

# NEO™

## 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](http://www.manitowocice.com)





## **Safety Notices**

### **Read these precautions to prevent personal injury:**

- 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.
- Routine adjustments and maintenance procedures outlined in this manual are not covered by the warranty.
- Proper installation, care and maintenance are essential for maximum performance and trouble-free operation of your equipment.
- Visit our website [www.manitowocice.com](http://www.manitowocice.com) for manual updates, translations, or contact information for service agents in your area.
- 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.
- This equipment is intended for indoor use only. Do not install or operate this equipment in outdoor areas.
- As you work on this 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.

## **Warning**

### **Follow these electrical requirements during installation of this equipment.**

- All field wiring must conform to all applicable codes of the authority having jurisdiction. It is the responsibility of the end user to provide the disconnect means to satisfy local codes. Refer to rating plate for proper voltage.
- This appliance must be grounded.
- This equipment must be positioned so that the plug is accessible unless other means for disconnection from the power supply (e.g., circuit breaker or disconnect switch) is provided.
- Check all wiring connections, including factory terminals, before operation. Connections can become loose during shipment and installation.
- 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

## **Warning**

### **Follow these precautions to prevent personal injury during installation of this equipment:**

- Installation must comply with all applicable equipment fire and health codes with the authority having jurisdiction.
- To avoid instability the installation area must be capable of supporting the combined weight of the equipment and product. Additionally the equipment must be level side to side and front to back.
- Ice machines require a deflector when installed on an ice storage bin. Prior to using a non-OEM ice storage system with this ice machine, contact the bin manufacturer to assure their ice deflector is compatible.
- Remove all removable panels before lifting and installing and use appropriate safety equipment during installation and servicing. Two or more people are required to lift or move this appliance to prevent tipping and/or injury.
- Do not damage the refrigeration circuit when installing, maintaining or servicing the unit.
- Connect to a potable water supply only.
- This equipment contains refrigerant charge.
- Installation of the line sets must be performed by a properly trained and EPA certified refrigeration technician aware of the dangers of dealing with refrigerant charged equipment.

## **Warning**

**Follow these precautions to prevent personal injury while operating or maintaining this equipment.**

- Legs or casters must be installed and the legs/ casters must be screwed in completely. When casters are installed the mass of this unit will allow it to move uncontrolled on an inclined surface. These units must be tethered/secured to comply with all applicable codes. Swivel casters must be mounted on the front and rigid casters must be mounted on the rear. Lock the front casters after installation is complete.
- Some 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.
- 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.
- Crush/Pinch Hazard. Keep hands clear of moving components. Components can move without warning unless power is disconnected and all potential energy is removed.
- Moisture collecting on the floor will create a slippery surface. Clean up any water on the floor immediately to prevent a slip hazard.

## **Warning**

**Follow these precautions to prevent personal injury while operating or maintaining this equipment.**

- Objects placed or dropped in the bin can affect human health and safety. Locate and remove any objects immediately.
- Never use sharp objects or tools to remove ice or frost.
- Do not use mechanical devices or other means to accelerate the defrosting process.
- When using cleaning fluids or chemicals, rubber gloves and eye protection (and/or face shield) must be worn.

## **DANGER**

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, clean or maintain this appliance without proper supervision.

## **DANGER**

### **Follow these precautions to prevent personal injury during use and maintenance of this equipment:**

- It is the responsibility of the equipment owner to perform a Personal Protective Equipment Hazard Assessment to ensure adequate protection during maintenance procedures.
- Do Not Store Or Use Gasoline Or Other Flammable Vapors Or Liquids In The Vicinity Of This Or Any Other
- Appliance. Never use flammable oil soaked cloths or combustible cleaning solutions for cleaning.
- All covers and access panels must be in place and properly secured when operating this equipment.
- Risk of fire/shock. All minimum clearances must be maintained. Do not obstruct vents or openings.
- Failure to disconnect power at the main power supply disconnect could result in serious injury or death. The power switch DOES NOT disconnect all incoming power.
- All utility connections and fixtures must be maintained in accordance with the authority having jurisdiction.
- Turn off and lockout all utilities (gas, electric, water) according to approved practices during maintenance or servicing.
- Units with two power cords must be plugged into individual branch circuits. During movement, cleaning or repair it is necessary to unplug both power cords.

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



# Table of Contents

---

## General Information

<b>Model Numbers</b> .....	15
<b>How to Read a Model Number</b> .....	16
<b>Ice Machine Warranty Information</b> .....	17

## Installation

<b>Location of Ice Machine</b> .....	19
<b>Ice Machine Clearance Requirements</b> .....	20
<b>Ice Machine Heat of Rejection</b> .....	20
<b>Leveling the Ice Machine</b> .....	21
<b>Electrical Requirements</b> .....	22
<b>Electrical Specifications</b> .....	23
<b>Water Service/Drains</b> .....	25
Water Supply .....	25
Water Inlet Lines .....	25
Drain Connections .....	26
Cooling Tower Applications .....	26
Water Supply and Drain Line Sizing/ Connections .....	27

## Maintenance

<b>Interior Cleaning and Sanitizing</b> .....	29
General .....	29
Cleaning and Sanitizing Procedure .....	29
Touch Pad Operation .....	30
Remove Parts for Cleaning .....	34
<b>Preventative Maintenance Cleaning</b> .....	39
<b>Ice Machine Inspection</b> .....	40
<b>Cleaning the Condenser</b> .....	41
<b>Removal from Service/Winterization</b> .....	42
<b>Bin Removal</b> .....	43

## Operation

<b>Touch Pad Features</b> .....	45
On/Off .....	45
Delay .....	46
Clean .....	46
Bin Full.....	47
Service.....	47
<b>Ice Making Sequence of Operation</b> .....	48
Control Board Timers .....	51
Safety Limits .....	52
Energized Parts Chart.....	54
<b>Operational Checks</b> .....	56
Ice Thickness Check .....	56
Ice Thickness Adjustment.....	56
Minimum/Maximum Slab weight .....	57

## **Troubleshooting**

<b>Problem Checklist</b> .....	59
<b>Control Board Test Mode</b> .....	61
Operating Ice Machine with Bin and Touch Pad Removed .....	61
<b>Diagnosing an Ice Machine that Will Not Run</b> .	62
<b>Ice Machine Does Not Cycle Into Harvest when Water Loses Contact with the Harvest Float Switch</b> .....	63
<b>Ice Machine Cycles Into Harvest Before Water Loses Contact with the Harvest Float Switch</b> ..	65
<b>Ice Production Check</b> .....	67
<b>Installation/Visual Inspection Checklist</b> .....	69
<b>Water System Checklist</b> .....	70
<b>Ice Formation Pattern</b> .....	71
<b>Safety Limit Feature</b> .....	73
<b>Analyzing Discharge Pressure</b> .....	80
<b>Analyzing Suction Pressure</b> .....	82
<b>Harvest Valve</b> .....	86
<b>Comparing Evaporator Inlet/Outlet Temperatures</b> .....	90
<b>Discharge Line Temperature Analysis</b> .....	91
<b>Refrigeration Component Diagnostics</b> .....	93
<b>Refrigeration Component Diagnostic Chart</b> ..	96

## Component Check Procedures

<b>Main Fuse</b> .....	101
<b>Bin Switch</b> .....	102
<b>Touch Pad</b> .....	104
<b>Float Switch</b> .....	106
<b>Water Trough Thermistor</b> .....	108
<b>Compressor Electrical Diagnostics</b> .....	110
<b>Fan Cycle Control</b> .....	112
<b>High Pressure Cutout (HPCO) Control</b> .....	113
<b>Filter-Driers</b> .....	114
<b>Refrigerant Recovery/Evacuation</b> .....	115
Definitions .....	115
Refrigerant Re-use Policy .....	116
Recovery and Recharging Procedures ....	118
<b>System Contamination Cleanup</b> .....	121
Determining Severity of Contamination ...	121
Mild System Contamination Cleanup Procedure .....	123
Severe System Contamination Cleanup Procedure .....	124
Replacing Pressure Controls without Removing Refrigerant Charge .....	125
<b>Total System Refrigerant Charge</b> .....	127

## Charts

<b>Cycle Times, 24 Hr. Ice Production and Refrigerant Pressure Charts</b> .....	129
U0140 Self-contained Air-cooled.....	130
U0140 Self-contained Water-cooled.....	131
U0190 Self-contained Air-cooled.....	132
U0240 Self-contained Air-cooled.....	133
U0240 Self-contained Water-cooled.....	134
U0310 Self-contained Air-cooled.....	135
U0310 Self-contained Water-cooled.....	136

## Diagrams

<b>Wiring Diagrams</b> .....	137
U140/U190/U240 wiring diagram Without J4 thermistor terminal .....	138
U310 wiring diagram Without J4 thermistor terminal .....	139
U140/U190/U240 wiring diagram With J4 thermistor terminal.....	140
U310 wiring diagram With J4 thermistor terminal.....	141
Electronic Control Board with J4 thermistor terminal.....	142
Electronic Control Board with J1 and without J4 Thermistor terminal .....	143
Electronic Control Board Prior to J1 the terminal.....	144
<b>Tubing Schematic - U0140</b> .....	145
<b>Tubing Schematic - U0190/U0240/U0310</b> ....	145

THIS PAGE INTENTIONALLY LEFT BLANK

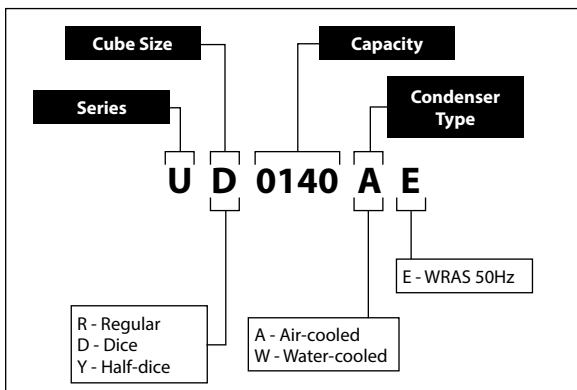
# General Information

## Model Numbers

This manual covers the following models:

<b>Self-contained Air-cooled</b>	<b>Self-contained Water-cooled</b>
UD0140A	UD0140W
UD0140AE	UD0140WE
UY0140A	UY0140W
UY0140AE	UY0140WE
UR0140A	–
UR0140AE	–
UD0190A	–
UD0190AE	–
UY0190A	–
UY0190AE	–
UR0190A	–
UR0190AE	–
UD0240A	UD0240W
UD0240AE	UD0240WE
UY0240A	UY0240W
UY0240AE	UY0240WE
UR0240A	–
UR0240AE	–
UD0310A	UD0310W
UD0310AE	UD0310WE
UY0310A	UY0310W
UY0310AE	UY0310WE
UR0310A	–
UR0310AE	–

## How to Read a Model Number



### **⚠ 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.



## **Ice Machine Warranty Information**

### **For warranty information visit:**

<http://www.kool-aire.com/Service/Warranty>

- Warranty Verification
- Warranty Registration
- View and download a copy of the warranty Owner Warranty Registration Card

Warranty coverage begins the day the ice machine is installed.

THIS PAGE INTENTIONALLY LEFT BLANK

# Installation

---

## 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 40°F (4°C) but must not exceed 110°F (43.4°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 32°F (0°C). Failure caused by exposure to freezing temperatures is not covered by the warranty.

## Ice Machine Clearance Requirements

	<b>Self-contained Air-cooled</b>	<b>Self-contained Water-cooled</b>
Top/Sides	5" (127 mm)*	5" (127 mm)*
Back	5" (127 mm)*	5" (127 mm)*

\*The ice machine may be built into a cabinet.

## Ice Machine Heat of Rejection

<b>Series Ice Machine</b>	<b>Heat of Rejection*</b>	
	<b>Air Conditioning**</b>	<b>Peak</b>
U140	2400	2900
U190	2200	2600
U240	2400	3400
U310	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.

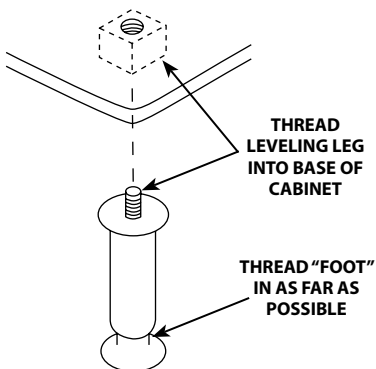
## Leveling the Ice Machine

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.



SV1606

### **Leg Installation**

## **Electrical Requirements**

### **Voltage**

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

### **Fuse/Circuit 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.

# Electrical Specifications

## Air-cooled Ice Machine

<b>Ice Machine</b>	<b>Voltage Phase Cycle</b>	<b>Max. Fuse/ Circuit Breaker</b>	<b>Total Amps</b>
U140	115/1/60	15	5.0
	208-230/1/60	15	2.5
	230/1/50	15	2.5
U190	115/1/60	15	6.0
	208-230/1/60	15	2.5
	230/1/50	15	2.5
U240	115/1/60	15	7.0
	208-230/1/60	15	4.0
	230/1/50	15	4.0
U310	115/1/60	15	10.0
	208-230/1/60	15	4.5
	230/1/50	15	4.5

## Water-cooled Ice Machine

Ice Machine	Voltage Phase Cycle	Max. Fuse/ Circuit Breaker	Total Amps
U140	115/1/60	15	5.0
	208-230/1/60	15	2.5
	230/1/50	15	2.5
U240	115/1/60	15	7.0
	208-230/1/60	15	4.0
	230/1/50	15	4.0
U310	115/1/60	15	10.0
	208-230/1/60	15	4.5
	230/1/50	15	4.5

### **Warning**

All wiring must conform to local, state and national codes.

### **Warning**

The ice machine must be grounded in accordance with national and local electrical code.



## Water Service/Drains

### WATER SUPPLY

Local water conditions may require treatment of the water to inhibit scale formation, filter sediment, and remove chlorine odor and taste.

#### **Important**

If you are installing a Manitowoc water filter system, refer to the Installation Instructions supplied with the filter system for ice making water inlet connections.

#### **⚠ Warning**

For ice making, connect to a potable water supply only.

### WATER INLET LINES

Follow these guidelines to install water inlet lines:

- Do not connect the ice machine to a hot water supply. Be sure all hot water restrictors installed for other equipment are working. (Check valves on sink faucets, dishwashers, etc.)
- If water pressure exceeds the maximum recommended pressure, 80 psig (5.5 bar) obtain a water pressure regulator from your Manitowoc distributor.
- Install a water shut-off valve for ice making potable water.
- Insulate water inlet lines to prevent condensation.

## **DRAIN CONNECTIONS**

Follow these guidelines when installing drain lines to prevent drain water from flowing back into the ice machine and storage bin:

- Drain lines must have a 1.5-inch drop per 5 feet of run (2.5 cm per meter), and must not create traps.
- The floor drain must be large enough to accommodate drainage from all drains.
- Install a tee to vent the ice machine drain to the atmosphere.
- Insulate drain lines to prevent condensation.

## **COOLING TOWER APPLICATIONS**

### **Water Cooled Models Only**

A water-cooling tower installation does not require modification of the ice machine. The water regulator valve for the condenser continues to control the refrigeration discharge pressure.

It is necessary to know the amount of heat rejected, and the pressure drop through the condenser and water valves (inlet to outlet) when using a cooling tower on an ice machine.

- Water entering the condenser must not exceed 90°F (32.2°C).
- Water flow through the condenser must not exceed 5 gallons (19 liters) per minute.
- Allow for a pressure drop of 7 psig (.48 bar) between the condenser water inlet and the outlet of the ice machine.
- Water exiting the condenser must not exceed 110°F (43.3°C).

### **Caution**

Plumbing must conform to state and local codes.

## WATER SUPPLY AND DRAIN LINE SIZING/ CONNECTIONS

Location	Water Temperature	Water Pressure	Ice Machine Fitting	Tubing Size Up to Ice Machine Fitting
<b>Ice Making Water Inlet</b>	40°F (4°C) min. 90°F (32°C) max.	20 psi (138 kPa) min. 80 psi (550 kPa) max.	3/8" Female Pipe Thread	3/8" (9.5 mm) min. inside diameter
<b>Condenser Water Inlet</b>	40°F (4°C) min. 90°F (32°C) max	20 psi (1.38 bar) min. 150 psi (10.3 bar) max.	3/8" Female Pipe Thread U310 only 1/2" Female Pipe Thread	3/8" (9.5 mm) min. inside diameter U310 only 1/2" Female Pipe Thread
<b>Condenser Water Drain</b>	—	—	3/8" Female Pipe Thread	1/2" (12.7 mm) min. inside diameter
<b>Bin Drain</b>	---	---	1/2" Female Pipe thread	1/2" (12.7 mm) min. inside diameter

THIS PAGE INTENTIONALLY LEFT BLANK

# Maintenance

---

## 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 and Sanitizer. 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

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

## TOUCH PAD OPERATION

Pressing and holding the clean button for 3 seconds starts the clean cycle. The Clean & On/Off lights energize indicating the clean cycle has started and ice making will automatically start when the Clean cycle is complete.

- **Setting the ice machine to stop after the clean cycle:** Press the On/Off button. The On/Off light will de-energize indicating the ice machine will stop after the clean cycle.
- **Pausing the cleaning cycle:** Press the Clean button. The clean light will flash indicating the clean cycle has paused. Pressing the Clean button again will restart the clean cycle.

**Step 1** Press the On/Off button after ice falls from the evaporator at the end of a Harvest cycle. Or, press the On/Off button 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.

### **Warning**

Wear rubber gloves and safety goggles (and/or face shield) when handling Ice Machine Cleaner or Sanitizer.

 **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.

**Step 3** To start a cleaning cycle, press the Clean button. Water will flow through the water dump valve and down the drain. Wait until the water trough refills, then add the proper amount of ice machine cleaner to the water trough.

<b>Model</b>	<b>Amount of Cleaner</b>
U0140	2 ounces (60 ml)
U0190	5 ounces (150 ml)
U0240	5 ounces (150 ml)
U0310	5 ounces (150 ml)

Wait until the clean cycle is complete (approximately 22 minutes) then press the On/Off button and disconnect power and water supplies to the ice machine.

**Step 4** Remove parts for cleaning.  
Refer to the proper parts removal for your machine.  
Continue with step 5 when the parts have been removed.

**Step 5** 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.

<b>Solution Type</b>	<b>Water</b>	<b>Mixed with</b>
Cleaner	1 gal. (4 l)	16 oz (500 ml) cleaner

 **Caution**

Do not immerse electrical connectors or motors for any components in water, cleaner or sanitizer solutions.

Use half 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 6** While components are soaking, use half 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 7** Mix a solution of sanitizer and warm water.

<b>Solution Type</b>	<b>Water</b>	<b>Mixed With</b>
Sanitizer	3 gal. (12 l)	2 oz (60 ml) sanitizer

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

**Step 8** Use half of the sanitizer/water solution to sanitize all foodzone surfaces of the ice machine and bin. Use a spray bottle 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 9** Replace all removed components, wait 10 minutes, then reapply power and water to the ice machine

**Step 10** Press the Clean button. Water will flow through the water dump valve and down the drain. Wait until the water trough refills, then add the proper amount of ice machine sanitizer to the water trough.

<b>Model</b>	<b>Amount of Sanitizer</b>
U0140	1 ounces (30 ml)
U0190	2 ounces (60 ml)
U0240	2 ounces (60 ml)
U0310	2 ounces (60 ml)

Wait until the sanitize cycle is complete (approximately 22 minutes) then press the Ice button to start ice making.

## REMOVE PARTS FOR CLEANING

### **Warning**

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

1. Remove the Harvest Float Switch and Ice Thickness Float Switch
  - Pull forward on the bottom of the bracket until clear of the tab, then slide bracket upward to remove the bracket and float as an assembly. At this point, the float switches can easily be cleaned. If complete removal is desired, follow the wires to the bulkhead grommet (exit point) in the back wall. Pull the wire connector through the bulkhead grommet, then disconnect the wire leads from the connector.

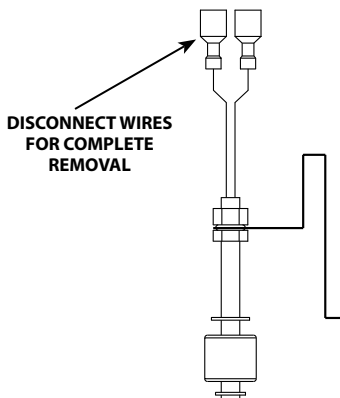
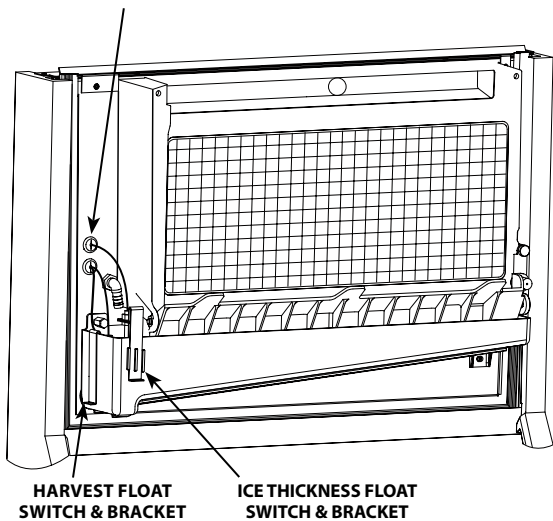
**NOTE:** The wire from the top grommet goes to the ice thickness float switch (front switch). The wire from the bottom grommet goes to the Harvest float switch (side switch).

### **Important**

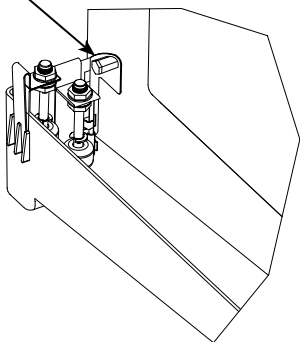
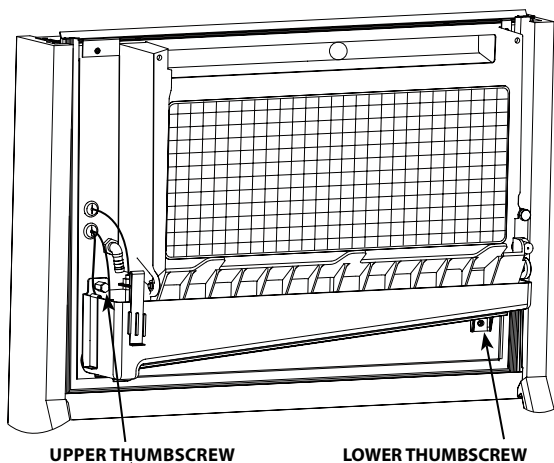
Reversing the mounting location of the ice thickness and the harvest floats will result in a safety limit 2 failure.

- The ice thickness float must be mounted to the front of the water trough and the electrical connection must be in the top bulkhead grommet.
- The harvest float must be mounted to the side of the water trough and the electrical connection must be in the bottom bulkhead grommet.
- The wire connectors for each float are different and will not allow incorrect electrical bulkhead connection.

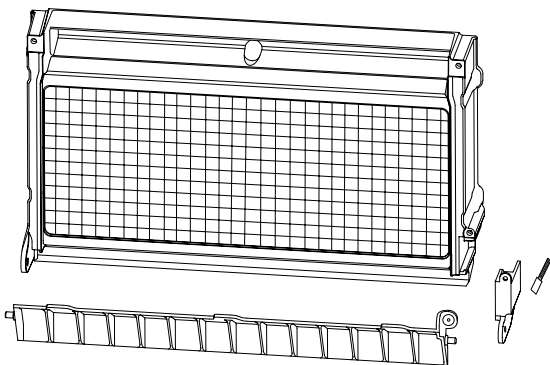
**WIRE CONNECTORS ARE LOCATED BEHIND BULKHEAD  
PULL THROUGH GROMMET TO DISCONNECT**



2. Remove the Water Trough Thermistor and Water Trough
- Remove the upper thumbscrew.
  - While supporting the water trough remove the thumbscrew and thermistor.
  - While supporting the water trough remove the lower thumbscrew from beneath the water trough.
  - Remove the water trough from the bin area.



3. Remove the Ice Damper
- Remove thumbscrew from bin switch cover.
  - Support ice damper and then pull bin switch cover and ice damper forward to remove.



**1. REMOVE THUMBSCREW**

**2. SUPPORT ICE DAMPER THEN  
SLIDE RIGHT SIDE FORWARD TO REMOVE**

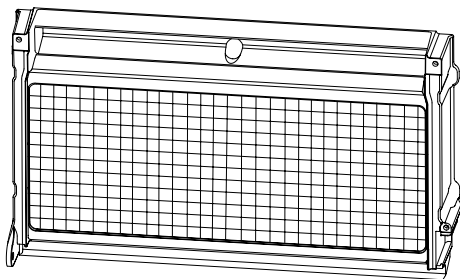
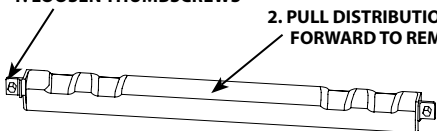
#### 4. Remove the Water Distribution Tube

- Distribution tube thumbscrews are retained to prevent loss. Loosen thumbscrews but do not pull thumbscrews out of distribution tube.
- Loosen the two outer screws and pull forward on the distribution tube to release.

NOTE: For ease of assembly when reinstalling the water distribution tube, install the top edge first.

**1. LOOSEN THUMBSCREWS**

**2. PULL DISTRIBUTION TUBE FORWARD TO REMOVE**



## Preventative Maintenance Cleaning

This cleaning procedure can be performed between the bi-annual cleaning and sanitizing cycles. This procedure does not require removing the ice from the bin.

**Step 1** Press the On/Off button after ice falls from the evaporator at the end of a Harvest cycle. Or, press the On/Off button and allow the ice to melt off the evaporator.

### **Caution**

Never use anything to force ice from the evaporator. Damage may result.

### **Warning**

Wear rubber gloves and safety goggles (and/or face shield) when handling Ice Machine Cleaner or Sanitizer.

**Step 2** To start a cleaning cycle, press the Clean button. Water will flow through the water dump valve and down the drain. Wait until the water trough refills, then add the proper amount of ice machine cleaner to the water trough.

<b>Model</b>	<b>Amount of Cleaner</b>
U0140	2 ounce (60 ml)
U0190	5 ounces (150 ml)
U0240	5 ounces (150 ml)
U0310	5 ounces (150 ml)

Wait until the clean cycle is complete (approximately 22 minutes) then press the On/Off button.

## **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.

Cleanup any fallen ice or water spills as they occur.



## Cleaning the Condenser

### General

#### **⚠ Warning**

Disconnect electric power to the ice machine head section and the remote condensing unit at the electric service switches before cleaning the 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.

#### **⚠ Warning**

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

- Shine a flashlight through the condenser to check for dirt between the fins.
- Blow compressed air or rinse with water from the inside out (opposite direction of airflow).

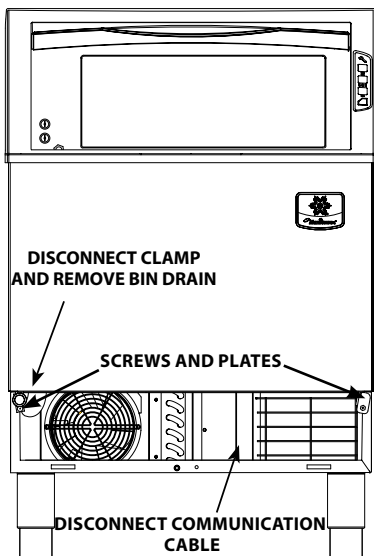
## **Removal from Service/Winterization**

1. Clean and sanitize the ice machine.
2. Press the On/Off button to turn off the ice machine.
3. Turn off the water supply, disconnect and drain the incoming ice-making water line at the rear of the ice machine and drain the water trough.
4. Energize the ice machine, wait one minute for the water inlet valve to open and blow compressed air in both the incoming water and the drain openings in the rear of the ice machine to remove all water.
5. Press the On/Off button and disconnect the electric power at the circuit breaker or the electric service switch.
6. Fill spray bottle with sanitizer and spray all interior food zone surfaces. Do not rinse and allow to air dry.
7. Replace all panels.

## Bin Removal

1. Disconnect power.
2. Remove all ice from bin.
3. Remove air filter and louver from lower front of machine.
4. Loosen screws and rotate clips to release bin from base.
5. Disconnect clamp and remove bin drain.
6. Remove control box panel.
7. Remove communication cable from control board.
8. Remove rear cover.
9. Slide bin forward to remove.

NOTE: When reinstalling the bin, ensure the bin seal is in place and is not pinched/folded as it mates to the cabinet. A watertight seal is required to prevent future condensation or water leakage from entering the ice machine base.



THIS PAGE INTENTIONALLY LEFT BLANK

# Operation

## Touch Pad Features

The touch pad offers a series of pressure sensitive buttons to control ice machine operation and provide operational status.



**On/Off - Blue = Machine On**  
**Off = Machine Is Off**

**Delay - Blue = Delay Mode On**  
**Off = Delay Mode Is Off**

**Clean - Yellow = Clean Cycle On**  
**Off = Cleaning is Off**  
**Flashing = Cleaning Is Paused**

**Bin Full - Blue = Bin Is Full**  
**Off = Bin Is Not Full**

**Service - Red = Needs Service**  
**Off = Doesn't Need Service**

### ON/OFF

The On/Off Button is used to start and stop ice making. The blue light indicates whether the ice machine is in Ice Making (light on) or Off (light off).

NOTE: Stopping and restarting a freeze cycle with ice on the evaporator will result in a thick bridge and larger than normal cubes; or result in an ice slab that will not release from the evaporator.

## **DELAY**

Pressing the Delay button will start a delay period. The ice machine will finish the freeze and harvest cycle and then start the delay period.

- Pressing the button once will start a 4 hour delay period.
- Pressing the button twice will start a 12 hour delay period.
- Pressing the button three times will start a 24 hour delay period.
- Pressing the button four times will cancel the delay periods.

NOTE: The delay period will be canceled if power is interrupted to the ice machine. When power is restored, the ice machine will start an ice making cycle.

## **CLEAN**

Pressing the Clean button for 3 seconds will start a clean cycle. After the clean cycle is complete, the ice machine will automatically start an ice making cycle.

- Pressing the Clean button again within 45seconds of the clean cycle starting will abort the clean cycle.
- Pressing the On/Off button after 45 seconds will pause the Clean cycle. The On/Off light will flash on/off to indicate pause mode. Pressing the On/Off button again will continue the Clean cycle from the point of interruption.
- Pressing the control board test button anytime during the clean cycle will cancel the clean cycle.
- Opening the damper for 30 seconds during the clean cycle will start and automatic shutdown sequence.

## **BIN FULL**

The Bin Full light energizes when the bin is full or is de-energized if the bin is not full.

## **SERVICE**

The service light indicates the machine needs attention.

- Refer to safety limits if this light is energized.

## Ice Making Sequence of Operation

NOTE: To date there are two main revisions to the sequence of operation.

1. Software version 2.58 and higher have a 25 second water pump delay in the freeze cycle.
2. Control boards with a J4 terminal can utilize a thermistor to control when the water pump delay occurs in the freeze cycle.

### WITH WATER TROUGH THERMISTOR

The following sequence occurs in the freeze cycle:

- When the temperature of the water reaches 34° F the water pump de-energizes for 25 seconds, then re energizes.
- When the water pump restarts the water inlet solenoid energizes for 7 seconds.

### WITHOUT WATER TROUGH THERMISTOR

The following sequence occurs in the freeze cycle:

- At 3.75 minutes the water pump de-energizes for 25 seconds, then re-energizes.
- When the water pump restarts the water inlet solenoid energizes for 7 seconds.



The On/Off button must be depressed and the ice damper must be closed before the ice machine will start.

### **Water Purge Cycle**

The ice machine purges any remaining water from the water trough down the drain.

### **Freeze Cycle**

Prechill - The refrigeration system chills the evaporator before water flow over the evaporator starts. The water inlet valve energizes during the pre-chill and remains on until the ice thickness float switch is satisfied.

Freeze - Water flowing across the evaporator cools as the freeze cycle progresses. (Software version 2.58 or higher: The water pump turns off for 25 seconds and the water inlet valve energizes for 7 seconds when the pump restarts) Water flowing across the evaporator will start to freeze and build ice on the evaporator. After a sheet of ice has formed, the harvest float switch signals the control board to start a harvest cycle.

### **Harvest Cycle**

Any remaining water is purged down the drain as refrigerant gas warms the evaporator. When the evaporator warms, the sheet of cubes slides off the evaporator and into the storage bin. If all cubes fall clear of the ice damper the ice machine starts another freeze cycle. The maximum harvest time is a total of 7 minutes. If the bin switch does not activate within 3.5 minutes, the harvest cycle extends another 3.5 minutes.

### **Full Bin Cycle**

If the ice damper is held open by ice cubes the ice machine shuts off. When the ice damper closes the ice machine starts a new cycle at the water purge.

## **Water Assist Harvest Cycle**

The maximum harvest time is a total of 7 minutes. If the bin switch does not activate within 7 minutes a water assist harvest cycle initiates using the following sequence:

1. The compressor de-energizes.
2. The water inlet valve energizes and fills the water trough.
3. The water pump energizes for 2 minutes and circulates water over the evaporator.

If the bin switch did not open & close.

4. The water dump valve energizes and drains water from the water trough.
5. Step 1 through 4 repeat.
6. A freeze cycle starts.

NOTE: If the bin switch opens & closes anytime during the cycle the ice machine starts a new freeze cycle.

- The maximum water fill time for the water assist harvest is 105 seconds.

## **CONTROL BOARD TIMERS**

- The ice machine is locked into the freeze cycle for 6 minutes before a harvest cycle can be initiated.
- The freeze time lock in feature is bypassed on the initial cycle (manual start or after a full bin/safety limit condition).
- If the harvest float switch is in the down position for 10 continuous seconds during the start of a freeze cycle, a harvest sequence is initiated.
- The maximum freeze time is 45 minutes at which time the control board automatically initiates a harvest sequence.
- The maximum harvest time is a total of 7 minutes. If the bin switch does not activate within 3.5 minutes, the harvest cycle extends another 3.5 minutes. If 7 minutes is exceeded a Harvest Assist Cycle starts.
- The water fill valve is de-energized 1 minute after the freeze cycle starts. The control board will energize the water inlet valve one more times 3 minutes into the freeze cycle.

### **Control boards with firmware version 2.58 or larger**

- The control board will stop the ice machine for 25 seconds during the freeze cycle and then re-energize.

## **SAFETY LIMITS**

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

Safety limits can be reset by pressing the On/Off button and starting a new ice making cycle.

A safety limit shutdown is indicated by the red Service light on the touch pad.

### **Safety Limit 1**

If the freeze time reaches 45 minutes, the control board automatically initiates a harvest cycle.

- After 3 consecutive 45 minute cycles control board light SL#1 along with the touch pad Service (wrench) light will flash on/off at 1 second intervals.
- If 6 consecutive 45-minute freeze cycles occur, the ice machine stops and the SL#1 light on the control board and the Service (wrench) light on the touch pad will be on continuously.

### **Safety Limit 2**

- If the harvest time reaches 3.5 minutes, the control board automatically energizes the water pump and extends the harvest cycle another 3.5 minutes (7 minutes total).
- If the ice damper does not open and close within the 7 minute harvest cycle the ice machine enters a water thaw cycle for 170 seconds.
- If the damper does not open/close within the 170 second thaw cycle, a second thaw cycle starts.
- The control board automatically initiates a freeze sequence when the thaw cycle(s) is complete.
- If 3 consecutive 7 minute harvest/thaw cycles occur, the ice machine stops.

### **Safety Limit 3**

If the freeze time reaches 4 minutes and water is not sensed (float remains down for 10 continuous seconds) the ice machine stops.

- Safety Limit 3 is bypassed on the initial cycle (manual start or after a full bin/safety limit condition). For all subsequent cycles if the freeze time reaches 4 minutes and water is not sensed, the ice machine stops and initiates a 30 minute delay period. Control board lights SL#1 and SL#2 along with the touch pad Service (wrench) light will flash on/off at 1 second intervals.
- The ice machine automatically restarts at the end of the 30 minute delay period and stops flashing the control board and Service (wrench) lights.
- If 100 consecutive failures occur the ice machine stops and the touch pad Service (wrench) light remains energized.

## ENERGIZED PARTS CHART

### Self-Contained Ice Machines

ICE MAKING SEQUENCE OF OPERATION	Water Pump	Harvest Valve	Water Inlet Valve	Dump Valve	Compressor & Condenser Fan Motor *	Harvest Float Switch	Ice Thickness Float Switch	Length of Time
<b>Initial Start-up</b> 1. Water purge	OFF	ON	OFF	ON	OFF	CLOSED	CLOSED	20 seconds
<b>2. Refrigeration System Start-up</b>	OFF	ON	OFF	OFF	ON	CLOSED	CLOSED	5 seconds
<b>Freeze Sequence</b> 3. Pre chill	OFF	OFF	ON	OFF	ON	OPEN	CLOSED	60 Seconds
<b>4. Freeze</b>	ON**	OFF	ON **	OFF	ON	OPEN THEN CLOSED	CLOSED THEN OPEN	Until Harvest Float Switch closes for 10 continual seconds

ICE MAKING SEQUENCE OF OPERATION	Water Pump	Harvest Valve	Water Inlet Valve	Dump Valve	Compressor & Condenser Fan Motor *	Harvest Float Switch	Ice Thickness Float Switch	Length of Time
Harvest Sequence	OFF	ON	OFF	ON FOR 20 SECONDS THEN OFF	ON	CLOSED	CLOSED	20 seconds
5. Water Purge								
6. Harvest	OFF***	ON	OFF***	OFF***	ON	CLOSED	CLOSED	Bin switch activation
7. Automatic Shut-off	OFF	OFF	OFF	OFF	OFF	CLOSED	CLOSED	Until bin switch re-closes

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

\*\* Firmware 2.58 with thermistor - when the water temperature reaches 34°F the water pump de-energizes for 25 seconds . When the pump restarts the water inlet valve energizes for 7 seconds. Firmware 2.58 without thermistor - At 3.75 minutes the water pump de-energizes for 25 seconds. When the pump restarts the water inlet valve energizes for 7 seconds.

Firmware prior to 2.58 - The water fill valve is de-energized by the control board 1 minute after the freeze cycle starts - The control board will energize the water inlet valve for 7 seconds one last time, 3 minutes into the freeze cycle, regardless of float position.

\*\*\* Will be energized during harvest when time exceeds 3.5 minutes.

\*\*\*\* The water pump de-energizes for 25 seconds then re-energizes

## Operational Checks

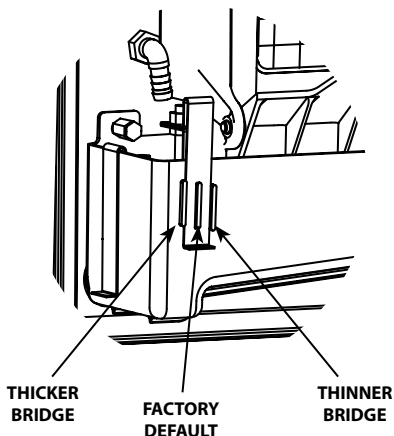
### ICE THICKNESS CHECK

After a harvest cycle, inspect the ice cubes in the ice storage bin. The ice bridge connects the ice cubes and must be set to maintain an ice bridge thickness of 1/8" (3.2 mm). To adjust the thickness of the bridge refer to ice thickness adjustment.

### ICE THICKNESS ADJUSTMENT

The ice thickness can be adjusted to three levels.

1. Pull forward on the bottom of the bracket until clear of the tab.
2. Slide the bracket over the desired tab and release.
  - The center position is the normal factory setting.
  - To increase bridge thickness, raise the water level.
  - To decrease bridge thickness, lower the water level.





## MINIMUM/MAXIMUM SLAB WEIGHT

<b>Model</b>	<b>Minimum Ice Weight Per Cycle lbs Grams</b>	<b>Maximum Ice Weight Per Cycle lbs Grams</b>
U140	1.13 lbs 513 grams	1.36 lbs 617 grams
U190	2.26 lbs 1025 grams	2.93 lbs 1329 grams
U240	2.26 lbs 1025 grams	2.93 lbs 1329 grams
U310	2.26 lbs 1025 grams	2.93 lbs 1329 grams

THIS PAGE INTENTIONALLY LEFT BLANK

# Troubleshooting

## Problem Checklist

<b>Problem</b>	<b>Possible Cause</b>	<b>Correction</b>
Ice machine does not operate	No electrical power to the ice machine.	Replace the fuse/reset the breaker/turn on the main switch/plug power cord into receptacle.
	Ice machine needs to be turned on.	Press the On/Off button to start ice making.
	Damper in open position (down).	Damper must be in upright position and capable of swinging freely.
Ice machine stops, and can be restarted by turning the ice machine OFF/ON.	Safety limit feature stopping the ice machine..	Refer to "Safety Limit Feature"
Ice sheet is thick	Water trough level is too high.	Adjust ice thickness float.
	Power button was turned off/on during freeze cycle and ice remained on evaporator.	Allow ice to thaw and release from evaporator, then restart
	Ice damper was opened then closed in the harvest cycle before the ice released.	Allow ice to thaw and release from evaporator, then restart
Ice machine does not release ice or is slow to harvest.	Ice machine is dirty.	Clean and sanitize the ice machine
	Ice machine is not level.	Level the ice machine
	Low air temperature around ice machine (air-cooled models).	Air temperature must be at least 40° F (4°C).
Ice machine does not release ice or is slow to harvest.	Water regulating valve leaks in harvest mode (water-cooled models).	Replace water regulating valve
Ice machine does not cycle into harvest mode.	The six-minute freeze time lock-in has not expired yet.	Wait for freeze lock-in to expire.
	Harvest float switch is dirty.	Clean and sanitize the ice machine.
	Harvest float switch wire is disconnected.	Connect the wire
	Harvest float switch is out of adjustment.	Adjust the harvest float switch.
	Uneven ice fill (thin at top of evaporator).	Refer to "Shallow or Incomplete Cubes"

<b>Problem</b>	<b>Possible Cause</b>	<b>Correction</b>
Ice quality is poor (soft or not clear).	Poor incoming water quality.	Test the quality of the incoming water and make appropriate filter recommendations.
	Water filtration is poor.	Replace the filter.
	Ice machine is dirty.	Clean and sanitize the ice machine.
	Water softener is working improperly (if applicable).	Repair the water softener
Ice machine produces shallow or incomplete cubes, or the ice fill pattern on the evaporator is incomplete.	Ice thickness switch is out of adjustment.	Adjust the ice thickness switch
	Water trough level is too high or too low.	Check the water level.
	Water filtration is poor.	Replace the filter.
	Hot incoming water.	Connect the ice machine to a cold water supply.
	Incorrect incoming water pressure.	Water pressure must be 20-80 psi (137.9 -551.5 kPa)
	Ice machine is not level.	Level the ice machine
Low ice capacity.	The condenser is dirty.	Clean the condenser.
	High air temperature around ice machine (air-cooled models).	Air temperature must not exceed 110° F (43°C).
	Inadequate clearance around the ice machine.	Provide adequate clearance
	Objects stacked around ice machine, blocking condenser airflow	Remove items blocking airflow
	Hot incoming water.	Connect to cold water
	Incorrect incoming water pressure. Water pressure is too low or water filter is restricted.	Water pressure must be 20-80 psi (137.9 -551.5 kPa). Replace water filter.
Ice sheet is thick	Water trough level is too high	Adjust ice thickness float
	Power button was turned off/on during the freeze cycle and ice remained on the evaporator	Allow ice to thaw and release from the evaporator, then restart
	Ice damper was opened and closed in the harvest cycle before the ice released	Allow ice to thaw and release from the evaporator, then restart
	Long harvest cycles with repeated safety limit indication	Clean the ice machine & perform diagnostic procedures as required

## **Control Board Test Mode**

NOTE: The ice damper/bin switch can be open or closed and does not effect the operation of the test mode.

To enter the test mode press and hold the test button on the control board for 3 seconds. The control board test mode performs the following functions for a 2 minute time period:

- Energizes all control board relays
- Energizes all control board lights
- Energizes all touch pad control lights

After 2 minutes the control board will automatically initiate and complete one ice making cycle, then stop.

### **Canceling a test cycle:**

To cancel a test cycle press the test button a second time.

### **Restarting a test cycle:**

The test cycle will restart each time the test button is pressed for a 3 second time period.

## **OPERATING ICE MACHINE WITH BIN AND TOUCH PAD REMOVED**

The ice machine is designed to allow diagnostic procedures to be performed with the bin removed. The touch pad is attached to the bin and is disconnected during the removal process. Use the control board test mode to operate the ice machine without connecting the touch pad.

## Diagnosing an Ice Machine that Will Not Run

### **Warning**

High (line) voltage is applied to the control board at all times. Removing the control board fuse or pressing the power button 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.

NOTE: If any control board lights are on, the fuse is okay.

3. Verify the bin switch functions properly. A defective bin switch can falsely indicate a full bin of ice.
4. Verify power button functions properly. A defective power button may keep the ice machine in the OFF mode. Refer to page 98 touch pad diagnostics when Steps 1 –3 test good.
5. Be sure Steps 1 – 4 were followed thoroughly. Intermittent problems are not usually related to the control board. Replace control board if touch pad operation is correct.

## Ice Machine Does Not Cycle Into Harvest when Water Loses Contact with the Harvest Float Switch

NOTE: The ice machine will make a thick or double slab when a new freeze cycle is started with ice already present on the evaporator.

Two of the most common scenarios are:

- Power is cycled off/on with ice on the evaporator.
- The ice damper/bin switch is opened/closed in the harvest cycle before the ice releases.

Remove all ice from the evaporator before starting diagnostic procedures.

### 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. After six minutes a harvest cycle can be initiated. To allow the service technician to initiate a harvest cycle without delay, this feature is not used on the first cycle after pressing the power button OFF and back to ON.

**Step 1** Disconnect power to the ice machine, remove the electrical panel to allow viewing of the control board lights and pull the wire connector for the harvest float switch through the bulkhead and disconnect. Attach a jumper wire to the wire terminals connected to the control board.

**Step 2** Bypass the freeze time lock-in feature by pressing the power button to cycle the ice machine on. Wait until water flows over the evaporator, then refer to chart.

Result	Correction
10 seconds into the freeze cycle the ice machine cycles from freeze to harvest and the control board harvest light energizes.	Refer to Float Switch Diagnostics.
The harvest light stays off and the ice machine remains in freeze.	Proceed to Step 3

**Step 3** Disconnect the harvest float switch wire from the control board and place a jumper on the control board harvest float switch terminals. Bypass the freeze time lock-in feature by pressing the power button to cycle the ice machine off/on. Wait until water flows over the evaporator, then refer to chart.

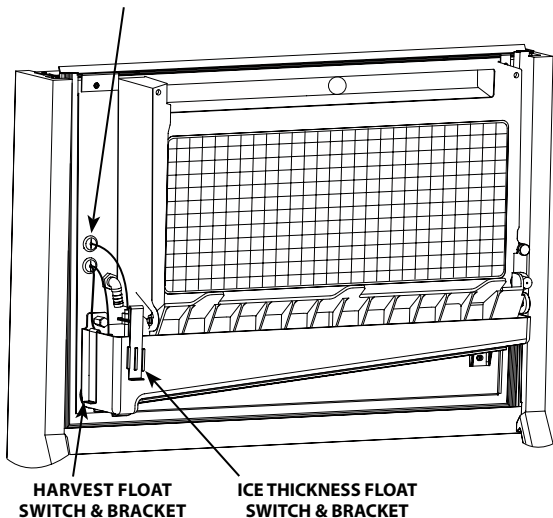
<b>Result</b>	<b>Correction</b>
10 seconds into the freeze cycle the ice machine cycles from freeze to harvest and the control board harvest light energizes.	The ice thickness float switch wire is causing the malfunction.
The harvest light comes on, but the ice machine remains in the freeze cycle.	The ice machine is in a 6 minute freeze lock - Cycle on/off and retest.
The harvest light stays off and the ice machine remains in freeze.	Replace the control board.



## Ice Machine Cycles Into Harvest Before Water Loses Contact with the Harvest Float Switch

**Step 1** Disconnect power to the ice machine, remove the electrical panel to allow viewing of the control board lights and pull the wire connector for the harvest float switch through the bulkhead and disconnect.

**WIRE CONNECTORS ARE LOCATED BEHIND BULKHEAD  
PULL THROUGH GROMMET TO DISCONNECT**



**Step 2** Reapply power and press the power button to cycle the ice machine off/on and bypass the freeze time lock-in feature. Wait until water flows over the evaporator, then refer to chart.

<b>Result</b>	<b>Correction</b>
The harvest light does not come on and the ice machine stays in freeze.	Refer to Float Switch Diagnostics
The harvest light comes on but the ice machine stays in a freeze cycle.	The ice machine is in a 6 minute freeze lock - Cycle on/off and retest.
10 seconds into the freeze cycle the ice machine cycles from freeze to harvest and the control board harvest light energizes.	Proceed to Step 3.

**Step 3** Disconnect the harvest float switch wire from the control board and bypass the freeze time lock-in feature by pressing the power button to cycle the ice machine off/on. Wait until water flows over the evaporator, then refer to chart.

<b>Result</b>	<b>Correction</b>
The harvest light does not come on.	The harvest float switch wire is causing the malfunction.
The harvest light comes on but the ice machine stays in the freeze sequence.	The ice machine is in a 6 minute freeze lock - Cycle on/off and retest.
10 seconds into the freeze cycle the ice machine cycles from freeze to harvest and the control board harvest light energizes.	Replace the control board.

## 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 70°F (21°C) ambient temperature and 50°F (10°C) water produces more ice than the same ice machine with 90°F (32°C) ambient and 70°F (21°C) water.

- Determine the ice machine operating conditions:  
 Air temp entering condenser: \_\_\_\_\_°  
 Air temp around ice machine: \_\_\_\_\_°  
 Water temp entering sump trough: \_\_\_\_\_°
- Refer to the appropriate 24-Hour Ice Production Chart (starting on page 121). Use the operating conditions determined in Step 1 to find published 24-Hour Ice Production: \_\_\_\_\_
  - Times are in minutes.  
 Example: 1 min. 15 sec. converts to 1.25 min.  
 (15 seconds ÷ 60 seconds = .25 minutes)
  - Weights are in pounds.  
 Example: 2 lb. 6 oz. converts to 2.375 lb.  
 (6 oz. ÷ 16 oz. = .375 lb.)
- Perform an ice production check using the formula below.

1.	$\frac{\text{Freeze Time}}{\text{Time}} + \frac{\text{Harvest Time}}{\text{Time}} = \frac{\text{Total Cycle Time}}{\text{Time}}$	=	$\frac{\text{Total Cycle Time}}{\text{Time}}$
2.	$\frac{1440}{\text{Minutes in 24 Hrs.}} \div \frac{\text{Total Cycle Time}}{\text{Time}} = \frac{\text{Cycles per Day}}{\text{Day}}$	=	$\frac{\text{Cycles per Day}}{\text{Day}}$
3.	$\frac{\text{Weight of One Harvest}}{\text{Harvest}} \times \frac{\text{Cycles per Day}}{\text{Day}} = \frac{\text{Actual 24-Hour Production}}{\text{Production}}$	=	$\frac{\text{Actual 24-Hour Production}}{\text{Production}}$

Weighing the ice is the only 100% accurate check.

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/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 20 and 80 psig (1–5 bar, 138–552 kPa)***

- Install a water regulator valve or increase the water pressure

### ***Incoming water temperature is not between 40°F (3°C) and 90°F (32°C)***

- If too hot, check the hot water line check valves in other store equipment

### ***Water filtration is plugged (if used)***

- Install a new water filter

### ***Vent tube is not installed on water outlet drain***

- See Installation Instructions

### ***Hoses, fittings, etc., are leaking water***

- Repair/replace as needed

### ***Water valve is stuck open, closed or is leaking***

- 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

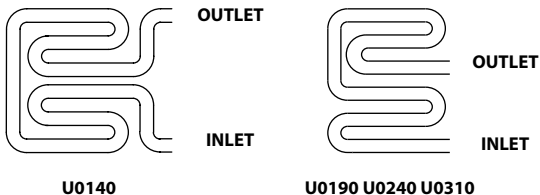
### ***Plastic extrusions and gaskets are not secured to the evaporator***

- 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.



### 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 1/2" to 1" 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.

**Service Light:** The Service light energizes whenever a safety limit has been exceeded.

### Safety Limit 1

If the freeze time reaches 45 minutes, the control board automatically initiates a harvest cycle.

- After 3 consecutive 45-minute cycles, control board light SL#1 along with the touch pad service (wrench) light will flash on/off at 1 second intervals.
- If 6 consecutive 45-minute freeze cycles occur, the ice machine stops and the SL#1 light on the control board and the Service (wrench) light on the touch pad will be on continuously.

### Safety Limit 2

- If the harvest time reaches 3.5 minutes, the control board automatically energizes the water pump and extends the harvest cycle another 3.5 minutes (7 minutes total).
- If the ice damper does not open and close within the 7 minute harvest cycle the ice machine enters a water thaw cycle for 170 seconds.
- If the damper does not open/close within the 170 second thaw cycle, a second thaw cycle starts.
- The control board automatically initiates a freeze sequence when the thaw cycle(s) is complete.
- If 3 consecutive 7 minute harvest/thaw cycles occur, the ice machine stops and the SL#2 light on the control board and the Service (wrench) light on the touch pad will be on continuously.

### **Safety Limit 3**

If the freeze time reaches 4 minutes and water is not sensed (float remains down for 10 continuous seconds) the ice machine stops.

- Safety Limit 3 is bypassed on the initial cycle (manual start or after a full bin/safety limit condition). For all subsequent cycles if the freeze time reaches 4 minutes and water is not sensed, the ice machine stops and initiates a 30 minute delay period. Control board lights SL#1 and SL#2 along with the touch pad Service (wrench) light will flash on/off at 1 second intervals.
- The ice machine automatically restarts at the end of the 30 minute delay period and stops flashing the control board and Service (wrench) lights.
- If 100 consecutive failures occur the ice machine stops and the touch pad Service (wrench) light remains energized.

## **Determining Which Safety Limit Stopped the Ice Machine:**

When a safety limit condition causes the ice machine to stop, the safety limit light on the control board continually flashes on and off.

### CONTROL BOARD SAFETY LIMIT LIGHT OPERATION, BEFORE THE POWER BUTTON HAS BEEN CYCLED ON/OFF:

Watch the safety limit lights on the control board:

- SL#1 flashes = 3 or more 45 minute cycles
- SL#1 continuously on = Six 45minute freeze cycles
- SL#2 flashes = One 3.5 minute harvest cycles
- SL#2 continuously on = 3 consecutive 3.5 minute harvest cycles
- SL#1 & SL#2 flash = SL#3, neither float opened within 4 minutes of the freeze cycle.

### CONTROL BOARD SAFETY LIMIT LIGHT OPERATION USING THE POWER BUTTON:

1. Press the power button once.
2. Press the power button again to start ice making.
3. Watch the safety limit lights.
  - One will flash corresponding to safety limits 1 or 2.
4. Safety limit 3 is indicated by both SL#1 & SL#2 flashing.

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

### **Safety Limit Notes**

- 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 power button is cycled OFF and then ON prior to reaching the 100-harvest point, the last safety limit exceeded will be indicated.

## **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 45 minutes for 3 consecutive freeze cycles.**

Possible Cause Checklist

#### ***Improper installation***

- Refer to "Installation/Visual Inspection Checklist" on page 69

#### ***Water System***

- Water Level too high or defective float switch (water escaping water trough)
- Low water pressure (20 psig min.)
- High water pressure (80 psig max.)
- High water temperature (90°F/32.2°C max.)
- Clogged water distribution tube
- Dirty/defective water inlet valve
- Defective water pump

#### ***Electrical System***

- Harvest cycle not initiated electrically
- Contactor not energizing
- Compressor electrically non-operational
- Restricted condenser air flow
- High inlet air temperature (110°F/43.3°C max.)
- Condenser discharge air re-circulation
- Dirty condenser fins
- Defective fan cycling control
- Defective fan motor
- Low water pressure (20 psig min.)
- High water temperature (90°F/32.2°C max.)
- 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 harvest valve

## **Safety Limit #2**

### **Harvest time exceeds 3.5 minutes for 3 Consecutive harvest cycles.**

#### Possible Cause Checklist

#### ***Improper installation***

- Refer to "Installation/Visual Inspection Checklist" on page 69

#### ***Water System***

- Water area (evaporator) dirty
- Dirty/defective water dump valve
- Vent tube not installed on water outlet drain
- Water freezing behind evaporator
- Plastic extrusions and gaskets not securely mounted to the evaporator
- Low water pressure (20 psig min.)
- Loss of water from sump area
- Clogged water distribution tube
- Dirty/defective water inlet valve
- Defective water pump

#### ***Electrical system***

- Water inlet valve defective
- Bin switch defective
- Premature harvest

#### ***Refrigeration system***

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

### **Safety Limit 3**

**Freeze time reaches 4 minutes and water is not sensed.**

Possible Cause Checklist

#### ***Improper installation***

- Refer to "Installation/Visual Inspection Checklist" on page 69

#### ***Water System***

- Dirty/defective water dump valve
- Low water float valve dirty or defective
- Vent tube not installed on water outlet drain
- Low water pressure (20 psig min.)
- Dirty defective water filter (when used)
- Loss of water from sump area
- Dirty/defective water inlet valve

#### ***Electrical system***

- Water inlet valve coil defective
- Low water float valve defective

## Analyzing Discharge Pressure

1. Determine the ice machine operating conditions:

Air temp. entering condenser \_\_\_\_\_

Air temp. around ice machine \_\_\_\_\_

Water temp. entering sump trough \_\_\_\_\_

2. Refer to "Installation/Visual Inspection Checklist" on page 69 for ice machine being checked.

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

Freeze Cycle \_\_\_\_\_

Harvest Cycle \_\_\_\_\_

3. Perform an actual discharge pressure check.

	<b>Freeze Cycle PSIG</b>	<b>Harvest Cycle PSIG</b>
Beginning of Cycle	_____	_____
Middle of Cycle	_____	_____
End of Cycle	_____	_____

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

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



## **Discharge Pressure High Checklist**

### ***Improper Installation***

- Refer to “Installation/Visual Inspection Checklist” on page 69

### ***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 Pressure Low Checklist**

### ***Improper Installation***

- Refer to “Installation/Visual Inspection Checklist” on page 69

### ***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 Pressure

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

To analyze and identify the proper suction pressure drop throughout the freeze cycle, compare the published suction pressure to the published freeze cycle time.

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

## Procedure

<b>Step</b>																					
<p>1. Determine the ice machine operating conditions.</p> <p><i>Example:</i></p> <p><i>Air temp. entering condenser: 90°F/32.2°C</i></p> <p><i>Air temp. around ice machine: 80°F/26.7°C</i></p> <p><i>Water temp. entering water fill valve: 70°F/21.1°C</i></p>																					
<p>2A. Refer to “Cycle Time” and “Operating Pressure” charts for ice machine model being checked. Using operating conditions from Step 1, determine published freeze cycle time and published freeze cycle suction pressure.</p> <p><i>Example:</i></p> <p><i>Published freeze cycle time: 14.8 - 15.9 minutes</i></p> <p><i>Published freeze cycle suction pressure: 65 - 26 psig</i></p>																					
<p>2B. Compare the published freeze cycle time and published freeze cycle suction pressure. Develop a chart.</p> <p><i>Example:</i></p> <p><u>Published Freeze Cycle Time (minutes)</u></p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">4</td> <td style="text-align: center;">7</td> <td style="text-align: center;">10</td> <td style="text-align: center;">12</td> <td style="text-align: center;">14</td> </tr> <tr> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> <td style="text-align: center;"> </td> </tr> <tr> <td style="text-align: center;">65</td> <td style="text-align: center;">55</td> <td style="text-align: center;">47</td> <td style="text-align: center;">39</td> <td style="text-align: center;">34</td> <td style="text-align: center;">30</td> <td style="text-align: center;">26</td> </tr> </table> <p><u>Published Freeze Cycle Suction Pressure (psig)</u></p> <p><i>In the example, the proper suction pressure should be approximately 39 psig at 7 minutes; 30 psig at 12 minutes; etc.</i></p>	1	2	4	7	10	12	14								65	55	47	39	34	30	26
1	2	4	7	10	12	14															
65	55	47	39	34	30	26															
<p>3. Perform an actual suction pressure check at the beginning, middle and end of the freeze cycle. Note the times at which the readings are taken.</p> <p><i>Example:</i></p> <p><i>Manifold gauges were connected to the example ice machine and suction pressure readings taken as follows: _____ PSIG</i></p> <p><i>Beginning of freeze cycle: 79 (at 1 min.)</i></p> <p><i>Middle of freeze cycle: 48 (at 7 min.)</i></p> <p><i>End of freeze cycle: 40 (at 14 min.)</i></p>																					
<p>4. Compare the actual freeze cycle suction pressure (Step 3) to the published freeze cycle time and pressure comparison (Step 2B). Determine if the suction pressure is high, low or acceptable.</p> <p><i>Example:</i></p> <p><i>In this example, the suction pressure is considered high throughout the freeze cycle. It should have been:</i></p> <p><i>Approximately 65 psig (at 1 minute) – not 79</i></p> <p><i>Approximately 39 psig (at 7 minutes) – not 48</i></p> <p><i>Approximately 26 psig (at 14 minutes) – not 40</i></p>																					

## **Suction Pressure High Checklist**

### ***Improper Installation***

- Refer to "Installation/Visual Inspection Checklist" on page 69

### ***Discharge Pressure***

- Discharge pressure is too high, and is affecting suction pressure, refer to "Discharge Pressure High Checklist" on page 81.

### ***Improper Refrigerant Charge***

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

### ***Other***

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

## **Suction Pressure Low Checklist**

### ***Improper Installation***

- Refer to "Installation/Visual Inspection Checklist" on page 69

### ***Discharge Pressure***

- Discharge pressure is too low, and is affecting suction pressure, refer to "Freeze Cycle Discharge Pressure Low Checklist" on page 81.

### ***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 70.
- 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.

# Harvest Valve

## General

The harvest 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 harvest valve is not used during the freeze cycle. The harvest 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 harvest 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 pressures vary according to ambient temperature and ice machine model. Harvest pressures can be found in the Cycle Time/24 Hour Ice Production/ Refrigerant Pressure Charts in this book.

## **Harvest 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.

### VALVE REMAINS OPEN IN THE FREEZE CYCLE:

Symptoms of a harvest 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 harvest valve is remaining partially open during the freeze cycle.

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

### **Important**

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

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

3. Feel the compressor discharge line.

### **▲ Warning**

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



<b>Findings</b>	<b>Comments</b>
<p>The inlet of the harvest valve is cool enough to touch and the compressor discharge line is hot.</p> <p><b>Cool &amp; Hot</b></p>	<p>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.</p>
<p>The inlet of the harvest valve is hot and approaches the temperature of a hot compressor discharge line.</p> <p><b>Hot &amp; Hot</b></p>	<p>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.</p>
<p>Both the inlet of the harvest valve and the compressor discharge line are cool enough to touch.</p> <p><b>Cool &amp; Cool</b></p>	<p>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.</p>

5. Record your findings on the table.

## Comparing Evaporator Inlet/Outlet Temperatures

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

The actual temperatures entering and leaving the evaporator vary by model, and change throughout the freeze cycle. This makes documenting the "normal" inlet and outlet temperature readings difficult. The key to the diagnosis lies in the difference between the two temperatures five minutes into the freeze cycle. These temperatures must be within 7°F (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 7°F (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 150°F (66°C) on a normally operating ice machine.

### PROCEDURE

Connect a temperature probe on the compressor discharge line within 6" (15.2 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 150°F (66°C) at End of Freeze Cycle:**

Ice machines that are operating normally will have consistent maximum discharge line temperatures above 150°F (66°C).

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

### **Discharge Line Temperature Below 150°F (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 Diagnostics**

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 pressure 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 – Harvest Valve Leaking**

A leaking harvest valve must be replaced.

### **Column 2 – Low Charge/TXV Starving**

Normally, a starving expansion valve only affects the freeze cycle pressures, not the harvest cycle pressures. A low refrigerant charge normally affects both pressures. Verify the ice machine is not low on charge before replacing an expansion valve.

Add refrigerant charge in 2 oz. increments as a diagnostic procedure to verify a low charge. (Do not add more than the total charge of refrigerant). If the problem is corrected, the ice machine is low on charge. Find the refrigerant leak.

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

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

### **Column 3 – TXV Flooding**

A loose or improperly mounted expansion valve bulb causes the expansion valve to flood. Check bulb mounting, insulation, etc., before changing the valve.

### **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

Operational Analysis	1	2	3	4
<p><b>Ice Production</b></p>	<p>Published 24 hour ice production _____            Calculated (actual) 24 hour ice production _____</p> <p>NOTE: The ice machine is operating properly if the ice fill pattern is normal and ice production is within 10% of charted capacity.</p>			
<p><b>Installation and Water System</b></p>	<p>All installation and water related problems must be corrected before proceeding with chart.</p>			



<p><b>Operational Analysis</b></p>	<p><b>1</b></p>	<p><b>2</b></p>	<p><b>3</b></p>	<p><b>4</b></p>
<p><b>Ice Formation Pattern</b></p>	<p>Ice formation is extremely thin on outlet of evaporator -or- No ice formation on entire evaporator</p>	<p>Ice formation is extremely thin on outlet of evaporator -or- No ice formation on entire evaporator</p>	<p>Ice formation is normal -or- Ice formation is extremely thin on the bottom of evaporator -or- No ice formation on evaporator</p>	<p>Ice formation is normal -or- No ice formation on entire evaporator</p>
<p><b>Safety Limits</b> Refer to "Analyzing Safety Limits" to eliminate all non-refrigeration problems.</p>	<p>Stops on safety limit: <b>1 or 2</b></p>	<p>Stops on safety limit: <b>1</b></p>	<p>Stops on safety limit: <b>1 or 2</b></p>	<p>Stops on safety limit: <b>1</b></p>

<b>Operational Analysis</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Freeze Cycle Discharge Pressure</b> <hr/> <b>1 minute Middle End</b>	If discharge pressure is High or Low, refer to freeze cycle high or low discharge pressure problem checklist to eliminate problems and/or components not listed on this table before proceeding.			
<b>Freeze Cycle Suction Pressure</b> <hr/> <b>1 minute Middle End</b>	If suction pressure is High or Low refer to freeze cycle high or low suction pressure problem checklist to eliminate problems and/or components not listed on this table before proceeding.			
<hr/> <b>1 minute Middle End</b>	Suction pressure is <b>High</b>	Suction pressure is <b>Low</b>	Suction pressure is <b>High</b>	Suction pressure is <b>High</b>

Operational Analysis	1	2	3	4
<b>Harvest Valve</b>	The harvest valve inlet is <b>HOT</b> and the compressor discharge line is <b>HOT</b>	The harvest valve inlet is <b>COOL</b> and the compressor discharge line is <b>HOT</b>	The harvest valve inlet is <b>COOL</b> and the compressor discharge line is <b>COOL</b>	The harvest valve inlet is <b>COOL</b> and the compressor discharge line is <b>HOT</b>
<b>Discharge Line Temp.</b> Record freeze cycle discharge line temp at the end of freeze cycle.	Discharge line temp <b>150°F (66°C) or higher</b> at the end of freeze cycle	Discharge line temp <b>150°F (66°C) or higher</b> at the end of freeze cycle	Discharge line temp <b>less than 150°F (66°C)</b> at the end of freeze cycle	Discharge line temp <b>150°F (66°C) or higher</b> at the end of freeze cycle
<b>Final Analysis</b> Enter total number of boxes checked in each column.	Harvest Valve Leaking	Low On Charge -or- TXV Starving	TXV Flooding	Compressor

THIS PAGE INTENTIONALLY LEFT BLANK

# 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 pressing the power button will not remove the power supplied to the control board.

### Check Procedure

1. If the curtain 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. Press the power button to OFF.
2. Watch the curtain light on the control board.
3. Move the ice damper upward, toward the evaporator. The bin switch must close. The curtain light "on" indicates the bin switch has closed properly.
4. Move the ice damper away from the evaporator. The bin switch must open. The curtain 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).

# Touch Pad

## Function

User interface to select ice making, delay start or cleaning cycle and provides feedback on ice machine operation.

## Check For Normal Operation

<b>Action</b>	<b>Normal Function</b>
Press and hold the control board test button for 3 seconds	All Touch Pad lights turn on
Press test button	All Touch Pad lights turn off
Press power button	Power light turns on
With power light energized press the delay button 4 times	Cycles through 4 hour delay, 12 hour delay, 24 hour delay and off
Press and hold the power button for 3 seconds	Power light turns off
Press and hold the clean button for 3 seconds	Clean light turns on
Press and hold the clean button for 3 seconds	Clean light turns off
If any switches do not operate correctly, disconnect main power to the ice machine to reset the control board and perform a second test. If the second test doesn't show normal function, perform the Ohm test to verify the issue is not a wiring or control board issue.	



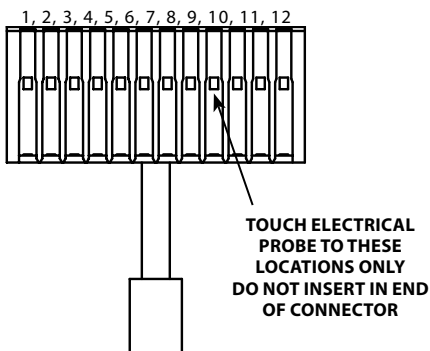
## Ohm Test

Disconnect power from ice machine.

Disconnect wire from control board and Ohm touch pad and interconnecting wire to verify correct operation. Pressing and depressing the touch pad must open and close the circuit. A switch that functions correctly will close as the button is pressed and open as the button is released.

Do not insert electrical probe into end of connector. This will stretch the connector and cause intermittent connection issues. All readings must be taken on the flat exterior of the connector.

Selection	Wires
On/Off	#2 & #7
Delay	#3 & #7
Clean	#4 & #7



**Control Board Connector**

# Float Switch

## Function

Open and close to indicate to the control board the level of water in the water trough.

## Specifications

Normally closed, float operated magnetic reed switch.

The float switch contacts are closed in the down position. When water raises the float to the up position the magnet in the float opens the contacts.

## Check Procedure

The ice machine uses two float switches.

Ice Thickness Float -Indicates the water level has been reached.

Harvest Float - Indicates a harvest cycle needs to be initiated.

Initial testing can be performed by viewing the control board light(s) while raising and lowering the float. The corresponding control board light must turn on and off when the float is raised and lowered.

### Harvest Float switch:

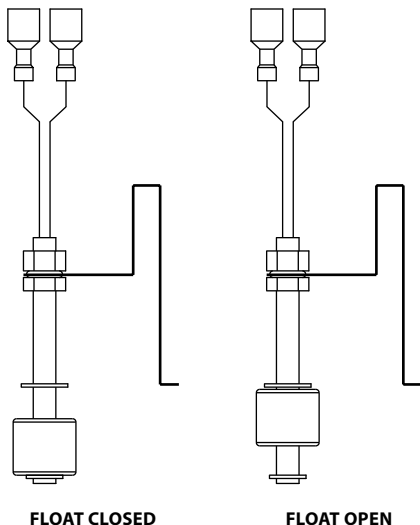
- A. The light must be on in the up position.
- B. The light must be off in the down position.

### Ice Thickness Float Switch:

- A. The light must be off in the down position.
- B. The light must be on in the up position.

If the control board light does not respond to the float proceed with step 1 below.

1. Disconnect power to the ice machine, pull the wire connector for the float switch through the bulkhead and disconnect.
2. Attach an ohm meter lead to each float switch wire.
3. Place the float in the down position - The float switch must be closed.
4. Place the float in the up position - The float switch must be open.



NOTE: Make adjustments with the ice machine in the off position. Making adjustments during the freeze cycle may produce an initial sheet of ice that is thicker than future cycles.

<b>Float</b>	<b>Float Up</b>	<b>Float Down</b>
Ice Thickness Float	OL	< 1 Ohm
Harvest Float	OL	< 1 Ohm

# Water Trough Thermistor

## Function

Thermistor resistance values change with temperature. The value supplied to the control board is used to identify temperature at the thermistor location.

When the resistance value indicates a temperature of 34°F (1.1°C) the control board will delay the water pump for 25 seconds. When the water pump restarts the water inlet valve will energize for 7 seconds then turn off.

## Check procedure

### THERMISTOR

1. Disconnect thermistor from control board and measure resistance.
2. Measure temperature at the thermistor.
3. Compare measured resistance/temperature readings to resistance/temperature relationship chart.
  - A. Within 10% of the published resistance value  
Thermistor is good
  - B. Not within 10% of the published resistance value - Thermistor is defective.

### CONTROL BOARD OPERATION

1. Disconnect thermistor from control board - The control board thermistor LED will flash 1 second on and 1 second off.
2. The control board will default to the 3.75 minute pump delay in the freeze cycle.

## THERMISTOR CHART

Temperature of Thermistor		Resistance
°C	°F	K Ohms (x1000)
-7 - -1.0	19 - 30	470.63 - 343.67
0.0	32	326.51
0.5	33	318.29
1.0	33.8	310.30
1.1	34	308.57
1.5	34.7	302.54
2.0	35.6	294.99
2.5	36.5	287.66
3.0	37	280.53
3.5	38	273.60
4.0 - 10.5	39 - 51	266.86 - 194.30
11.0 - 15.0	52 - 59	189.72 - 157.12
15.5 - 20.0	60 - 68	153.51 - 124.93
20.5 - 25.0	69 - 77	122.14 - 100.00
25.5 - 30.0	78 - 86	97.83 - 80.57
30.5 - 35.0	87 - 95	78.87 - 63.98
36.5 - 40.0	98 - 104	61.40 - 53.27
40.5 - 46.0	105 - 115	52.21 - 42.02

NOTE: The control board will default to a 3.75 minute pump delay in the freeze cycle, whenever the thermistor is disconnected or reads outside the resistance ranges in the table.

## Compressor Electrical Diagnostics

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

### Check Resistance (Ohm) Values

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

Perform the resistance test after the compressor cools. The compressor dome should be cool enough to touch (below 120°F/49°C) to 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

To determine which you have:

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

## **Compressor Drawing High Amps**

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

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  $\pm 10\%$  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)
U140 U190	250 psig $\pm 5$	200 psig $\pm 5$
U240 U310	275 psig $\pm 5$	225 psig $\pm 5$

## 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 gauge to ice machine.

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

Reconnect electrical power to the ice machine and press the power button 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: 450 psig  $\pm$ 10

Cut-in: Automatic reset

(Must be below 300 psig to reset)

### Check Procedure

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

### Warning

If discharge pressure exceeds 460 psig and the HPCO control does not cut out, press the power button to stop ice machine operation.

Replace the HPCO control if it:

- Will not reset (below 300 psig)
- Does not open at the specified cut-out point

## **Filter-Driers**

### **Liquid Line Filter Drier**

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

## DEFINITIONS

### Recover

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

### Recycle

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

### Reclaim

To reprocess refrigerant to new product specifications (see below) by means which may include distillation. A chemical analysis of the refrigerant is required after processing to be sure that product specifications are met. This term usually implies the use of processes and procedures available only at a reprocessing or manufacturing facility.

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

### New Product Specifications

This means ARI Standard 700 (latest edition). Chemical analysis is required to assure that this standard is met.

## REFRIGERANT RE-USE POLICY

Manitowoc recognizes and supports the need for proper handling, re-use, and disposal of refrigerants. Manitowoc service procedures require recapturing refrigerants, not venting them to the atmosphere.

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

### **Important**

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

Manitowoc approves the use of:

1. New Refrigerant
  - Must be of original nameplate type.
2. Reclaimed Refrigerant
  - Must be of original nameplate type.
  - Must meet ARI Standard 700 (latest edition) specifications.
3. Recovered or Recycled Refrigerant
  - Must be recovered or recycled in accordance with current local, state and federal laws.
  - Must be recovered from and re-used in the same Manitowoc product. Re-use of recovered or recycled refrigerant from other products is not approved.
  - Recycling equipment must be certified to ARI Standard 740 (latest edition) and be maintained to consistently meet this standard.

4. Recovered refrigerant must come from a “contaminant-free” system. To decide whether the system is contaminant free, consider:
  - Type(s) of previous failure(s)
  - Whether the system was cleaned, evacuated and recharged properly following failure(s)
  - Whether the system has been contaminated by this failure
  - Compressor motor burnouts and improper past service prevent refrigerant re-use.
  - Refer to “System Contamination Cleanup” on page 121 to test for contamination.
5. “Substitute” or “Alternative” Refrigerant
  - Must use only Manitowoc-approved alternative refrigerants.
  - Must follow Manitowoc-published conversion procedures.

## RECOVERY AND RECHARGING PROCEDURES

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

### **Important**

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

### **Important**

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

## CONNECTIONS

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

## SELF-CONTAINED RECOVERY/EVACUATION

1. Place the power button in the OFF position.
2. Install manifold gauge set, charging cylinder/scale, and recovery unit or two-stage vacuum pump.
3. Open (backseat) the high and low side ice machine service valves, and open high and low side on manifold gauge set.
4. Perform recovery or evacuation:
  - A. Recovery: Operate the recovery unit as directed by the manufacturer's instructions.
  - B. Evacuation prior to recharging: Pull the system down to 500 microns. Then, allow the pump to run for an additional half hour. Turn off the pump and perform a standing vacuum leak check.

NOTE: Check for leaks using an electronic leak detector after charging the ice machine.

Follow the Charging Procedures below.

## CHARGING PROCEDURES

### **Important**

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

1. Be sure the power button is in the OFF position.
2. Close the vacuum pump valve, the low side service valve, and the low side manifold gauge valve.
3. Open the high side manifold gauge valve, and backseat the high side service valve.
4. Open the charging cylinder and add the proper refrigerant charge (shown on nameplate) through the discharge service valve.
5. Let the system "settle" for 2 to 3 minutes.
6. Press the power button to the on position.

7. Close the high side on the manifold gauge set. Add any remaining vapor charge through the suction service valve (if necessary).

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

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



## System Contamination Cleanup

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

### Important

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

### DETERMINING SEVERITY OF CONTAMINATION

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

Inspection of the refrigerant usually provides the first indication of system contamination. Obvious moisture or an acid odor in the refrigerant indicates contamination.

If either condition is found, or if contamination is suspected, use a Total Test Kit from Totaline or a similar diagnostic tool. These devices sample refrigerant, eliminating the need to take an oil sample. Follow the manufacturer's directions.

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

1. Remove the refrigerant charge from the ice machine.
2. Remove the compressor from the system.
3. Check the odor and appearance of the oil.
4. Inspect open suction and discharge lines at the compressor for burnout deposits.
5. If no signs of contamination are present, perform an acid oil test to determine the type of cleanup required.

<b>Contamination/Cleanup Chart</b>	
<b>Symptoms/Findings</b>	<b>Required Cleanup Procedure</b>
No symptoms or suspicion of contamination	Normal evacuation/recharging procedure
Moisture/Air Contamination symptoms Refrigeration system open to atmosphere for longer than 15 minutes Refrigeration test kit and/or acid oil test shows contamination No burnout deposits in open compressor lines	Mild contamination cleanup procedure
Mild Compressor Burnout symptoms Oil appears clean but smells acrid Refrigeration test kit or acid oil test shows harmful acid content No burnout deposits in open compressor lines	Mild contamination cleanup procedure
Severe Compressor Burnout symptoms Oil is discolored, acidic, and smells acrid Burnout deposits found in the compressor, lines, and other components	Severe contamination cleanup procedure

## **MILD SYSTEM CONTAMINATION CLEANUP PROCEDURE**

1. Replace any failed components.
2. If the compressor is good, change the oil.
3. Replace the liquid line drier.

NOTE: If the contamination is from moisture, use heat lamps during evacuation. Position them at the compressor, condenser and evaporator prior to evacuation. Do not position heat lamps too close to plastic components, or they may melt or warp.

4. Follow the normal evacuation procedure, except replace the evacuation step with the following:
  - A. Pull vacuum to 1000 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psig.
  - B. Pull vacuum to 500 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psig.
  - C. Change the vacuum pump oil.
  - D. Pull vacuum to 500 microns. Run the vacuum pump for 1/2 hour on self-contained models, 1 hour on remotes.

NOTE: You may perform a pressure test as a preliminary leak check. You should use an electronic leak detector after system charging to be sure there are no leaks.

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

## **SEVERE SYSTEM CONTAMINATION CLEANUP PROCEDURE**

1. Remove the refrigerant charge.
2. Remove the compressor.
3. Disassemble the harvest solenoid valve. If burnout deposits are found inside the valve, install a rebuild kit, and replace the TXV and head pressure control valve.
4. Wipe away any burnout deposits from suction and discharge lines at compressor.
5. Sweep through the open system with dry nitrogen.
6. Install a new compressor and new start components.
7. Install suction line filter-drier in front of compressor.
8. Install a new liquid line drier.
9. Follow the normal evacuation procedure, except replace the evacuation step with the following:
  - A. Pull vacuum to 1000 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psig.
  - B. Change the vacuum pump oil.
  - C. Pull vacuum to 500 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psig.
  - D. Change the vacuum pump oil.
  - E. Pull vacuum to 500 microns. Run the vacuum pump for 1 additional hour.
10. Charge the system with the proper refrigerant to the nameplate charge.
11. Operate the ice machine for one hour. Then, check the pressure drop across the suction line filter-drier.
  - A. If the pressure drop is less than 2 psig, the filter-drier should be adequate for complete cleanup.
  - B. If the pressure drop exceeds 2 psig, change the suction line filter-drier and the liquid line drier. Repeat until the pressure drop is acceptable.
12. Operate the ice machine for 48 – 72 hours. Replace the suction line and liquid line drier if necessary.
13. Follow normal evacuation procedures.

## REPLACING PRESSURE CONTROLS WITHOUT REMOVING REFRIGERANT CHARGE

This procedure reduces repair time and cost. Use it when any of the following components require replacement, and the refrigeration system is operational and leak-free.

- Fan cycle control
- High pressure cut-out control
- High side access valve
- Low side access valve

### Important

This is a required in-warranty repair procedure.

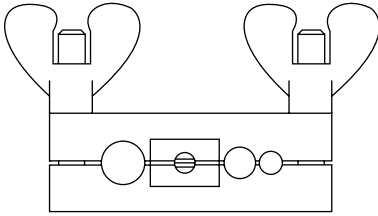
1. Disconnect power to the ice machine.
2. Follow all manufacturers' instructions supplied with the pinch-off tool. Position the pinch-off tool around the tubing as far from the pressure control as feasible. (See the figure on next page.) Clamp down on the tubing until the pinch-off is complete.

### Warning

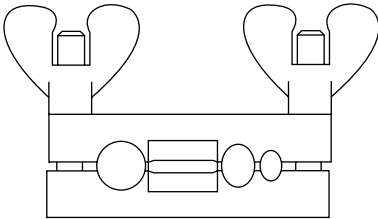
Do not unsolder a defective component. Cut it out of the system. Do not remove the pinch-off tool until the new component is securely in place.

3. Cut the tubing of the defective component with a small tubing cutter.
4. Solder the replacement component in place. Allow the solder joint to cool.
5. Remove the pinch-off tool.
6. Re-round the tubing. Position the flattened tubing in the proper hole in the pinch off tool. Tighten the wing nuts until the block is tight and the tubing is rounded.

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



**FIG. A - "PINCHING OFF" TUBING**



**FIG. B - RE-ROUNDING TUBING**

**SV1406**

### **Using Pinch Off Tool**

## 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.

<b>Model</b>	<b>Air-Cooled</b>	<b>Water-Cooled</b>	<b>Refrigerant Type</b>
U140	10 oz (283 g)	11 oz (312 g)	R404A
U190	12 oz (340 g)	N/A	R404A
U240	13 oz (369 g)	12 oz (340 g)	R404A
U310 Serial Number 310304977 and Earlier	15 oz (425 g)	14 oz (397 g)	R404A
U310 Serial Number 310304978 and After	15 oz (425 g)	18 oz (510g)	R404A

THIS PAGE INTENTIONALLY LEFT BLANK



## Charts

---

### **Cycle Times, 24 Hr. Ice Production and Refrigerant Pressure Charts**

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

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

- Production and cycle times are for dice cube - Half dice cube cycle times can be 1-2 minutes faster depending on model and ambient temperature.
- 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.
- Regular cube production derate is 7%.
- Refer to "Operational Analysis Chart" for the list of data that must be collected for refrigeration diagnostics.
- Zero out manifold gauge set before obtaining pressure readings to avoid mis-diagnosis.
- Discharge and suction pressure are highest at the beginning of the cycle. Suction pressure will drop throughout the cycle. Verify the pressures are within the range indicated.
- Record beginning of freeze cycle suction pressure one minute after the water pump energizes.
- 50Hz dice and half dice production derate is 12%.
- 50Hz regular cube production derate is 14%.

## U0140 SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

### Cycle Times

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	10.2-11.7	12.4-14.1	13.0-14.8	1.0-2.5
80/27	11.2-12.8	13.0-14.8	14.6-16.5	
90/32	11.8-13.4	14.6-16.5	17.6-19.9	
100/38	14.6-16.5	17.6-19.9	19.9-17.6	
110/43	16.5-18.7	19.9-17.6	20.3-23.0	

Times in minutes

### 24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10	70/21	90/32
70/21	130	110	105
80/27	120	105	95
90/32	115	95	85
100/38	95	85	80
110/43	85	80	70

Based on average ice slab weight of 1.06 – 1.19 lb (481 – 540 g).  
Regular cube derate is 7%

### Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-250	55-18	135-170	75-110
70/21	200-250	60-20	140-170	75-120
80/27	220-265	65-22	145-190	75-120
90/32	240-315	70-24	165-200	75-120
100/38	300-380	80-30	200-235	75-120
110/43	310-400	90-32	210-240	75-120

Suction pressure drops gradually throughout the freeze cycle

## U0140 SELF-CONTAINED WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

### Cycle Times

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	9.8-11.2	11.2-12.8	13.0-14.8	1.0-2.5
80/27	10.2-11.7	11.8-13.4	13.8-15.6	
90/32	11.8-13.4	13.0-14.8	15.5-17.5	
100/38	13.0-14.8	15.5-17.5	17.6-19.9	
110/43	14.6-16.5	17.6-19.9	20.3-23.0	

Times in minutes

### 24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10	70/21	90/32
70/21	135	120	105
80/27	130	115	100
90/32	115	105	90
100/38	105	90	80
110/43	95	80	70

Based on average ice slab weight of 1.06 - 1.19 lb (481 – 540 g).

Regular cube derate is 7%

Water regulating valve set to maintain 230 PSIG discharge pressure  
Condenser water usage = 185 gallons per 100 lbs of ice at 90°F/70°F

### Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	225-235	55-22	135-155	90-115
70/21	225-235	65-24	145-160	100-130
80/27	225-240	65-24	145-165	100-130
90/32	225-245	65-24	145-165	110-130
100/38	225-245	70-25	150-175	115-140
110/43	225-245	70-26	150-180	115-145

Suction pressure drops gradually throughout the freeze cycle

## U0190 SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

### Cycle Times

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	16.1-18.3	19.8-22.5	21.2-24.0	1.0-2.5
80/27	19.8-22.5	21.9-24.9	24.5-27.8	
90/32	21.9-24.9	23.6-26.8	29.0-32.9	
100/38	25.5-29.0	29.1-32.9	32.0-36.2	
110/43	29.1-32.9	32.0-36.2	33.6-38.1	

Times in minutes

### 24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10	70/21	90/32
70/21	200	165	155
80/27	165	150	135
90/32	150	140	115
100/38	130	115	105
110/43	115	105	100

Based on average ice slab weight of 2.44 - 2.75 lb (1107 – 1247 g).  
Regular cube derate is 7%

### Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-250	60-38	150-170	90-110
70/21	200-260	80-38	150-170	95-130
80/27	240-290	80-39	160-190	100-130
90/32	260-330	80-40	160-190	100-130
100/38	310-380	85-41	180-210	105-135
110/43	315-390	90-41	180-215	110-135

Suction pressure drops gradually throughout the freeze cycle

## U0240 SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

### Cycle Times

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10	70/21	90/32	
<b>70/21</b>	14.1-16.1	17.0-19.3	18.6-21.1	1.0-2.5
<b>80/27</b>	15.2-17.4	18.0-20.5	20.5-23.3	
<b>90/32</b>	16.5-18.8	20.5-23.3	22.7-25.8	
<b>100/38</b>	19.2-21.8	21.9-24.9	23.6-26.8	
<b>110/43</b>	21.9-24.9	23.6-26.8	24.5-27.8	

Times in minutes

### 24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10	70/21	90/32
<b>70/21</b>	225	190	175
<b>80/27</b>	210	180	160
<b>90/32</b>	195	160	145
<b>100/38</b>	170	150	140
<b>110/43</b>	150	140	135

Based on average ice slab weight of 2.44 - 2.75 lb (1107 – 1247 g).  
Regular cube derate is 7%

### Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
<b>50/10</b>	220-275	65-32	145-200	85-110
<b>70/21</b>	220-310	75-34	155-210	90-120
<b>80/27</b>	270-330	80-36	175-225	90-140
<b>90/32</b>	290-350	80-38	185-245	90-150
<b>100/38</b>	320-410	85-39	200-260	90-155
<b>110/43</b>	355-430	90-40	220-280	90-160

Suction pressure drops gradually throughout the freeze cycle

## U0240 SELF-CONTAINED WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

### Cycle Times

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	16.1-18.3	17.0-19.3	18.0-20.5	1.0-2.5
80/27	16.5-18.8	17.5-19.9	18.6-21.1	
90/32	18.0-20.5	19.2-21.8	20.5-23.3	
100/38	18.6-21.1	19.8-22.5	21.2-24.0	
110/43	19.2-21.8	20.5-23.3	21.9-24.9	

Times in minutes

### 24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10	70/21	90/32
70/21	200	190	180
80/27	195	185	175
90/32	180	170	160
100/38	175	165	155
110/43	170	160	150

Based on average ice slab weight of 2.44 - 2.75 lb (1107 – 1247 g).  
Regular cube derate is 7%

Water regulating valve set to maintain 235 PSIG discharge pressure  
Condenser water usage = 149 gallons per 100 lbs of ice at 90°F/70°F

### Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	230-240	65-30	130-150	80-110
70/21	230-240	70-32	135-160	90-120
80/27	230-240	70-34	135-160	90-120
90/32	230-240	70-36	135-165	90-120
100/38	230-245	75-35	135-170	90-120
110/43	230-250	80-38	140-175	95-125

Suction pressure drops gradually throughout the freeze cycle

## U0310 SELF-CONTAINED AIR-COOLED

NOTE: These characteristics may vary depending on operating conditions.

### Cycle Times

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Entering Condenser °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	10.0-11.5	11.8-13.4	14.1-16.1	1.0-2.5
80/27	10.4-11.9	12.3-14.0	13.5-15.4	
90/32	11.0-12.6	13.5-15.4	15.2-17.4	
100/38	12.3-14.0	15.2-17.4	17.5-19.9	
110/43	15.6-17.8	19.2-21.8	21.2-24.0	

Times in minutes

### 24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10	70/21	90/32
70/21	305	265	225
80/27	295	255	235
90/32	280	235	210
100/38	255	210	185
110/43	205	170	155

Based on average ice slab weight of 2.44 - 2.75 lb (1107 – 1247 g).  
Regular cube derate is 7%

### Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	200-250	45-18	130-150	75-105
70/21	200-250	50-18	135-150	75-105
80/27	200-270	55-20	140-175	75-110
90/32	240-300	60-22	165-185	105-125
100/38	275-350	65-23	175-220	130-150
110/43	400-320	70-25	210-240	135-155

Suction pressure drops gradually throughout the freeze cycle

## U0310 SELF-CONTAINED WATER-COOLED

NOTE: These characteristics may vary depending on operating conditions.

### Cycle Times

Freeze Time + Harvest Time = Total Cycle Time

Air Temp. Around Ice Machine °F/°C	Freeze Time			Harvest Time
	Water Temperature °F/°C			
	50/10	70/21	90/32	
70/21	11.5-13.2	11.3-12.9	12.0-13.7	1.0-2.5
80/27	10.0-11.5	11.5-13.2	12.3-14.0	
90/32	10.2-11.7	12.6-14.3	13.1-15.0	
100/38	10.4-11.9	12.6-14.3	13.5-15.4	
110/43	10.6-12.2	12.8-14.7	13.8-15.7	

Times in minutes

### 24 Hour Ice Production

Air Temp. Around Ice Machine °F/°C	Water Temperature °F/°C		
	50/10	70/21	90/32
70/21	270	275	260
80/27	305	270	255
90/32	300	250	240
100/38	295	250	235
110/43	290	245	230

Based on average ice slab weight of 2.44 - 2.75 lb (1107 – 1247 g).  
Regular cube derate is 7%

Water regulating valve set to maintain 235 PSIG discharge pressure  
Condenser water usage = 149 gallons per 100 lbs of ice a 90°F/70°F

### Operating Pressures

Air Temp. Around Ice Machine °F/°C	Freeze Cycle		Harvest Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG	Discharge Pressure PSIG	Suction Pressure PSIG
50/10	230-240	50-24	150-175	75-90
70/21	230-240	50-25	150-175	75-90
80/27	235-240	50-26	155-175	75-95
90/32	235-240	55-27	165-180	80-100
100/38	235-250	60-27	165-180	80-100
110/43	235-255	60-28	165-180	80-100

Suction pressure drops gradually throughout the freeze cycle



# Diagrams

---

## Wiring Diagrams

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

### **Warning**

Always disconnect power before working on electrical circuitry.

## Wiring Diagram Legend

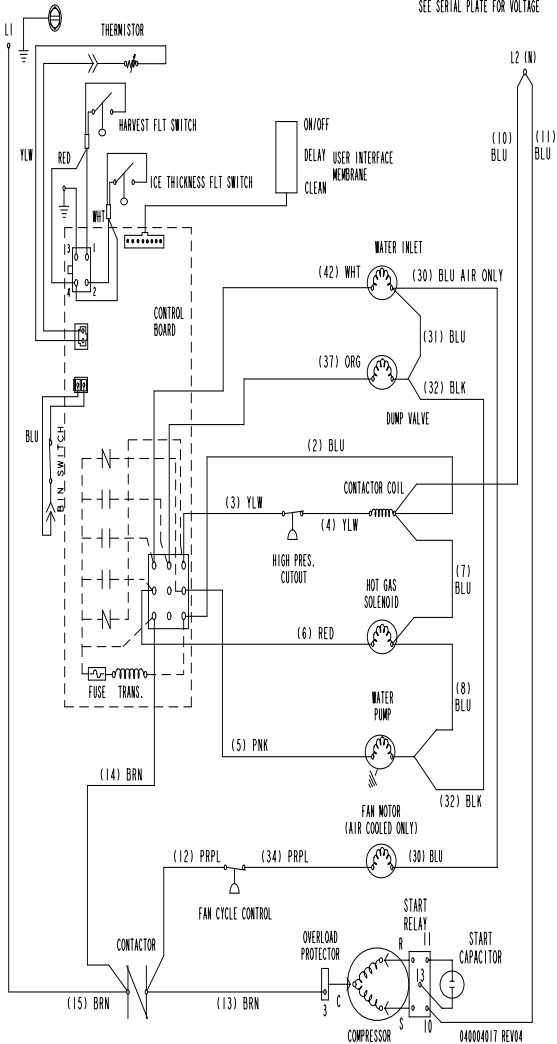
The following symbols are used on all of the wiring diagrams:

- \* 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)

# U140/U190/U240 WIRING DIAGRAM WITHOUT J4 THERMISTOR TERMINAL

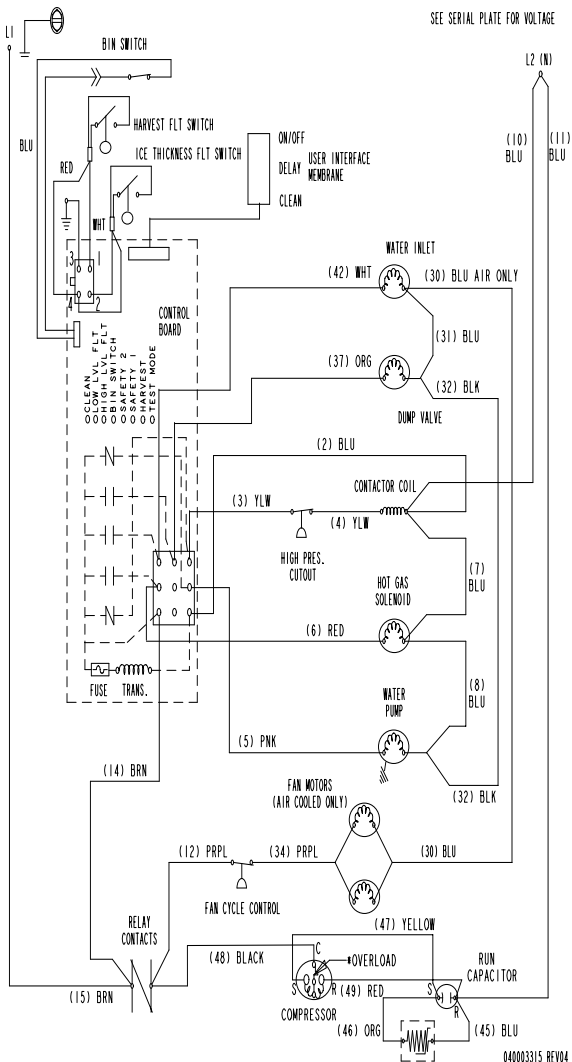
## Self Contained Air & Water-cooled

SEE SERIAL PLATE FOR VOLTAGE



# U310 WIRING DIAGRAM WITHOUT J4 THERMISTOR TERMINAL

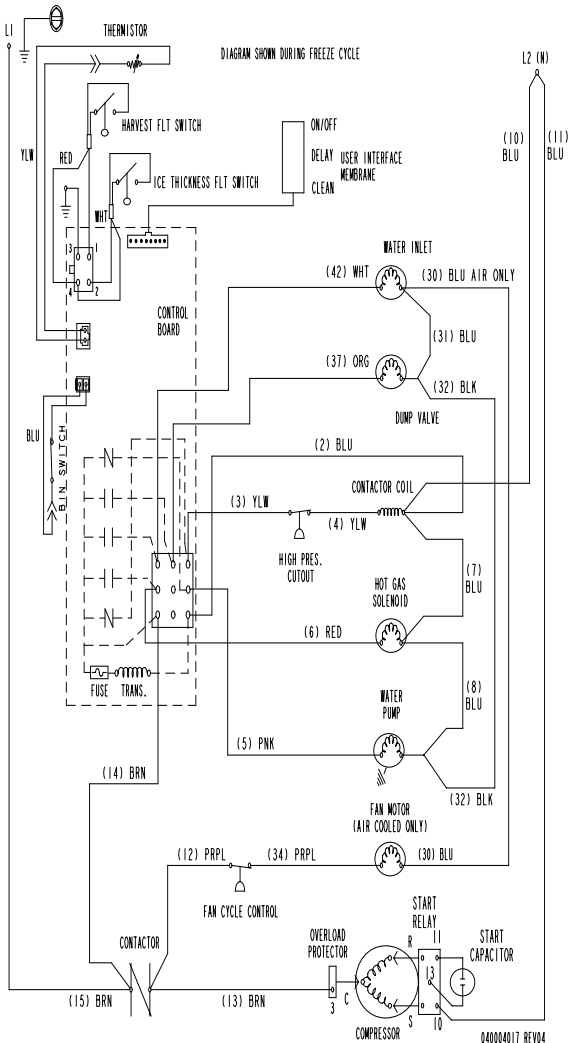
## Self Contained Air & Water-cooled



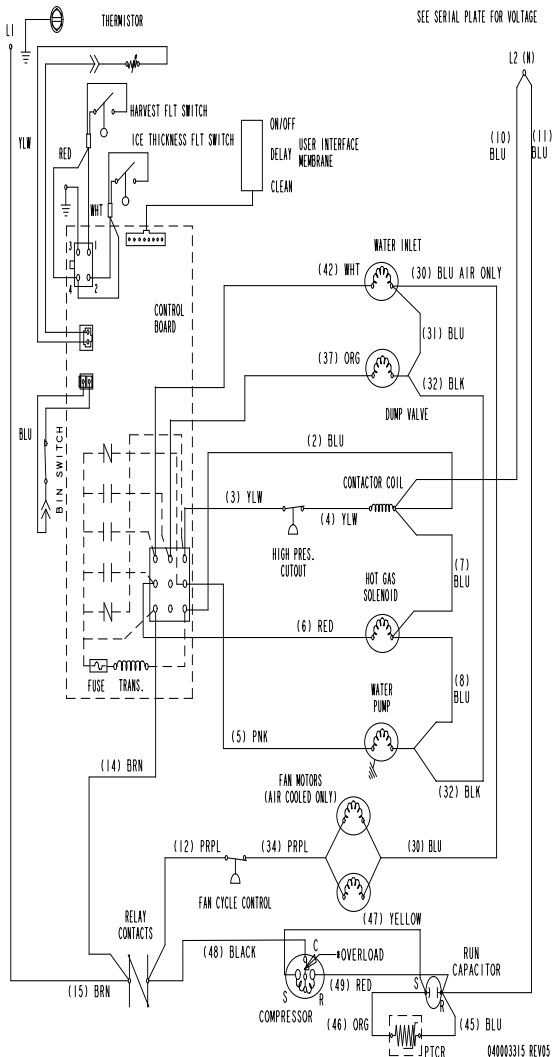
040003315 REV04

# U140/U190/U240 WIRING DIAGRAM WITH J4 THERMISTOR TERMINAL - 1PH AIR/WATER

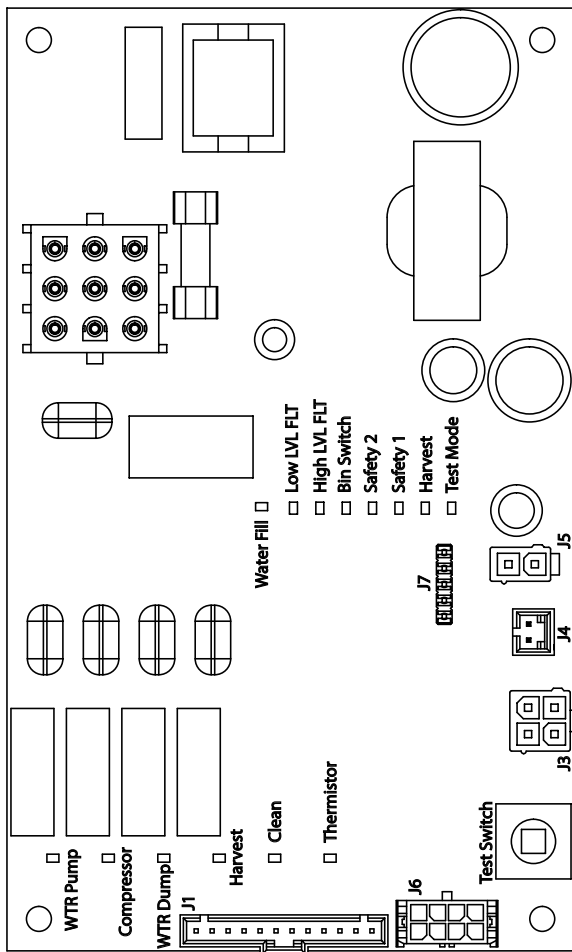
## Self Contained Air & Water-cooled



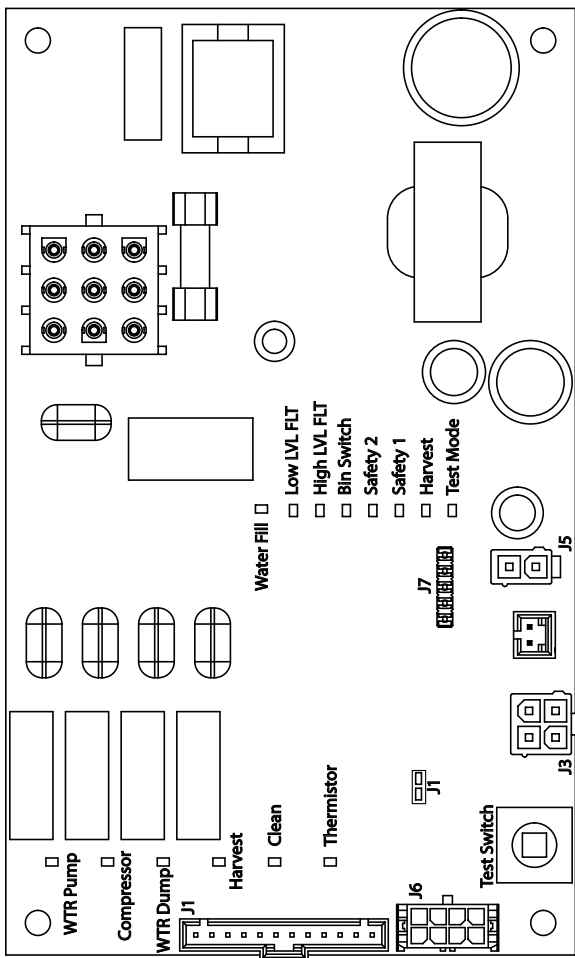
# U310 WIRING DIAGRAM WITH J4 THERMISTOR TERMINAL - 1PH AIR/WATER Self Contained Air & Water-cooled



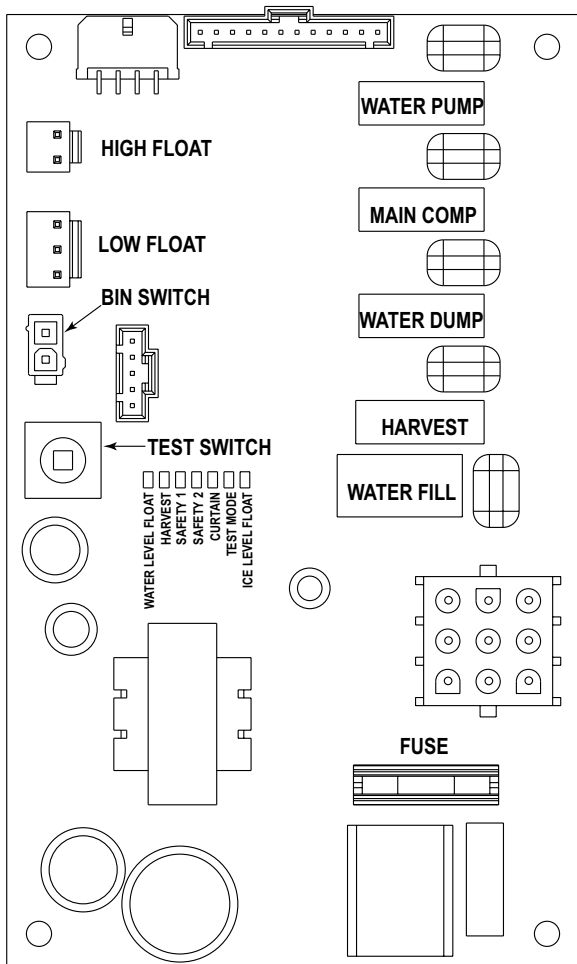
# ELECTRONIC CONTROL BOARD WITH J4 THERMISTOR TERMINAL



# ELECTRONIC CONTROL BOARD WITH J1 AND WITHOUT J4 THERMISTOR TERMINAL

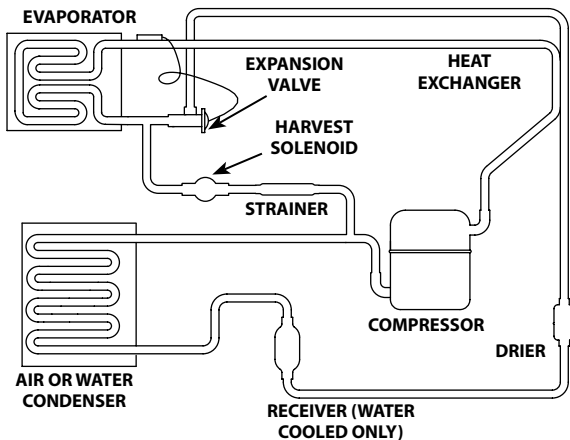


# ELECTRONIC CONTROL BOARD PRIOR TO J1 THE TERMINAL

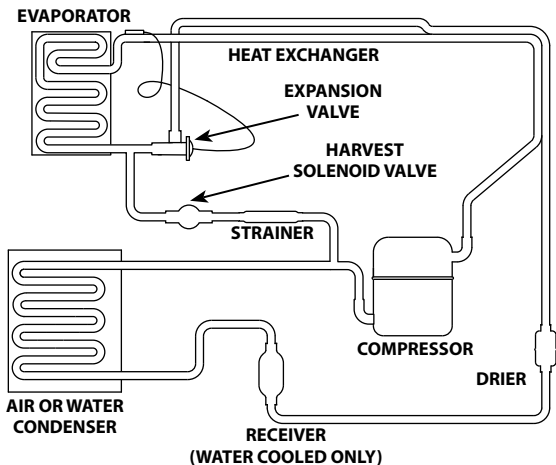




## Tubing Schematic - U0140



## Tubing Schematic - U0190/U0240/U0310



THIS PAGE INTENTIONALLY LEFT BLANK





MANITOWOC FOODSERVICE  
ICE MACHINE DIVISION  
2110 SOUTH 26TH STREET  
MANITOWOC, WI 54220

800-545-5720

WWW.MANITOWOCICE.COM

Every new piece of Manitowoc Foodservice equipment comes with KitchenCare™ and you choose the level of service that meets your operational needs from one restaurant to multiple locations.



**StarCare** – Warranty & lifetime service, certified OEM parts, global parts inventory, performance audited

**ExtraCare** – CareCode, 24/7 Support, online/mobile product information

**LifeCare** – Install & equipment orientation, planned maintenance, KitchenConnect™, MenuConnect

**Talk with KitchenCare™** • 1-844-724-CARE • [www.mtwkitchencare.com](http://www.mtwkitchencare.com)

To learn how Manitowoc Foodservice and its leading brands can equip you, visit our global web site at [www.manitowocfoodservice.com](http://www.manitowocfoodservice.com), then discover the regional or local resources available to you.



©2015 Manitowoc Foodservice except where explicitly stated otherwise. All rights reserved. Continuing product improvement may necessitate change of specifications without notice.

Part Number STH042 11/16