Manitowoc



Q210/Q270 Undercounter Ice Machines

Technician's Handbook

This manual is updated as new information and models are released. Visit our website for the latest manual.
www.manitowocice.com

America's #1 Selling Ice Machine

Part Number STH039 8/13

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 equipment. Visit our website www.manitowocfsg.com for manual updates, translations, or contact information for service agents in your area.

Important

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

⚠ Warning

Read this manual thoroughly before operating, installing or performing maintenance on the equipment. Failure to follow instructions in this manual can cause property damage, injury or death.

⚠ Warning

Do not use electrical appliances or accessories other than those supplied by Manitowoc for your ice machine model.

⚠ Warning

Two or more people or a lifting device are required to lift this appliance.

⚠ Warning

This equipment contains high voltage electricity and refrigerant charge. Installation and repairs are to be performed by properly trained technicians aware of the dangers of dealing with high voltage electricity and refrigerant under pressure.The technician must also be certified in proper refrigerant handling and servicing procedures. All lockout and tag out procedures must be followed when working on this equipment.

⚠ Warning

Do not damage the refrigeration circuit when installing, maintaining or servicing the unit.

⚠ Warning

Do not operate equipment that has been misused, abused, neglected, damaged, or altered/modified from that of original manufactured specifications. This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision concerning use of the appliance by a person responsible for their safety. Do not allow children to play with this appliance.

⚠ Warning

All covers and access panels must be in place and properly secured, before operating this equipment.

⚠ Warning

Do not obstruct machine vents or openings.

⚠ Warning

Do not store gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.

⚠ Warning

Do not clean with water jet.

⚠ Warning

It is the responsibility of the equipment owner to perform a Personal Protective Equipment Hazard Assessment to ensure adequate protection during maintenance procedures.

⚠ Warning

Two or more people are required to move this equipment to prevent tipping.

⚠ Warning

When using electric appliances, basic precautions must always be followed, including the following:

a. Read all the instructions before using the appliance.
b. To reduce the risk of injury, close supervision is necessary when an appliance is used near children.
c. Do not contact moving parts.
d. Only use attachments recommended or sold by the manufacturer.
e. Do not use outdoors.
f. For a cord-connected appliance, the following must be included:
   - Do not unplug by pulling on cord. To unplug, grasp the plug, not the cord.
   - Unplug from outlet when not in use and before servicing or cleaning.
   - Do not operate any appliance with a damaged cord or plug, or after the appliance malfunctions or is dropped or damaged in any manner. Contact the nearest authorized service facility for examination, repair, or electrical or mechanical adjustment.
g. Follow applicable lock out tag out procedures before working on equipment.
h. Connect to a properly grounded outlet only.

⚠ Warning

These 50 hz models contain up to 150 grams of R290 (propane) refrigerant. R290 (propane) is flammable in concentrations of air between approximately 2.1% and 9.5% by volume (LEL lower explosion limit and UEL upper explosion limit). An ignition source at a temperature higher than 470°C is needed for a combustion to occur. Refer to nameplate to identify the type of refrigerant in your equipment. Only trained and qualified personnel aware of the dangers are allowed to work on the equipment.

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

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General Information

Model Numbers

This manual covers the following models:

Self-contained Air-cooled
QYP0214A
QYP0274A

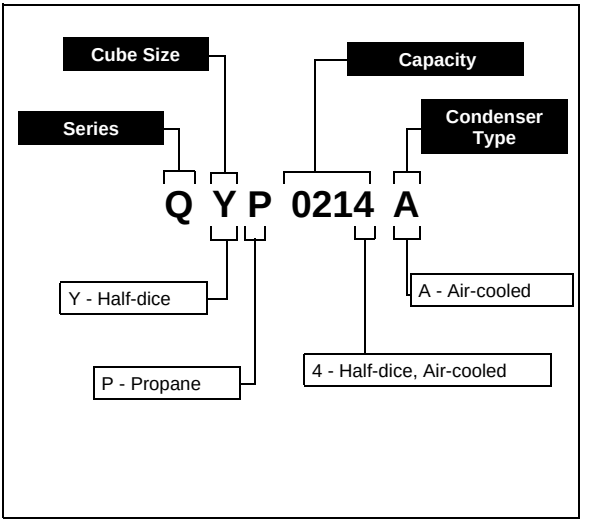
⚠ Warning

An ice machine contains high voltage electricity and refrigerant charge. Repairs are to be performed by properly trained refrigeration technicians aware of the dangers of dealing with high voltage electricity and refrigerant under pressure.The technician must also be certified in proper refrigerant handling and servicing procedures. All lockout and tag out procedures must be followed when working on this equipment.

⚠ Warning

These 50 hz models may contain up to 150 grams of R290 (propane) refrigerant. R290 (propane) is flammable in concentrations of air between approximately 2.1% and 9.5% by volume (LEL lower explosion limit and UEL upper explosion limit). An ignition source at a temperature higher than 470°C is needed for a combustion to occur. Refer to nameplate to identify the type of refrigerant in your equipment. Only trained and qualified personnel aware of the dangers are allowed to work on the equipment.

How to Read a Model Number

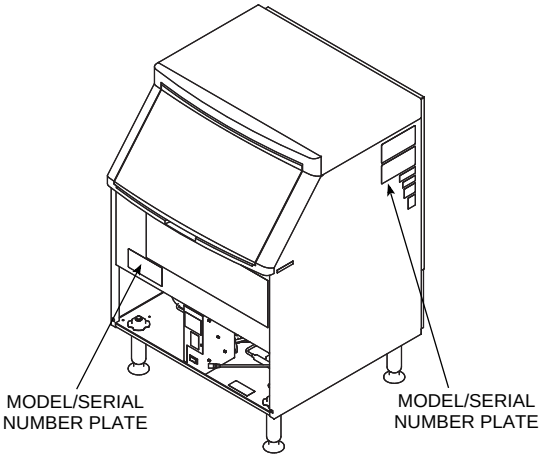


⚠ Caution

Use only Manitowoc approved Ice Machine Cleaner (part number 94-0546-3 original green ice machine cleaner or 000000084 clear metal safe ice machine cleaner) and Sanitizer (part number 94-0565-3). It is a violation of Federal law to use these solutions in a manner inconsistent with their labeling. Read and understand all labels printed on bottles before use.

Model/Serial Number Location

The model and serial numbers are required when requesting information from your local Manitowoc distributor, service representative, or Manitowoc Ice. 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.



Model/Serial Number Location

Ice Machine Warranty Information

OWNER WARRANTY REGISTRATION CARD

General

Warranty coverage begins the day the ice machine is installed.

If the OWNER WARRANTY REGISTRATION CARD is not returned, Manitowoc will use the date of sale to the Manitowoc Distributor as the first day of warranty coverage for your new ice machine.

COMMERCIAL WARRANTY COVERAGE

General

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

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

Parts

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

Labor

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

Exclusions

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

1. Normal maintenance, adjustments and cleaning as outlined in this manual.
2. Repairs due to unauthorized modifications to the ice machine or use of non-standard parts without prior written approval from Manitowoc Ice.
3. Damage caused by improper installation of the ice machine, electrical supply, water supply or drainage, or damage caused by floods, storms, or other acts of God.
4. Premium labor rates due to holidays, overtime, etc.; travel time; flat rate service call charges; mileage and miscellaneous tools and material charges not listed on the payment schedule. Additional labor charges resulting from the inaccessibility of equipment are also excluded.
5. Parts or assemblies subjected to misuse, abuse, neglect or accidents.
6. Damage or problems caused by installation, cleaning and/or maintenance procedures inconsistent with the technical instructions provided in this manual.
7. This warranty is intended exclusively for commercial application. No warranty is extended for personal, family, or household purposes.

Authorized Warranty Service

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

Service Calls

Normal maintenance, adjustments and cleaning as outlined in this manual are not covered by the warranty.

How State Law Applies

This limited warranty gives you specific legal rights, and you may also have rights that vary from state to state or from one jurisdiction to another.

Registration Card

To secure prompt and continuing warranty service, this warranty registration card must be completed and sent to Manitowoc within thirty (30) days from the sale date. Complete the following registration card and send it to Manitowoc at the address shown above. Retain a copy for your records.

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Location of Ice Machine

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

- The location must be indoors.
- The location must be free of airborne and other contaminants.
- Air temperature must be at least 4°C but must not exceed 43°C.
- The location must not be near heat-generating equipment or in direct sunlight.
- The location must be capable of supporting the weight of the ice machine and a full bin of ice.
- The location must allow enough clearance for water, drain, and electrical connections in the **rear of the ice machine.**
- The location must not obstruct airflow through or around the ice machine (condenser airflow is in and out the front). Refer to the chart below for clearance requirements.
- The ice machine must be protected if it will be subjected to temperatures below 0°C. Failure caused by exposure to freezing temperatures is not covered by the warranty.

Ice Machine Clearance Requirements

Self-contained Air-cooled	
Top/Sides	127 mm*
Back	127 mm*

*NOTE: The ice machine may be built into a cabinet.

⚠ Warning

Do not obstruct machine vents or openings.

There is no minimum clearance requirement for the top or left and right sides of the ice machine. The listed values are recommended for efficient operation and servicing only.

Ice Machine Heat of Rejection

Series Ice Machine	Heat of Rejection*	
	Air Conditioning**	Peak
Q210	2400	3400
Q270	3800	6000

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

Ice machines, like other refrigeration equipment, reject heat through the condenser. It is helpful to know the amount of heat rejected by the ice machine when sizing air conditioning equipment where self-contained air-cooled ice machines are installed.

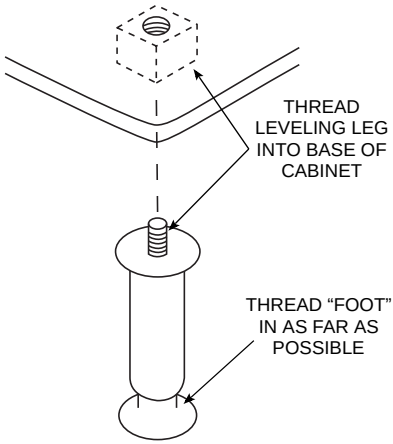
Leveling the Ice Machine

1. Screw the leveling legs onto the bottom of the ice machine.
2. Screw the foot of each leg in as far as possible.

> **⚠ Caution**
>
> The legs must be screwed in tightly to prevent them from bending.

3. Move the ice machine into its final position.
4. Level the ice machine to ensure that the siphon system functions correctly. Use a level on top of the ice machine. Turn each foot as necessary to level the ice machine from front to back and side to side.

NOTE: An optional 6.35 cm caster assembly is available for use in place of the legs. Installation instructions are supplied with the casters.



Leg Installation

Electrical Requirements

Voltage

The maximum allowable voltage variation is +10/-0% of the rated voltage on the ice machine model/serial number plate at start-up (when the electrical load is highest).

Fuse/Breaker

A separate fuse/circuit breaker must be provided for each ice machine.

Total Circuit Ampacity

The total circuit ampacity is used to help select the wire size of the electrical supply.

The wire size (or gauge) is also dependent upon location, materials used, length of run, etc., so it must be determined by a qualified electrician.

NOTE: This table is for reference only. Nameplate information over rides the information in the table below.

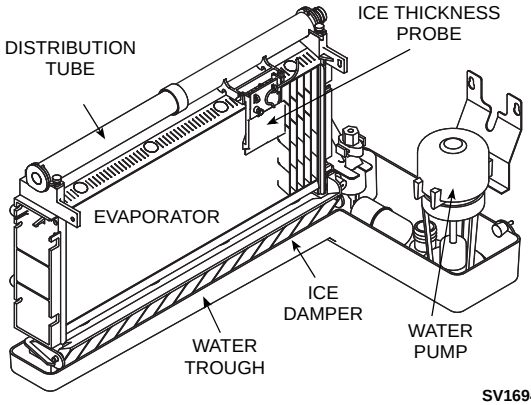
Electrical Specifications

Ice Machine	Voltage Phase Cycle	Maximum. Fuse/ Circuit Breaker	Total Amps
Q210	230/1/50	15 amp	3.6
Q270	230/1/50	15 amp	5.2
* Indicates Preliminary Data			

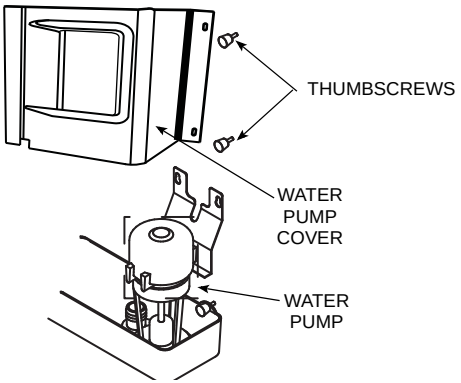
⚠ Warning

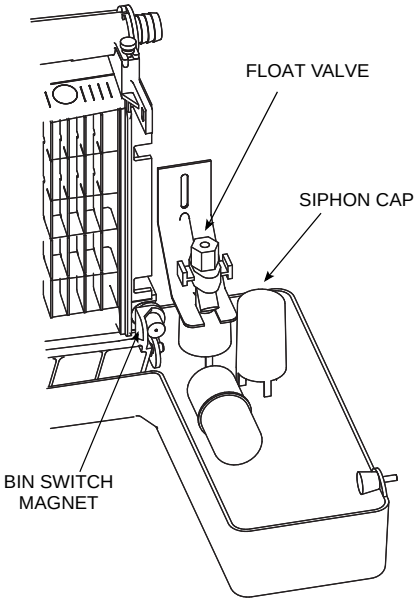
All wiring must conform to local, state and national codes and the appliance must be grounded.

Component Identification

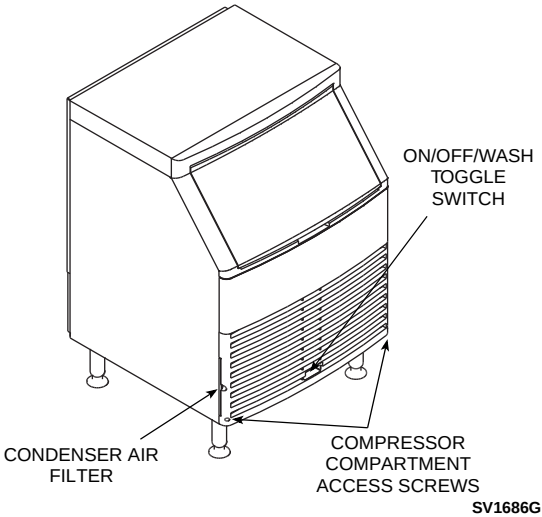


Evaporator Compartment

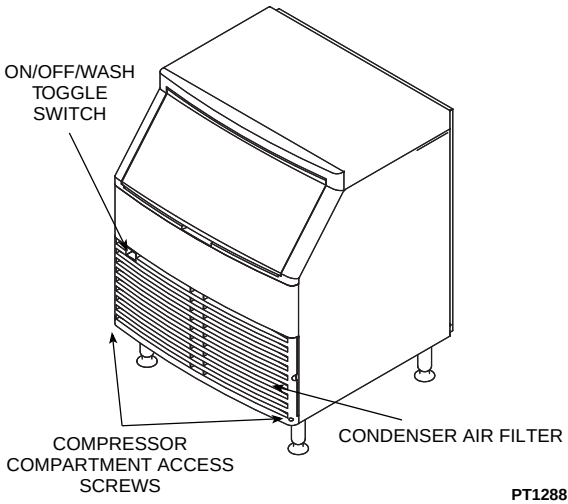




Evaporator Compartment



Q210 Ice Machines



Q270 Ice Machines

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Maintenance

Ice Machine Inspection

Check all water fittings and lines for leaks. Also, make sure the refrigeration tubing is not rubbing or vibrating against other tubing, panels, etc.

Do not put anything (boxes, etc.) in front of the ice machine. There must be adequate airflow through and around the ice machine to maximize ice production and ensure long component life.

Exterior Cleaning

Clean the area around the ice machine as often as necessary to maintain cleanliness and efficient operation.

Sponge any dust and dirt off the outside of the ice machine with mild soap and water. Wipe dry with a clean, soft cloth.

A commercial grade stainless steel cleaner/polish can be used as necessary.

clean up any spills on or around the unit.

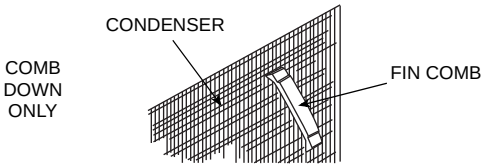
Cleaning the Condenser

⚠ Warning

Disconnect electric power to the ice machine at the electric service switch and follow lockout tag out procedures before cleaning the condenser.

⚠ Caution

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



AIR-COOLED CONDENSER

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

⚠ Warning

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

1. The washable aluminum filter on self-contained air-cooled ice machines is designed to catch dust, dirt, lint and grease. This helps keep the condenser clean. Clean the filter with a mild soap and water solution.
2. Clean the outside of the condenser with a soft brush or a vacuum with a brush attachment. Clean from top to bottom, not side to side. Be careful not to bend the condenser fins.
3. Shine a flashlight through the condenser to check for dirt between the fins. If dirt remains:

4. Blow compressed air through the condenser fins from the inside. Be careful not to bend the fan blades.
5. Use a commercial condenser coil cleaner. Follow the directions and cautions supplied with the cleaner.
6. Straighten any bent condenser fins with a fin comb.
7. Carefully wipe off the fan blades and motor with a soft cloth. Do not bend the fan blades. If the fan blades are excessively dirty, wash with warm, soapy water and rinse thoroughly.

INTERIOR CLEANING AND SANITIZING

General

Clean and sanitize the ice machine every six months for efficient operation. If the ice machine requires more frequent cleaning and sanitizing, consult a qualified service company to test the water quality and recommend appropriate water treatment.

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

⚠ Caution

Use only Manitowoc approved Ice Machine Cleaner (part number 95-0546-3) and Sanitizer (part number 94-0565-3). It is a violation of Federal law to use these solutions in a manner inconsistent with their labeling. Read and understand all labels printed on bottles before use.

Cleaning and Sanitizing Procedure

⚠ Caution

Do not mix Ice Machine 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 all ice from the bin.

Step 3 To start a cleaning cycle, move the toggle switch to the WASH position.

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

Model	Amount of Cleaner
Q210	60 ml
Q270	60 ml

Step 5 Wait until the clean cycle is complete (approximately 22 minutes) then place the toggle switch in the OFF position, disconnect power and water supplies to the ice machine.

> **⚠ Warning**
>
> Disconnect electric power to the ice machine at the electric service switch and follow lockout tag out procedures before proceeding.

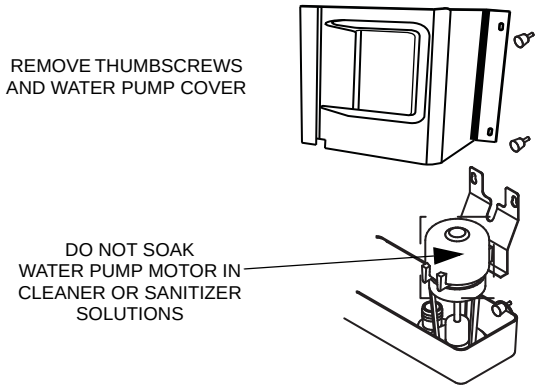
Step 6 Remove parts for cleaning.

A. Remove Two Thumbscrews and Water Pump Cover.

B. Remove the Vinyl Hose Connecting the Water Pump and Water Distribution Tube

C. Remove Water Pump

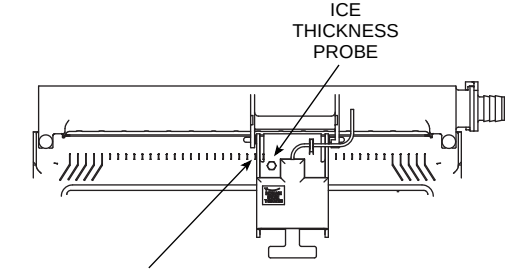
- Disconnect the water pump power cord
- Loosen the screws securing the pump-mounting bracket to the bulkhead
- Lift the pump and bracket assembly off the mounting screws.



Water Pump Removal

D. Remove the Ice Thickness Probe

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



Ice Thickness Probe Removal

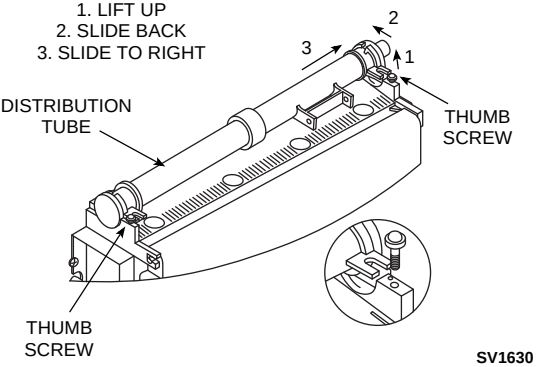
NOTE: At this point, the ice thickness probe can easily be cleaned. If complete removal is desired follow the ice thickness probe wire to the bulkhead grommet (exit point) in the back wall. Pop the bulkhead grommet out of the back wall by inserting fingernails or a flat object between the back wall and the grommet and prying forward. Pull the bulkhead grommet and wire forward until the connector is accessible, then disconnect the wire lead from the connector.

Ice Thickness Probe Cleaning

- Mix a solution of Manitowoc ice machine cleaner and water (60 ml of cleaner to 475 ml of water) in a container.
- Soak the ice thickness probe a minimum of 10 minutes.

Clean all ice thickness probe surfaces and verify the ice thickness probe cavity is clean. Rinse thoroughly with clean water, then dry completely. Incomplete rinsing and drying of the ice thickness probe can cause premature harvest.

E. Remove the Water Distribution Tube



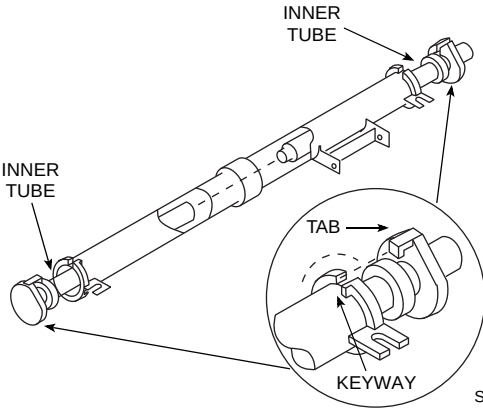
Water Distribution Tube Removal

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

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

Disassembly

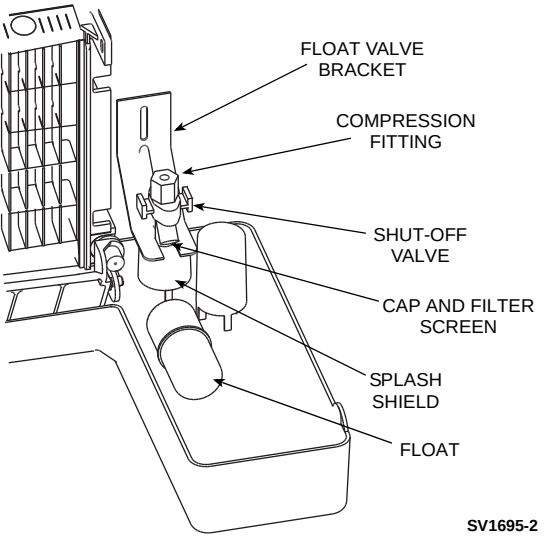
- Twist both of the inner tube ends until the tabs line up with the keyways.
- Pull the inner tube ends outward.



Water Distribution Tube Disassembly

F. Remove the Float Valve

- Turn the splash shield counterclockwise one or two turns.

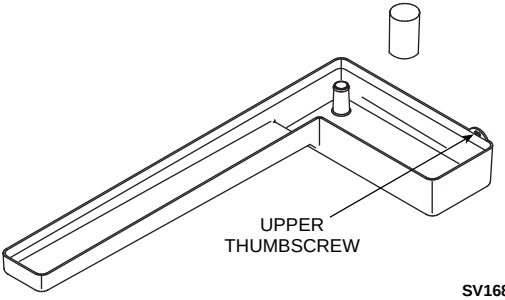


Float Valve Removal

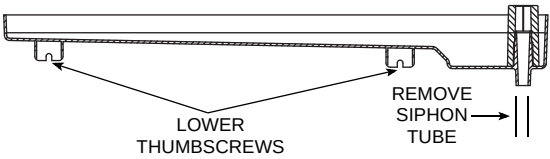
- Pull the float valve forward and off the mounting bracket.
- Disconnect the water inlet tube from the float valve at the compression fitting.
- Remove the cap and filter screen for cleaning.

G. Remove the Water Trough

- Apply downward pressure on the siphon tube and remove from the bottom of the water trough.
- Remove the upper thumbscrew.
- While supporting the water trough remove the two thumbscrews from beneath the water trough.
- Remove the water trough from the bin area.



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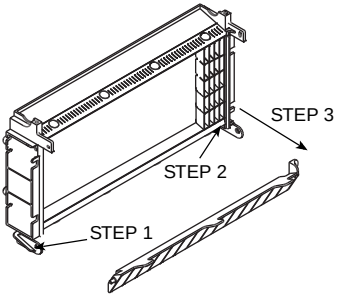


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Remove Water Trough

H. Remove Damper

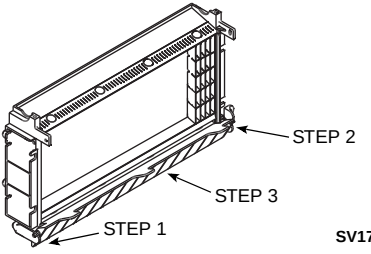
- Grasp ice damper and apply pressure toward the left hand mounting bracket.
- Apply pressure to the right hand mounting bracket with thumb.
- Pull ice damper forward when the right hand ice damper pin disengages.



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Installation

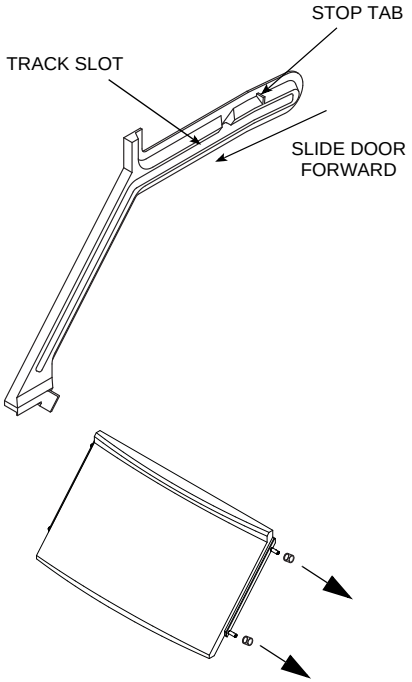
- Place ice damper pin in left hand mounting bracket and apply pressure toward the left hand mounting bracket.
- Apply pressure to the right hand mounting bracket with thumb.
- Push ice damper toward evaporator until right hand damper pin engages.



SV1742H

Remove the Bin Door

- Grasp the rear of the bin door and pull bin door forward approximately 13 cm.
- Slide bin door to the rear while applying upward pressure (The rear door pins will ride up into the track slot and slide backward to the stop tab).
- While applying pressure against the bin door pull down on the rear of each bin door track until the door pins clear the stop tabs.
- Slide the rear door pins off the end and then below the door track. Slide bin door forward allowing the back of the door to lower into the bin. Continue forward with the bin door until the front pins bottom out in the track.
- Lift right side of door until the front pins clear the track, then remove door from bin.
- Remove rollers (4) from all door pins.



Step 7 Mix a solution of cleaner and warm water. Depending on 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	4 l	500 ml cleaner

Step 8 Use ½ of the cleaner/water solution 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 brush, sponge or cloth (not a wire brush) to carefully clean the parts. Soak the parts for 5 minutes (15 – 20 minutes for heavily scaled parts). Rinse all components with clean water.

Step 9 While components are soaking, use ½ of the cleaner/water solution to clean all foodzone surfaces of the ice machine and bin. Use a nylon brush or cloth to thoroughly clean the following ice machine areas:

- Evaporator plastic parts – including top, bottom and sides
- Bin bottom, sides and top

Rinse all areas thoroughly with clean water.

Step 10 Mix a solution of sanitizer and warm water.

Solution Type	Water	Mixed With
Sanitizer	23 l	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. Use a cloth or sponge to liberally apply the solution. When sanitizing, pay particular attention to the following areas:

- Evaporator plastic parts - including top, bottom and sides
- Bin bottom, sides and top

Do not rinse the sanitized areas.

Step 13 Replace all removed components.

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

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

Model	Amount of Sanitizer
Q210	66 ml
Q270	57 ml

Step 15 Wait until the sanitize cycle is complete (approximately 22 minutes) then place the toggle switch in the OFF position, disconnect power and water supplies to the ice machine.

⚠ Warning

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

Step 16 Repeat step 6 to remove parts for hand sanitizing.

Step 17 Mix a solution of sanitizer and warm water.

Solution Type	Water	Mixed With
Sanitizer	23 l	120 ml sanitizer

Step 18 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 19 Use 1/2 of the sanitizer/water solution to sanitize all foodzone surfaces of the ice machine and bin. Use a cloth or sponge to liberally apply the solution. When sanitizing, pay particular attention to the following areas:

- Evaporator plastic parts - including top, bottom and sides
- Bin bottom, sides and top

Do not rinse the sanitized areas.

Step 20 Replace all removed components.

Step 21 Reapply power and water to the ice machine and place the toggle switch in the ICE position.

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 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.

Self-contained Air-cooled Ice Machines

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

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

1. Pressure Equalization

Before the compressor starts the hot gas valve is energized for 15 seconds to equalize pressures during the initial refrigeration system start-up.

2. Refrigeration System Start-up

The compressor starts after the 15-second pressure equalization, and remains on throughout the entire Freeze and Harvest Sequences. The hot gas valve remains on for 5 seconds during initial compressor start-up and then shuts off.

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

FREEZE SEQUENCE

3. Prechill

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

4. Freeze

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

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

HARVEST SEQUENCE

5. Harvest

The water pump de-energizes stopping flow over the evaporator. The rising level of water in the sump trough diverts water out of the overflow tube, purging excess minerals from the sump trough. The hot gas valve also opens to divert hot refrigerant gas into the evaporator.

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 contacts the ice damper, 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 (steps 3 - 4).

AUTOMATIC SHUT-OFF

6. Automatic Shut-off

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

The ice machine remains off until enough ice has been removed from the storage bin to allow the ice to fall clear of the damper. As the ice damper 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 PARTS CHART

ICE MAKING SEQUENCE OF OPERATION	Control Board Relays			Relay		Length of Time
	1 Water Pump	2 Hot Gas Valve	3 Relay Coil	3A Compressor	3B Compressor Fan Motor*	
Initial Start-up						
1. Water purge	off	on	off	off	off	15 seconds
2. Refrigeration System Start-up	off	on	on	on	on	5 seconds
Freeze Sequence						
3. Pre chill	off	off	on	on	on	30 seconds
4. Freeze	on	off	on	on	on	Until 7 sec. Water contact w/ice thickness probe

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

ICE MAKING SEQUENCE OF OPERATION	Control Board Relays			Relay		Length of Time
	1 Water Pump	2 Hot Gas Valve	3 Relay Coil	3A Compressor	3B Condenser Fan Motor*	
Harvest Sequence 5. Harvest	off	on	on	on	on	Bin switch activation
Automatic Shut-off 6. Auto Shut-off	off	off	off	off	off	Until bin switch re-closes

Operational Checks

Siphon System

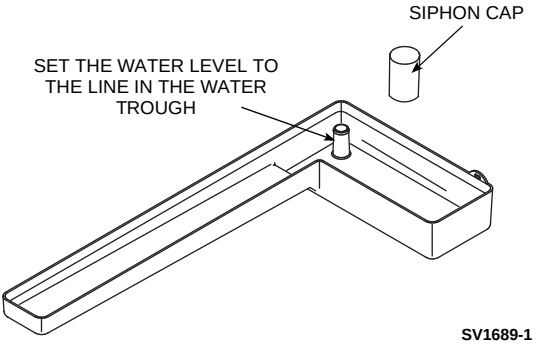
To reduce mineral build-up and cleaning frequency, the water in the sump trough must be purged during each harvest cycle.

When the water pump de-energizes the level in the water trough rises above the standpipe starting a siphon action. The siphon action stops when the water level in the sump trough drops. When the siphon action stops, the float valve refills the water trough to the correct level.

Follow steps 1 through 6 under water level check to verify the siphon system functions correctly

Water Level

Check the water level while the ice machine is in the ice mode and the water pump is running. The correct water level is 6 mm to 10 mm below the top of the standpipe, a line in the water trough indicates the correct level.



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Water Level Check

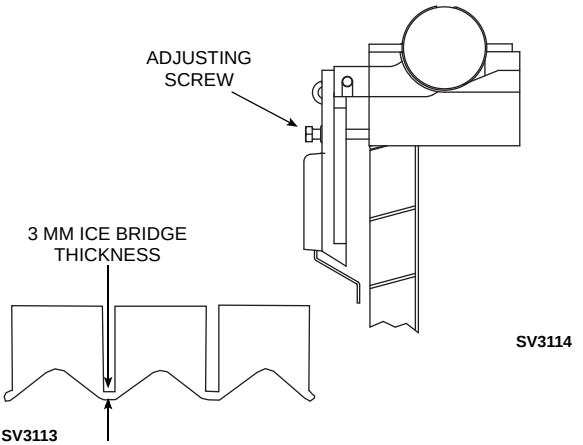
The float valve is factory-set for the proper water level. If adjustments are necessary:

1. Verify the ice machine is level.
2. Remove the siphon cap from the standpipe.
3. Place the main ON/OFF/WASH toggle switch to the ON position, and wait until the float valve stops adding water.
4. Adjust the water level 6 mm to 10mm below the standpipe, to the line in the water trough:
   A. Loosen the two screws on the float valve bracket.
   B. Raise or lower the float valve assembly as necessary, then tighten the screws.
5. Move the main ON/OFF/WASH toggle switch to the OFF position. The water level in the trough will rise above the standpipe and run down the drain.
6. Replace the siphon cap on the standpipe, and verify water level and siphon action by repeating steps 3 through 5.

Ice Thickness Check

After a harvest cycle, inspect the ice cubes in the ice storage bin. The ice thickness probe is set to maintain an ice bridge of 3 mm. If an adjustment is needed, follow the steps below.

1. Turn the ice thickness probe adjustment screw clockwise for a thicker ice bridge, or counterclockwise for a thinner ice bridge.



Ice Thickness Adjustment

2. Make sure the ice thickness probe wire and bracket does not restrict movement of the probe.

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Troubleshooting

ICE MACHINE WILL NOT RUN

⚠ Warning

An ice machine contains high voltage electricity and refrigerant charge. Repairs are to be performed by properly trained refrigeration technicians aware of the dangers of dealing with high voltage electricity and R290 (propane) refrigerant under pressure.The technician must also be certified in proper refrigerant handling and servicing procedures. All lockout and tag out procedures must be followed when working on this equipment.

High (line) voltage is applied to the control board (terminals #2 and #4) at all times. Removing control board fuse or moving the toggle switch to OFF will not remove the power supplied to the control board.

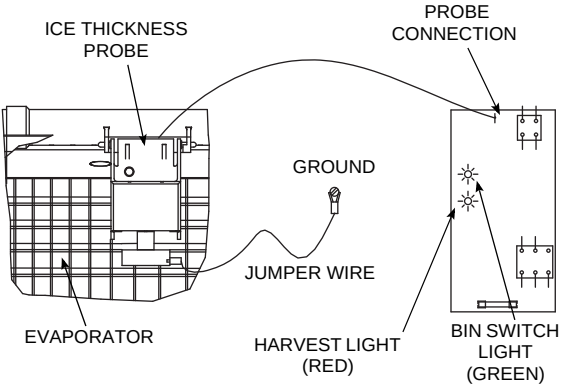
1. Verify primary voltage is supplied to ice machine and the fuse/circuit breaker is closed.
2. Verify control board fuse is okay.
3. If the bin switch light functions, the fuse is okay.
4. Verify the bin switch functions properly. A defective bin switch can falsely indicate a full bin of ice.
5. Verify ON/OFF/WASH toggle switch functions properly. A defective toggle switch may keep the ice machine in the OFF mode.
6. Verify low DC voltage is properly grounded. Loose DC wire connections may intermittently stop the ice machine.
7. Replace the control board.
8. Be sure Steps 1 – 5 were followed thoroughly. Intermittent problems are not usually related to the control board.

DIAGNOSING ICE THICKNESS CONTROL CIRCUITRY

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 ON/OFF/WASH switch to OFF and back to ON. Wait until the water starts to flow over the evaporator.

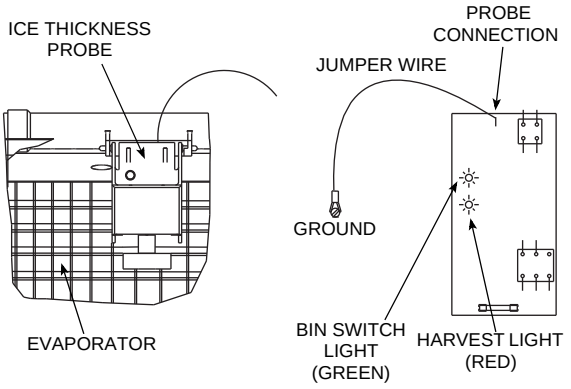
Step 2 Clip the jumper wire to the ice thickness probe and any cabinet ground.



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Step 2 Jumper wire connected from probe to ground	
Monitoring Harvest Light	**Correction**
The harvest light comes on, and 6-10 seconds later, ice machine cycles from freeze to harvest.	The ice thickness control circuitry is functioning properly. Do not change any parts.
The harvest light comes on but the ice machine stays in the freeze sequence.	The ice control circuitry is functioning properly. The ice machine is in a six minute freeze time lock-in. Verify Step 1 of this procedure was followed correctly.
The harvest light does not come on.	Proceed to Step 3.

Step 3 Disconnect the ice thickness probe from the control board terminal. Clip the jumper wire to the terminal on the control board and any cabinet ground. Monitor the harvest light.

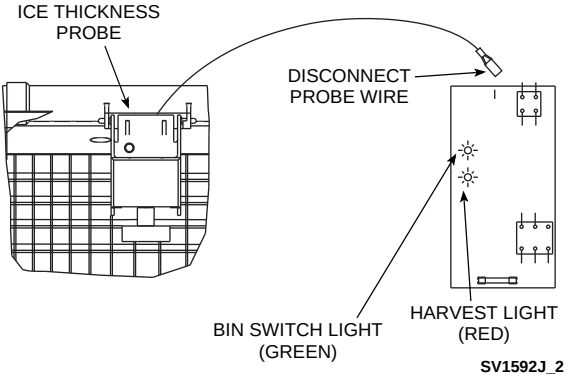


Step 3 Jumper wire connected from control board terminal to ground	
Monitoring Harvest Light	**Correction**
The harvest light comes on, and 6-10 seconds later, ice machine cycles from freeze to harvest.	The ice thickness probe is causing the malfunction.
The harvest light comes on but the ice machine stays in the freeze sequence.	The control circuitry is functioning properly. The ice machine is in a six-minute freeze time lock-in (verify step 1 of this procedure was followed correctly).
The harvest light does not come on.	The control board is causing the malfunction.

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 ON/OFF/WASH switch to OFF and back to ON. Wait until the water starts to flow over the evaporator, then monitor the harvest light.

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



Step 2 Disconnect probe from control board terminal.	
Monitoring Harvest Light	**Correction**
The harvest light stays off and the ice machine remains in the freeze sequence.	The ice thickness probe is causing the malfunction. Verify that the Ice Thickness probe is adjusted correctly.
The harvest light comes on, and 6-10 seconds later, the ice machine cycles from freeze to harvest.	The control board is causing the malfunction.

ICE PRODUCTION CHECK

The amount of ice a machine produces directly relates to the operating water and air temperatures. This means an ice machine with a 21°C) ambient temperature and 10°C water produces more ice than the same ice machine with 32°C ambient and 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. Use the operating conditions determined in Step 1 to find published 24 hr. ice production:____
   Times are in minutes.
   Example: 1 minute, 15 seconds converts to 1.25 minutes, (15 seconds ÷ 60 seconds = .25 minutes)
3. Perform an ice production check using the formula below.

1. _____	+	_____	=	_____	
Freeze Time		Harvest Time		Total Cycle Time	
2. 1440	÷	_____	=	_____	
Minutess in 24 hrs		Total Cycle Time		Cycles Per Day	
3. _____	x	_____	=	_____	
Weight of One Harvest		Cycles Per Day		Actual 24 Hr Production	

Weighing the ice is the only 100% accurate check. However, if the ice pattern is normal and the 3mm thickness is maintained, the ice slab weights listed with the 24-Hour Ice Production Charts may be used.

4. Compare the results of step 3 with step 2. Ice production is normal when these numbers match closely. If they match closely, determine if:

   Another larger ice machine 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 AND VISUAL INSPECTION CHECKLIST

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

WATER SYSTEM CHECKLIST

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

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

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

Water area (evaporator) is dirty

- Clean as needed

Water inlet pressure not between 1–5 bar (138–552 kPa)

- Install a water regulator valve or increase the water pressure

Incoming water temperature is not between 4°C and 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

Vent tube is not installed on water outlet drain

- See Installation Instructions

Hoses, fittings, etc., are leaking water

- Repair/replace as needed

Water float valve is stuck open or closed

- Clean/replace as needed

Water is spraying out of the sump trough area

- Stop the water spray

Uneven water flow across the evaporator

- Clean the ice machine

Water is freezing behind the evaporator

- Correct the water flow

Plastic extrusions and gaskets are not secured to the evaporator

- Remount/replace as needed

ICE FORMATION PATTERN

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

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

Any number of problems can cause improper ice formation.

Example: An ice formation that is "extremely thin at the outlet" could be caused by a hot water supply, water leaking out the overflow pipe, a faulty water float valve, a low refrigerant charge, etc.



Examples of Evaporator Tubing Routing

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 at 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 at the inlet. This is normal.

If ice forms uniformly across the evaporator surface, but does not do so in the proper amount of time, this is still considered a normal ice fill pattern.

Extremely Thin at Evaporator Outlet

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

Examples: No ice at all at the outlet of the evaporator, but ice forms at the inlet half of the evaporator. Or, the ice at the outlet of the evaporator reaches the correct thickness, but the outlet of the evaporator already has 12 mm to 25 mm of ice formation.

Possible cause: Water loss, low on refrigerant, starving TXV, hot water supply, faulty float valve, etc.

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 the correct thickness, but there is no ice formation at all at the inlet of the evaporator.

Possible cause: Insufficient water flow, flooding TXV, etc.

Spotty Ice Formation

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

No Ice Formation

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

Possible cause: Water float valve, water pump, starving expansion valve, low refrigerant charge, compressor, etc.

SAFETY LIMIT FEATURE

In addition to the standard safety controls, your Manitowoc ice machine features built-in safety limits that will stop the ice machine if conditions arise which could cause a major component failure.

Before calling for service, re-start the ice machine using the following procedure:

1. Move the ON/OFF/WASH switch to OFF and then back to ON.
2. If the safety limit feature has stopped the ice machine, it will restart after a short delay. Proceed to step 4.
3. If the ice machine does not restart, see “Ice machine does not operate”.
4. Allow the ice machine to run to determine if the condition is reoccurring.
   A. If the ice machine stops again, the condition has reoccurred. Call for service.
   B. If the ice machine continues to run, the condition has corrected itself. Allow the ice machine to continue running.

Safety Limits

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

Safety Limit #1: If the freeze time reaches 60 minutes, the control board automatically initiates a harvest cycle. 3 cycles outside the time limit = 1 hour Stand-by Mode.

Safety Limit #2: If the harvest time reaches 3.5 minutes, the control board automatically returns the ice machine to the freeze cycle. 3 cycles outside the time limit = Safety Limit (must be MANUALLY reset).

Safety Limit Stand-by Mode: The first time a safety limit shut down occurs, the ice machine turns off for 60 minutes (Stand-by Mode). The ice machine will then automatically restart to see if the problem reoccurs. During the Stand-by Mode the harvest light will be flashing continuously and a safety limit indication can be viewed. If the same safety limit is reached a second time (the problem has reoccurred), 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.

Determining Which Safety Limit Stopped the Ice Machine: When a safety limit condition causes the ice machine to stop, the harvest light on the control board continually flashes on and off. Use the following procedures to determine which safety limit has stopped the ice machine.

1. Move the toggle switch to OFF.
2. Move the toggle switch back to ON.
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 Notes

- A safety limit indication is completed before the water pump starts. Water contacting the ice thickness probe in the freeze cycle will cause the harvest light to flash. Do not mistake a harvest light flashing in the freeze cycle with a safety limit indication.
- A continuous run of 100 harvests automatically erases the safety limit code.
- The control board will store and indicate only one safety limit – the last one exceeded.
- If the toggle switch is moved to the OFF position and then back to the ON position prior to reaching the 100-harvest point, the last safety limit exceeded will be indicated.
- If the harvest light did not flash prior to the ice machine restarting, then the ice machine did not stop because it exceeded a safety limit.

Safety Limit Checklist

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

Safety Limit #1

Freeze time exceeds 60 minutes for 6 consecutive freeze cycles.

Possible Cause Checklist

Improper installation

- Refer to “Installation and Visual Inspection Checklist” on page 52

Water System

- Water Level set too high (water escaping through over flow tube)
- Low water pressure 1.37 bar minimum
- High water pressure 5.52 bar maximum
- High water temperature 32°C maximum
- Clogged water distribution tube
- Dirty/defective float valve
- Defective water pump

Electrical System

- Ice thickness probe out of adjustment
- Harvest cycle not initiated electrically
- Contactor not energizing
- Compressor electrically non-operational
- Restricted condenser air flow
- High inlet air temperature 43°C maximum
- Condenser discharge air re-circulation
- Dirty condenser fins
- Defective fan cycling control
- Defective fan motor
- Low water pressure 1.37 bar minimum
- High water temperature 32°C maximum
- Dirty condenser

Refrigeration System

- Non-Manitowoc components
- Improper refrigerant charge
- Defective compressor
- TXV starving or flooding (check bulb mounting)
- Non-condensable in refrigeration system
- Plugged or restricted high side refrigerant lines or component
- Defective hot gas valve

Safety Limit #2

Harvest time exceeds 3.5 minutes for 6 Consecutive harvest cycles.

Possible Cause Checklist

Improper installation

- Refer to “Installation and Visual Inspection Checklist” on page 52.

Water System

- Water area (evaporator) dirty
- Dirty/defective water dump valve
- Vent tube not installed on water outlet drain
- Water freezing behind evaporator
- Plastic extrusions and gaskets not securely mounted to the evaporator
- Low water pressure 1.37 bar minimum
- Loss of water from sump area
- Clogged water distribution tube
- Dirty/defective float valve
- Defective water pump

Electrical system

- Ice thickness probe out of adjustment
- Ice thickness probe dirty
- Bin switch defective
- Premature harvest

Refrigeration system

- Non-Manitowoc components
- Improper refrigerant charge
- Defective hot gas valve
- TXV flooding (check bulb mounting)
- Defective fan cycling control

ANALYZING DISCHARGE LINE TEMPERATURE

1. Determine the ice machine operating conditions:

   Air temp. entering condenser _____

   Air temp. around ice machine _____

   Water temp. entering sump trough _____

2. Refer to “Cycle Times, 24 Hr. Ice Production and Refrigerant Temperature Charts” on page 101 for ice machine being checked.

Use the operating conditions determined in step 1 to find the published normal discharge temperatures.

Freeze Cycle _____

Harvest Cycle _____

3. Perform an actual discharge temperature check.

	Freeze Cycle PSIG	**Harvest Cycle PSIG**
Beginning of Cycle	_____	_____
Middle of Cycle	_____	_____
End of Cycle	_____	_____

4. Compare the actual discharge temperature (step 3) with the published discharge temperature (step 2).

The discharge temperature is normal when the actual temperature falls within the published temperature range for the ice machine’s operating conditions. It is normal for the discharge temperature to be higher at the beginning of the freeze cycle (when load is greatest), then drop through out the freeze cycle.

Discharge temperature High Checklist

Improper Installation

- Refer to “Installation and Visual Inspection Checklist” on page 52.

Restricted Condenser Air Flow

- High inlet air temperature
- Condenser discharge air re-circulation
- Dirty condenser fins
- Defective fan cycling control
- Defective fan motor

Improper Refrigerant Charge

- Overcharged
- Non-condensable in system
- Wrong type of refrigerant

Other

- Non-Manitowoc components in system
- High side refrigerant lines/component
- Restricted (before mid-condenser)

Freeze Cycle Discharge temperature Low Checklist

Improper Installation

- Refer to “Installation and Visual Inspection Checklist” on page 52.

Improper Refrigerant Charge

- Undercharged
- Wrong type of refrigerant

Other

- Non-Manitowoc components in system
- High side refrigerant lines/component restricted (before mid-condenser)
- Defective fan cycle control

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

ANALYZING SUCTION TEMPERATURE

The suction temperature gradually drops throughout the freeze cycle. The actual suction temperature (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 temperature drop throughout the freeze cycle, compare the published suction temperature to the published freeze cycle time.

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

Procedure

Step
1. Determine the ice machine operating conditions. *Example:* *Air temp. entering condenser: 32°C* *Air temp. around ice machine: 27°C* *Water temp. entering water fill valve: 21°C*
2A. Refer to “Cycle Time” and “Operating temperature” charts for ice machine model being checked. Using operating conditions from Step 1, determine published freeze cycle time and published freeze cycle suction temperature. *Example:* *Published freeze cycle time: 19.5 - 21.4 minutes* *Published freeze cycle suction temperature: -6 to -17*
2B. Compare the published freeze cycle time and published freeze cycle suction temperature. Develop a chart. *Example:* *Published Freeze Cycle Time (minutes)* 1 2 5 10 13 17 20 | | | | | | | -6 -8 -10 -12 -14 -16 -17 *Published Freeze Cycle Suction temperature* *In the example, the proper suction temperature should be approximately -10 degrees at 5 minutes; -14 degrees at 13 minutes.*
3. Perform an actual suction temperature check at the beginning, middle and end of the freeze cycle. Note the times at which the readings are taken. *Example:* *Thermocouples were connected to the example ice machine and suction temperature readings taken as follows: _____* *Beginning of Freeze cycle: -1 (at 1 minute)* *Middle of freeze cycle: -6 (at 10 minutes)* *End of freeze cycle: -12 (at 20 minutes)*

Step
4. Compare the actual freeze cycle suction temperature (Step 3) to the published freeze cycle time and temperature comparison (Step 2B). Determine if the suction temperature is high, low or acceptable. *Example:* *In this example, the suction temperature is considered high throughout the freeze cycle. It should have been:* *Approximately -6 (at 1 minute) – not -1* *Approximately -12 (at 10 minutes) – not -6* *Approximately -17 (at 20 minutes) – not -12*

Suction temperature High Checklist

Improper Installation

- Refer to “Installation and Visual Inspection Checklist” on page 52.

Discharge temperature

- Discharge temperature is too high, and is affecting suction temperature

Improper Refrigerant Charge

- Overcharged
- Wrong type of refrigerant
- Non-condensables in system

Other

- Non-Manitowoc components in system
- Hot gas valve leaking
- TXV flooding (check bulb mounting)
- Defective compressor

Suction temperature Low Checklist

Improper Installation

- Refer to “Installation and Visual Inspection Checklist” on page 52.

Discharge temperature

- Discharge temperature is too low, and is affecting suction temperature, refer to “Freeze Cycle Discharge temperature Low Checklist”

Improper Refrigerant Charge

- Undercharged
- Wrong type of refrigerant

Other

- Non-Manitowoc components in system
- Improper water supply over evaporator refer to “Water System Checklist” on page 53.
- Loss of heat transfer from tubing on back side of evaporator
- Restricted/plugged liquid line drier
- Restricted/plugged tubing in suction side of refrigeration system
- TXV starving

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

HOT GAS VALVE

General

The hot gas valve is an electrically operated valve that opens when energized, and closes when de-energized.

Normal Operation

The valve is de-energized (closed) during the freeze cycle and energized (open) during the harvest cycle. The valve is positioned between the receiver and the evaporator and performs two functions:

1. Prevents refrigerant from entering the evaporator during the freeze cycle.

   The hot gas valve is not used during the freeze cycle. The hot gas valve is de-energized (closed) preventing refrigerant flow from the receiver into the evaporator.

2. Allows refrigerant vapor to enter the evaporator in the harvest cycle.

   During the harvest cycle, the hot gas valve is energized (open) allowing refrigerant gas from the discharge line of the compressor to flow into the evaporator. The heat is absorbed by the evaporator and allows release of the ice slab.

Exact temperatures vary according to ambient temperature and ice machine model. Harvest temperatures can be found in the Cycle Time/24 Hour Ice Production/ Refrigerant Temperature Charts in this book.

Hot Gas Valve Analysis

The valve can fail in two positions:

- Valve will not open in the harvest cycle.
- Valve remains open during the freeze cycle.

VALVE WILL NOT OPEN IN THE HARVEST CYCLE

Although the circuit board has initiated a harvest cycle, the evaporator temperature remains unchanged from the freeze cycle.

⚠ Caution

Coil must be seated 100% on solenoid to function correctly. Install coil with a twisting motion to properly seat.

VALVE REMAINS OPEN IN THE FREEZE CYCLE:

Symptoms of a hot gas valve remaining partially open during the freeze cycle can be similar to symptoms of an expansion valve, float valve or compressor problem. Symptoms are dependent on the amount of leakage in the freeze cycle.

A small amount of leakage will cause increased freeze times and an ice fill pattern that is “Thin at the Outlet”, but fills in at the end of the cycle.

As the amount of leakage increases the length of the freeze cycle increases and the amount of ice at the outlet of the evaporator decreases.

Refer to the Parts Manual for proper valve application. If replacement is necessary, use only “original” Manitowoc replacement parts.

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

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

Important

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

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

3. Feel the compressor discharge line.

⚠ Warning

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

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

Findings	Comments
The inlet of the 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.

COMPARING EVAPORATOR INLET/OUTLET TEMPERATURES

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

The actual temperatures entering and leaving the evaporator vary by model, and change throughout the freeze cycle. This makes documenting the "normal" inlet and outlet temperature readings difficult. The key to the diagnosis lies in the difference between the two temperatures five minutes into the freeze cycle. These temperatures must be within 4°C of each other.

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

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

Important

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

3. Wait five minutes into the freeze cycle.
4. Record the temperatures below and determine the difference between them.

_____	_____	_____
Inlet Temperature	Difference must be within 4°C at 5 minutes into the freeze cycle	Outlet Temperature

5. Use this with other information gathered on the Refrigeration System Operational Analysis Table to determine the ice machine malfunction.

DISCHARGE LINE TEMPERATURE ANALYSIS

GENERAL

Knowing if the discharge line temperature is increasing, decreasing or remaining constant can be an important diagnostic tool. Maximum compressor discharge line temperature on a normally operating ice machine steadily increases throughout the freeze cycle. Comparing the temperatures over several cycles will result in a consistent maximum discharge line temperature.

Ambient air temperatures affect the maximum discharge line temperature.

Higher ambient air temperatures at the condenser = higher discharge line temperatures at the compressor.

Lower ambient air temperatures at the condenser = lower discharge line temperatures at the compressor.

Regardless of ambient temperature, the freeze cycle discharge line temperature will be higher than 66°C on a normally operating ice machine.

PROCEDURE

Connect a temperature probe on the compressor discharge line within 15 cm of the compressor. Observe the discharge line temperature for the last three minutes of the freeze cycle and record the maximum discharge line temperature.

Discharge Line Temperature Above 66°C at End of Freeze Cycle:

Ice machines that are operating normally will have consistent maximum discharge line temperatures above 66°C.

Verify the expansion valve sensing bulb is positioned and secured correctly.

Discharge Line Temperature Below 66°C at End of Freeze Cycle

Ice machines that have a flooding expansion valve will have a maximum discharge line temperature that decreases each cycle.

Verify the expansion valve sensing bulb is 100% insulated and sealed airtight. Condenser air contacting an incorrectly insulated sensing bulb will cause overfeeding of the expansion valve.

REFRIGERATION COMPONENT DIAGNOSTIC CHART

All electrical and water related problems must be corrected before these charts will work properly. These tables must be used with charts, checklists and other references to eliminate refrigeration components not listed and external items and problems that will cause good refrigeration components to appear defective.

The tables list four 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.

PROCEDURE

Step 1 Complete each item individually in the "Operational Analysis" column.

Enter check marks (✓) in the boxes.

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

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

Perform the procedures and check all information listed. Each item in this column has supporting reference material.

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 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 and/or supporting material was not analyzed correctly.

FINAL ANALYSIS

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

Column 1 – Hot Gas Valve Leaking

A leaking hot gas valve must be replaced.

Column 2 – Low Charge/TXV Starving

Normally, a starving expansion valve only affects the freeze cycle temperatures, not the harvest cycle temperatures. A low refrigerant charge normally affects both temperatures.

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.

Column 4 – Compressor

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

REFRIGERATION COMPONENT DIAGNOSTIC CHART

SINGLE EXPANSION VALVE SELF CONTAINED AIR COOLED CONDENSER

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
Discharge Line Temperature 3 minutes into the freeze cycle	Normal or High	Normal or High	Low	Normal or High

SINGLE EXPANSION VALVE SELF CONTAINED AIR COOLED CONDENSER

Operational Analysis	**1**	**2**	**3**	**4**
Suction Line Temperature 3 minutes into the freeze cycle	Normal or High	Normal or High	Low	Normal or High
Freeze Cycle Suction Temperature _____ _____ _____ **1 minute Middle End**	If suction temperature is High or Low refer to freeze cycle high or low suction temperature problem checklist page 67 to eliminate problems and/or components not listed on this table before proceeding.			
	Suction temperature is **High**	Suction temperature is **Low or Normal**	Suction temperature is **High**	Suction temperature is **High**
Wait 5 minutes into the freeze cycle. Compare temperatures of **evaporator inlet** and **evaporator outlet.** **Inlet** _____ **°C** **Outlet** _____ **°C** **Difference**_____ **°C**	Inlet and outlet **within 4°C** of each other	Inlet and outlet **not within 4°C** of each other -and- Inlet is colder than outlet	Inlet and outlet **within4°C** of each other -or- Inlet and outlet **not within 4°C** of each other -and- Inlet is warmer than outlet	Inlet and outlet **within 4°C** of each other

SINGLE EXPANSION VALVE SELF CONTAINED AIR COOLED CONDENSER

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 _____**°C**	Discharge line temperature **71°C or higher** at the end of the freeze cycle	Discharge line temperature **71°C or higher** at the end of the freeze cycle	Discharge line temperature **71°C or Lower** at the end of the freeze cycle	Discharge line temperature **71°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**

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Component Check Procedures

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, 10 amp.

> **⚠ Warning**
>
> High (line) voltage is applied to the control board 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 ice damper closed, the fuse is good.

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

2. Remove the fuse. Check the resistance across the fuse with an ohmmeter.

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

Bin Switch

Function

Bin switch operation is controlled by the movement of the ice damper. The bin switch has two main functions:

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

   This occurs when the bin switch is opened and closed again within 7 seconds of opening 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 ice damper and holds it down. After the ice damper is held down for 7 seconds, the ice machine shuts off.

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

Important

The ice damper must be up (bin switch closed) to start ice making.

Check Procedure

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

Ohm Test

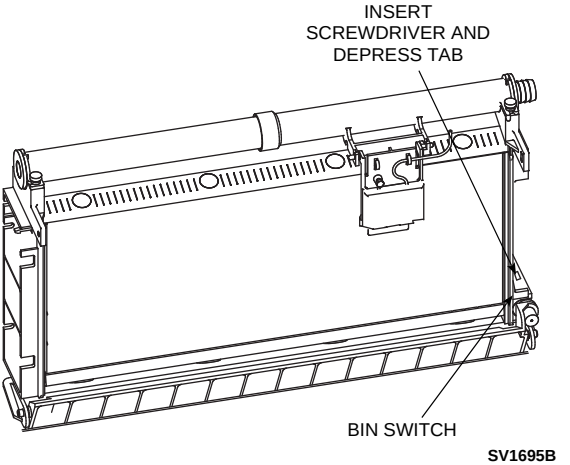
1. Disconnect the bin switch wires to isolate the bin switch from the control board.
2. Connect an ohmmeter to the disconnected bin switch wires.
3. Cycle the bin switch open and closed numerous times by opening and closing the water curtain.

NOTE: To prevent misdiagnosis:

- Always use the water curtain magnet to cycle the switch (a larger or smaller magnet will affect switch operation).
- Watch for consistent readings when the bin switch is cycled open and closed (bin switch failure could be erratic).

Bin Switch Removal

1. Disconnect power to the ice machine at service disconnect.
2. Disconnect bin switch wires in control box.
3. Insert a small screwdriver through the hole located in the top of the bin switch, and depress mounting tab slightly.
4. While depressing mounting tab roll bin switch to right to release.
5. Pull wiring into evaporator compartment.



Bin Switch Removal

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.

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 open. The relay senses the voltage generated by the start winding and closes and then opens the contacts as the compressor motor starts. The contacts remain open until the compressor is de-energized.

ON/OFF/WASH Toggle Switch

Function

The switch is used to place the ice machine in ON, OFF or WASH 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 all wires from the switch, or by disconnecting the Molex connector from the control board.
3. Check across the toggle switch terminals using a calibrated ohmmeter. 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
ON	24-21	Open
	24-20	Closed
	20-21	Open
WASH	24-20	Open
	24-21	Closed
	20-21	Open
OFF	24-20	Open
	24-21	Open
	20-21	Open

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

Ice Thickness Probe

How The Probe Works

Manitowoc's electronic sensing circuit does not rely on refrigerant temperature, 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.

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 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 ON.

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.

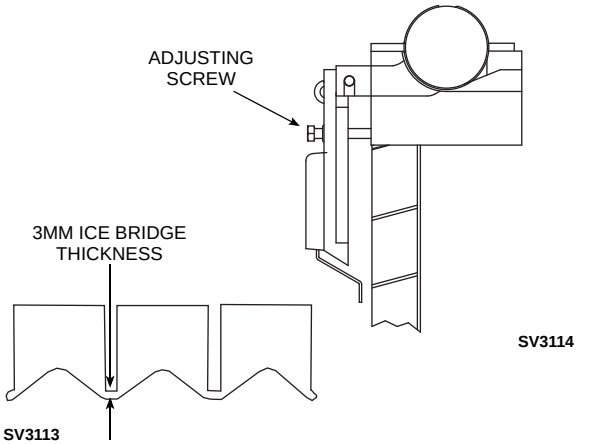
ICE THICKNESS CHECK

The ice thickness probe is factory-set to maintain the ice bridge thickness at 3 mm.

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

1. Inspect the bridge connecting the cubes. It should be about 3 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.

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



Ice Thickness Check

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

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 49°C) to ensure that the overload is closed and the resistance readings will be accurate.

Single Phase Compressors

1. Disconnect power from the condensing unit and 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.

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.

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

Compressor Drawing Locked Rotor

The two likely causes of this are:

- Defective starting component
- Mechanically seized compressor

Compressor Drawing High Amps

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

The wiring must be correctly sized to minimize voltage drop at compressor start-up. The voltage when the compressor is trying to start must be within ±10% of the nameplate voltage.

Fan Cycle Control

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)
Q210	13.78 bar ±.34	10.34 bar ±.34
Q270	13.78 bar ±.34	10.34 bar ±.34

Check Procedure

Disconnect electrical power to the ice machine at the electrical service disconnect.

Verify fan motor windings are not open or grounded, and fan spins freely.

Connect manifold gauges to ice machine.

Hook voltmeter in parallel across the fan cycle control, leaving wires attached.

Reconnect electrical power to the ice machine and set the ON/OFF/WASH toggle switch to ON.

Wait until water flows over the evaporator then refer to chart below.

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

High Pressure Cutout (HPCO) Control

Function

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

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

Specifications

Cut-out: 24.13 ±.69 bar

Cut-in: Automatic reset

(Must be below 17.23 bar to reset).

Check Procedure

1. Set ON/OFF/WASH switch to OFF.
2. Connect manifold gauges.
3. Hook voltmeter in parallel across the HPCO, leaving wires attached.
4. Disconnect the fan motor.
5. Set ON/OFF/WASH switch to ON.
6. No 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 31.71 bar and the HPCO control does not cut out, set ON/OFF/WASH switch to OFF to stop ice machine operation.

Replace the HPCO control if it:

- Will not reset (below 17.23 bar)
- Does not open at the specified cut-out point

Liquid Line Filter-Driers

The filter-drier 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 a very high moisture removal capability and a good acid removal capacity.

Important

The liquid line drier is covered as a warranty part. The liquid line drier must be replaced any time the system is opened for repair.

Refrigerant Recovery/Evacuation

RECOVERY AND RECHARGING PROCEDURES

Requirements and procedures vary by location. Follow your local laws governing the recovery, evacuation and charging of equipment that contains propane refrigerant.

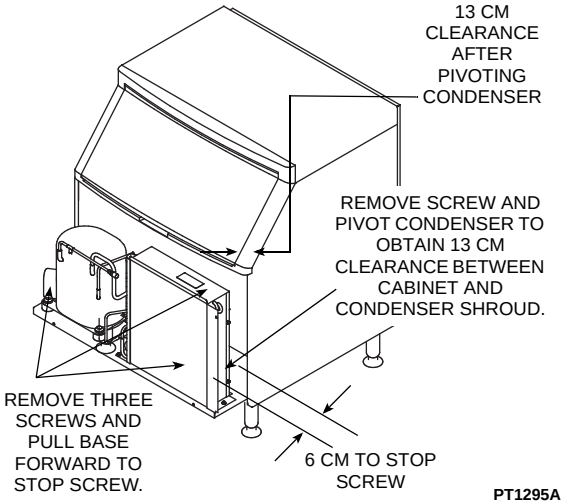
Q270 Condenser Fan Motor Replacement

Access to remove, clean or replace the condenser fan/motor can be obtained by performing the following:

1. Disconnect electrical power to the ice machine at the electrical service disconnect.
2. Remove the screws that secure the condenser to the cabinet and the base to the cabinet.
3. Slide the base forward until contact is made with the stop screw approximately 6 cm.

> **⚠ Caution**
>
> Do not move base past the stop screw, tubing damage could result.

4. Remove right hand screw securing condenser to base.
5. Pivot condenser forward to obtain 13 cm between the cabinet and condenser shroud. Take care not to kink refrigeration tubing.



Accessing the Condenser Fan Motor

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Component Specifications

Main Fuse

	Volt	Amp
Q210/Q270	250	10

Bin Switch

Bin switch operation is controlled by the movement of the ice damper.

ON/OFF/WASH Toggle Switch

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

Fan Control Cycle

Model	Cut-in (Close)	Cut-out (Open)
Q210/Q270	13.78 bar ±.34	10.34 bar ±.34

High Pressure Cutout (HPCO) Control

Cut-out	Cut-in
31 bar ±.69	Automatic Reset
Must be below 20.68 bar to reset.	

Total System Refrigerant Charge

Important

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 this page.

Model	Air-Cooled	Refrigerant Type
Q210	130 grams	R290
Q270	130 grams	R290

Cycle Times, 24 Hr. Ice Production and Refrigerant Temperature Charts

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

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

- Beginning temperatures are taken 1 minute after the water pump energizes.
- Refer to “Operational Analysis Chart” for the list of data that must be collected for refrigeration diagnostics.
- 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.
- Suction temperature is highest at the beginning of the cycle. Suction temperature will drop throughout the cycle. Verify the temperatures are within the range indicated.

Q210 SELF-CONTAINED AIR-COOLED

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °C/°F	Freeze Time			Harvest Time[1]
	Water Temperature °C/°F			
	10°C/50°F	21°C/70°F	32°C/90°F	
21°C/70°F	14.8-16.9	17.5-19.9	19.8-22.5	1-2.5
27°C/80°F	16.5-16.9	19.8-22.5	22.7-25.8	
32°C/90°F	18.6-21.1	22.7-25.8	26.6-30.2	
38°C/100°F	21.2-24.0	26.6-30.2	32.2-36.2	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °C/°F	Water Temperature °C/°F[1]		
	10°C 50°F	21°C 70°F	32°C 90°F
21°C - kgs 70°F - lbs	98 kgs 215 lbs	84 kg 185 lbs	75 kg 165 lbs
27°C - kgs 80°F - lbs	88 kg 195 lbs	75 kg 165 lbs	66 kg 145 lbs
32°C - kgs 90°F - lbs	79 kg 175 lbs	66 kg 145 lbs	57 kg 125 lbs
38°C - kgs 100°F - lbs	70 kg 155 lbs	57 kg 125 lbs	48 kg 105 lbs

1 Based on average ice slab weight of 1107 - 1247 g (2.44 - 2.75 lb.)

OPERATING TEMPERATURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Temp	Evaporator Outlet Temp[1]	Discharge Temp	Evaporator Outlet Temp
10°C 50°F	63° - 93° 145° - 200°	-6° to -17° 20° to 01°	21° to 29° 70° to 85°	21° to 27° 70° to 80°
21°C 70°F	66° - 93° 150° - 200°	-6° to -17° 20° to 01°	21° to 29° 70° to 85°	21° to 27° 70° to 80°
27°C 80°F	71° - 93° 160° - 200°	-6° to -17° 20° to 01°	24° to 32° 75° to 90°	21° to 29° 70° to 85°
32°C 90°F	88° - 93° 190° - 200°	2° to -9° 35° to 15°	29° to 35° 85° to 95°	24° to 32° 75° to 90°
43°C 110°F	110° - 121° 230° - 250°	5° to -9° 40° to 15°	32° to 40° 90° to 105°	29° to 38° 85° to 100°

1 Suction temperature drops gradually throughout the freeze cycle

Q270 SELF-CONTAINED AIR-COOLED

CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °C/°F	Freeze Time			Harvest Time[1]
	Water Temperature °C/°F			
	10°C/50°F	21°C/70°F	32°C/90°F	
21°C/70°F	11.0-12.6	12.6-14.3	13.8-15.7	1-2.5
27°C/80°F	12.0-13.7	13.8-15.7	15.2-17.4	
32°C/90°F	13.1-15.0	15.6-17.8	17.5-19.9	
38°C/100°F	14.5-16.5	17.0-19.3	19.2-21.8	

1 Times in minutes

24 HOUR ICE PRODUCTION

Air Temp. Entering Condenser °C/°F	Water Temperature °C/°F[1]		
	10°C 50°F	21°C 70°F	32°C 90°F
21°C - kgs 70°F - lbs	127 kg 280 lbs	113 kg 250 lbs	104 kg 230 lbs
27°C - kgs 80°F - lbs	118 kg 260 lbs	104 kg 230 lbs	95 kg 210 lbs
32°C - kgs 90°F - lbs	109 kg 240 lbs	93 kg 205 lbs	84 kg 185 lbs
38°C - kgs 100°F - lbs	100 kg 220 lbs	86 kg 190 lbs	77 kg 170 lbs

1 Based on average ice slab weight of 1107 - 1247 g (2.44 - 2.75 lb.)

OPERATING TEMPERATURES

Air Temp Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Temp	Evaporator Outlet Temp[1]	Discharge Temp	Evaporator Outlet Temp
10°C 50°F	82° to-88° 180°-190°	-2° to -16° 28° to 04°	43° to 52° 110° to125°	4° to 10° 40° to 50°
21°C 70°F	82° to 88° 180° to 190°	-2° to -16° 28° to 04°	43° to 52° 110° to 125°	4° to 10° 40° to 50°
27°C 80°F	85° to 90° 185° to 195°	-1° to -16° 29° to 04°	46° to 57° 115° to 135°	4° to 13° 40° to 55°
32°C 90°F	88° to 93° 190° to 200°	-1° to -16° 30° to 04°	54° to -60° 130° to 140°	7° to 13° 45° to -55°
38°C 100°F	90° to 96° 195° to 205°	0° to -16° 32° to 04°	54° to 63° 130° to 145°	7° to 16° 45° to 60°

1 Suction temperature drops gradually throughout the freeze cycle

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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

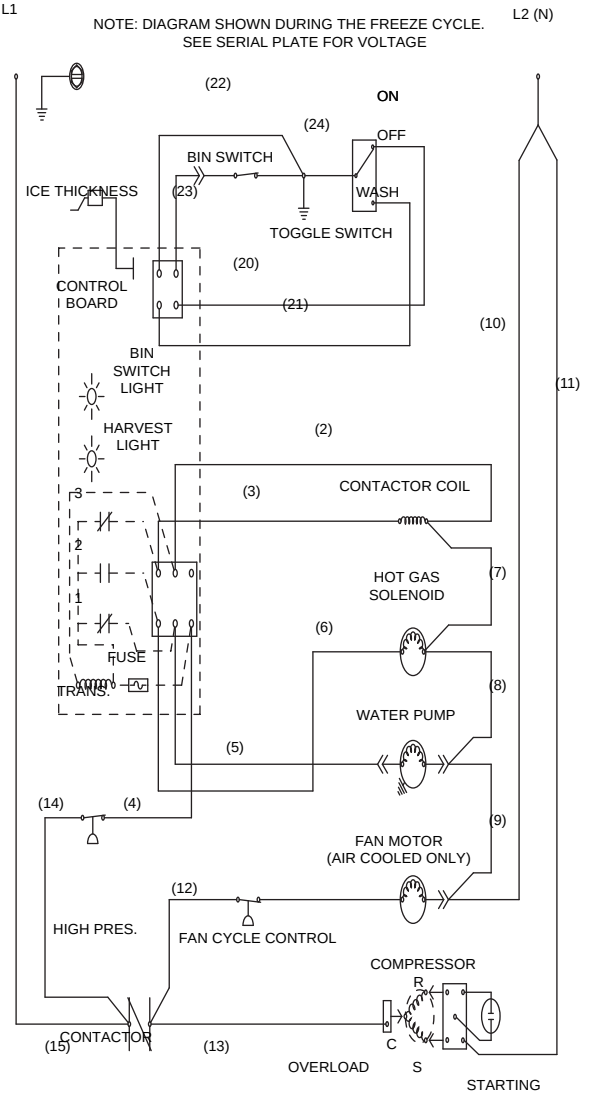
Always disconnect power before working on electrical circuitry.

Wiring Diagram Legend

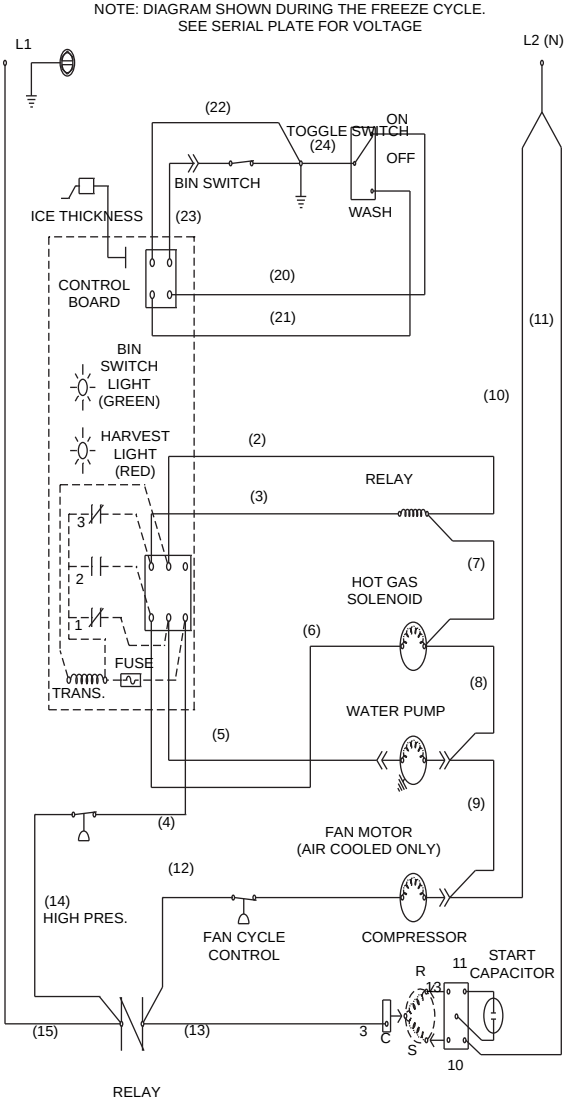
The following symbols are used on all of the wiring diagrams:

*	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)

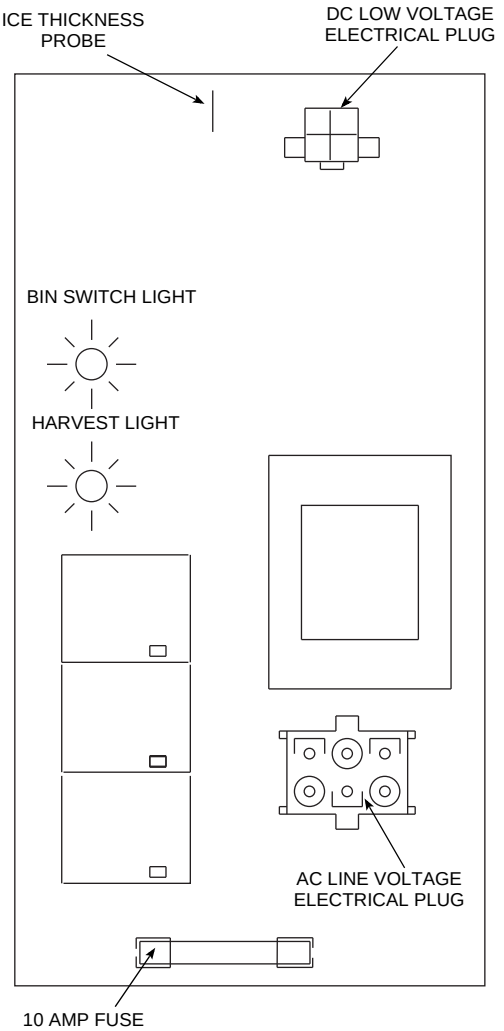
Q210


L1
L2 (N)
NOTE: DIAGRAM SHOWN DURING THE FREEZE CYCLE.
SEE SERIAL PLATE FOR VOLTAGE
(22)
ON
(24)
OFF
BIN SWITCH
ICE THICKNESS
(23)
WASH
TOGGLE SWITCH
(20)
CONTROL
BOARD
(21)
(10)
BIN
SWITCH
LIGHT
(11)
HARVEST
LIGHT
(2)
3
(3)
CONTACTOR COIL
2
HOT GAS
SOLENOID
(7)
1
(6)
FUSE
TRANS.
(8)
WATER PUMP
(5)
(14)
(4)
(9)
FAN MOTOR
(AIR COOLED ONLY)
(12)
HIGH PRES.
FAN CYCLE CONTROL
COMPRESSOR
R
CONTACTOR
(15)
(13)
C
S
OVERLOAD
STARTING

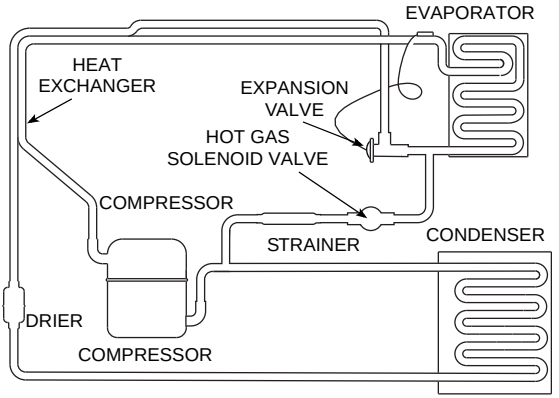
Q270


NOTE: DIAGRAM SHOWN DURING THE FREEZE CYCLE.
SEE SERIAL PLATE FOR VOLTAGE
L1
L2 (N)
(22)
TOGGLE SWITCH
(24)
ON
OFF
BIN SWITCH
ICE THICKNESS
(23)
WASH
CONTROL BOARD
(20)
(21)
(11)
BIN SWITCH LIGHT (GREEN)
(10)
HARVEST LIGHT (RED)
(2)
RELAY
(3)
3
2
1
(7)
HOT GAS SOLENOID
(6)
FUSE
TRANS.
(8)
WATER PUMP
(5)
(9)
(4)
FAN MOTOR (AIR COOLED ONLY)
(12)
(14)
HIGH PRES.
FAN CYCLE CONTROL
COMPRESSOR
START CAPACITOR
R
11
C
S
3
(15)
(13)
10
RELAY

Electronic Control Boards



Tubing Schematic



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