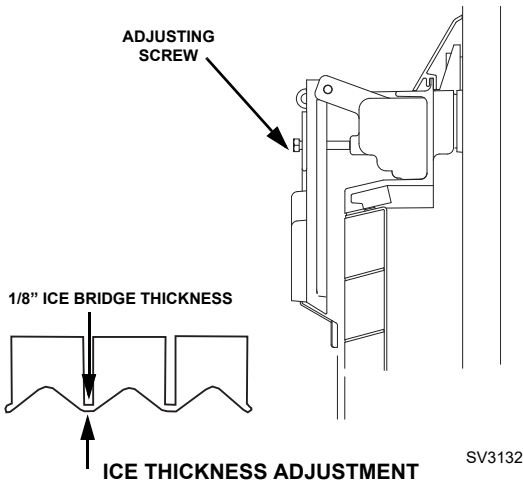
ICE THICKNESS CHECK

The ice thickness probe is factory-set to maintain the ice bridge thickness at 1/8 in. (32 mm).

NOTE: Make sure the water curtain/splash shields are 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 in. (32 mm) thick.
2. If adjustment is necessary, turn the ice thickness probe adjustment screw clockwise to increase bridge thickness or counterclockwise to decrease bridge thickness. Set a 1/4" gap between the ice thickness probe and evaporator as a starting point. Then adjust to achieve 1/8" ice thickness.

NOTE: The starting point before final adjustment is approximately a 1/4 in. gap.
Make sure the ice thickness probe wire and the bracket do not restrict movement of the probe



ICE THICKNESS ADJUSTMENT

Diagnosing Ice Thickness Control Circuitry

PROBLEM: ICE MACHINE DOES NOT CYCLE INTO HARVEST WHEN WATER CONTACTS THE ICE THICKNESS CONTROL PROBE

Step 1 Bypass the freeze time lock-in feature by moving the ICE/OFF/CLEAN switch to OFF and back to ICE.

Step 2 Wait until water starts to flow over the evaporator (freeze cycle).

Step 3 Disconnect the ice thickness control from the control board, then connect a jumper wire from the control board to any cabinet ground and monitor the ice probe light.

Ice Probe Light On

- The ice probe light comes on, and 10 seconds later, the ice machine cycles from Freeze to Harvest.
- The ice thickness probe is causing the malfunction.
- The ice probe light comes on, but the ice machine stays in the Freeze sequence.

The control board is causing the malfunction.

Ice Probe Light Off

- The ice probe light does not come on.

The control board is causing the malfunction.

If you suspect a defective probe check for continuity from the ice thickness probe to the connector.

- With continuity DO NOT change the probe.
- Without continuity, the probe is defective.

PROBLEM: ICE MACHINE CYCLES INTO HARVEST BEFORE WATER CONTACT WITH THE ICE THICKNESS PROBE

Step 1 Bypass the freeze time lock-in feature by moving the ICE/OFF/CLEAN switch to OFF and back to ICE.

Step 2 Disconnect the ice thickness probe from the control board.

Step 3 Wait until water starts to flow over the evaporator, then monitor the ice probe light:

Ice Probe Light Off

- The ice probe light stays off, and the ice machine remains in the Freeze sequence.

The ice thickness probe is causing the malfunction. Verify that the ice thickness probe is adjusted correctly and clean.

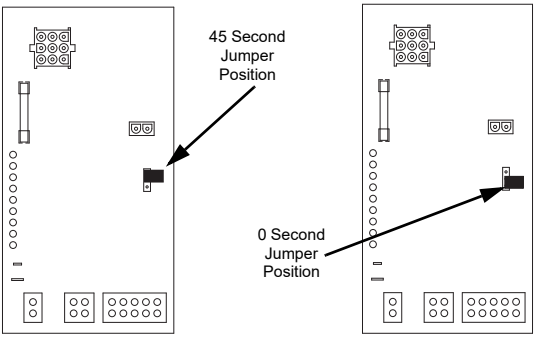
Ice Probe Light On

- The ice probe light comes on, and 10 seconds later, the ice machine cycles from Freeze to Harvest.

The control board is causing the malfunction.

HARVEST CYCLE CIRCUITRY

The water level probe does not control the water inlet valve during the harvest cycle. During the harvest cycle water purge, the water inlet valve energizes and de-energizes strictly by time. The harvest water purge may be set at 45 seconds (top and center terminals) or 0 seconds (center and bottom terminals). Set the harvest water purge to 0 seconds when reverse osmosis or deionized water is used. Use the factory setting of 45 seconds for all other types of water.



HARVEST ASSIST AIR PUMP

FUNCTION

The air pump breaks the vacuum between the sheet of ice and the evaporator which results in shorter harvest cycles.

SPECIFICATIONS

115 Volt or 230 Volt - matches the ice machine voltage.

CHECK PROCEDURE

1. Verify when the air pump should be running in the sequence of operation.
2. If the compressor is not running when it should be check voltage at the control board.
3. If there is no voltage present at the control board, replace the control board.
4. If there is voltage present at the control board check for voltage at the air pump connector.
5. If there is no voltage present at the air pump connector replace wire.
6. If there is voltage at the air pump connector, use a volt ohm meter to verify there is no continuity through the motor windings then replace motor.

Compressor Electrical Diagnostics

The compressor does 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 then remove the wires from the compressor terminals.
2. 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 and remove the wires from the compressor terminals.
2. 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. Scrape metal surface to get good contact. If continuity is present, the compressor windings are grounded and the compressor should be replaced.

COMPRESSOR DRAWING LOCKED ROTOR

To determine if the compressor is seized, check the amp draw while the compressor is trying to start.

The two likely causes of this are a defective starting component and a 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 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.

DIAGNOSING START COMPONENTS

If the compressor attempts to start, or hums and trips the overload protector, check the start components before replacing the compressor.

Capacitor

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.

- 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.

Relay

The relay has a set of contacts that connect and disconnect the start capacitor from the compressor start winding. The contacts on the relay are normally closed (start capacitor in series with the start winding). The relay senses the voltage generated by the start winding and opens the contacts as the compressor motor starts. The contacts remain open until the compressor is de-energized.

RELAY OPERATION CHECK

1. Disconnect wires from relay terminals.
2. Verify the contacts are closed.
   Measure the resistance between terminals 1 and 2. No continuity indicates open contacts. Replace the relay.
3. Check the relay coil.
   Measure the resistance between terminals 2 and 5. No resistance indicates an open coil. Replace the relay.

PTCR

The PTCR allows current to flow through the start winding at compressor startup. Current flow heats the ceramic discs in the PTCR. The electrical resistance increases with temperature and stops all except a trickle of current flow through the start winding. The small flow of current keeps the PTCR hot (260°F/ 127°C) and the start winding out of the circuit.

The PTCR must be cooled before attempting to start the compressor, otherwise the PTCR will heat up too quickly and stop current flow through the start winding before the compressor motor reaches full speed..

⚠ Warning

Disconnect electrical power to the entire ice machine at the building electrical disconnect box before proceeding.

NOTE: If a PTCR is dropped internal damage can occur to the ceramic PTCR discs. The ceramic disc can chip and cause arcing which leads to PTCR failure. Since there is no way to open the PTCR in order to determine if the ceramic disc is chipped or not, it must be discarded when dropped.

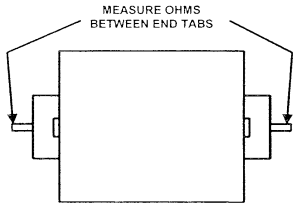
PTCR Operation Check

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

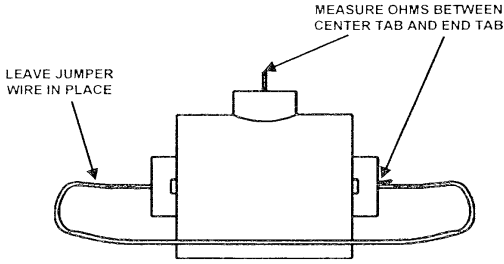
NOTE: The PTCR case temperature may reach 210°F (100°C) while the compressor is running. This is normal. Do not change a PTCR just because it is hot.

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. The resistance reading must be between:

- S600/S850/S1000 =18 to 40 ohms
- S1200/S1400/S1600/S1800 = 8 to 22 ohms.



S600/S850/S1000



S1200/S1400/S1600/S1800

Refrigeration Components

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	**Cut-In**
450 psig ±10 (3103 kPa ±69 31 bar ±.69)	Automatic Reset
(Must be below 300 psig (2068 kPa 20.68 bar) to reset.)	
ST3000 R410A Refrigerant Only	
600 psig ±10 (3147 kPa ±69)	450 psig ±10 (3103 kPa ±69)

CHECK PROCEDURE

1. Set ICE/OFF/CLEAN switch to OFF, (Manual reset HPCO reset if tripped).
2. Connect manifold gauge set.
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 cutout setting 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:

7. Will not reset [below 300 psig (2068 kPa 20.68 bar).
8. Does not open at the specified cut-out point.

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)**
S300 / S320 S420 / S450 S500 / S600 S850	250 ±5 (1723 kPa ±.34) (17.23 bar ±.34)	200 ±5 (1517 kPa ±.34) (15.17 bar ±.34)
S1000 / S1200 S1400 / S1600 S1800	275 psig ±5 (1896 kPa ±34) (18.96 bar±.34)	225 psig ±5 (1551 kPa ±34) (15.51 bar ±.34)

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.

FCC Setpoint:	Reading Should Be:	Fan Should Be:
Above Cut-In	0 Volts	Running
Below Cut-Out	Line Voltage	Off

WATER REGULATING VALVE

Self-Contained Water-Cooled Models Only

FUNCTION

The water regulating valve maintains the freeze cycle discharge pressure.

- The valve setting for the ST3000W is 230 psig.
- The valve setting for the S3300W-HP is 240 psig.

CHECK PROCEDURE

1. Determine if the head pressure is high or low (refer to Operational Pressure Charts page 179).
2. Verify the condenser water meets specifications.
3. Adjust valve to increase or decrease discharge pressure.
4. Determine the temperature of the liquid line entering the receiver by feeling it. This line is normally warm; body temperature.
5. Using the information gathered, refer to the list for diagnosis.

Problem (Freeze Cycle)

Valve not maintaining discharge pressure.

- Valve incorrectly set, dirty or defective. Adjust, clean or replace valve.

Discharge pressure extremely high; Liquid line entering receiver feels hot.

- Water regulating valve incorrectly set or not opening.

Discharge pressure low, Liquid line entering receiver feels warm to hot.

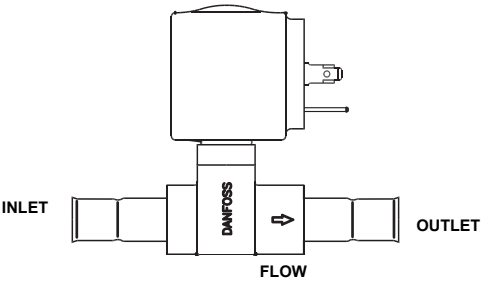
- Ice machine low on charge. Verify Total System Refrigerant Charge page 177.

HARVEST PRESSURE REGULATING (HPR) SYSTEM REMOTES ONLY

GENERAL

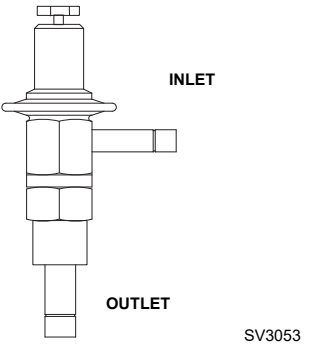
The harvest pressure regulating (H.P.R.) system includes:

- Harvest pressure regulating solenoid valve (H.P.R. solenoid). This is an electrically operated valve which opens when energized, and closes when de-energized.



HPR SOLENOID

- Harvest pressure regulating valve (H.P.R. valve). This is a 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.



HPR VALVE

FREEZE CYCLE

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.

HARVEST CYCLE

During the harvest cycle, the check valve in the discharge line prevents refrigerant in the remote condenser and receiver from back feeding 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 70-100 psig (517-758 kPa). Exact pressures vary from model to model. Refer to the “Operational Refrigerant Pressures” charts page 179.

HPR DIAGNOSTICS

Steps 1 through 4 can be quickly verified without attaching a manifold gauge set or thermometer.

All questions must have a yes answer to continue the diagnostic procedure.

1. Liquid line warm?
   (Body temperature is normal)
   If liquid line is cooler than body temperature, refer to head pressure control valve diagnostics page 153.
2. Ice fill pattern normal?
   Refer to “Ice Formation Pattern” if ice fill is not normal page 99.

3. Freeze time normal?
   (Refer to Cycle Times/Refrigerant Pressures/24 Hour Ice Production Charts page 179)
   Shorter freeze cycles - Refer to head pressure control valve diagnostics page 153.
   Longer freeze cycles - Refer to water system checklist page 98, then refer to Refrigeration Diagnostic Procedures .
4. Harvest time is longer than normal and control board indicates safety limit #2?
   (Refer to Cycle Times/Refrigerant Pressures/24 Hour Ice Production Charts page 179)
   Connect refrigeration manifold gauge set to the access valves on the front of the ice machine. Establish baseline by recording suction and discharge pressure and freeze & harvest cycle times. (Refer to "**Freeze Cycle Refrigeration System Operational Analysis Tables**" for data collection detail page 80).
5. Discharge line temperature is greater than 150°F (66°C) [S850/S1000 Air/Water Only - 140°F (60°C)] at the end of the freeze cycle? (See Discharge Line Temperature Analysis on page 111)
6. Freeze cycle Head Pressure 220 psig (1517 kPa 15.17 bar) or higher?
   If the head pressure is lower than 220 psig (1517 kPa 15.17 bar) refer to head pressure control valve diagnostics page 153.
7. Freeze cycle Suction Pressure normal?
   Refer to analyzing suction pressure if suction pressure is high or low page 104.
8. Harvest cycle suction and discharge pressures are lower than indicated in the cycle times/ refrigerant pressures/24 hour ice production chart?
   Replace Harvest Pressure Regulating solenoid.

HEAD PRESSURE CONTROL VALVE

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

OPERATION

The R404A head pressure control valve is non adjustable.

At ambient temperatures of approximately 70°F (21°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 if the coil is clean. Air passes through the condenser from the bottom up. Verify the coil is clean by looking from the bottom up. Do not look down through the fan.
2. Determine the air temperature entering the remote condenser.
3. Determine if the head pressure is high or low in relationship to the outside temperature. (Refer to the proper “Cycle Times/24-Hour Ice Production/ Refrigerant Pressure Charts” page 179).
4. Determine the temperature of the liquid line entering the receiver by feeling it. This line is normally warm; “body temperature.”

5. Using the information gathered, refer to the chart below.

NOTE: A head pressure control valve that will not bypass, will function properly with condenser air temperatures of approximately 70°F (21°C) or above. When the temperature drops below 70°F (21°C), the head pressure control valve 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.

Condition	Probable Cause	Corrective Measure
Discharge Pressure - High Liquid Line Temperature - Hot	Valve stuck in bypass	Replace valve
Discharge Pressure - Low Liquid Line Temperature - Cold	Valve not bypassing	Replace valve
Discharge Pressure - Low Liquid Line Temperature - Hot	Ice Machine Low on Charge	Low on Charge Verification

FAN CYCLE CONTROL VS. HEAD PRESSURE CONTROL VALVE

A fan cycle control cannot be used in place of a head pressure control valve. 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.

LOW PRESSURE CUTOUT (LPCO) CONTROL (ST3000/S3300 Only)

FUNCTION

Signals the control board to energize and de-energize the ice machine when suction pressure rises above or falls below setpoint.

The LPCO control is closed at pressures above setpoint and opens at pressures below setpoint.

Two controls have been used and either will function correctly.

Specifications	
Cut-Out	**Cut-In**
12 psig ±3	35 psig ±3
7 psig ±3	22 psig ±3

CHECK PROCEDURE

1. Connect manifold gauge set at suction and discharge access valves and verify refrigerant pressure exceeds LPCO cut-in.
2. Isolate LPCO electrical leads, connect a multimeter and read resistance.

Open = Replace Switch

Closed = Switch OK

NOTE: When the LPCO opens the compressor contactor opens and the control board light will flash When the control closes the compressor contactor closes and the control board light stops flashing.

HARVEST PRESSURE SOLENOID VALVE (ST3000/S3300 Only)

FUNCTION

Transfers refrigerant from the high side to the low side during the harvest cycle.

CHECK PROCEDURE

1. Reset the ice machine with the toggle switch to over ride the 6 minute freeze lock.
2. Initiate a premature harvest by grounding the ice thickness probe.
3. Verify the coil has line voltage supplied in the harvest cycle and magnetism is present
4. If voltage and magnetism are present Refer to S Model Quad evaporator operational analysis chart page 88.

Refrigerant Recovery/Evacuation

NORMAL SELF-CONTAINED MODEL PROCEDURES

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

Important

Manitowoc 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 (OEM) liquid line filter-drier to prevent voiding the warranty.

Connections

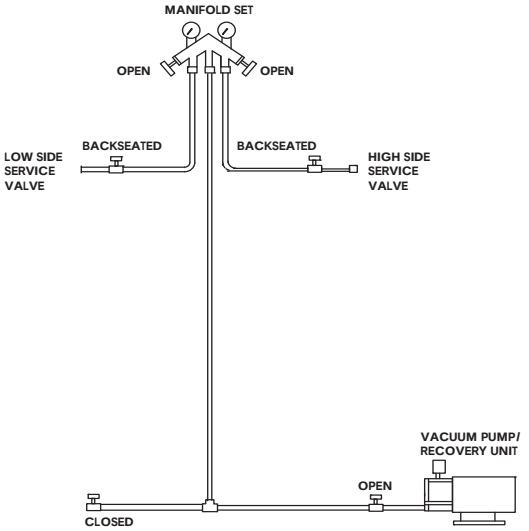
Manifold gauge sets must utilize low loss fittings to comply with U.S. Government rules and regulations.

Make these connections:

- Suction side of the compressor through the suction service valve.
- 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 gauge set, scale and recovery unit or two-stage vacuum pump.



RECOVERY/EVACUATION CONNECTIONS

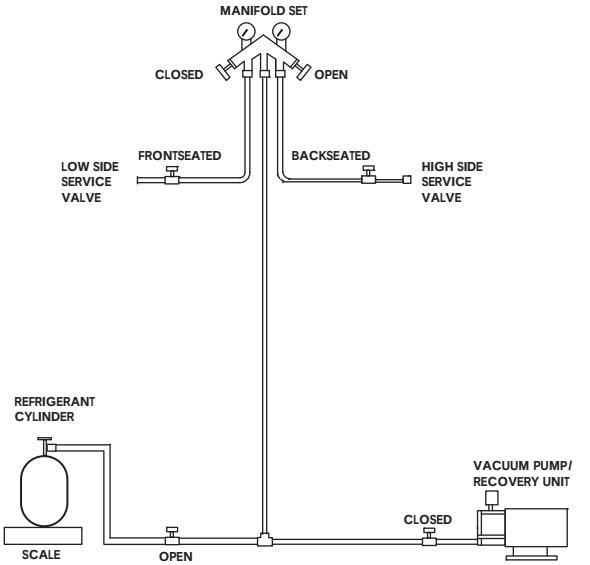
3. Open (backseat) the high and low side ice machine service valves if required, and open high and low side on manifold gauge set.
4. Perform recovery or evacuation:
   A. Recovery: Operate the recovery unit as directed by the manufacturer's instructions.
   B. Evacuation prior to recharging: Pull the system down to 500 microns. Then, allow the pump to run for an additional half hour. Turn off the pump and perform a standing vacuum leak check.
5. Follow the Charging Procedures.

Self-Contained Charging Procedures

Important

The charge is critical on all Manitowoc ice machines. Use a scale 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 gauge set 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 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.

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 (Schrader) 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.

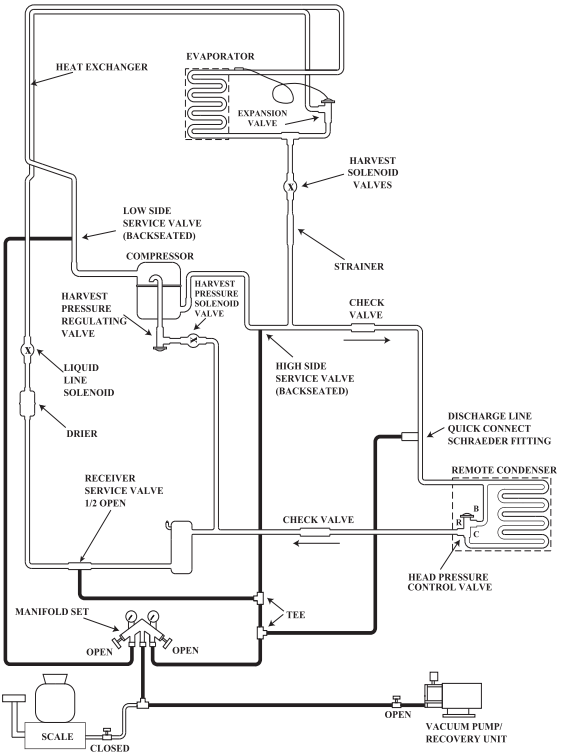
NOTE: Manitowoc recommends using an access valve core removal and installation tool on the discharge line quick-connect fitting. This permits access valve core removal. This allows for faster evacuation and charging, without removing the manifold gauge hose.

REMOTE RECOVERY/EVACUATION

1. Place the toggle switch in the OFF position.
2. Install manifold gauge set, 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 500 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.



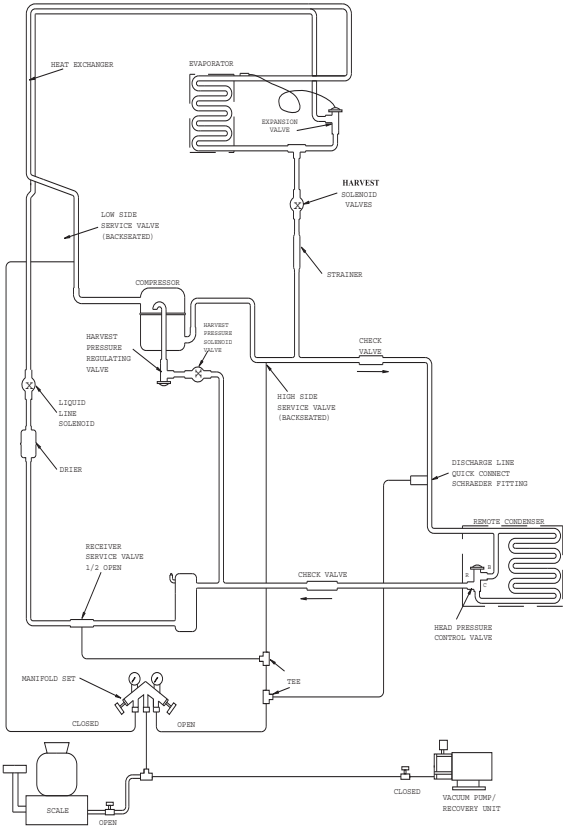
REMOTE RECOVERY/EVACUATION CONNECTIONS

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 (front seat), and the low side manifold gauge valve.
3. Open the refrigerant 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 gauge set.

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 Schrader 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 Clean-Up

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 on the next page 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, lines, and other components	Severe contamination cleanup procedure

CLEANUP PROCEDURE

Mild System Contamination

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 psig (35 kPa, .35 bar).
   B. Pull vacuum to 500 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psig (35 kPa, .35 bar).
   C. Change the vacuum pump oil.
   D. Pull vacuum to 500 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 are no leaks.

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

Severe System Contamination

1. Remove the refrigerant charge.
2. Remove the compressor.
3. Disassemble the harvest solenoid valve. If burnout deposits are found inside the valve, install a new harvest valve, replace the manifold strainer, 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 CFCs into the atmosphere.

6. Install a new compressor and new start components.
7. Install a suction line filter-drier with acid and moisture removal capability. Place the filter drier as close to the compressor as possible.
8. Install an access valve at the inlet of the suction line drier.
9. Install a new liquid line drier.

Important

Dry nitrogen is recommended for this procedure. This will prevent CFC release.

10. 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 psig (35 kPa, .35 bar).
    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 psig (35 kPa, .35 bar).
    D. Change the vacuum pump oil.
    E. Pull vacuum to 500 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 are no leaks.

11. Charge the system with the proper refrigerant to the nameplate charge.
12. 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 psig (7 kPa, .7 bar), the filter-drier should be adequate for complete cleanup.
    B. If the pressure drop exceeds 1 psig (7 kPa, .7 bar), change the suction line filter-drier and the liquid line drier. Repeat until the pressure drop is acceptable.
13. Operate the ice machine for 48-72 hours. Then remove the suction line drier and change the liquid line drier.
14. 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 wing nuts until the block is tight and the tubing is rounded.

NOTE: The pressure controls will operate normally once the tubing is re-rounded. Tubing may not re-round 100%.

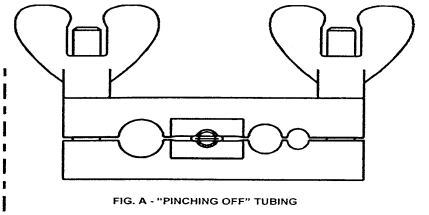


FIG. A - "PINCHING OFF" TUBING

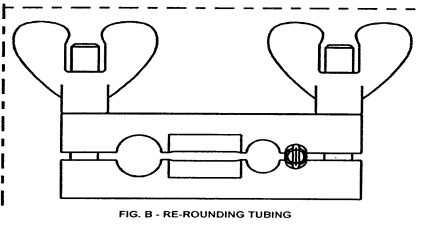


FIG. B - RE-ROUNDING TUBING

SV1406

USING PINCH-OFF TOOL

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MAIN FUSE

The main fuse is 250 Volt, 7 amp.

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

Model	Cut-In (Close)	Cut-Out (Open)
S300 / S320 S420 / S450 S500 / S600 S850	250 ±5 (1723 kPa ±.34) (17.23 bar ±.34)	200 ±5 (1517 kPa ±.34) (15.17 bar ±.34)
S1000 / S1200 S1400 / S1600 S1800	275 psig ±5 (1896 kPa ±34) (18.96 bar±.34)	225 psig ±5 (1551 kPa ±34) (15.51 bar ±.34)

HIGH PRESSURE CUTOUT (HPCO) CONTROL

Specifications	
Cut-Out	**Cut-In**
450 psig ±10 (3103 kPa ±69 31 bar ±.69)	Automatic Reset
(Must be below 300 psig (2068 kPa 20.68 bar) to reset.)	
ST3000 R410A Refrigerant Only	
600 psig ±10 (3147 kPa ±69)	450 psig ±10 (3103 kPa ±69)

FILTER-DRIERS

The filter-driers used on Manitowoc ice machines are manufactured to Manitowoc specifications.

The difference between a Manitowoc drier and an off-the-shelf drier is in filtration. A Manitowoc drier has 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 that takes place during every Harvest cycle.

A Manitowoc filter-drier has high moisture and acid removal capability.

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.

Refer to the parts section in the Electronic Document Catalog for the current field replacement drier for the model.

Important

Driers are covered as a warranty part. The drier must be replaced any time the system is opened for repairs.

TOTAL SYSTEM REFRIGERANT CHARGE

NOTE: This information is for reference only.
Refer to the ice machine serial number tag to verify the system charge.
Serial plate information overrides information listed on these pages.
All machines listed use R-404A refrigerant except, ST3000 which uses R410A refrigerant.

Model	Air Cooled	Water Cooled	Remote	Additional Refrigerant for Line Sets 51'-100'	Maximum System Charge
S300	18 oz.	11 oz.	NA	NA	NA
S320	20 oz.	15 oz.	NA	NA	NA
S420/S450	21 oz.	14 oz.	NA	NA	NA
S500 Before 110684316	24 oz.	20 oz.	6 lb.	1.5 lb.	7.5 lb.
S500 After 110684316	24 oz.	23 oz.	6 lb.	1.5 lb.	7.5 lb.
S600	32 oz.	28 oz.	6.5 lb.	1.5 lb.	8 lb.
S850 Before 110683282	36 oz.	26 oz.	8.5 lb.	2 lb.	10.5 lb.
S850 After 110683282	34 oz.	26 oz.	8.5 lb.	2 lb.	10.5 lb.
S1000 Before 110697023	36 oz.	26 oz.	8.5 lb.	2 lb.	10.5 lb.
S1000 After 110697023	34 oz.	28 oz.	8.5 lb.	2 lb.	10.5 lb.

Model	Air Cooled	Water Cooled	Remote	Additional Refrigerant for Line Sets 51'-100'	Maximum System Charge
S1200 Before 110560252	42 oz.	42 oz.	NA	NA	NA
S1200 After 110560252	42 oz.	34 oz.	NA	NA	NA
S1400 Before Manufacture Date 0711	44 oz.	30 oz.	11 lb.	2 lb.	13 lb.
S1400 Between 0711 & 0905 Manufacture Date	44 oz.	52 oz.	11 lb.	2 lb.	13 lb.
S1400 After 0905 Manufacture Date	46 oz.	40 oz.	11 lb.	2 lb.	13 lb.
S1600 Before 110566844	48 oz.	46 oz.	11.5 lb.	2 lb.	13.5 lb.
S1600 After 110566844	48 oz.	36 oz.	11.5 lb.	2 lb.	13.5 lb.
S1800 Before 0910 Manufacture Date	52 oz.	48 oz.	12.5 lb.	1 lb.	13.5 lb.
S1800 After 0910 Manufacture Date	52 oz.	40 oz.	12.5 lb.	1 lb.	13.5 lb.
ST3000 - R410A	NA	6 lb.	NA	NA	NA
S3300 - R404A	NA	6 lb.	NA	NA	NA

Cycle Times/24-Hour Ice Production/ Refrigerant Pressure Charts

These charts are used as guidelines to verify correct ice machine operation.

Accurate collection of data is essential to obtain the correct diagnosis.

- Refer to “Symptom #2 - Operational Analysis Table” page 80 for the list of data that must be collected for refrigeration diagnostics. This list includes: before beginning service, ice production check, installation/visual inspection, water system checklist, ice formation pattern, safety limits, comparing evaporator inlet/outlet temperatures, discharge and suction pressure analysis.
- Ice production checks that are within 10% of the chart are considered normal. This is due to variances in water and air temperature. Actual temperatures will seldom match the chart exactly.
- Zero out manifold gauge set before obtaining pressure readings to avoid mis-diagnosis.
- Discharge and suction pressure are highest at the beginning of the cycle. Suction pressure will drop throughout the cycle. Verify the pressures are within the range indicated.
- Record beginning of freeze cycle suction pressure one minute after water pump energizes.
- Regular cube production derate is 7%.
- 50Hz production derate is 7%.
- 50Hz regular cube total production derate is 14%.

S300 SERIES

S300A

All Self-Contained Air-cooled Models Before Serial Number 110704351

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.3-11.0	10.4-12.2	11.5-13.5	1-2.5
80/27	10.0-11.8	11.3-13.2	12.6-14.7	
90/32	10.8-12.7	12.3-14.4	13.5-15.7	
100/38	12.3-14.4	13.5-15.7	14.8-17.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	325	295	270
80/27	305	275	250
90/32	285	255	235
100/38	255	235	215

1 Based on average ice slab weight of 2.44 - 2.81 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	50-23	135-160	75-110
70/21	195-260	55-24	135-165	80-110
80/27	220-290	60-25	150-170	90-120
90/32	250-330	70-27	170-195	115-135
100/38	285-370	74-28	200-220	130-155
110/43	330-415	78-30	230-250	150-175

1 Suction pressure drops gradually throughout the freeze cycle

S300A

All Self-Contained Air-cooled Models After Serial Number 110704351

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.7-10.4	9.5-11.3	10.4-12.4	1-2.5
80/27	9.6-11.5	10.6-12.6	11.5-13.7	
90/32	10.8-12.9	11.3-13.4	12.9-15.3	
100/38	12.3-14.6	13.5-16.0	14.6-17.3	
110/43	14.2-16.8	15.4-18.2	16.7-18.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	340	315	290
80/27	310	285	265
90/32	280	270	240
100/38	250	230	215
110/43	220	205	190

1 Based on average ice slab weight of 2.44 - 2.81 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-245	50-23	135-160	75-100
70/21	195-260	60-24	135-165	80-110
80/27	220-290	60-25	150-170	90-120
90/32	250-330	60-27	170-195	115-135
100/38	285-370	70-30	200-220	130-155
110/43	330-415	78-32	230-250	150-175

1 Suction pressure drops gradually throughout the freeze cycle

S300W

All Self-Contained Water-cooled Models Before Serial Number 110704351

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.8-11.6	10.8-12.7	12.0-14.7	1-2.5
80/27	10.0-11.8	11.0-13.0	12.3-14.4	
90/32	10.4-12.2	11.5-13.5	12.6-14.7	
100/38	10.6-12.5	11.8-13.8	12.8-15.0	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	310	285	260
80/27	305	280	255
90/32	295	270	250
100/38	290	265	245

1 Based on average ice slab weight of 2.44-2.81 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 hours	250	485	2100

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	Suction Pressure PSIG [1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-245	50-24	140-180	75-100
70/21	235-245	60-25	160-190	90-120
80/27	235-265	65-27	160-190	100-130
90/32	235-275	65-27	160-190	100-135
100/38	235-275	65-28	160-190	100-140
110/43	235-275	65-28	170-200	100-140

1 Suction pressure drops gradually throughout the freeze cycle

S300W

All Self-Contained Water-cooled Models After Serial Number 110704351

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.1-10.9	10.0-11.9	11.1-13.2	1-2.5
80/27	9.3-11.1	10.2-12.2	11.3-13.4	
90/32	9.5-11.3	10.4-12.4	11.5-13.7	
100/38	9.6-11.5	10.6-12.6	11.8-14.0	
110/43	9.8-11.7	10.8-12.9	12.1-14.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	325	300	275
80/27	320	295	270
90/32	315	290	265
100/38	310	285	260
110/43	305	280	255

1 Based on average ice slab weight of 2.44 - 2.81 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 hours	250	510	3300

1 Water regulating valve set to maintain 240 PSIG discharge pressure

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-230	50-24	130-170	75-100
70/21	220-230	60-25	140-180	90-100
80/27	225-245	65-26	140-185	90-125
90/32	230-250	65-27	145-185	90-130
100/38	230-260	70-28	145-190	90-135
110/43	235-260	70-28	150-190	90-140

1 Suction pressure drops gradually throughout the freeze cycle

S320 SERIES

S300A

All Self-Contained Air-Cooled Models

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	12.3-14.0	13.1-14.9	14.1-16.0	1-2.5
80/27	13.1-14.9	14.6-16.6	15.8-18.0	
90/32	15.2-17.3	17.2-19.5	18.0-20.4	
100/38	18.0-20.4	19.8-22.4	20.8-23.5	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	340	320	300
80/27	320	290	270
90/32	280	250	240
100/38	240	220	210

1 Based on average ice slab weight of 3.25 - 3.65 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-260	60-34	130-160	80-115
70/21	195-260	70-36	130-165	90-120
80/27	215-295	75-36	140-165	110-125
90/32	240-320	80-38	155-180	120-135
100/38	290-365	90-40	175-215	140-165
110/43	325-415	95-42	200-230	160-185

1 Suction pressure drops gradually throughout the freeze cycle

S320 Series

All Self-Contained Water-Cooled Models

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	12.7-14.4	13.6-15.5	15.2-17.3	1-2.5
80/27	13.1-14.9	14.1-16.0	15.2-17.3	
90/32	13.6-15.5	14.6-16.6	15.8-18.0	
100/38	14.1-16.0	15.2-17.3	16.5-18.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	330	310	280
80/27	320	300	280
90/32	310	290	270
100/38	300	280	260

1 Based on average ice slab weight of 3.25-3.65 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	90	160	1010

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-245	60-38	150-185	85-105
70/21	235-245	68-38	150-190	100-120
80/27	235-250	78-39	155-195	110-145
90/32	235-255	80-40	155-200	115-145
100/38	235-260	82-41	155-205	120-150
110/43	235-265	85-42	155-210	120-150

1 Suction pressure drops gradually throughout the freeze cycle

S420 SERIES

S420A

All Self-Contained Air-cooled Models Before Serial Number110667970

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	11.9-12.7	13.1-14.0	14.6-15.5	1-2.5
80/27	13.1-14.0	14.3-15.2	16.0-17.0	
90/32	14.6-15.5	16.3-17.4	17.3-18.4	
100/38	16.3-17.4	17.3-18.4	18.9-20.1	
110/43	18.1-19.2	19.8-21.0	21.3-22.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	365	335	305
80/27	335	310	280
90/32	305	275	260
100/38	275	260	240
110/43	250	230	215

1 Based on average ice slab weight of 3.4 - 3.6 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	50-30	125-185	70-90
70/21	195-270	60-30	135-190	80-115
80/27	220-285	62-32	135-195	80-115
90/32	250-320	70-34	175-195	85-115
100/38	290-390	75-35	190-215	115-140
110/43	320-400	80-37	225-250	130-170

1 Suction pressure drops gradually throughout the freeze cycle

S420A

All Self-Contained Air-cooled Models After Serial Number 110667970

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	11.9-12.7	13.1-14.0	14.6-15.5	1-2.5
80/27	13.1-14.0	14.3-15.2	16.0-17.0	
90/32	14.6-15.5	16.3-17.4	17.3-18.4	
100/38	16.3-17.4	17.3-18.4	18.9-20.1	
110/43	18.1-19.2	19.8-21.0	21.3-22.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	365	335	305
80/27	335	310	280
90/32	305	275	260
100/38	275	260	240
110/43	250	230	215

1 Based on average ice slab weight of 3.4 - 3.6 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	50-30	125-185	70-90
70/21	195-270	60-30	135-190	80-115
80/27	220-285	62-32	135-195	80-115
90/32	250-320	70-34	175-195	85-115
100/38	290-390	75-35	190-215	115-140
110/43	320-400	80-37	225-250	130-170

1 Suction pressure drops gradually throughout the freeze cycle

S420W

All Self-Contained Water-cooled Models Before Serial Number 110667970

Characteristics vary depending on operating conditions.

CYCLE TIMES

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	12.7-13.5	11.2-15.2	12.7-13.5	1-2.5
80/27	13.1-14.0	14.6-15.5	12.9-17.7	
90/32	13.3-14.2	11.7-15.8	13.1-18.1	
110/43	14.0-15.0	15.4-16.4	17.7-18.8	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	345	310	275
80/27	335	305	270
90/32	330	300	265
110/43	315	290	255

1 Based on average ice slab weight of 3.40-3.60 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	NA	200	NA

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-240	48-29	150-185	70-95
70/21	235-265	52-30	160-190	85-100
80/27	235-265	56-30	170-190	90-110
90/32	235-270	62-31	170-195	95-115
100/38	235-275	65-31	170-200	100-120
110/43	240-280	65-32	170-205	100-120

1 Suction pressure drops gradually throughout the freeze cycle

S420W

All Self-Contained Water-cooled Models After Serial Number 110667970

Characteristics vary depending on operating conditions.

CYCLE TIMES

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	12.7-13.5	11.2-15.2	12.7-13.5	1-2.5
80/27	13.1-14.0	14.6-15.5	12.9-17.7	
90/32	13.3-14.2	11.7-15.8	13.1-18.1	
110/43	14.0-15.0	15.4-16.4	17.7-18.8	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	345	310	275
80/27	335	305	270
90/32	330	300	265
110/43	315	290	255

1 Based on average ice slab weight of 3.40-3.60 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	NA	200	NA

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-240	48-29	150-185	70-95
70/21	235-265	52-30	160-190	85-100
80/27	235-265	56-30	170-190	90-110
90/32	235-270	62-31	170-195	95-115
100/38	235-275	65-31	170-200	100-120
110/43	240-280	65-32	170-205	100-120

1 Suction pressure drops gradually throughout the freeze cycle

S450 SERIES

S450A

All Self-Contained Air-cooled Models Before Serial Number 110670157

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	11.9-12.7	13.1-14.0	14.6-15.5	1-2.5
80/27	13.1-14.0	14.3-15.2	16.0-17.0	
90/32	14.6-15.5	16.3-17.4	17.3-18.4	
100/38	16.3-17.4	17.3-18.4	18.9-20.1	
110/43	18.1-19.2	19.8-21.0	21.3-22.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	365	335	305
80/27	335	310	280
90/32	305	275	260
100/38	275	260	240
110/43	250	230	215

1 Based on average ice slab weight of 3.4 - 3.6 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	50-30	125-185	70-90
70/21	195-270	60-30	135-190	80-115
80/27	220-285	62-32	135-195	80-115
90/32	250-320	70-34	175-195	85-115
100/38	290-390	75-35	190-215	115-140
110/43	320-400	80-37	225-250	130-170

1 Suction pressure drops gradually throughout the freeze cycle

S450A

All Self-Contained Air-cooled Models After Serial Number 110670157

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	11.9-12.7	13.1-14.0	14.6-15.5	1-2.5
80/27	13.1-14.0	14.3-15.2	16.0-17.0	
90/32	14.6-15.5	16.3-17.4	17.3-18.4	
100/38	16.3-17.4	17.3-18.4	18.9-20.1	
110/43	18.1-19.2	19.8-21.0	21.3-22.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	365	335	305
80/27	335	310	280
90/32	305	275	260
100/38	275	260	240
110/43	250	230	215

1 Based on average ice slab weight of 3.4 - 3.6 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	50-30	125-185	70-90
70/21	195-270	60-30	135-190	80-115
80/27	220-285	62-32	135-195	80-115
90/32	250-320	70-34	175-195	85-115
100/38	290-390	75-35	190-215	115-140
110/43	320-400	80-37	225-250	130-170

1 Suction pressure drops gradually throughout the freeze cycle

S450W

All Self-Contained Water-cooled Models Before Serial Number 110670157

Characteristics vary depending on operating conditions.

CYCLE TIMES

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	12.7-13.5	11.2-15.2	12.7-13.5	1-2.5
80/27	13.1-14.0	14.6-15.5	12.9-17.7	
90/32	13.3-14.2	11.7-15.8	13.1-18.1	
110/43	14.0-15.0	15.4-16.4	17.7-18.8	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	345	310	275
80/27	335	305	270
90/32	330	300	265
110/43	315	290	255

1 Based on average ice slab weight of 3.40-3.60 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	NA	200	NA

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 [1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-240	48-29	150-185	70-95
70/21	235-265	52-30	160-190	85-100
80/27	235-265	56-30	170-190	90-110
90/32	235-270	62-31	170-195	95-115
100/38	235-275	65-31	170-200	100-120
110/43	240-280	65-32	170-205	100-120

1 Suction pressure drops gradually throughout the freeze cycle

S450W

All Self-Contained Water-cooled Models After Serial Number 110670157

Characteristics vary depending on operating conditions.

CYCLE TIMES

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	12.7-13.5	11.2-15.2	12.7-13.5	1-2.5
80/27	13.1-14.0	14.6-15.5	12.9-17.7	
90/32	13.3-14.2	11.7-15.8	13.1-18.1	
110/43	14.0-15.0	15.4-16.4	17.7-18.8	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	345	310	275
80/27	335	305	270
90/32	330	300	265
110/43	315	290	255

1 Based on average ice slab weight of 3.40-3.60 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	NA	200	NA

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-240	48-29	150-185	70-95
70/21	235-265	52-30	160-190	85-100
80/27	235-265	56-30	170-190	90-110
90/32	235-270	62-31	170-195	95-115
100/38	235-275	65-31	170-200	100-120
110/43	240-280	65-32	170-205	100-120

1 Suction pressure drops gradually throughout the freeze cycle

S500 SERIES

S500A

All Self-Contained Air-cooled Models Before Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.5-11.2	11.1-13.1	12.0-14.0	**1-2.5**
80/27	10.4-12.2	12.3-14.4	12.6-14.8	
90/32	11.4-13.4	13.3-15.6	14.1-16.5	
100/38	13.7-16.0	15.0-17.5	15.9-18.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	540	470	440
80/27	500	430	420
90/32	460	400	380
100/38	390	360	340

1 Based on average ice slab weight of 4.12-4.75 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	44-26	130-160	75-90
70/21	195-255	47-28	135-160	80-95
80/27	220-295	50-29	160-175	90-105
90/32	250-325	55-31	175-205	105-120
100/38	270-370	60-32	200-225	120-145
110/43	290-425	75-36	220-260	150-165

1 Suction pressure drops gradually throughout the freeze cycle

SD0502A

Dice Cube, Self-Contained Air-cooled After Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
35/2 to 70/21	10.4-12.1	11.5-13.3	12.7-14.7	0.75-2.0
90/32	12.8-14.9	13.5-15.6	15.5-18.0	
100/38	14.5-16.7	15.8-18.2	17.6-20.3	
110/43	16.5-19.1	18.2-21.0	19.9-22.9	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
35/2 to 70/21	530	485	445
90/32	440	420	370
100/38	395	365	330
110/43	350	320	295

1 Based on average ice slab weight of 4.38 - 5.0 lb
2 230/50/1 is approximately 12% lower than 230/60/1

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-255	50-33	120-145	70-100
70/21	205-260	70-35	120-150	80-110
80/27	210-270	70-36	145-165	80-110
90/32	270-325	70-37	165-190	100-120
100/38	300-400	90-38	210-230	130-150
110/43	330-425	100-38	220-240	140-160

1 Suction pressure drops gradually throughout the freeze cycle

SY0504A

Half Dice Cube, Self-Contained Air-cooled After Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
35/2 to 70/21	9.8-11.4	10.9-12.6	12.1-14.0	0.75-2.0
90/32	12.2-14.2	12.8-14.9	14.7-17.0	
100/38	13.9-16.1	15.1-17.4	16.5-19.1	
110/43	16.0-18.5	17.3-20.0	18.8-21.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
35/2 to 70/21	560	510	465
90/32	560	440	390
100/38	410	380	350
110/43	360	335	310

1 Based on average ice slab weight of 4.38 - 5.0 lb
2 230/50/1 is approximately 12% lower than 230/60/1

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	200-255	50-33	120-145	70-100
70/21	205-260	70-35	130-150	80-110
80/27	210-270	70-36	145-165	80-110
90/32	270-325	70-37	165-190	100-120
100/38	300-400	90-38	210-230	130-150
110/43	330-425	100-38	220-240	140-160

1 Suction pressure drops gradually throughout the freeze cycle

S500W

All Self-Contained Water-cooled Models Before Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.3-10.9	10.6-12.5	12.0-14.0	1-2.5
80/27	9.7-11.4	10.9-12.8	12.3-14.4	
90/32	9.9-11.7	10.9-12.8	12.6-14.8	
100/38	10.1-11.9	11.4-13.4	13.0-15.2	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	550	490	440
80/27	530	480	430
90/32	520	480	420
100/38	510	460	410

1 Based on average ice slab weight of 4.12-4.75 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32.2°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	87	138	458

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-240	45-30	160-180	80-115
70/21	235-260	45-30	165-195	90-120
80/27	235-265	46-31	165-195	95-120
90/32	235-265	46-32	165-195	95-120
100/38	235-270	48-32	165-200	100-125
110/43	235-270	50-32	165-205	105-125

1 Suction pressure drops gradually throughout the freeze cycle

SD0503W

Dice Cube, Self-Contained Water-cooled Models After Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
35/2 to 70/21	10.0-11.6	11.1-12.9	12.8-14.9	0.75-2.0
90/32	10.4-12.1	11.9-13.8	13.3-15.4	
100/38	10.6-12.3	12.1-14.0	13.7-15.8	
110/43	10.9-12.6	12.2-14.2	14.1-16.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
35/2 to 70/21	550	500	440
90/32	530	470	425
100/38	520	465	415
110/43	510	460	405

1 Based on average ice slab weight of 4.38 - 5.0 lb

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32.2°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	355	700	3160

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-230	50-33	125-140	75-110
70/21	220-230	60-33	130-150	95-120
80/27	220-240	65-33	130-160	95-120
90/32	230-250	70-33	170-190	95-120
100/38	235-250	75-33	170-190	95-120
110/43	235-250	75-33	170-190	95-120

1 Suction pressure drops gradually throughout the freeze cycle

SY0505W

Half Dice Cube, Self-Contained Water-cooled After Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
35/2 to 70/21	10.0-11.6	11.1-12.9	12.8-14.9	0.75-2.0
90/32	10.4-12.1	11.5-13.3	13.3-15.4	
100/38	10.5-12.2	11.9-13.8	13.5-15.6	
110/43	10.7-12.5	12.1-14.0	13.9-16.1	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
35/2 to 70/21	550	500	440
90/32	530	485	425
100/38	525	470	420
110/43	515	465	410

1 Based on average ice slab weight of 4.38 - 5.0 lb

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32.2°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	355	700	3160

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-230	50-33	125-140	75-110
70/21	220-230	60-33	130-150	95-120
80/27	220-240	65-33	130-160	95-120
90/32	230-250	70-33	170-190	95-120
100/38	235-250	75-33	170-190	95-120
110/43	235-250	75-33	170-190	95-120

1 Suction pressure drops gradually throughout the freeze cycle

S500N

All Remote Air-cooled Condenser Models Before Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	9.9-11.7	11.1-13.1	12.6-14.8	1-2.5
80/27	9.9-11.7	11.4-13.4	12.6-14.8	
90/32	10.1-11.9	11.4-13.4	12.6-14.8	
100/38	10.9-12.8	12.3-14.4	13.3-15.6	
110/43	12.0-14.0	13.3-15.6	14.1-16.5	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	520	470	420
80/27	520	460	420
90/32	510	460	420
100/38	480	430	400
110/43	440	400	380

1 Based on average ice slab weight of 4.12 - 4.75 lb
2 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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	210-240	42-29	105-160	75-100
70/21	235-250	48-31	105-165	85-100
80/27	245-260	50-32	110-165	85-100
90/32	250-270	52-33	110-170	90-105
100/38	265-315	60-34	125-175	90-110
110/43	295-365	62-35	130-185	95-115

1 Suction pressure drops gradually throughout the freeze cycle

SD0592N

Dice Cube, Remote Air-cooled Condenser Models After Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	11.6-13.5	12.7-14.7	13.7-15.8	0.75-2.0
90/32	12.4-14.3	13.3-15.4	14.7-17.0	
100/38	12.8-14.9	14.1-16.3	15.3-17.7	
110/43	13.3-15.4	14.5-16.7	16.0-18.5	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
-20/-29 to 70/21	480	445	415
90/32	455	425	390
100/38	440	405	375
110/43	425	395	360

1 Based on average ice slab weight of 4.38 - 5.0 lb

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	205-220	50-32	100-150	75-100
70/21	240-260	60-32	110-160	75-100
80/27	240-270	60-32	110-160	75-100
90/32	250-270	60-32	120-160	80-100
100/38	300-375	85-35	130-170	80-100
110/43	310-375	90-36	130-170	80-100

1 Suction pressure drops gradually throughout the freeze cycle

SY0594N

Half Dice Cube, Remote Air-cooled Condenser Models After Serial Number 110684316

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	10.9-12.6	12.1-14.0	13.3-15.4	0.75-2.0
90/32	11.8-13.7	12.5-14.5	14.3-16.5	
100/38	12.2-14.2	13.5-15.6	14.9-17.2	
110/43	12.8-14.9	14.1-16.3	15.5-18.0	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
-20/-29 to 70/21	510	465	425
90/32	475	450	400
100/38	460	420	385
110/43	440	405	370

1 Based on average ice slab weight of 4.38 - 5.0 lb

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	205-220	50-32	100-150	75-100
70/21	240-260	60-32	110-160	75-100
80/27	240-270	60-32	110-160	75-100
90/32	250-270	60-32	120-160	80-100
100/38	300-375	85-35	130-170	80-100
110/43	310-375	90-36	130-170	80-100

1 Suction pressure drops gradually throughout the freeze cycle

S600 SERIES

S600A

All Self-Contained Air-Cooled Models

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10.0	70/21.1	90/32.2	
70/21	7.6-9.0	8.4-9.9	9.1-10.7	1-2.5
80/27	7.8-9.2	8.8-10.3	9.3-10.9	
90/32	8.6-10.1	9.5-11.2	10.2-11.9	
100/38	9.9-11.7	10.9-12.8	11.4-13.4	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10.0	70/21.1	90/32.2
70/21	650	600	560
80/27	640	580	550
90/32	590	540	510
100/38	520	480	460

1 Based on average ice slab weight of 4.12-4.75 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-255	45-27	140-160	60-80
70/21	220-270	45-28	145-170	70-90
80/27	230-300	50-30	165-185	75-95
90/32	265-345	54-32	180-215	80-105
100/38	300-395	60-35	210-245	85-120
110/43	340-430	65-39	240-280	100-140

1 Suction pressure drops gradually throughout the freeze cycle

S600W

All Self-Contained Water-Cooled Models

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	7.6-9.0	7.9-9.4	8.6-10.1	1-2.5
80/27	7.8-9.2	8.1-9.5	8.8-10.3	
90/32	7.9-9.4	8.2-9.7	8.8-10.3	
100/38	8.1-9.5	8.4-9.9	9.1-10.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	650	630	590
80/27	640	620	580
90/32	630	610	580
100/38	620	600	560

1 Based on average ice slab weight of 4.12-4.75 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	110	170	870

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-245	36-26	140-190	65-95
70/21	235-245	36-26	140-190	65-95
80/27	235-245	40-28	150-195	70-100
90/32	235-255	40-29	160-200	70-100
100/38	235-260	40-30	170-205	75-105
110/43	235-260	40-30	180-210	80-110

1 Suction pressure drops gradually throughout the freeze cycle

S600N

All Remote Air-Cooled Condenser Models

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	7.9-9.4	8.8-10.3	9.3-10.9	1-2.5
80/27	7.9-94	8.9-10.5-	9.5-11.2	
90/32	8.1-9.5	8.9-10.5	9.7-11.4	
100/38	8.8-10.3	9.7-11.4	10.4-12.2	
110/43	9.7-11.4	10.6-12.5	11.4-13.4	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	630	580	550
80/27	630	570	530
90/32	620	570	540
100/38	580	530	500
110/43	530	490	460

1 Based on average ice slab weight of 4.12 - 4.75 lb
2 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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	210-240	40-29	130-190	62-80
70/21	225-250	50-30	130-200	75-95
80/27	245-275	52-31	130-200	75-100
90/32	245-285	52-32	135-200	80-100
100/38	260-315	55-32	140-200	80-100
110/43	290-365	60-34	170-200	85-100

1 Suction pressure drops gradually throughout the freeze cycle

S850 SERIES

S850A

All Self-Contained Air-Cooled Models Before Serial Number 110683282

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.0-9.3	8.9-10.2	9.3-10.7	1-2.5
80/27	8.5-9.8	9.4-10.8	9.8-11.3	
90/32	9.7-11.1	10.9-12.5	11.4-13.1	
100/38	10.7-12.3	12.1-13.8	12.8-14.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	870	800	770
80/27	830	760	730
90/32	740	670	640
100/38	680	610	580

1 Based on average ice slab weight of 5.75 - 6.50 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-250	40-28	130-145	70-85
70/21	195-250	40-28	130-145	70-85
80/27	230-275	50-28	150-165	70-90
90/32	260-310	54-32	165-185	85-105
100/38	300-355	65-32	180-210	105-125
110/43	325-405	70-38	215-235	120-150

1 Suction pressure drops gradually throughout the freeze cycle

SD0852A

Dice Cube, Self-Contained Air-Cooled Models After Serial Number 110683282

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
35/2 to 70/21	9.0-10.4	9.8-11.2	10.5-11.2	0.75-2.0
90/32	11.3-13.0	12.0-13.7	12.9-14.8	
100/38	12.9-14.8	13.7-15.7	14.6-16.7	
110/43	14.9-17.0	15.8-18.0	16.5-18.8	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
35/2 to 70/21	785	735	690
90/32	645	615	575
100/38	575	545	515
110/43	505	480	460

1 Based on average ice slab weight of 5.75 -6.5 lb
2 230/50/1 is approximately 12% lower than 230/60/1

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-255	45-25	125-140	70-90
70/21	200-255	45-26	125-140	75-90
80/27	250-275	50-28	130-160	80-100
90/32	315-260	55-30	160-175	90-115
100/38	330-385	75-34	200-225	130-160
110/43	335-400	78-35	200-230	130-160

1 Suction pressure drops gradually throughout the freeze cycle

SY0854A

Half Dice Cube, Self-Contained Air-Cooled Models After Serial Number 110683282

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
35/2 to 70/21	7.3-8.5	8.0-9.3	8.9-10.2	0.75-2.0
90/32	9.4-10.8	9.9-11.4	11.2-12.9	
100/38	10.8-12.4	11.7-13.5	12.9-14.8	
110/43	12.7-14.5	13.7-15.7	14.9-17.0	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
35/2 to 70/21	940	870	800
90/32	760	725	650
100/38	675	625	575
110/43	585	545	505

1 Based on average ice slab weight of 5.75 -6.5 lb
2 230/50/1 is approximately 12% lower than 230/60/1

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-255	45-25	125-140	70-90
70/21	200-255	45-26	125-140	75-90
80/27	250-275	50-28	130-160	80-100
90/32	315-260	55-30	160-175	90-115
100/38	330-385	75-34	200-225	130-160
110/43	335-400	78-35	200-230	130-160

1 Suction pressure drops gradually throughout the freeze cycle

S850W

All Self-Contained Water-Cooled Models Before Serial Number 110683282

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	7.9-9.1	8.7-10.1	9.8-11.3	1-2.5
80/27	8.0-9.3	8.9-10.2	10.0-11.5	
90/32	8.1-9.4	9.0-10.3	10.2-11.7	
100/38	8.2-9.5	9.1-10.5	10.3-11.9	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	880	810	730
80/27	870	800	720
90/32	860	790	710
100/38	850	780	700

1 Based on average ice slab weight of 5.75 - 6.50 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 hours	690	1420	5200

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-245	46-28	150-160	75-90
70/21	235-245	46-28	150-160	75-90
80/27	235-245	50-30	155-175	80-95
90/32	235-270	60-30	155-185	85-105
100/38	240-275	60-30	165-185	90-110
110/43	245-280	60-30	175-190	95-115

1 Suction pressure drops gradually throughout the freeze cycle

SD0853W

Dice Cube, Self-Contained Water-Cooled Models After Serial Number 110683282

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.4-9.7	9.5-10.9	10.7-12.3	1-2.5
80/27	9.1-10.5	9.7-11.1	11.1-12.8	
90/32	9.5-10.9	10.3-11.9	11.3-13.0	
100/38	9.8-11.3	10.7-12.3	11.5-13.2	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	835	755	680
80/27	780	740	655
90/32	755	700	645
100/38	730	680	635

1 Based on average ice slab weight of 5.75 - 6.50 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 hours	580	1150	4200

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-225	45-30	140-160	70-85
70/21	235-225	60-30	140-160	70-85
80/27	235-225	65-30	140-160	70-85
90/32	250-230	65-30	140-160	70-90
100/38	255-240	70-33	140-160	75-95
110/43	260-240	70-34	140-160	75-95

1 Suction pressure drops gradually throughout the freeze cycle

SY0855W

Half Dice Cube, Self-Contained Water-Cooled Models After Serial Number 110683282

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.0-9.2	8.9-10.2	10.0-11.5	1-2.5
80/27	8.2-9.4	8.7-10.1	10.2-11.7	
90/32	8.3-9.6	9.2-10.6	10.2-11.8	
100/38	8.4-9.7	9.3-10.7	10.3-11.9	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	875	800	720
80/27	855	810	710
90/32	845	775	705
100/38	835	765	700

1 Based on average ice slab weight of 5.75 - 6.50 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 hours	580	1150	4200

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-225	45-30	140-160	70-85
70/21	235-225	60-30	140-160	70-85
80/27	235-225	65-30	140-160	70-85
90/32	250-230	65-30	140-160	70-90
100/38	255-240	70-33	140-160	75-95
110/43	260-240	70-34	140-160	75-95

1 Suction pressure drops gradually throughout the freeze cycle

S850N Remote Air-cooled Condenser

All Remote Condenser Air-Cooled Before Serial Number 110682385

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	8.6-9.9	9.1-10.5	9.7-11.1	1-2.5
80/27	8.9-10.2	9.5-11.0	10.0-11.5	
90/32	9.1-10.5	9.8-11.3	11.3-11.9	
100/38	9.8-11.3	10.7-12.3	11.2-12.9	
110/43	10.9-12.5	11.9-13.6	12.5-14.4	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	820	780	740
80/27	800	750	720
90/32	780	730	700
100/38	730	680	650
110/43	670	620	590

1 Based on average ice slab weight of 5.75 -6.50 lb
2 Ratings with JC0895 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	220-250	50-30	100-160	70-90
70/21	220-260	50-30	100-160	70-90
80/27	240-265	50-30	100-160	75-90
90/32	250-280	52-30	100-160	75-95
100/38	280-320	56-30	110-165	75-95
110/43	310-365	62-31	125-170	80-100

1 Suction pressure drops gradually throughout the freeze cycle

SD0892N

Dice Cube, Remote Condenser Air-Cooled After Serial Number 110682385

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	9.5-11.0	10.3-11.9	11.3-13.0	0.75-2.0
90/32	10.7-12.3	11.3-13.0	12.7-14.5	
100/38	11.3-13.0	12.3-14.1	13.3-15.2	
110/43	12.1-13.8	13.0-14.9	14.1-16.2	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
-20/-29 to 70/21	750	700	645
90/32	680	645	585
100/38	645	600	560
110/43	610	570	530

1 Based on average ice slab weight of 5.75 -6.5 lb

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-220	40-21	140-160	70-85
70/21	225-250	50-30	140-160	70-90
80/27	250-265	55-31	140-160	70-95
90/32	260-295	60-32	140-160	70-95
100/38	310-375	65-35	145-170	75-100
110/43	325-390	70-36	145-170	80-100

1 Suction pressure drops gradually throughout the freeze cycle

SY0894N

Half Dice Cube, Remote Condenser Air-Cooled After Serial Number 110682385

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	8.1-9.4	8.9-10.3	9.8-11.3	0.75-2.0
90/32	9.1-10.5	9.5-11.0	11.1-12.8	
100/38	9.7-11.1	10.7-12.3	11.8-13.6	
110/43	10.3-11.9	11.3-13.0	12.7-14.5	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
-20/-29 to 70/21	860	795	730
90/32	780	750	655
100/38	740	680	620
110/43	700	645	585

1 Based on average ice slab weight of 5.75 -6.5 lb

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-220	40-21	140-160	70-85
70/21	225-250	50-30	140-160	70-90
80/27	250-265	55-31	140-160	70-95
90/32	260-295	60-32	140-160	70-95
100/38	310-375	65-35	145-170	75-100
110/43	325-390	70-36	145-170	80-100

1 Suction pressure drops gradually throughout the freeze cycle

S1000 SERIES

S1000A

All Self-Contained Air-cooled Before Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	6.3-7.3	6.9-8.0	7.6-8.8	.75-2.0
80/27	6.9-8.1	7.6-8.8	8.4-9.6	
90/32	7.8-9.0	8.5-9.8	9.4-10.8	
100/38	9.3-10.7	10.2-11.7	11.0-12.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1060	990	910
80/27	980	910	840
90/32	890	830	760
100/38	770	710	660

1 Based on average ice slab weight of 5.75 - 6.50 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	50-26	130-145	70-90
70/21	220-275	50-26	130-145	70-90
80/27	235-290	52-28	150-165	75-95
90/32	265-330	58-28	165-185	85-110
100/38	300-360	60-31	180-210	95-120
110/43	330-415	66-32	215-235	115-145

1 Suction pressure drops gradually throughout the freeze cycle

SD1002A

Dice Cube, Self-Contained Air-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	6.4-7.4	7.0-8.1	7.8-9.0	0.75-2.0
90/32	7.9-9.1	8.4-9.6	9.6-11.1	
100/38	8.9-10.2	9.7-11.1	10.7-12.3	
110/43	10.2-11.7	11.0-12.7	12.0-13.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
70/21	1050	970	890
90/32	880	840	745
100/38	800	740	680
110/43	710	660	615

1 Based on average ice slab weight of 5.75 -6.5 lb
2 230/50/1 is approximately 12% lower than 230/60/1

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	45-26	130-145	70-90
70/21	220-275	50-27	130-145	70-90
80/27	235-290	50-28	150-165	75-95
90/32	265-330	55-30	165-185	85-110
100/38	300-360	60-35	180-210	95-120
110/43	330-415	60-37	215-235	115-145

1 Suction pressure drops gradually throughout the freeze cycle

SY1004A

Half Dice Cube, Self-Contained Air-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
35/2 to 70/21	6.4-7.4	7.0-8.1	7.8-9.0	0.75-2.0
90/32	7.9-9.1	8.4-9.6	9.6-11.1	
100/38	8.9-10.2	9.7-11.1	10.7-12.3	
110/43	10.2-11.7	11.0-12.7	12.0-13.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
35/2 to 70/21	1050	970	890
90/32	880	840	745
100/38	800	740	680
110/43	710	660	615

1 Based on average ice slab weight of 5.75 -6.5 lb
2 230/50/1 is approximately 12% lower than 230/60/1

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	45-26	130-145	70-90
70/21	220-275	50-27	130-145	70-90
80/27	235-290	50-28	150-165	75-95
90/32	265-330	55-30	165-185	85-110
100/38	300-360	60-35	180-210	95-120
110/43	330-415	60-37	215-235	115-145

1 Suction pressure drops gradually throughout the freeze cycle

S1000W

All Self-Contained Water-cooled Before Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	6.8-7.9	7.4-8.6	8.5-9.8	.75-2.0
80/27	6.9-8.0	7.5-8.7	8.6-9.9	
90/32	6.9-8.1	7.6-8.8	8.7-10.1	
100/38	7.0-8.1	7.7-8.9	8.9-10.2	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1000	930	830
80/27	990	920	820
90/32	980	910	810
100/38	970	900	800

1 Based on average ice slab weight of 5.75 - 6.50 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 hours	710	1500	5100

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-245	40-24	160-175	75-90
70/21	235-245	40-25	160-175	75-90
80/27	235-250	42-26	170-185	80-95
90/32	240-270	48-28	175-205	85-105
100/38	250-280	52-28	180-210	90-110
110/43	250-285	54-28	185-215	95-115

1 Suction pressure drops gradually throughout the freeze cycle

SD1003W

Dice Cube, Self-Contained Water-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	6.8-7.9	7.1-8.2	8.2-9.5	0.75-2.0
90/32	7.0-8.1	7.2-8.3	8.4-9.6	
100/38	7.1-8.2	7.7-8.9	8.5-9.8	
110/43	7.2-8.3	7.8-9.0	8.5-9.8	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1000	965	850
90/32	975	955	840
100/38	965	900	930
110/43	955	890	825

1 Based on average ice slab weight of 5.75 -6.5 lb

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 Hours	760	1600	5500

1 Water regulating valve set to maintain 220 PSIG discharge pressure

OPERATING PRESSURES

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	215-225	45-22	145-170	75-85
70/21	215-225	45-23	150-170	75-90
80/27	220-225	45-24	150-175	75-95
90/32	220-230	45-25	155-175	80-100
100/38	230-250	50-26	160-195	80-110
110/43	240-260	50-27	170-200	80-115

1 Suction pressure drops gradually throughout the freeze cycle

SY1005W

Half Dice Cube, Self-Contained Water-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	6.2-7.2	7.0-8.1	8.0-9.3	0.75-2.0
90/32	6.5-7.6	7.1-8.3	8.2-9.4	
100/38	6.7-7.8	7.4-8.6	8.2-9.5	
110/43	6.9-8.0	7.5-8.7	8.3-9.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1075	970	870
90/32	1030	960	855
100/38	1010	930	850
110/43	990	915	845

1 Based on average ice slab weight of 5.75 -6.5 lb

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 Hours	760	1600	5500

1 Water regulating valve set to maintain 220 PSIG discharge pressure

OPERATING PRESSURES

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	215-225	45-22	145-170	75-85
70/21	215-225	45-23	150-170	75-90
80/27	220-225	45-24	150-175	75-95
90/32	220-230	45-25	155-175	80-100
100/38	230-250	50-26	160-195	80-110
110/43	240-260	50-27	170-200	80-115

1 Suction pressure drops gradually throughout the freeze cycle

S1000N

All Remote Condenser Air-cooled Before Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	7.1-8.3	7.6-8.8	8.4-9.6	.75-2.0
80/27	7.5-8.7	8.0-9.3	8.9-10.2	
90/32	7.7-8.9	8.2-9.5	9.1-10.5	
100/38	8.1-9.4	8.7-10.1	9.7-11.1	
110/43	8.7-10.1	9.4-10.8	10.7-12.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	960	910	840
80/27	920	870	800
90/32	900	850	780
100/38	860	810	740
110/43	810	760	680

1 Based on average ice slab weight of 5.75 - 6.50 lb
2 Ratings with JC0895 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	220-255	40-26	100-170	65-90
70/21	245-260	40-27	100-170	65-90
80/27	245-285	42-28	100-170	65-95
90/32	250-300	44-28	100-175	65-100
100/38	275-330	48-29	115-180	65-105
110/43	310-375	56-31	125-195	65-105

1 Suction pressure drops gradually throughout the freeze cycle

SD1092N

Dice Cube, Remote Condenser Air-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	6.5-7.6	7.1-8.3	7.9-9.1	0.75-2.0
90/32	7.5-8.7	8.0-9.3	9.1-10.5	
100/38	8.1-9.3	8.9-10.2	9.8-11.3	
110/43	8.7-10.1	9.6-11.1	10.8-12.4	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1030	960	885
90/32	920	870	780
100/38	865	800	730
110/43	810	745	675

1 Based on average ice slab weight of 5.75 -6.5 lb

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-220	35-22	100-165	70-85
70/21	220-260	40-24	100-170	70-90
80/27	245-285	45-25	100-170	70-95
90/32	250-300	50-27	100-170	70-95
100/38	285-330	60-32	130-180	75-100
110/43	300-375	60-32	130-190	80-100

1 Suction pressure drops gradually throughout the freeze cycle

SY1094N

Half Dice Cube, Remote Condenser Air-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	6.3-7.3	6.8-7.9	7.4-8.5	0.75-2.0
90/32	7.2-8.4	7.5-8.7	8.5-9.8	
100/38	7.7-8.9	8.4-9.6	9.2-10.6	
110/43	8.3-9.6	9.0-10.4	9.9-11.4	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1060	1000	935
90/32	950	920	830
100/38	900	840	775
110/43	845	785	725

1 Based on average ice slab weight of 5.75 -6.5 lb

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-220	35-22	100-165	70-85
70/21	220-260	40-24	100-170	70-90
80/27	245-285	45-25	100-170	70-95
90/32	250-300	50-27	100-170	70-95
100/38	285-330	60-32	130-180	75-100
110/43	300-375	60-32	130-190	80-100

1 Suction pressure drops gradually throughout the freeze cycle

S1200 SERIES

S1200A

All Self-Contained Air-cooled Before Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	7.3-8.2	8.3-9.3	8.8-9.8	1-2.5
80/27	7.6-8.5	8.6-9.6	9.2-10.3	
90/32	8.4-9.4	9.2-10.3	10.1-11.3	
100/38	9.5-10.6	10.5-11.7	11.4-12.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1230	1100	1050
80/27	1190	1070	1010
90/32	1090	1010	930
100/38	980	900	840

1 Based on average ice slab weight of 7.5 - 8.25 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	36-23	135-155	65-85
70/21	220-275	38-24	140-180	70-90
80/27	240-300	38-25	155-180	75-95
90/32	265-340	38-26	175-195	85-100
100/38	310-390	40-27	200-215	95-110
110/43	340-430	42-29	225-240	115-130

1 Suction pressure drops gradually throughout the freeze cycle

SD1202A

Dice Cube, Self-Contained Air-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.3-9.3	8.9-10.0	9.7-10.8	0.75-2.0
80/27	9.2-10.3	9.9-11.0	10.6-11.8	
90/32	10.2-11.3	10.6-11.8	11.8-13.2	
100/38	11.4-12.6	12.3-13.6	13.3-14.8	
110/43	12.9-14.3	13.9-15.5	15.1-16.8	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
70/21	1100	1035	965
80/27	1010	950	890
90/32	925	890	810
100/38	840	785	730
110/43	750	700	650

1 Based on average ice slab weight of 7.5 - 8.25 lb
2 230/50/1 is approximately 12% lower than 230/60/1

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	40-23	135-155	65-85
70/21	220-280	50-24	140-180	70-90
80/27	240-300	50-24	155-180	75-95
90/32	265-340	55-25	175-195	85-100
100/38	310-390	60-28	200-215	95-110
110/43	340-430	60-30	225-240	115-130

1 Suction pressure drops gradually throughout the freeze cycle

SY1204A

Half Dice Cube, Self-Contained Air-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	7.5-8.4	8.2-9.2	9.1-10.2	0.75-2.0
80/27	8.2-9.2	9.0-10.0	10.0-11.1	
90/32	9.0-10.1	9.9-11.1	11.0-12.2	
100/38	10.1-11.2	11.0-12.2	12.1-13.4	
110/43	11.3-12.6	12.3-13.6	13.5-15.0	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
70/21	1205	1110	1015
80/27	1115	1030	940
90/32	1025	945	865
100/38	935	865	795
110/43	845	785	720

1 Based on average ice slab weight of 5.75 -6.5 lb
2 230/50/1 is approximately 12% lower than 230/60/1

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	195-255	40-23	135-155	65-85
70/21	220-280	50-24	140-180	70-90
80/27	240-300	50-24	155-180	75-95
90/32	265-340	55-25	175-195	85-100
100/38	310-390	60-28	200-215	95-110
110/43	340-430	60-30	225-240	115-130

1 Suction pressure drops gradually throughout the freeze cycle

S1200W

All Self-Contained Water-cooled Before Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	7.1-7.9	7.8-8.7	9.1-10.1	1-2.5
80/27	7.4-8.2	7.9-8.8	9.1-10.1	
90/32	7.5-8.4	8.1-9.1	9.3-10.4	
100/38	7.9-8.8	8.2-9.2	9.4-10.5	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1260	1160	1020
80/27	1220	1150	1020
90/32	1200	1120	1000
100/38	1150	1110	990

1 Based on average ice slab weight of 7.5 - 8.25 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	91	150	660

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-245	36-24	150-175	70-85
70/21	235-245	36-24	150-185	70-90
80/27	235-250	38-25	160-190	80-95
90/32	240-270	40-26	170-195	80-105
100/38	250-280	40-26	175-205	85-110
110/43	250-285	42-26	180-215	90-115

1 Suction pressure drops gradually throughout the freeze cycle

SD1203W

Dice Cube, Self-Contained Water-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	7.8-8.7	8.8-8.9	10.1-11.3	0.75-2.0
80/27	7.9-8.8	8.9-9.9	10.2-11.3	
90/32	7.9-8.9	9.0-10.0	10.2-11.4	
100/38	8.0-9.0	9.0-10.1	10.3-11.5	
110/43	8.1-9.1	9.1-10.2	10.4-11.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1165	1050	930
80/27	1155	1040	925
90/32	1145	1030	920
100/38	1135	1025	915
110/43	1125	1015	905

1 Based on average ice slab weight of 5.75 -6.5 lb

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 Hours	770	1560	5700

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	215-225	40-20	150-175	70-85
70/21	215-225	42-20	150-185	70-90
80/27	235-250	44-22	160-190	80-95
90/32	240-270	45-22	170-195	80-105
100/38	240-280	50-22	175-205	85-110
110/43	240-280	50-23	180-215	85-115

1 Suction pressure drops gradually throughout the freeze cycle

SY1205W

Half Dice Cube, Self-Contained Water-cooled After Serial Number 110697023

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	7.7-8.7	8.5-9.4	9.8-10.9	0.75-2.0
80/27	7.8-8.7	8.5-9.6	9.9-11.0	
90/32	7.8-8.7	8.6-9.7	9.9-11.1	
100/38	7.9-8.8	8.8-9.8	10.0-11.1	
110/43	7.9-8.9	8.9-9.9	10.1-11.2	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1170	1085	955
80/27	1165	1075	950
90/32	1160	1065	945
100/38	1155	1050	940
110/43	1145	1040	935

1 Based on average ice slab weight of 5.75 -6.5 lb

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/24 Hours	770	1560	5700

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	215-225	40-20	150-175	70-85
70/21	215-225	42-20	150-185	70-90
80/27	235-250	44-22	160-190	80-95
90/32	240-270	45-22	170-195	80-105
100/38	240-280	50-22	175-205	85-110
110/43	240-280	50-23	180-215	85-115

1 Suction pressure drops gradually throughout the freeze cycle

S1400 SERIES

S1400 Self-contained air-cooled

All Self-Contained Air-cooled with a Manufacture Date Before 0905 (May 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.4-9.4	9.4-10.5	10.0-11.2	1 - 2.5
80/27	8.9-9.9	9.9-11.1	10.8-12.0	
90/32	10.2-11.2	10.9-12.2	11.8-13.2	
100/38	11.6-12.9	12.8-14.2	13.8-15.4	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1450	1320	1250
80/27	1390	1260	1170
90/32	1250	1160	1080
100/38	1100	1010	940

1 Based on average ice slab weight of 10 - 11 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	40-28	150-180	70-90
70/21	220-280	42-28	160-180	70-90
80/27	225-290	44-30	160-180	70-90
90/32	260-310	46-30	180-200	80-100
100/38	290-360	48-31	200-220	90-115
110/43	320-400	50-32	220-250	100-140

1 Suction pressure drops gradually throughout the freeze cycle

SD1402A

Dice Cube, Self-Contained Air-Cooled With a Manufacture Date of 0905 (May 2009) or Later

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.8-10.0	9.6-11.0	10.3-11.7	0.75 - 2.5
80/27	9.5-10.9	10.4-11.9	11.2-12.8	
90/32	10.1-11.5	11.1-12.7	12.0-13.7	
100/38	11.3-12.9	12.6-14.3	13.7-15.6	
110/43	13.0-14.7	14.5-16.5	16.1-18.2	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1440	1330	1250
80/27	1340	1240	1160
90/32	1270	1170	1090
100/38	1150	1050	970
110/43	1020	920	840

1 Based on average ice slab weight of 10.25 - 11.5 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	40-24	150-180	70-90
70/21	220-280	40-26	160-180	70-90
80/27	240-290	50-27	160-180	70-90
90/32	260-330	50-27	180-200	80-100
100/38	300-370	54-28	200-220	90-115
110/43	330-410	60-29	220-250	100-130

1 Suction pressure drops gradually throughout the freeze cycle

SY1404A

Half Dice Cube, Self-Contained Air-Cooled With a Manufacture Date of 0905 (May 2009) or Later

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.7-9.9	9.6-11.0	10.2-11.6	0.75 - 2.5
80/27	9.1-10.4	10.1-11.5	10.8-12.3	
90/32	9.7-11.0	10.8-12.3	11.6-13.2	
100/38	10.6-12.1	11.9-13.6	12.8-14.6	
110/43	11.9-13.6	13.6-15.4	14.7-16.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1450	1330	1260
80/27	1390	1270	1200
90/32	1320	1200	1130
100/38	1220	1100	1030
110/43	1100	980	910

1 Based on average ice slab weight of 10.25 - 11.5 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	40-24	150-180	70-90
70/21	220-280	40-26	160-180	70-90
80/27	240-290	50-27	160-180	70-90
90/32	260-330	50-27	180-200	80-100
100/38	300-370	54-28	200-220	90-115
110/43	330-410	60-29	220-250	100-130

1 Suction pressure drops gradually throughout the freeze cycle

S1400 Self-contained Water-cooled

All Self-Contained Water-cooled with a Manufacture Date Before 0711 (November 2007)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.9-10.0	9.8-10.9	11.2-12.5	1 - 2.5
80/27	8.9-10.0	9.8-10.9	11.4-12.6	
90/32	8.9-10.0	9.6-10.7	11.6-12.9	
100/38	9.0-10.1	10.0-11.2	11.7-13.0	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1380	1280	1130
80/27	1380	1280	1120
90/32	1380	1300	1100
100/38	1370	1250	1090

1 Based on average ice slab weight of 10 - 11 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	90	145	590

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-245	40-28	160-175	70-90
70/21	235-245	42-29	160-175	75-100
80/27	235-260	42-30	170-195	80-105
90/32	240-270	42-30	180-200	85-110
100/38	250-280	43-30	185-200	90-110
110/43	250-285	44-31	190-205	90-115

1 Suction pressure drops gradually throughout the freeze cycle

SD1403W

Dice Cube, Self-Contained Water-Cooled With a Manufacture Date From 0711 to 0905 (November 2007 to May 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.0-10.0	10.0-11.2	11.3-12.6	0.75-2.0
90/32	9.4-10.5	10.4-11.6	11.8-13.1	
100/38	9.6-10.7	10.7-11.9	12.0-13.3	
110/43	9.8-10.9	10.9-12.1	12.2-13.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1375	1250	1125
90/32	1325	1210	1085
100/38	1300	1185	1070
110/43	1280	1165	1050

1 Based on average ice slab weight of 10 - 11 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	85	140	510

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	225-235	40-28	160-175	70-90
70/21	225-235	42-28	160-175	75-100
80/27	230-260	42-28	170-195	80-105
90/32	240-270	42-28	180-200	85-110
100/38	250-280	43-30	185-200	90-110
110/43	250-285	44-31	190-205	90-115

1 Suction pressure drops gradually throughout the freeze cycle

SY1405W

Half Dice Cube, Self-Contained Water-Cooled With a Manufacture Date From 0711 to 0905 (November 2007 to May 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES -

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.6-9.8	9.4-10.8	10.8-12.3	0.75-2.0
80/27	8.8-10.0	9.6-11.0	11.0-12.5	
90/32	8.8-10.1	9.8-11.1	11.2-12.8	
100/38	8.9-10.2	9.9-11.2	11.3-12.9	
110/43	9.0-10.2	9.9-11.3	11.4-13.0	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1460	1350	1200
90/32	1430	1310	1160
100/38	1420	1300	1150
110/43	1410	1290	1140

1 Based on average ice slab weight of 10.25 - 11.5 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	82	143	430

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	40-24	150-180	70-90
70/21	220-280	40-26	160-180	70-90
80/27	240-290	50-27	160-180	70-90
90/32	260-330	50-27	180-200	80-100
100/38	300-370	54-28	200-220	90-115
110/43	330-410	60-29	220-250	100-130

1 Suction pressure drops gradually throughout the freeze cycle

SD1403W

Dice Cube, Self-Contained Water-Cooled With a Manufacture Date of 0905 (May 2009) or Later

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.8-10.1	9.8-11.1	11.2-12.8	0.75-2.0
80/27	8.9-10.2	9.9-11.2	11.3-12.9	
90/32	9.0-10.2	9.9-11.3	11.4-13.0	
100/38	9.0-10.3	10.0-11.4	11.6-13.2	
110/43	9.1-10.4	10.1-11.5	11.7-13.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1430	1310	1160
90/32	1410	1290	1140
100/38	1400	1280	1130
110/43	1390	1270	1120

1 Based on average ice slab weight of 10.25 - 11.5 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	82	143	430

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	40-24	150-180	70-90
70/21	220-280	40-26	160-180	70-90
80/27	240-290	50-27	160-180	70-90
90/32	260-330	50-27	180-200	80-100
100/38	300-370	54-28	200-220	90-115
110/43	330-410	60-29	220-250	100-130

1 Suction pressure drops gradually throughout the freeze cycle

SY1405W

Half Dice Cube, Self-Contained Water-Cooled With a Manufacture Date of 0905 (May 2009) or Later

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.6-9.6	9.6-10.7	10.9-12.2	0.75-2.0
90/32	8.8-9.9	9.8-10.9	11.2-12.5	
100/38	9.0-10.0	10.1-11.2	11.4-12.7	
110/43	9.1-10.1	10.2-11.4	11.6-12.9	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1430	1300	1160
90/32	1395	1275	1130
100/38	1375	1245	1115
110/43	1360	1230	1100

1 Based on average ice slab weight of 10 - 11 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	85	140	510

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	225-235	40-28	160-175	70-90
70/21	225-235	42-28	160-175	75-100
80/27	230-260	42-28	170-195	80-105
90/32	240-270	42-28	180-200	85-110
100/38	250-280	43-30	185-200	90-110
110/43	250-285	44-31	190-205	90-115

1 Suction pressure drops gradually throughout the freeze cycle

S1400 Remote Air-cooled Condenser

All Remote Condenser Air-cooled with a Manufacture Date Before 0905 (May 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	9.1-10.1	10.1-11.3	11.0-12.3	1 - 2.5
80/27	9.2-10.2	10.0-11.2	11.2-12.5	
90/32	9.4-10.5	10.4-11.6	11.4-12.6	
100/38	9.9-11.1	11.1-12.4	12.3-13.7	
110/43	9.1-10.1	10.1-11.3	11.0-12.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	1360	1240	1150
80/37	1350	1250	1130
90/32	1320	1210	1120
100/38	1260	1140	1040
110/43	1360	1240	1150

1 Based on average ice slab weight of 10 - 11 lb
2 Ratings with JC1395 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	210-240	38-28	100-160	70-85
70/21	240-265	40-28	110-170	70-90
80/27	250-275	41-29	110-180	70-95
90/32	250-290	42-30	110-180	70-95
100/38	275-335	43-31	110-185	75-100
110/43	310-375	45-32	120-190	80-100

1 Suction pressure drops gradually throughout the freeze cycle

SD1492N

Dice Cube, Remote Condenser Air-Cooled With a Manufacture Date of 0905 (May 2009) or Later

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.2-10.5	10.1-11.5	10.8-12.3	0.75 - 2.5
80/27	9.4-10.7	10.3-11.7	11.0-12.5	
90/32	9.6-11.0	10.7-12.2	11.4-13.0	
100/38	10.4-11.9	11.7-13.3	12.6-14.3	
110/43	11.2-12.8	12.7-14.4	13.7-15.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
70/21	1380	1270	1200
80/37	1360	1250	1180
90/32	1330	1210	1140
100/38	1240	1120	1050
110/43	1160	1040	970

1 Based on average ice slab weight of 10.25 - 11.5 lb
2 Ratings with JC1395 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	210-240	38-24	100-160	70-85
70/21	240-265	40-26	110-170	70-90
80/27	250-275	45-28	110-180	70-95
90/32	250-290	48-29	110-180	70-95
100/38	275-335	51-31	110-185	75-100
110/43	310-375	55-32	120-190	80-110

1 Suction pressure drops gradually throughout the freeze cycle

SY1494N

Half Dice Cube, Remote Condenser Air-Cooled With a Manufacture Date of 0905 (May 2009) or Later

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.8-10.1	9.7-11.0	10.6-12.1	0.75 - 2.5
80/27	9.0-10.3	9.9-11.3	10.9-12.4	
90/32	9.3-10.6	10.5-12.0	11.2-12.8	
100/38	9.9-11.2	11.2-12.8	12.0-13.7	
110/43	10.6-12.1	12.0-13.7	13.1-14.9	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
70/21	1430	1320	1220
80/37	1400	1290	1190
90/32	1370	1230	1160
100/38	1300	1160	1090
110/43	1220	1090	1010

1 Based on average ice slab weight of 10.25 - 11.5 lb
2 Ratings with JC1395 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	210-240	38-24	100-160	70-85
70/21	240-265	40-26	110-170	70-90
80/27	250-275	45-28	110-180	70-95
90/32	250-290	48-29	110-180	70-95
100/38	275-335	51-31	110-185	75-100
110/43	310-375	55-32	120-190	80-110

1 Suction pressure drops gradually throughout the freeze cycle

S1600 SERIES

S1600A

All Self-Contained Air-cooled

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.6-10.5	10.7-11.7	11.1-12.2	1 - 2.5
80/27	10.0-11.0	11.3-12.4	12.1-13.2	
90/32	11.1-12.2	12.2-13.3	12.2-13.3	
100/38	12.5-13.7	13.7-15.0	15.1-16.5	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1690	1540	1480
80/27	1630	1460	1380
90/32	1490	1370	1370
100/38	1340	1230	1130

1 Based on average ice slab weight of 13 - 14.125 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	46-27	150-165	70-90
70/21	220-280	50-28	150-165	70-90
80/27	240-300	55-32	155-175	75-95
90/32	270-330	58-34	165-185	80-100
100/38	310-375	65-36	185-200	90-105
110/43	330-415	70-38	200-245	95-115

1 Suction pressure drops gradually throughout the freeze cycle

S1600W

All Self-Contained Water-cooled

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.8-10.8	10.9-12.0	12.4-13.6	1 - 2.5
80/27	10.1-11.1	11.0-12.1	12.7-13.9	
90/32	10.2-11.2	11.1-12.2	12.8-14.0	
100/38	10.4-11.5	11.4-12.5	13.0-14.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1660	1510	1350
80/27	1610	1500	1320
90/32	1600	1480	1310
100/38	1570	1450	1290

1 Based on average ice slab weight of 13 - 14.125 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C Gal/100 lbs. of Ice	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
	100	150	550

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	235-245	46-27	160-175	70-90
70/21.1	235-275	50-27	160-180	70-95
80/26.7	240-280	52-28	160-190	70-100
90/32.2	240-285	52-28	160-190	75-100
100/37.8	250-290	52-29	165-195	75-100
110/43.3	255-295	52-30	170-200	80-100

1 Suction pressure drops gradually throughout the freeze cycle

S1600N

All Remote Air-cooled Condenser

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	10.4-11.5	11.2-12.3	12.4-13.6	1 - 2.5
80/27	10.5-11.5	11.7-12.8	12.5-13.7	
90/32	10.8-11.9	11.7-12.8	13.0-14.3	
100/38	11.7-12.8	12.9-14.1	13.8-15.2	
110/43	10.4-11.5	11.2-12.3	12.4-13.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	1570	1470	1350
80/27	1560	1420	1340
90/32	1520	1420	1290
100/38	1420	1300	1220
110/43	1570	1470	1350

1 Based on average ice slab weight of 13 - 14.125 lb.
2 Ratings with JC1395 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	220-230	40-28	100-160	65-85
70/21	250-275	50-28	100-170	70-85
80/27	250-290	50-28	100-175	70-90
90/32	255-300	52-30	100-175	75-95
100/38	270-340	54-31	110-180	75-95
110/43	310-370	56-32	120-190	80-100

1 Suction pressure drops gradually throughout the freeze cycle

S1800 SERIES

S1800 Self-contained air-cooled

All Self-Contained Air-cooled with a Manufacture Date Before 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.7-9.6	9.6-10.6	10.4-11.5	1 - 2.5
80/27	9.4-10.3	10.2-11.2	10.9-12.0	
90/32	10.0-11.0	10.7-11.8	11.8-12.9	
100/38	11.2-12.3	12.2-13.3	13.0-14.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1830	1680	1570
80/27	1720	1600	1510
90/32	1630	1530	1410
100/38	1470	1370	1290

1 Based on average ice slab weight of 13 - 14.125 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	40-25	160-170	70-85
70/21	220-280	40-26	160-180	70-85
80/27	225-290	42-28	175-200	80-95
90/32	260-330	44-28	175-200	80-95
100/38	300-380	46-30	190-215	90-110
110/43	320-415	50-30	210-250	105-140

1 Suction pressure drops gradually throughout the freeze cycle

SD1802A

Dice Cube, Self-Contained Air-cooled with a Manufacture Date After 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.9-10.1	9.7-11.0	10.5-12.0	1 - 2.5
80/27	9.7-11.0	10.6-12.1	11.6-13.2	
90/32	10.5-11.9	11.5-13.1	12.7-14.4	
100/38	11.5-13.1	12.8-14.5	14.2-16.1	
110/43	12.9-14.6	14.5-16.4	16.3-18.4	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1830	1700	1580
80/27	1700	1570	1450
90/32	1590	1460	1340
100/38	1460	1330	1210
110/43	1320	1190	1070

1 Based on average ice slab weight of 13 - 14.125 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	40-24	150-180	70-90
70/21	220-280	40-26	160-180	70-90
80/27	240-290	50-27	160-180	70-90
90/32	260-330	50-27	180-200	80-100
100/38	300-370	54-28	200-220	90-115
110/43	330-410	60-30	220-250	100-130

1 Suction pressure drops gradually throughout the freeze cycle

SY1804A

Half Dice Cube, Self-Contained Air-cooled with a Manufacture Date After 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.6-9.8	9.6-10.9	10.2-11.7	1 - 2.5
80/27	8.9-10.2	10.0-11.4	10.8-12.2	
90/32	9.7-11.1	11.0-12.5	11.9-13.5	
100/38	10.7-12.2	12.2-13.8	13.2-15.0	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1890	1720	1620
80/27	1820	1650	1550
90/32	1690	1520	1420
100/38	1560	1390	1290

1 Based on average ice slab weight of 13 - 14.125 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	220-280	40-24	150-180	70-90
70/21	220-280	40-26	160-180	70-90
80/27	240-290	50-27	160-180	70-90
90/32	260-330	50-27	180-200	80-100
100/38	300-370	54-28	200-220	90-115
110/43	330-410	60-30	220-250	100-130

1 Suction pressure drops gradually throughout the freeze cycle

S1800 Self-Contained Water-Cooled

All Self-Contained Water-cooled with a Manufacture Date Before 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.5-9.4	9.2-10.1	10.7-11.8	1 - 2.5
80/27	8.5-9.4	9.3-10.3	10.9-12.0	
90/32	8.6-9.4	9.4-10.4	11.1-12.2	
100/38	8.7-9.6	9.6-10.5	11.2-12.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1870	1750	1530
80/27	1870	1730	1510
90/32	1860	1710	1490
100/38	1830	1690	1470

1 Based on average ice slab weight of 13 - 14.125 lb.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	95	155	510

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	235-245	40-25	160-190	70-90
70/21	235-265	40-26	160-190	70-90
80/27	240-270	42-26	165-190	70-90
90/32	240-275	45-27	165-190	70-90
100/38	245-280	50-28	165-190	70-95
110/43	245-290	52-28	175-200	80-100

1 Suction pressure drops gradually throughout the freeze cycle

SD1803W

Dice Cube, Self-Contained Water-cooled with a Manufacture Date After 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.6-9.8	9.6-11.0	10.8-12.2	1 - 2.5
80/27	8.8-10.0	9.8-11.2	11.0-12.5	
90/32	8.8-10.1	9.9-11.3	11.1-12.6	
100/38	9.0-10.3	10.1-11.5	11.3-12.9	
110/43	9.1-10.4	10.2-11.7	11.5-13.1	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1880	1710	1550
80/27	1850	1680	1520
90/32	1840	1670	1510
100/38	1810	1640	1480
110/43	1790	1620	1460

1 Based on average ice slab weight of 13 - 14.125 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	230-240	45-25	145-165	65-80
70/21	220-280	40-26	160-180	70-90
80/27	230-240	45-25	145-165	65-80
90/32	240-270	50-25	150-190	70-90
100/38	240-270	55-25	155-190	70-90
110/43	240-270	55-25	155-190	70-90

1 Suction pressure drops gradually throughout the freeze cycle

SY1805W

Half Dice Cube, Self-Contained Water-cooled with a Manufacture Date After 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	8.6-9.8	9.1-10.4	10.6-12.1	1 - 2.5
80/27	8.7-10.0	9.3-10.6	10.8-12.3	
90/32	8.8-10.0	9.4-10.7	10.9-12.4	
100/38	8.9-10.1	9.5-10.8	11.1-12.6	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	1890	1790	1570
80/27	1860	1760	1540
90/32	1850	1750	1530
100/38	1830	1730	1510

1 Based on average ice slab weight of 13 - 14.125 lb.

OPERATING PRESSURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	230-240	45-25	145-165	65-80
70/21	220-280	40-26	160-180	70-90
80/27	230-240	45-25	145-165	65-80
90/32	240-270	50-25	150-190	70-90
100/38	240-270	55-25	155-190	70-90
110/43	240-270	55-25	155-190	70-90

1 Suction pressure drops gradually throughout the freeze cycle

S1800 Remote Air-cooled Condenser

All Remote Condenser Air-cooled with a Manufacture Date Before 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	8.9-9.8	10.0-11.0	10.7-11.7	1 - 2.5
80/27	9.0-9.9	10.1-11.1	10.8-11.9	
90/32	9.2-10.1	10.1-11.1	10.8-11.9	
100/38	9.6-10.5	10.0-11.0	11.6-12.7	
110/43	10.4-11.5	11.5-12.6	12.5-13.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	1800	1630	1540
80/27	1780	1620	1520
90/32	1750	1610	1520
100/38	1690	1630	1430
110/43	1570	1440	1340

1 Based on average ice slab weight of 13 - 14.125 lb

2 Ratings with JC1395 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	220-250	44-26	110-170	65-85
70/21	240-280	50-28	115-180	70-90
80/27	245-290	50-28	115-180	70-90
90/32	250-300	52-28	120-195	70-90
100/38	260-340	60-28	125-210	70-90
110/43	295-390	60-30	125-220	80-100

1 Suction pressure drops gradually throughout the freeze cycle

SD1892N

Dice Cube, Remote Condenser Air-cooled with a Manufacture Date After 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	9.4-10.7	10.3-11.7	11.1-12.6	1 - 2.5
80/27	9.5-10.8	10.5-11.9	11.3-12.8	
90/32	10.0-11.4	11.1-12.6	12.0-13.6	
100/38	10.8-12.2	12.0-13.6	13.0-14.8	
110/43	11.7-13.3	13.1-14.9	14.3-16.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	1750	1610	1510
80/27	1730	1590	1490
90/32	1650	1510	1410
100/38	1550	1410	1310
110/43	1440	1300	1200

1 Based on average ice slab weight of 13 - 14.125 lb

2 Ratings with JC1395 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	230-265	38-24	100-160	70-85
70/21	240-265	40-26	110-170	70-90
80/27	250-275	45-28	110-180	70-95
90/32	250-300	52-29	110-180	70-95
100/38	275-335	55-31	110-185	75-100
110/43	310-385	55-32	120-190	80-110

1 Suction pressure drops gradually throughout the freeze cycle

SY1894N

Half Dice Cube, Remote Condenser Air-cooled with a Manufacture Date After 0910 (October 2009)

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
-20/-29 to 70/21	9.2-10.5	10.0-11.4	10.8-12.2	1 - 2.5
80/27	9.6-10.9	10.4-11.8	11.2-12.7	
90/32	10.2-11.6	10.8-12.3	11.7-13.3	
100/38	10.8-12.2	11.5-13.1	12.5-14.2	
110/43	11.8-13.4	12.7-14.4	13.8-15.7	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C[12]		
	50/10	70/21	90/32
-20/-29 to 70/21	1770	1650	1550
80/27	1720	1600	1500
90/32	1630	1540	1440
100/38	1550	1460	1360
110/43	1430	1340	1240

1 Based on average ice slab weight of 13 - 14.125 lb

2 Ratings with JC1395 condenser

OPERATING PRESSURES

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
-20/-29 to 50/10	230-265	38-24	100-160	70-85
70/21	240-265	40-26	110-170	70-90
80/27	250-275	45-28	110-180	70-95
90/32	250-300	52-29	110-180	70-95
100/38	275-335	55-31	110-185	75-100
110/43	310-385	55-32	120-190	80-110

1 Suction pressure drops gradually throughout the freeze cycle

S3300 SERIES

SDT3000W Self Contained Water-Cooled

All Dice Cube, Self-Contained Water-cooled Ice Machines

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	10.9-12.3	11.9-13.4	13.8-15.6	0.75 - 2.5
80/27	11.0-12.5	12.1-13.7	14.1-15.9	
90/32	11.1-12.6	12.6-14.2	14.3-16.2	
100/38	11.2-12.6	12.7-14.4	14.5-16.4	
110/43	11.2-12.7	12.9-14.5	14.6-16.5	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	2970	2750	2395
80/27	2940	2705	2355
90/32	2920	2610	2325
100/38	2905	2580	2300
110/43	2885	2560	2280

1 Based on average ice slab weight of 6.38-7.13 lb. per evaporator.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	52	108	358

1 Water regulating valve set to maintain 330 PSIG discharge pressure

OPERATING PRESSURES

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
70/21	325-335	60-44	180-200	95-115
80/27	325-335	70-45	185-205	110-125
90/32	325-335	75-45	180-210	110-125
100/38	325-335	75-45	180-210	110-125
110/43	335-355	80-45	185-220	110-125

1 Suction pressure drops gradually throughout the freeze cycle

SYT3000W Self Contained Water-Cooled

All Dice Cube, Self-Contained Water-cooled Ice Machines

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	10.7-12.1	11.5-13.0	13.3-15.1	0.75 - 2.5
80/27	10.8-12.3	11.8-13.4	13.7-15.5	
90/32	10.9-12.4	12.2-13.9	13.9-15.7	
100/38	11.0-12.4	12.4-14.0	14.0-15.9	
110/43	11.1-12.5	12.5-14.1	14.2-16.1	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	3015	2815	2480
80/27	2985	2765	2425
90/32	2965	2675	2390
100/38	2950	2645	2365
110/43	2925	2625	2340

1 Based on average ice slab weight of 6.38-7.13 lb. per evaporator.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	52	108	358

1 Water regulating valve set to maintain 330 PSIG discharge pressure

OPERATING PRESSURES

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	325-335	60-44	180-200	95-115
70/21	325-335	70-45	185-205	110-125
80/27	325-335	75-45	180-210	110-125
90/32	325-335	75-45	180-210	110-125
100/38	335-355	80-45	185-220	110-125
110/43	325-335	60-44	180-200	95-115

1 Suction pressure drops gradually throughout the freeze cycle

SD3303W Self-Contained Water-Cooled

All Dice Cube, Self-Contained Water-cooled Ice Machines

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.6-10.9	11.1-12.6	12.7-14.4	0.75 - 2.5
80/27	9.7-11.0	11.3-12.8	13.0-14.7	
90/32	9.9-11.2	11.5-13.1	13.3-15.0	
100/38	10.0-11.4	11.7-13.3	13.5-15.3	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	3320	2920	2580
80/27	3280	2880	2540
90/32	3220	2820	2480
100/38	3180	2780	2440

1 Based on average ice slab weight of 6.38-7.13 lb. per evaporator.

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	97	166	419

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	230-240	40-30	110-160	75-100
70/21	230-250	45-30	125-160	75-100
80/27	230-250	50-31	125-160	75-100
90/32	260-280	50-31	130-160	75-110
100/38	260-290	50-31	130-180	75-110
110/43	260-290	50-31	130-190	80-110

1 Suction pressure drops gradually throughout the freeze cycle

SY3305W

All Half Dice Cube, Self-Contained Water-cooled Ice Machines

Characteristics may vary depending on operating conditions.

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time[1]
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.4-10.6	10.5-12.0	12.4-14.0	0.75 - 2.5
80/27	9.6-10.9	10.9-12.3	12.8-14.5	
90/32	9.8-11.1	11.0-12.5	13.1-14.8	
100/38	9.9-11.3	11.2-12.7	13.3-15.0	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
70/21	3380	3050	2640
80/27	3300	2970	2560
90/32	3260	2930	2520
100/38	3210	2890	2480

1 Based on average ice slab weight of 6.38-7.13 lb. per evaporator

CONDENSER WATER CONSUMPTION

Air Temp. Around Ice Machine 90°F/32°C	Water Temperature °F/°C[1]		
	50/10	70/21	90/32
Gal/100 lbs. of Ice	97	166	419

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[1]	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	230-240	40-30	110-160	75-100
70/21	230-250	45-30	125-160	75-100
80/27	230-250	50-31	125-160	75-100
90/32	260-280	50-31	130-160	75-110
100/38	260-290	50-31	130-180	75-110
110/43	260-290	50-31	130-190	80-110

1 Suction pressure drops gradually throughout the freeze cycle

Diagrams

Wiring Diagrams

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

> **⚠ Warning**
>
> Always disconnect power before working on electrical circuitry.

Some components are wired differently on energy efficient machines. Please verify your serial number (page 12) to reference the correct diagrams.

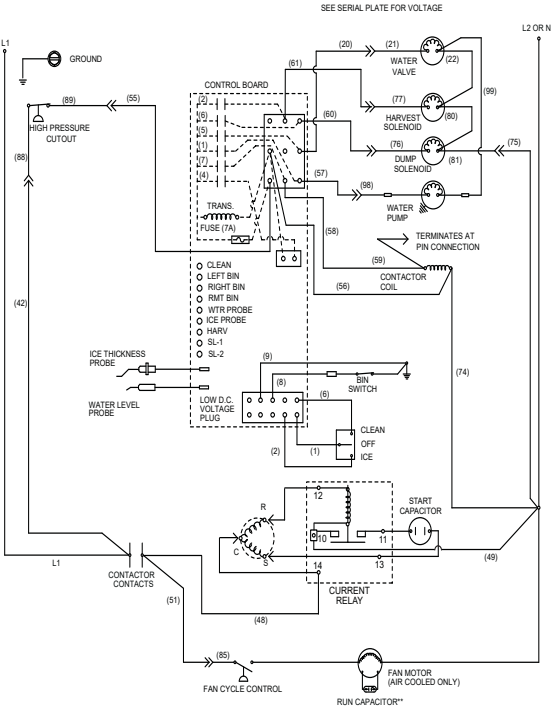
WIRING DIAGRAM LEGEND

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

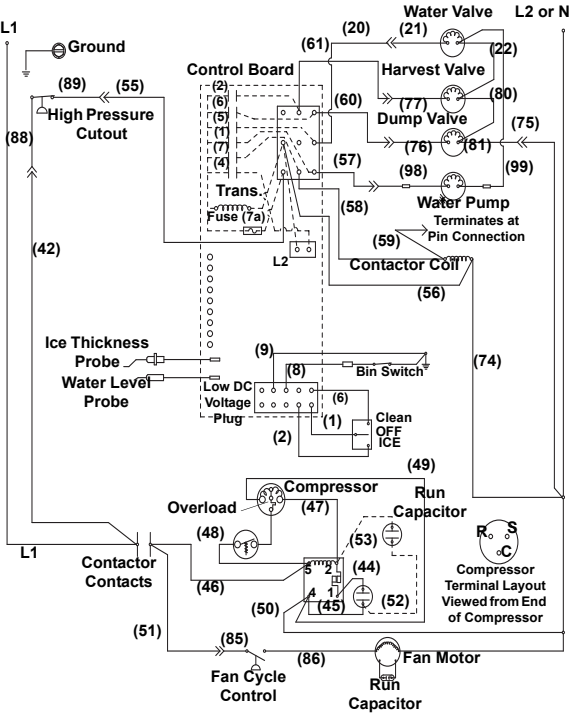
*	Internal Compressor Overload (Some models have external compressor overloads)
**	Fan Motor Run Capacitor (Some models do not incorporate fan motor run capacitor)
( )	Wire Number Designation (The number is marked at each end of the wire)
—>>—	Multi-Pin Connection (Electrical Box Side) —>>— (Compressor Compartment Side)

WIRING DIAGRAMS BEFORE ENERGY EFFICIENT & ENERGYSTAR MACHINES

S320
Self Contained - 1 Phase

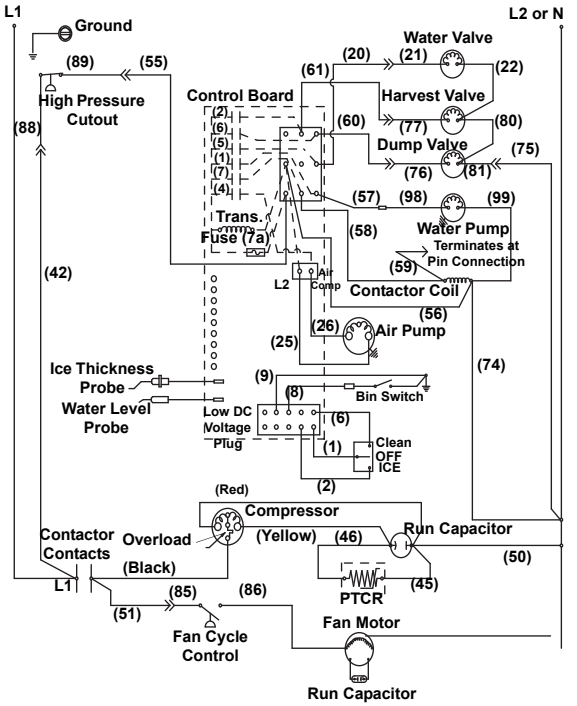


S300/S420/S450/ S500 (after serial number 110074051) - Self Contained - 1 Phase



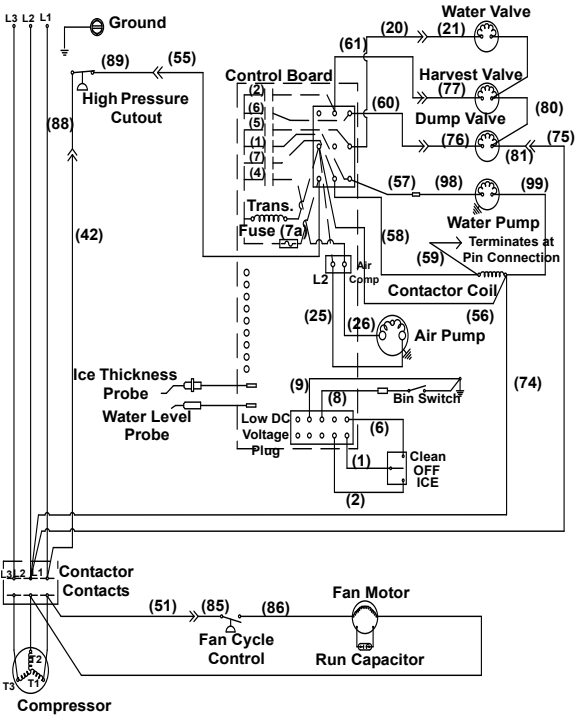
SV3137A

S500 (before serial number 110074051)
S600/S850/S1000/S1200-
Self Contained- 1 Phase



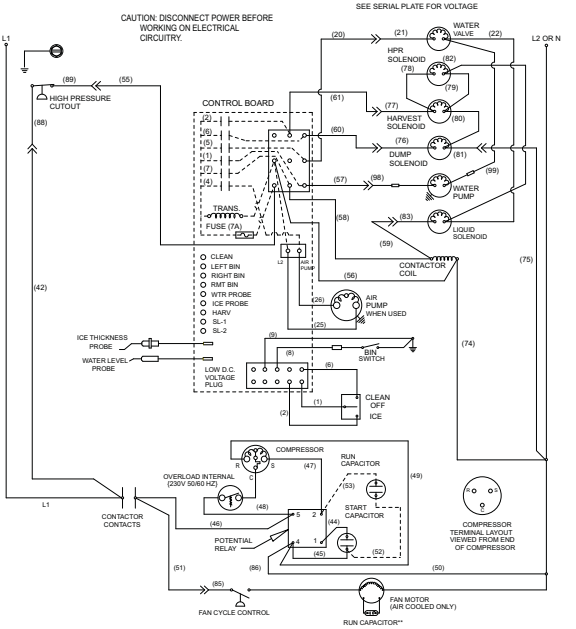
SV3130

S850/S1000/S1200 - Self Contained - 3 Phase

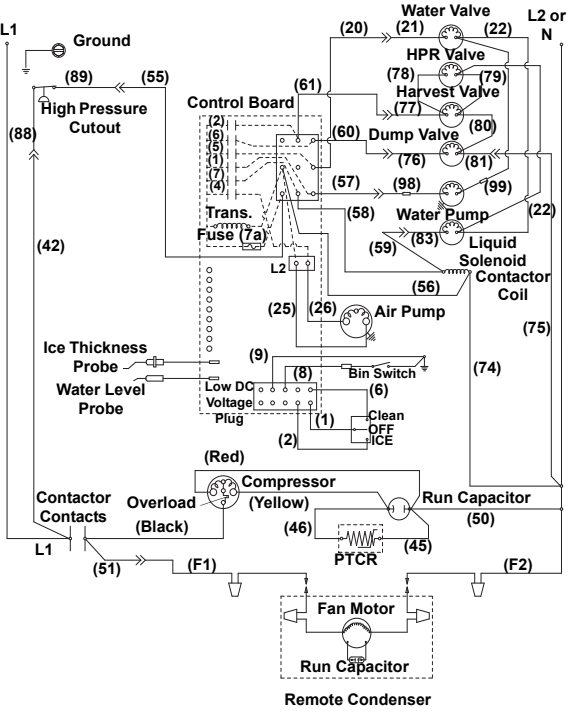


SV3131

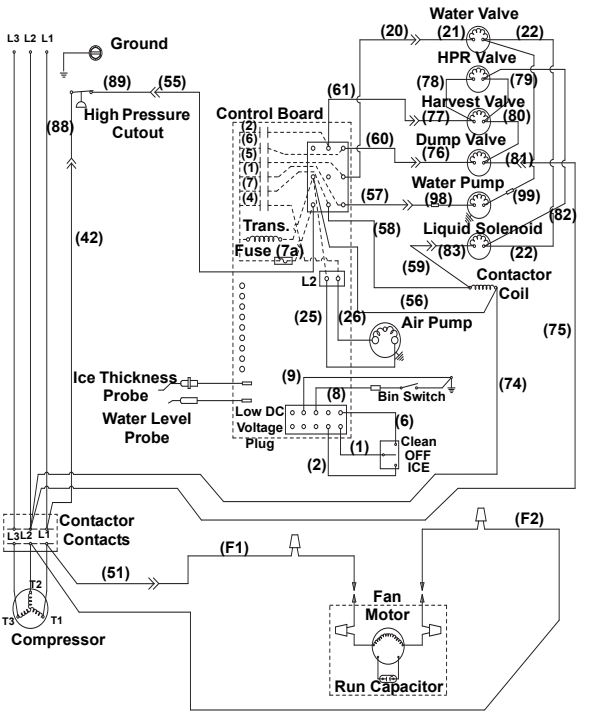
S500 Danfoss Compressor (after serial number 110074051) - Remote - 1 Phase



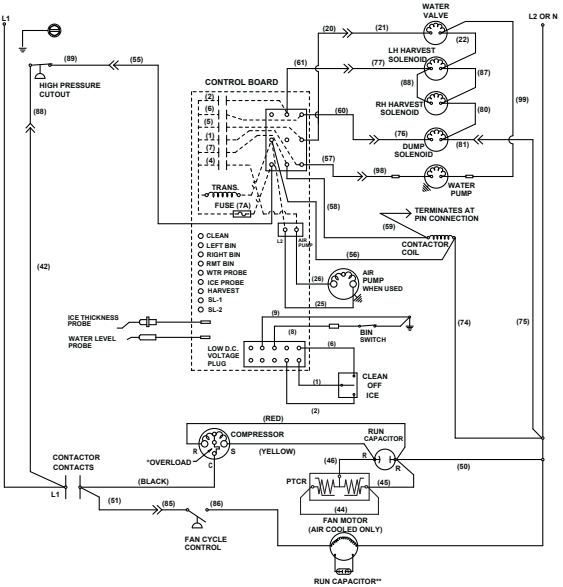
S500 (before serial number 110074051)/ S600/S850/S1000/S1200 - Remote - 1 Phase



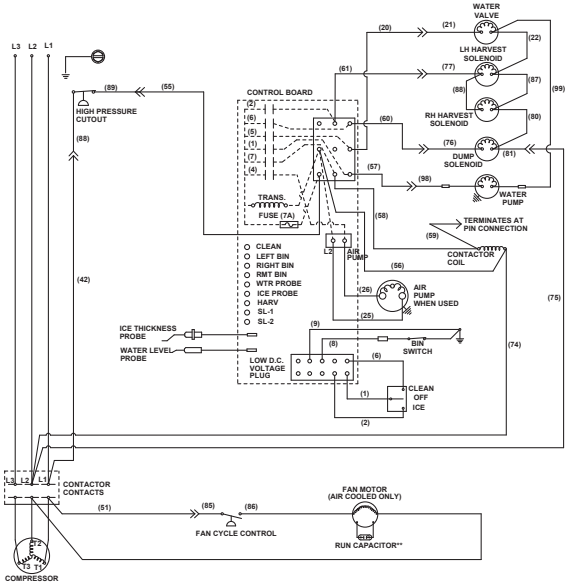
S850/S1000/S1200 - Remote - 3 Phase



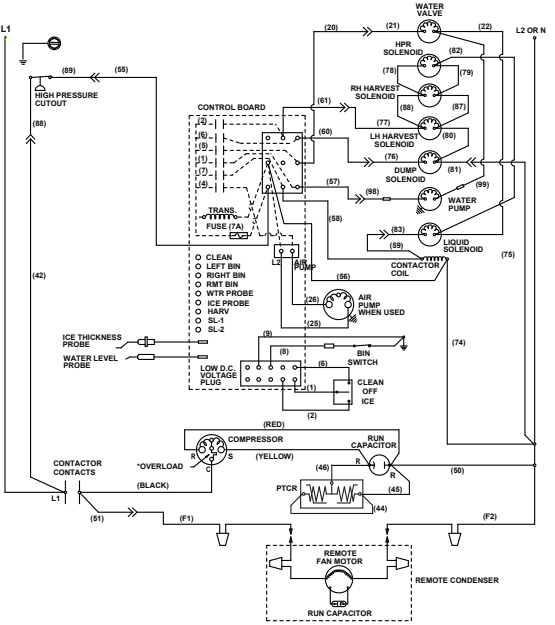
S1400/S1600/S1800 - Self-Contained - 1 Phase



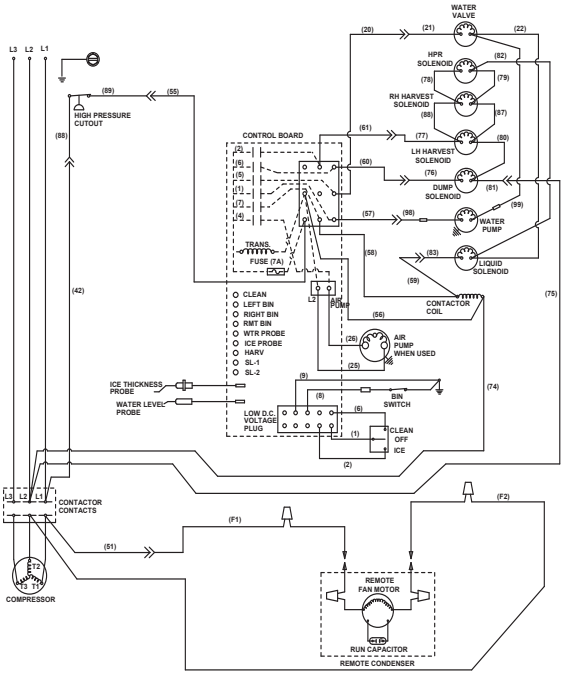
S1400/S1600/S1800 - Self-Contained - 3 Phase



S1400/S1600/S1800 - Remote - 1 Phase

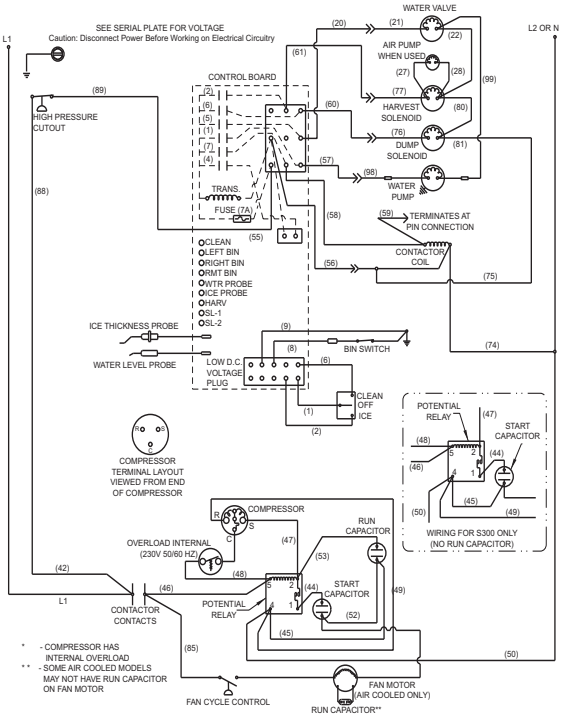


S1400/S1600/S1800 - Remote - 3 Phase

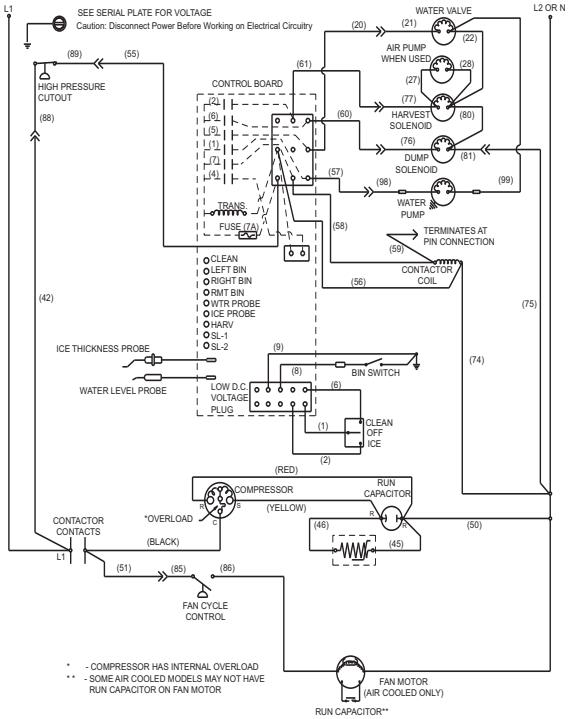


WIRING DIAGRAMS FOR ENERGY EFFICIENT & ENERGYSTAR MACHINES

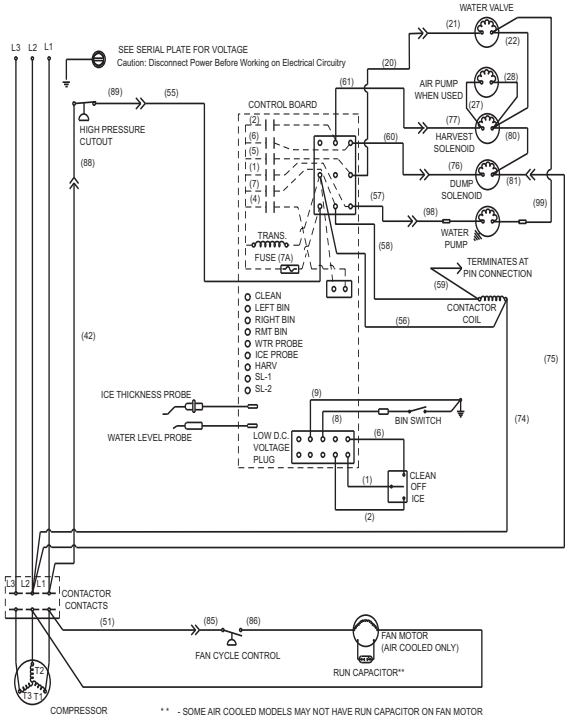
S300/S420/S450/S500
Self-Contained - 1 Phase



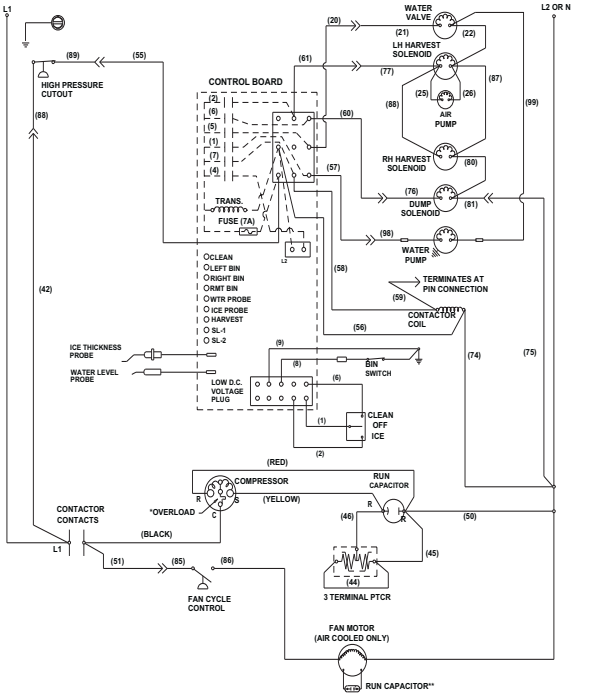
S600/S850/S1000/S1200
Self-Contained - 1 Phase



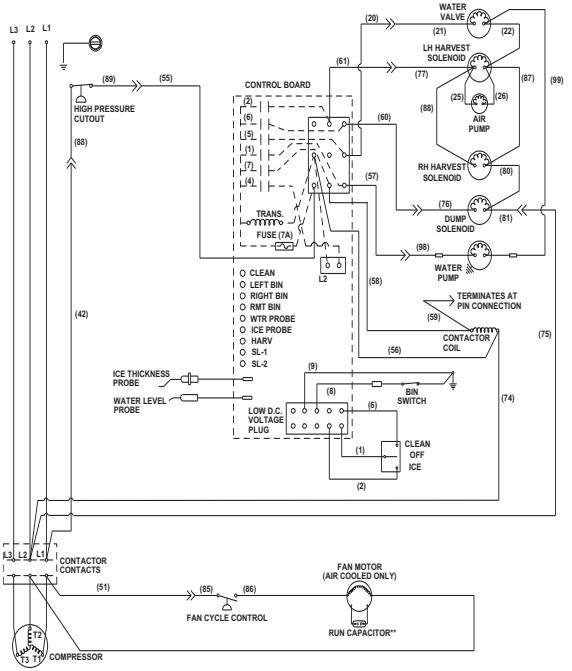
S850/S1000/S1200
Self-Contained - 3 Phase



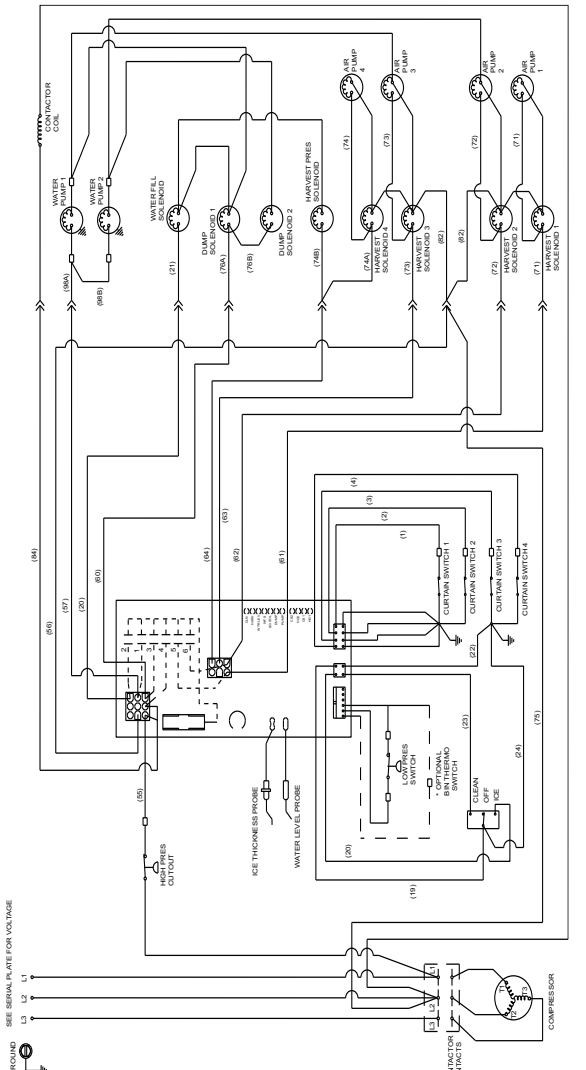
S1400/S1800
Self-Contained - 1 Phase



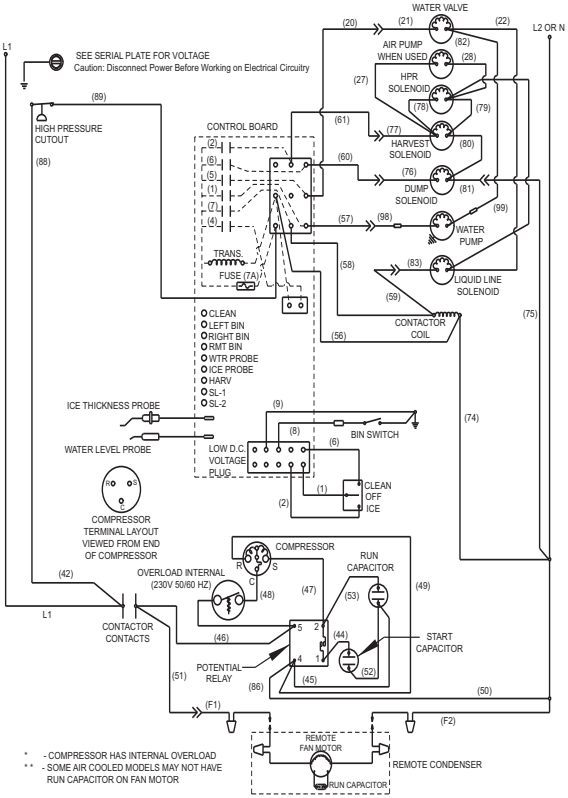
S1400/S1800
Self-Contained - 3 Phase



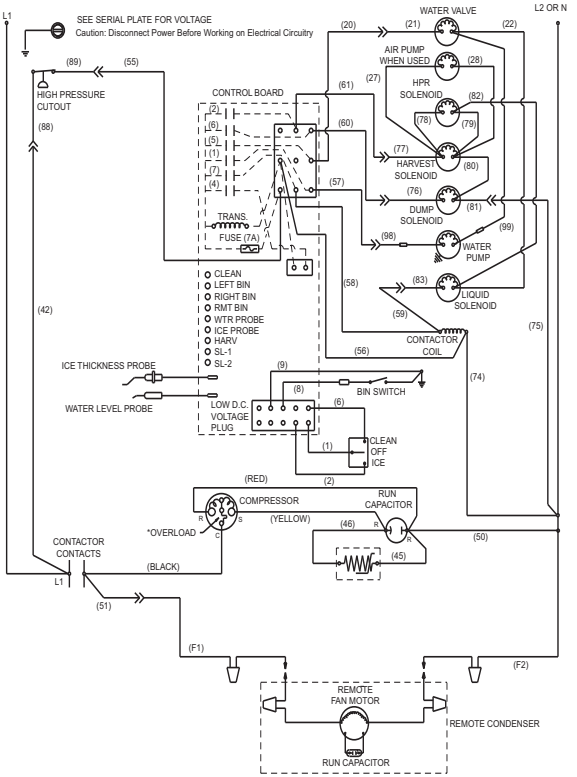
S3300
Water-Cooled - 3 phase



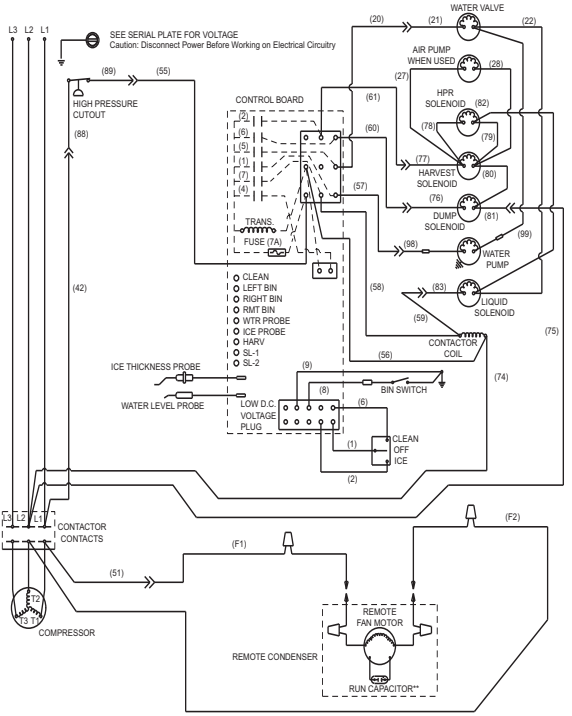
S500
Remote - 1 Phase



S600/S850/S1000/S1200
Remote - 1 Phase

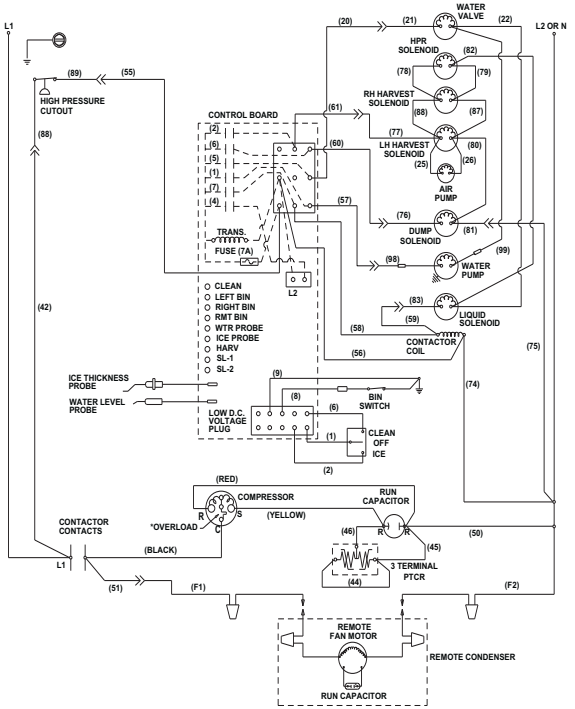


S850/S1000/S1200
Remote - 3 Phase

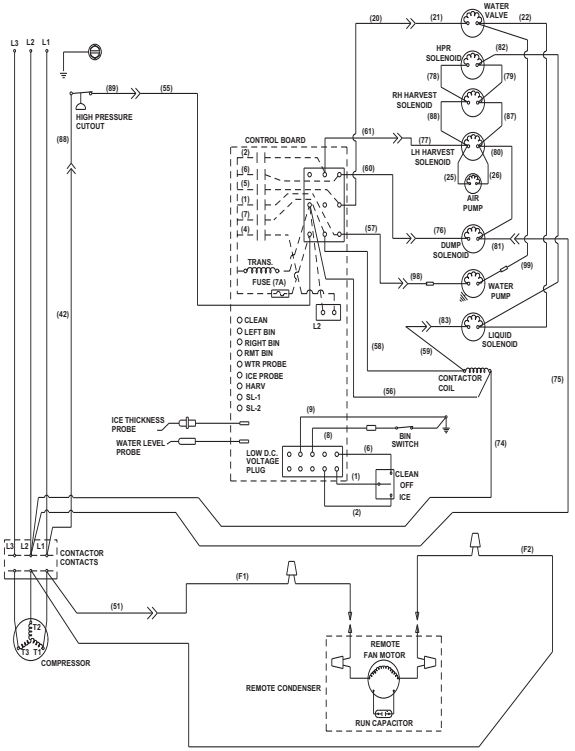


* - COMPRESSOR HAS INTERNAL OVERLOAD
** - SOME AIR COOLED MODELS MAY NOT HAVE RUN CAPACITOR ON FAN MOTOR

S1400/S1800
Remote - 1 Phase

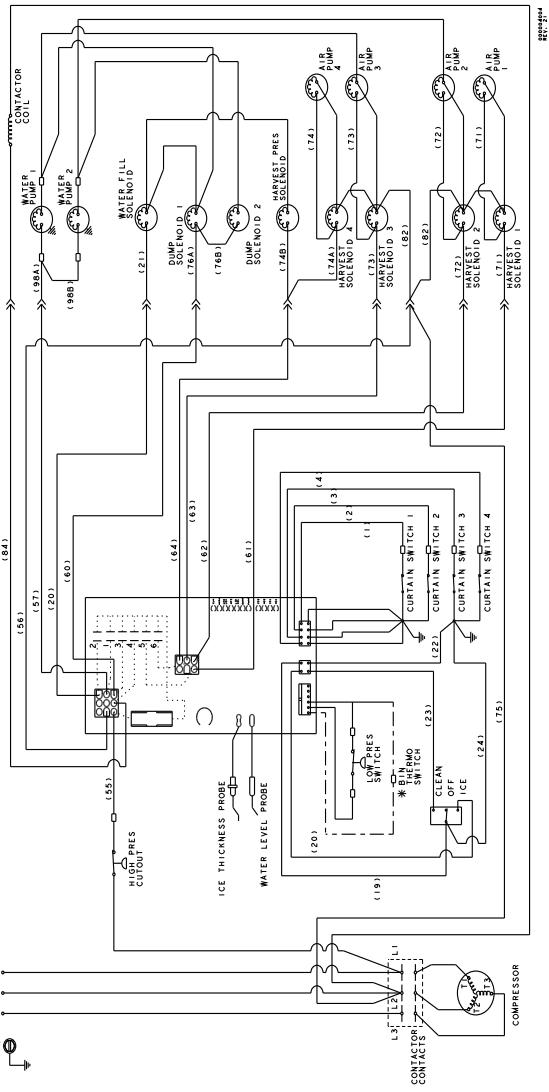


S1400/S1800
Remote - 3 Phase



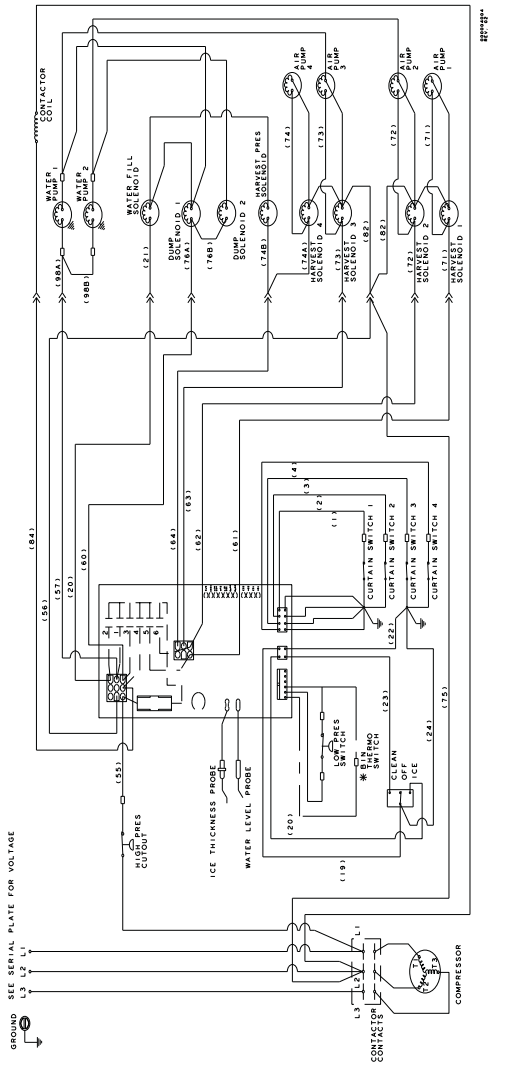
ST3000W

Self-Contained - 3 Phase

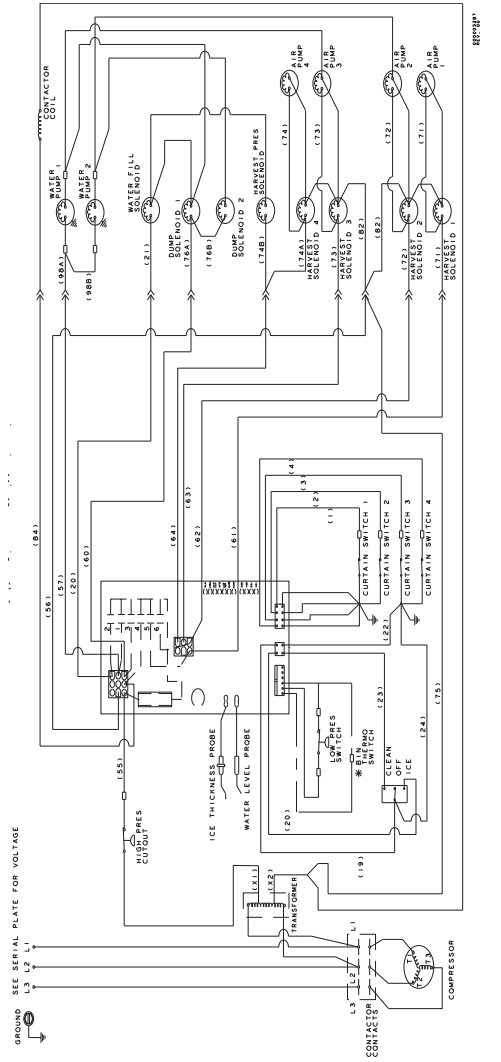


S3300W

Self-Contained - 3 Phase

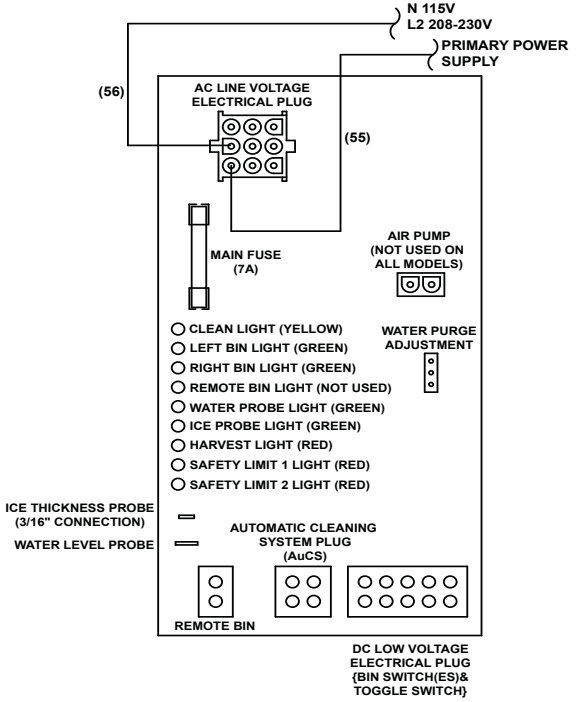


S3300WM Marine
Self-Contained - 3 Phase

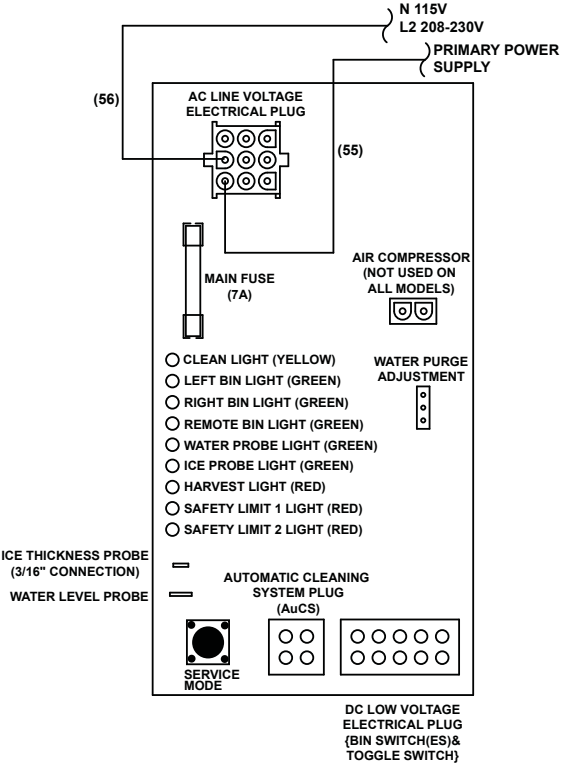


Electronic Control Board

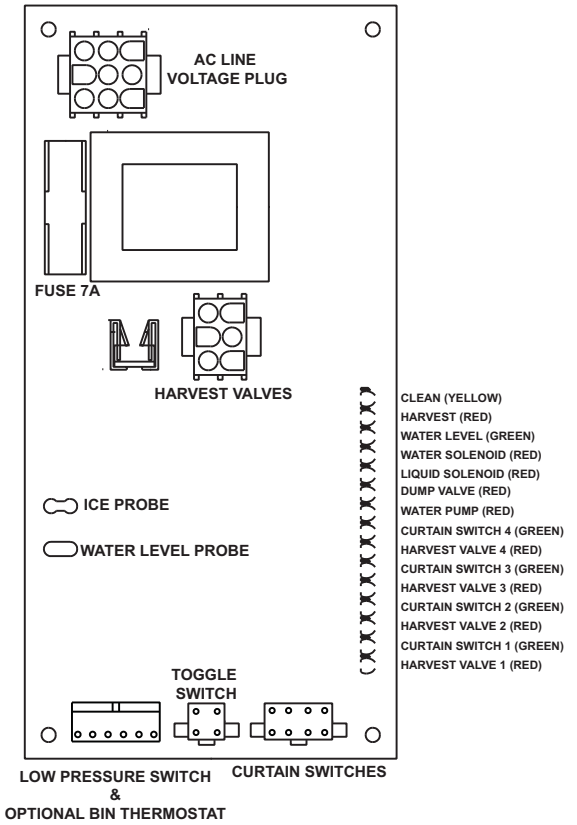
Single and Twin Evaporator Without Test Button



Single and Twin Evaporator With Test Button



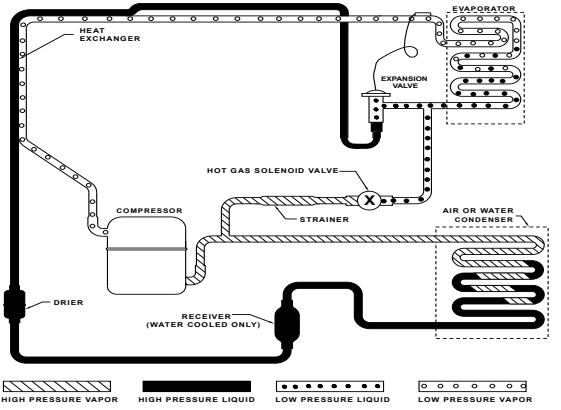
Quad Evaporator Ice Machines



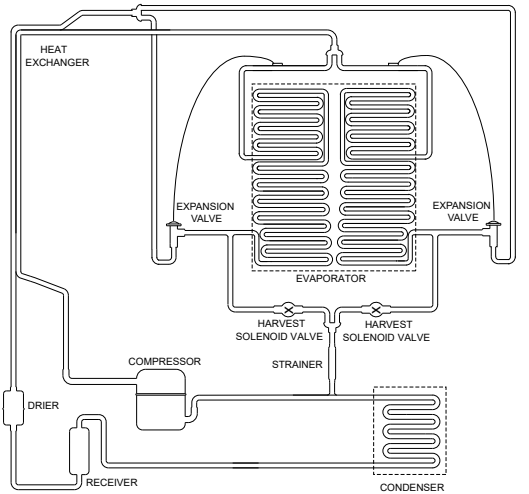
Refrigeration Tubing Schematics

SELF-CONTAINED AIR- OR WATER -COOLED MODELS

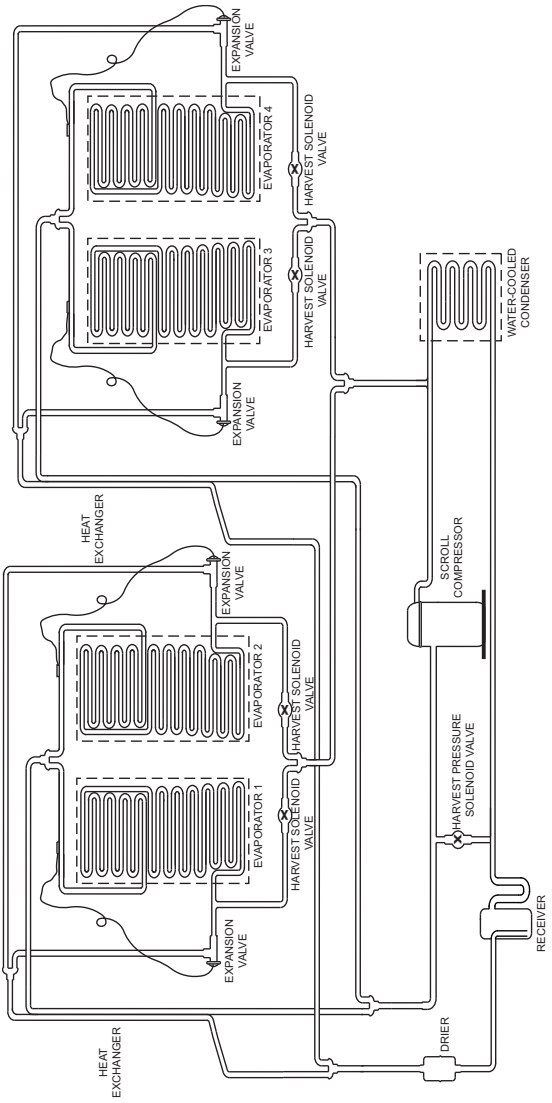
S300/S320/S420/S450/S500/S600/S850/S1000/S1200



S1400/S1600/S1800

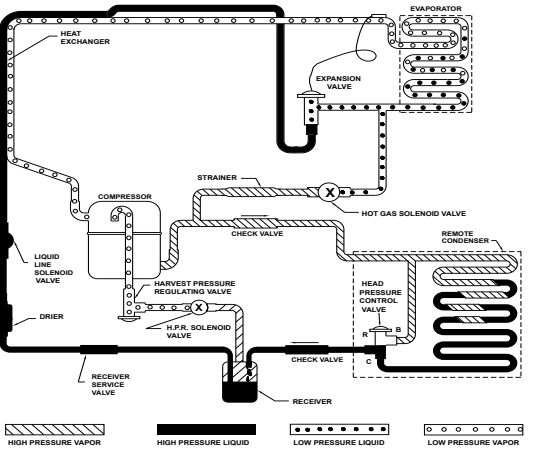


ST3000W/S3300W

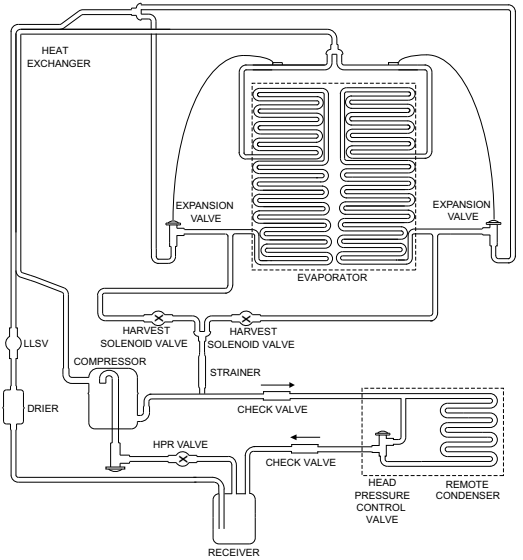


REMOTE MODELS

S500/S600/S850/S1000



S1400/S1600/S1800



MANITOWOC ICE
2110 SOUTH 26TH STREET
MANITOWOC, WI 54220

800-545-5720
WWW.MANITOWOCICE.COM

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