

# Indigo™ Series

## Air/Water/Remote Condenser Ice Machines

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### Technician's Handbook



## Safety Notices

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

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

### **Warning**

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

### **Caution**

Text in a Caution box alerts you to a situation in which you could damage the equipment. Be sure to read the Caution statement before proceeding, and work carefully.

## Procedural Notices

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

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

### **Important**

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

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

## Read These Before Proceeding:

### **Caution**

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

### **Caution**

Proper installation, care and maintenance are essential for maximum performance and trouble-free operation of your equipment. Visit our website [www.manitowocfsg.com](http://www.manitowocfsg.com) for manual updates, translations, or contact information for service agents in your area.

### **Important**

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

### **Warning**

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

### **⚠ Warning**

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

### **⚠ Warning**

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

### **⚠ Warning**

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

### **⚠ Warning**

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

### **⚠ Warning**

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

### **⚠ Warning**

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

### **⚠ Warning**

Do not obstruct machine vents or openings.

### **⚠ Warning**

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

### **⚠ Warning**

Do not clean with water jet.

**⚠ Warning**

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

**⚠ Warning**

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

## **Warning**

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

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

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



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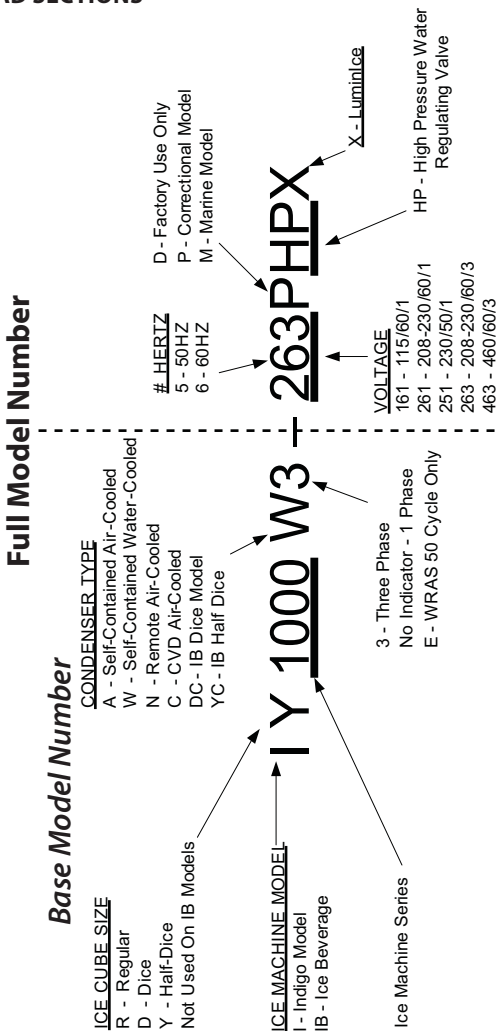
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# General Information

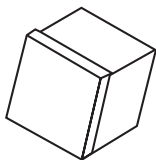
## How to Read a Model Number

### HEAD SECTIONS



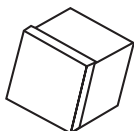


## Ice Cube Sizes



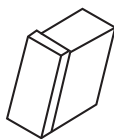
Regular

1-1/8" x 1-1/8" x 7/8"  
2.86 x 2.86 x 2.22 cm



Dice

7/8" x 7/8" x 7/8"  
2.22 x 2.22 x 2.22 cm



Half Dice

3/8" x 1-1/8" x 7/8"  
0.95 x 2.86 x 2.22 cm

### **▲ Warning**

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

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

## Model/Serial Number Location

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

## Model Numbers

### AIR-WATER-REMOTE CONDENSER MODELS

| <b>Self-Contained<br/>Air-Cooled</b> | <b>Self-Contained<br/>Water-Cooled</b> | <b>Remote</b>                 |
|--------------------------------------|--|-------------------------------|
| ID0302A<br>IY0304A                   | ID0303W<br>IY0305W                     | ----                          |
| ID0306A<br>IY0306A                   | ID0306W<br>IY0306W                     | ----                          |
| ID0322A<br>IY0324A                   | ID0323W<br>IY0325W                     | ----                          |
| ID0452A<br>IY0454A                   | D0453W<br>IY0455W                      | ----                          |
| ID0456A<br>IY0456A                   | IID0456W<br>IY0456W                    | ----                          |
| IR0500A<br>ID0502A<br>IY0504A        | IR0501W<br>ID0503W<br>IY0505W          | IR0590N<br>ID0592N<br>IY0594N |
| IR0520A<br>ID0522A<br>IY0524A        | IR0521W<br>ID0523W<br>IY0525W          | ----<br>----                  |
| ID0602A<br>IY0604A                   | ID0603W<br>IY0605W                     | ID0692N<br>IY0694N            |
| ID0606A<br>IY0606A                   | ID0606W<br>IY0606W                     | ID0696N<br>IY0696N            |
| IR0850A<br>ID0852A<br>IY0854A        | IR0851W<br>ID0853W<br>IY0855W          | IR0890N<br>ID0892N<br>IY0894N |
| IR0906A<br>ID0906A<br>IY0906A        | IR0906W<br>ID0906W<br>IY0906W          | IR0996N<br>ID0996N<br>IY0996N |
| ID1002A<br>IY1004A                   | ID1003W<br>IY1005W                     | ID1092N<br>IY1094N            |
| ID1106A<br>IY1106A                   | ID1106W<br>IY1106W                     | ID1196N<br>IY1196N            |
| ID1202A<br>IY1204A                   | ID1203W<br>IY1205W                     |                               |
| ID1402A<br>IY1404A                   | ID1403W<br>IY1405W                     | ID1492N<br>IY1494N            |
| ID1406A<br>IY1406A                   | ID1406W<br>IY1406W                     | ID1496N<br>IY1496N            |
| IR1800A<br>ID1802A<br>IY1804A        | IR1801W<br>ID1803W<br>IY1805W          | IR1890N<br>ID1892N<br>IY1894N |

| <b>Self-Contained<br/>Air-Cooled</b> | <b>Self-Contained<br/>Water-Cooled</b> | <b>Remote</b> |
|--------------------------------------|--|---------------|
| IR1806A                              | IR1806W                                | IR1896N       |
| ID1806A                              | ID1806W                                | ID1896N       |
| IY1806A                              | IY1806W                                | IY1896N       |

NOTE: Marine and Prison models have a M or P suffix - Example ID0853WM

3 suffix at the end of the model number indicates a 3 phase unit  
- Example IY1004A3

K suffix indicates a Korean model.

## Ice Machine Warranty Information

### OWNER WARRANTY REGISTRATION CARD

Warranty coverage begins the day the ice machine is installed.

#### **Important**

Complete and mail the OWNER WARRANTY REGISTRATION CARD as soon as possible to validate the installation date.

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

## **COMMERCIAL WARRANTY COVERAGE**

Manitowoc Ice, (hereinafter referred to as the "COMPANY") warrants for a period of thirty-six months from the installation date (except as limited below) that new ice machines manufactured by the COMPANY shall be free of defects in material or workmanship under normal and proper use and maintenance as specified by the COMPANY and upon proper installation and start-up in accordance with the instruction manual supplied with the ice machine.

The COMPANY'S warranty hereunder with respect to the compressor shall apply for an additional twenty-four months, excluding all labor charges, and with respect to the evaporator for an additional twenty-four months, including labor charges.

The obligation of the COMPANY under this warranty is limited to the repair or replacement of parts, components, or assemblies that in the opinion of the COMPANY are defective. This warranty is further limited to the cost of parts, components or assemblies and standard straight time labor charges at the servicing location. Time and hourly rate schedules, as published from time to time by the COMPANY, apply to all service procedures.

Additional expenses including without limitation, travel time, overtime premium, material cost, accessing or removal of the ice machine, or shipping are the responsibility of the owner, along with all maintenance, adjustments, cleaning, and ice purchases.

Labor covered under this warranty must be performed by a COMPANY Contracted Service Representative or a refrigeration service agency as qualified and authorized by the COMPANY'S local Distributor.

The COMPANY'S liability under this warranty shall in no event be greater than the actual purchase price paid by customer for the ice machine.

The foregoing warranty shall not apply to (1) any part or assembly that has been altered, modified, or changed; (2) any part or assembly that has been subjected to misuse, abuse, neglect, or accidents; (3) any ice machine that has been installed and/or maintained inconsistent with the technical instructions provided by the COMPANY; or (4) any ice machine initially installed more than five years from the serial number production date. This warranty shall not apply if the Ice Machine's refrigeration system is modified with a condenser, heat reclaim device, or parts and assemblies other than those manufactured by the COMPANY, unless the COMPANY approves these modifications for specific locations in writing.

**THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OR GUARANTEES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

In no event shall the COMPANY be liable for any special, indirect, incidental or consequential damages. Upon the expiration of the warranty period, the COMPANY'S liability under this warranty shall terminate. The foregoing warranty shall constitute the sole liability of the COMPANY and the exclusive remedy of the customer or user.

To secure prompt and continuing warranty service, the warranty registration card must be completed and sent to the COMPANY within five (5) days from the installation date.

## **RESIDENTIAL ICE MACHINE WARRANTY**

### WHAT DOES THIS LIMITED WARRANTY COVER?

Subject to the exclusions and limitations below, Manitowoc Ice (“Manitowoc”) warrants to the original consumer that any new ice machine manufactured by Manitowoc (the “Product”) shall be free of defects in material or workmanship for the warranty period outlined below under normal use and maintenance, and upon proper installation and start-up in accordance with the instruction manual supplied with the Product.

### HOW LONG DOES THIS LIMITED WARRANTY LAST?

| <b>Product Covered</b> | <b>Warranty Period</b>           |
|------------------------|----------------------------------|
| Ice Machine            | Twelve months from the sale date |

### WHO IS COVERED BY THIS LIMITED WARRANTY?

This limited warranty only applies to the original consumer of the Product and is not transferable.

## WHAT ARE MANITOWOC ICE'S OBLIGATIONS UNDER THIS LIMITED WARRANTY?

If a defect arises and Manitowoc receives a valid warranty claim prior to the expiration of the warranty period, Manitowoc shall, at its option: (1) repair the Product at Manitowoc's cost, including standard straight time labor charges, (2) replace the Product with one that is new or at least as functionally equivalent as the original, or (3) refund the purchase price for the Product. Replacement parts are warranted for 90 days or the balance of the original warranty period, whichever is longer. The foregoing constitutes Manitowoc's sole obligation and the consumer's exclusive remedy for any breach of this limited warranty. Manitowoc's liability under this limited warranty is limited to the purchase price of Product. Additional expenses including, without limitation, service travel time, overtime or premium labor charges, accessing or removing the Product, or shipping are the responsibility of the consumer.



## WHAT IS NOT COVERED?

This limited warranty does not cover, and you are solely responsible for the costs of: (1) periodic or routine maintenance, (2) repair or replacement of the Product or parts due to normal wear and tear, (3) defects or damage to the Product or parts resulting from misuse, abuse, neglect, or accidents, (4) defects or damage to the Product or parts resulting from improper or unauthorized alterations, modifications, or changes; and (5) defects or damage to any Product that has not been installed and/or maintained in accordance with the instruction manual or technical instructions provided by Manitowoc. To the extent that warranty exclusions are not permitted under some state laws, these exclusions may not apply to you.

EXCEPT AS STATED IN THE FOLLOWING SENTENCE, THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY OF MANITOWOC WITH REGARD TO THE PRODUCT. ALL IMPLIED WARRANTIES ARE STRICTLY LIMITED TO THE DURATION OF THE LIMITED WARRANTY APPLICABLE TO THE PRODUCTS AS STATED ABOVE, INCLUDING BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

IN NO EVENT SHALL MANITOWOC OR ANY OF ITS AFFILIATES BE LIABLE TO THE CONSUMER OR ANY OTHER PERSON FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND (INCLUDING, WITHOUT LIMITATION, LOSS OF PROFITS, REVENUE OR BUSINESS) ARISING FROM OR IN ANY MANNER CONNECTED WITH THE PRODUCT, ANY BREACH OF THIS LIMITED WARRANTY, OR ANY OTHER CAUSE WHATSOEVER, WHETHER BASED ON CONTRACT, TORT OR ANY OTHER THEORY OF LIABILITY.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

#### HOW STATE LAW APPLIES

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

#### REGISTRATION CARD

To secure prompt and continuing warranty service, this warranty registration card must be completed and sent to Manitowoc within thirty (30) days from the sale date. Complete the registration card and send it to Manitowoc.

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# Installation

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## **Warning**

### **PERSONAL INJURY POTENTIAL**

Remove all ice machine panels before lifting.

## **Caution**

The ice machine head section must be protected if it will be subjected to temperatures below 32°F (0°C). Failure caused by exposure to freezing temperatures is not covered by the warranty. See "Removal from Service/Winterization" page 55.

## **ICE DEFLECTOR**

An ice deflector is required for all ice machines installed on a bin.

## 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 free of airborne and other contaminants.
- Self contained air and water cooled - The air temperature must be at least 35°F (1.6°C), but must not exceed 110°F (43.4°C).
- Remote air cooled - The air temperature must be at least -20°F (-29°C), but must not exceed 120°F (49°C)
- Ice Making Water Inlet - Water Pressure must be at least 20 psi (1.38 bar), but must not exceed 80 psi (5.52 bar).
- Condenser Water Inlet - Water Pressure must be at least 20 psi (1.38 bar), but must not exceed 150 psi (10.34 bar).
- The location must not be near heat-generating equipment or in direct sunlight and protected from weather.
- The location must not obstruct air flow through or around the ice machine. Refer to chart below for clearance requirements.
- The ice machine must be protected if it will be subjected to temperatures below 32°F (0°C). Failure caused by exposure to freezing temperatures is not covered by the warranty. See "Removal from Service/ Winterization"

## Clearance Requirements

### AIR, WATER, REMOTE CONDENSER MODELS

| <b>I0300</b> | <b>Self-Contained Air-Cooled</b> | <b>Self-Contained Water-Cooled</b> |
|--------------|----------------------------------|------------------------------------|
| Top/Sides    | 16" (40.6 cm)                    | 8" (20.3 cm)                       |
| Back         | 5" (12.7 cm)                     | 5" (12.7 cm)                       |

| <b>I0450<br/>I0500 - I0600<br/>I0850 - I0900<br/>I1000 - I1100</b> | <b>Self-Contained Air-Cooled</b> | <b>Water-Cooled and Remote*</b> |
|--|----------------------------------|---------------------------------|
| Top/Sides  | 8" (20.3 cm)                     | 8" (20.3 cm)                    |
| Back   | 5" (12.7 cm)                     | 5" (12.7 cm)                    |

| <b>I0320 - I0520</b>                                  | <b>Self-Contained Air-Cooled</b> | <b>Water-Cooled and Remote*</b> |
|---|----------------------------------|---------------------------------|
| Top/Sides   | 12" (30.5 cm)                    | 8" (20.3 cm)                    |
| Back  | 5" (12.7 cm)                     | 5" (12.7 cm)                    |
| <b>I0500 Tropical Rating 230/50/1 Air-Cooled Only</b> |                                  |                                 |
| Top   | 24" (61 cm)                      | N/A                             |
| Sides/back  | 12" (30.5 cm)                    | N/A                             |

| <b>I1200</b> | <b>Self-Contained Air-Cooled</b> | <b>Water-Cooled and Remote*</b> |
|--------------|----------------------------------|---------------------------------|
| Top          | 8" (20.3 cm)                     | 8" (20.3 cm)                    |
| Sides        | 12" (30.5 cm)                    | 8" (20.3 cm)                    |
| Back         | 5" (12.7 cm)                     | 5" (12.7 cm)                    |

| <b>I1400 - I1800</b> | <b>Self-Contained Air-Cooled</b> | <b>Water-Cooled and Remote*</b> |
|----------------------|----------------------------------|---------------------------------|
| Top/Sides            | 24" (61.0 cm)                    | 8" (20.3 cm)                    |
| Back                 | 12" (30.5 cm)                    | 5" (12.7 cm)                    |

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

## Ice Machine Heat of Rejection

| Series Ice Machine | Heat of Rejection |       |
|--------------------|-------------------|-------|
|                    | Air Conditioning* | Peak  |
| I0300              | 4600              | 5450  |
| I0320              | 3300              | 4500  |
| I0450              | 5400              | 6300  |
| I0500              | 6100              | 6900  |
| I0520              | 5400              | 6300  |
| I0600              | 9000              | 13900 |
| I0850              | 13000             | 16000 |
| I0906              | 12700             | 14800 |
| I1000/I1106        | 16250             | 18600 |
| I1100/I1106        | 16250             | 18600 |
| I1200              | 20700             | 24500 |
| I1400/I1406        | 23500             | 27000 |
| I1800              | 30000             | 35000 |

\*BTU/Hour

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

## Installation on a Bin

An ice deflector is required for all bin installations and is included with all Manitowoc bins. Order the appropriate deflector kit (30" or 48") for any bin without a deflector..

### **Warning**

#### **PERSONAL INJURY POTENTIAL**

Do not operate any ice machine with the deflector removed.

## Ice Machine on a Dispenser Installation

No deflector is needed for machines that match the size of the dispenser (30" head section on a 30" dispenser) unless required by the dispenser manufacturer. Adapters are required when a smaller ice machine is going on a larger dispenser (22" machine on a 30" dispenser).



## Lineset Applications

### **Warning**

The 60-month compressor warranty (including the 36-month labor replacement warranty) will not apply if the Manitowoc Ice Machine, Condenser or QuietQube® Condensing Unit were not installed according to specifications. This warranty also will not apply if the refrigeration system is modified with a condenser, heat reclaim device, or other parts or assemblies not manufactured by Manitowoc Ice.

### **Caution**

Recovery locations vary by model. Verify you are making the correct connections for your model to prevent accidental release of high pressure refrigerant.

### **Important**

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

## REMOTE CONDENSER

| Ice Machine                | Remote Single Circuit Condenser | Line Set*                                 |
|----------------------------|---------------------------------|---|
| I0590N                     | JC0495                          | RT-20-R404A<br>RT-35-R404A<br>RT-50-R404A |
| I0690N<br>I0890N           | JC0895                          | RT-20-R404A<br>RT-35-R404A<br>RT-50-R404A |
| I0990N<br>I1090N<br>I1190N | JC0995                          | RT-20-R404A<br>RT-35-R404A<br>RT-50-R404A |
| I1490N<br>I1890N           | JC1395                          | RL-20-R404A<br>RL-35-R404A<br>RL-50-R404A |

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

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

## **ADDITIONAL REFRIGERANT CHARGE FOR 51' TO 100' LINE SETS**

| <b>Ice Machine</b> | <b>Condenser</b> | <b>Additional Amount of Refrigerant To Be Added To Nameplate Charge</b> |
|--------------------|------------------|---|
| I0590N             | JC0495           | 1.5 lbs - 680g  |
| I0690N             | JC0895           | 1.5 lbs - 680g  |
| I0696N             | JC0895           | 2 lbs - 907g  |
| I0890N             | JC0895           | 2 lbs - 907g  |
| I0996N             | JC0995           | 2 lbs - 907g  |
| I1090N             | JC0995           | 2 lbs - 907g  |
| I1196N             | JC0995           | 2 lbs - 907g  |
| I1490N             | JC1395           | 2 lbs - 907g  |
| I1496N             | JC1395           | 2 lbs - 907g  |
| I1890N             | JC1395           | 2 lbs - 907g  |

## CALCULATING ALLOWABLE LINESET DISTANCE

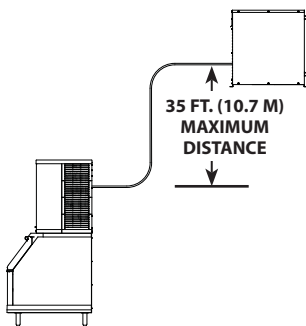
### Line Set Length

The maximum length is 100' (30.5 m).

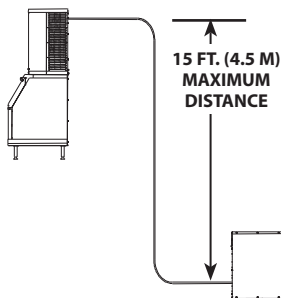
### Line Set Rise/Drop

The maximum rise is 35' (10.7 m).

The maximum drop is 15' (4.5 m).



**35 ft. (10.7 m) Rise:** The maximum distance the Condenser or Condensing Unit can be above the ice machine.



**15 ft. (4.5 m) Drop:** The maximum distance the Condenser or Condensing Unit can be below the ice machine.

## Calculated Line Set Distance

The maximum calculated distance is 150' (45.7 m).

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

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

1. Insert the **measured rise** into the formula below. Multiply by 1.7 to get the calculated rise. (Example: A condenser located 10 feet above the ice machine has a **calculated rise** of 17 feet.)
2. Insert the **measured drop** into the formula below. Multiply by 6.6 to get the calculated drop. (Example. A condenser located 10 feet below the ice machine has a **calculated drop** of 66 feet.)
3. Insert the **measured horizontal distance** into the formula below. No calculation is necessary.
4. Add together the **calculated rise, calculated drop, and horizontal distance** to get the **total calculated distance**. If this total exceeds 150' (45.7 m), move the condenser to a new location and perform the calculations again.

## Maximum Line Set Distance Formula

### Step 1

Measured Rise \_\_\_\_\_ X 1.7 = \_\_\_\_\_ Calculated Rise  
(35 ft. Max)

### Step 2

Measured Drop \_\_\_\_\_ X 6.6 = \_\_\_\_\_ Calculated Drop  
(15 ft. Max.)

### Step 3

Measured Horizontal Distance = \_\_\_\_\_ Horizontal  
(100 ft. Max.) Distance

### Step 4

Total Calculated Distance = \_\_\_\_\_ Total Calculated  
(150 ft. Max.) Distance

# Maintenance

---

## Cleaning and Sanitizing

### GENERAL

You are responsible for maintaining the ice machine in accordance with the instructions in this manual. Maintenance procedures are not covered by the warranty.

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. An extremely dirty ice machine must be taken apart for cleaning and sanitizing.

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

 **Caution**

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

 **Caution**

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

 **Warning**

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

## **CLEANING/SANITIZING PROCEDURE**

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

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

## **PREVENTATIVE MAINTENANCE CLEANING PROCEDURE**

- This procedure cleans all components in the water flow path, and is used to clean the ice machine between the bi-yearly cleaning/sanitizing procedure.
- This technology will also allow initiation and completion of a clean or sanitize cycle, after which the ice machine automatically starts ice making again.

## **EXTERIOR CLEANING**

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

Wipe surfaces with a damp cloth rinsed in water to remove dust and dirt from the outside of the ice machine. If a greasy residue persists, use a damp cloth rinsed in a mild dish soap and water solution. Wipe dry with a clean, soft cloth.

The exterior panels have a clear coating that is stain resistant and easy to clean. Products containing abrasives will damage the coating and scratch the panels.

- Never use steel wool or abrasive pads for cleaning.
- Never use chlorinated, citrus based or abrasive cleaners on exterior panels and plastic trim pieces.



## Cleaning / Sanitizing Procedure

### **Caution**

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

## CLEANING PROCEDURE

### **Caution**

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

### **Warning**

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

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

NOTE: Although not required and dependant on your installation, removing the ice machine top cover may allow easier access.

**Step 1** Open the front door to access the evaporator compartment. Ice must not be on the evaporator during the clean/sanitize cycle. Follow one of the methods below:

- Press the power switch at the end of a harvest cycle after ice falls from the evaporator(s).
- Press the power switch and allow the ice to melt.

 **Caution**

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

**Step 2** Remove all ice from the bin/dispenser.

**Step 3** Press the clean switch. Water will flow through the water dump valve and down the drain. Wait until the water trough refills and the display indicates add solution (approximately 1 minute), then add the proper amount of ice machine cleaner.

| <b>Model</b>                                       | <b>Amount of Cleaner</b> |
|--|--------------------------|
| I0300/I0320/I0520                                  | 3 ounces (90 ml)         |
| I0450/I0500/I0600/I0850<br>I0906/I1000/I1100/I1200 | 5 ounces (150 ml)        |
| I1400/I1800  | 9 ounces (265 ml)        |

**Step 4** Wait until the clean cycle is complete (approximately 24 minutes). Then disconnect power to the ice machine (and dispenser when used).

**⚠ Warning**

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

**Step 5** Remove parts for cleaning.

Please refer to the proper parts removal for your ice machine. Continue with step 6 when the parts have been removed.

**Single Evaporator Ice Machines - page 48**

**Step 6** Mix a solution of cleaner and lukewarm water. Depending upon the amount of mineral buildup, a larger quantity of solution may be required. Use the ratio in the table below to mix enough solution to thoroughly clean all parts.

| <b>Solution Type</b> | <b>Water</b> | <b>Mixed With</b>         |
|----------------------|--------------|---------------------------|
| Cleaner              | 1 gal. (4 L) | 16 oz (500 ml)<br>cleaner |

**Step 7** Use 1/2 of the cleaner/water mixture to clean all components. The cleaner solution will foam when it contacts lime scale and mineral deposits; once the foaming stops use a soft-bristle nylon brush, sponge or cloth (NOT a wire brush) to carefully clean the parts. Soak parts for 5 minutes (15 - 20 minutes for heavily scaled parts). Rinse all components with clean water.

**Step 8** While components are soaking, use 1/2 of the cleaner/water solution to clean all food zone surfaces of the ice machine and bin (or dispenser). Use a nylon brush or cloth to thoroughly clean the following ice machine areas:

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

Rinse all areas thoroughly with clean water.

## **SANITIZING PROCEDURE**

**Step 9** Mix a solution of sanitizer and lukewarm water.

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

**Step 10** Use 1/2 of the sanitizer/water solution to sanitize all removed components. Use a spray bottle to liberally apply the solution to all surfaces of the removed parts or soak the removed parts in the sanitizer/water solution. Do not rinse parts after sanitizing.

**Step 11** Use 1/2 of the sanitizer/water solution to sanitize all food zone surfaces of the ice machine and bin (or dispenser). Use a spray bottle to liberally apply the solution. When sanitizing, pay particular attention to the following areas:

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

Do not rinse the sanitized areas.

**Step 12** Replace all removed components.

**Step 13** Wait 20 minutes.

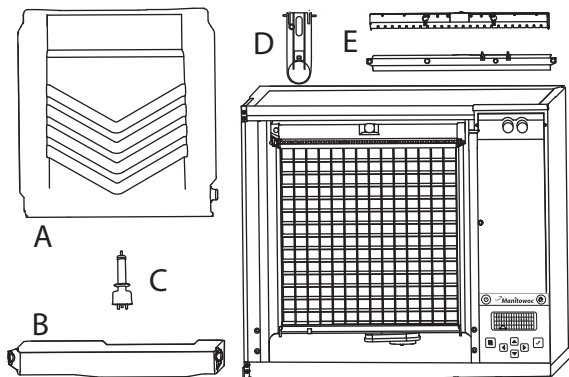
**Step 14** Reapply power to the ice machine and press the Clean button.

**Step 15** Wait until the water trough refills and the display indicates add solution (approximately 1 minute). Add the proper amount of Manitowoc Ice Machine Sanitizer to the water trough by pouring between the water curtain and evaporator.

| <b>Model</b>                                       | <b>Amount of Sanitizer</b> |
|--|----------------------------|
| I0300/I0320/I0520                                  | 3 ounces (90 ml)           |
| I0450/I0500/I0600/I0850<br>I0906/I1000/I1100/I1200 | 3 ounces (90 ml)           |
| I1400/I1800  | 6 ounces (180 ml)          |

**Step 16** Select Auto Ice On, press the Checkmark and close and secure the front door. The ice machine will automatically start ice making after the sanitize cycle is complete (approximately 24 minutes).

## PARTS REMOVAL FOR CLEANING/SANITIZING



### A. Remove the water curtain

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

### B. Remove the water trough

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

### C. Remove the water level probe

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

#### **D. Remove the ice thickness probe**

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

#### **E. Remove the water distribution tube**

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

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

Proceed to page 44, Step 6



## **Ice Thickness Probe & Water Level Probe**

Clean the probes using the following procedure.

1. Mix a solution of Manitowoc ice machine cleaner and water (2 ounces of cleaner to 16 ounces of water) in a container.
2. Clean all probe surfaces including all plastic parts (do not use abrasives). Verify all surfaces are clean. Thoroughly rinse probes with clean water.
3. Reinstall probe, then sanitize the ice machine and bin/dispenser interior surfaces.

## Water Inlet Valve

The water inlet valve normally does not require removal for cleaning. Refer to "Water System Checklist" page 136, if you are troubleshooting water related problems.

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

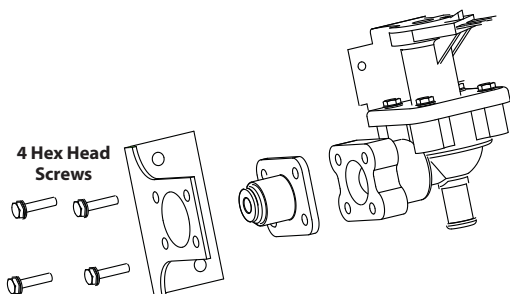
When the ice machine is on, the water inlet valve must allow the proper water flow through it. Press the Power button to energize the ice machine. Watch for water flow into the ice machine. If the water flow is slow or only trickles into the ice machine, refer to water system checklist.

### Warning

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

Follow the procedure below to remove the water inlet valve.

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



## Water Dump Valve

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

1. Locate the water dump valve.
2. Press the power button and stop ice making.
3. While the ice machine is in the freeze mode, check the water trough to determine if the dump valve is leaking. If there is no or little water in the water trough (during the freeze cycle) the dump valve is leaking.
  - A. If the dump valve is leaking, remove, disassemble and clean it.
  - B. If the dump valve is not leaking, do not remove it. Instead, follow the "Ice Machine Cleaning Procedure".

## Preventative Maintenance Cleaning Procedure

This procedure cleans all components in the water flow path, and is used to clean the ice machine between the bi-yearly cleaning/sanitizing procedure.

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

NOTE: Although not required and dependant on your installation, removing the ice machine top cover may allow easier access.

1. Ice must not be on the evaporator during the clean/sanitize cycle. Follow one of the methods below:
  - Press the power switch at the end of a harvest cycle after ice falls from the evaporator(s).
  - Press the power switch and allow the ice to melt.

 **Caution**

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

2. Open the front door to access the evaporator.

3. Press the Clean button. Water will flow through the water dump valve and down the drain. Wait until the water trough refills and the display indicates "Add Chemical" (approximately 1 minute), then add the proper amount of ice machine cleaner.

| <b>Model</b>                                       | <b>Amount of Cleaner</b> |
|--|--------------------------|
| I0300/I0320/I0520                                  | 3 ounces (90 ml)         |
| I0450/I0500/I0600/I0850<br>I0906/I1000/I1100/I1200 | 5 ounces (150 ml)        |
| I1400/I1800  | 9 ounces (265 ml)        |

4. Select "Auto Ice On", press the Checkmark and close and secure the front door. The ice machine will automatically start ice making after the clean cycle is complete (approximately 24 minutes).

## Removal from Service/Winterization

### General

Special precautions must be taken if the ice machine is to be removed from service for an extended period of time or exposed to ambient temperatures of 32°F (0°C) or below.

#### **Caution**

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

Follow the applicable procedure below.

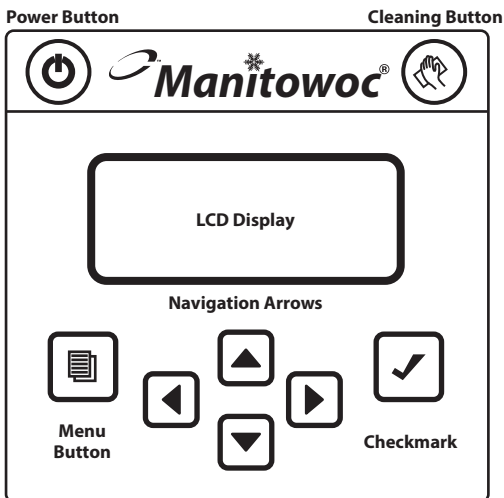
### **AIR-COOLED ICE MACHINES**

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

## **WATER-COOLED ICE MACHINES**

1. Perform steps 1-6 under "Self-Contained Air-Cooled Ice Machines."
2. Disconnect the incoming water and drain line from the water-cooled condenser.
3. Energize the ice machine in the freeze cycle. The increasing refrigerant pressure will open the water regulating valve.
4. Blow compressed air through the condenser until no water remains.

# Operation



## Control Panel Features

The control panel offers a series of pressure sensitive buttons and a four-line interactive display panel.

### BUTTONS

**Power Button:** Powers the ice machine when in the On/Off Mode. The ice machine can also be programmed to automatically power on and off in two Energy Saver modes.

**Cleaning Button:** Initiates a cleaning cycle. Refer to the *Maintenance* section for details.



**Menu Button:** Accesses main menu structure. Moves the display from the Home Screen, where ice machine status, alerts and messages are viewed, to the Main Menu, where machine information and its event log can be accessed, machine and Energy Saver settings can be adjusted, and service issues can be addressed.

**Left and Right Arrows:** The Left arrow moves the display to the previous screen, allowing the user to “back out” of programming. Both the Left and Right arrows will move the cursor (underline) within a line of settings. NOTE: The Right arrow can also be used on many screens interchangeably with the checkmark to make a selection.

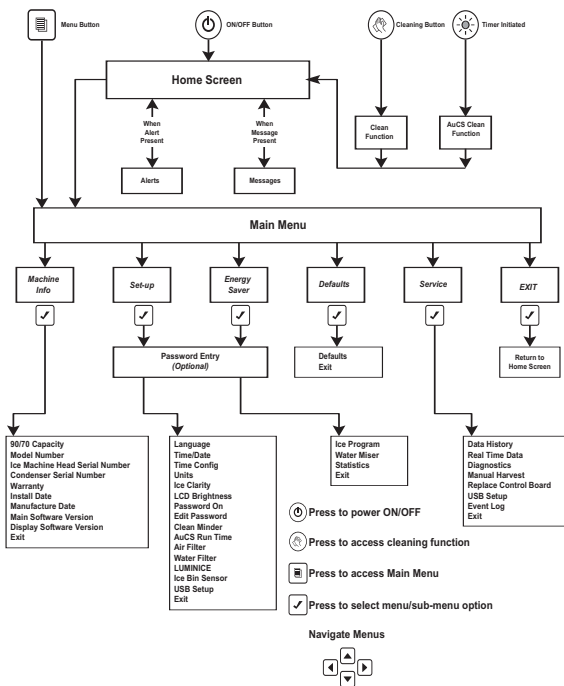
**Up and Down Arrows:** Move the highlight [brackets] up one line or down one line.

**Checkmark:** Makes a selection and/or moves to the next screen (or line) and is used like an “enter” button.

## **DISPLAY PANEL**

The LCD display panel is 16 characters wide and four lines deep. During ice machine operation and cleaning cycles, the Home screen’s top three lines provide valuable status information and the fourth line shows alerts and messages. In programming, four lines of the current screen are displayed and highlights, arrows, cursor and selections inform the user of available actions.

# Menu Navigation Overview



NOTE: The ice machine will automatically set the installation date after 100 freeze/harvest cycles.

## Display Panel Navigation

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [ | L | a | n | g | u | a | g | e |   |   |   | > | ] | ▼ |
|   | T | i | m | e |   | & |   | D | a | t | e |   | > |   |
|   | T | i | m | e |   | C | o | n | f | i | g |   | > |   |
|   | U | n | i | t | s |   |   |   |   |   |   |   | > | ▼ |

**Highlights:** Brackets indicate if a line on the screen is “highlighted” or actionable. Move the brackets from line to line using the Down or Up arrow. Move the brackets down from the fourth line to view more of the menu displayed.

**Arrows:** Two kinds of arrows give cues to additional information. “>” symbols show that another screen is available by pressing Checkmark or > while a line is highlighted. “▼” and “▲” symbols indicate the limits of the screen viewed. NOTE: Another cue to the length of a menu screen is that Exit is the last item.

|  |   |   |   |   |   |  |   |   |  |  |  |  |   |  |
|--|---|---|---|---|---|--|---|---|--|--|--|--|---|--|
|  | 0 | 7 |   | 2 | 4 |  | 1 | 0 |  |  |  |  |   |  |
|  | 1 | 4 | : | 0 | 8 |  |   |   |  |  |  |  |   |  |
|  | E | x | i | t |   |  |   |   |  |  |  |  | > |  |
|  |   |   |   |   |   |  |   |   |  |  |  |  |   |  |

**Cursor:** A cursor (flashing rectangle) is used within lines where actual settings can be adjusted. In these screens, use the Up and Down arrows to make changes to the value underlined. Move the cursor from digit to digit using the Right and Left arrows. Use the Checkmark to move the cursor down one line. Exit and re-enter the screen to start again at the top.

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [ | M | / | D | a | y | / | Y | r | ( | ✓ | ) | ] | ▼ |
|   | D | a | y | / | M | o | / | Y | r | ( |   | ) |   |
|   | 1 | 2 |   | H | o | u | r |   | ( |   | ) |   |   |
|   | 2 | 4 |   | H | o | u | r |   | ( | ✓ | ) |   | ▼ |

**Selections:** When parentheses ( ) appear, they indicate a selection is available by pressing Checkmark while the line is highlighted. If the choice is exclusive, selecting it with the Checkmark will uncheck another selection. That is, in the above Time Config example, selecting Day/Mo/Yr will deselect Mo/Day/Yr.

## Alerts and Messages

When messages and alerts exist, they will be highlighted and can be selected with the Left arrow. Alerts displayed will have priority over messages.

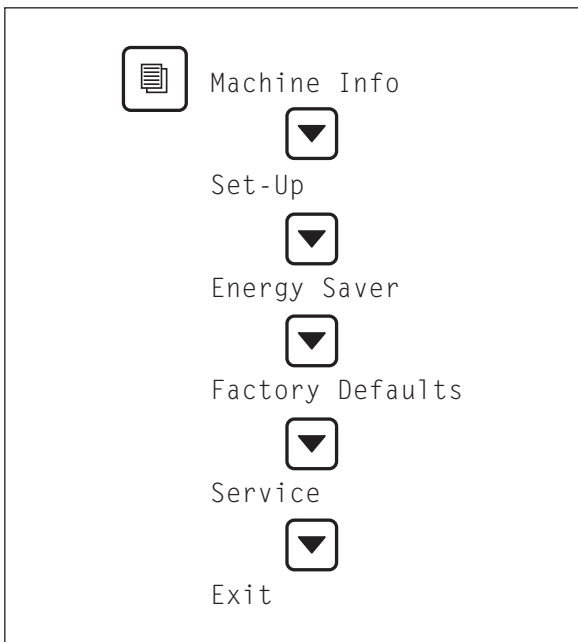
|   |   |   |   |   |   |   |   |   |   |  |  |  |  |  |   |
|---|---|---|---|---|---|---|---|---|---|--|--|--|--|--|---|
| 0 | f | f |   |   |   |   |   |   |   |  |  |  |  |  |   |
| 0 | n | / | 0 | f | f | M | o | d | e |  |  |  |  |  |   |
|   |   |   |   |   |   |   |   |   |   |  |  |  |  |  |   |
| [ | < | ! |   |   |   |   |   |   |   |  |  |  |  |  | ] |

For example, if alerts are appearing in the fourth line of the display:

1. Press the Left arrow. A list of alerts will appear in the display.
2. Choose the alert you wish to address by moving the highlight brackets with the Down arrow.
3. Press Checkmark again. A screen appears with the date, time and total number of times an alert has occurred. Pressing the Down arrow will list some possible causes for the alert. At the bottom of the screen you will be able to clear the alert by pressing the Checkmark.
4. Return to the Home screen by selecting Exit and pressing the Checkmark.

## Main Menu

From the Home screen, press the Menu button to enter the Main menu, where you can choose to see machine information, make setup changes, set the Energy Saver mode, or enter the Service Menu.



### Main Menu

## Machine Info Menu

From the Main menu, ensure that Machine Info is highlighted and press the Checkmark to view a list including capacity, model number, IMH (Ice Machine Head) serial number, condenser serial number, warranty, installation date, date of manufacture and software version. Use the Down arrow to highlight an item and use the Checkmark to view the information. Press the Left arrow to return to previous screens.

### Machine Info Menu

- 90/70 capacity
- Model #
- Ice Machine Head Serial #
- Condenser Serial #
- Warranty
  - Machine
  - Evaporator
  - Compressor
- Install Date
- Manufacture Date
- Main Control Board Software Version
- Display Software Version

## Password Entry

A password is not required, although a password can be turned on to prevent unauthorized control setting modification. You can use the Factory Default Password of "1234" or enter a four digit custom pin number of your choosing.

**To turn on the password feature use the following procedure.**

1. Press the Menu button.
2. From the Main menu, use the Down arrow to highlight setup and press the Right arrow.
3. Use the Down arrow to highlight Password ON and press the Right arrow.
4. Press the Right arrow again with Enter Passwrđ highlighted and a cursor will flash.
5. Use the Up & Down arrows to enter the factory password (1, 2, 3, 4). Enter the number 1 in the flashing cursor (first digit of the factory password).
6. Press the right arrow to move to the next cell and use the Up & Down arrows to add the number 2. Repeat this process to add 3 & 4.
7. When the last number is entered press the Checkmark button to save your entry.

|   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|---|
|   | E | n | t | e | r |  | P | a | s | s | w | r | d |   | ▲ |
| [ |   |   |   |   |   |  |   |   |   |   |   |   |   |   | ] |
|   | E | x | i | t |   |  |   |   |   |   |   |   |   | > |   |
|   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |



**To enter a four digit password of your choosing use the following procedure.**

1. Press the Menu button.
2. From the Main menu, use the Down arrow to highlight setup and press the Right arrow.
3. Use the Down arrow to select Edit Password and press the Right arrow.
4. Using the Up & Down arrows, enter the first digit of the factory password in the flashing icon.
5. Press the right arrow to move to the next cell and use the Up & Down arrows to add the number 2. Repeat this process to add 3 & 4.
6. When the last number is entered press the Checkmark button.
7. Follow steps 4 & 5 and enter your 4 digit password.
8. When the last number is entered press the Checkmark button to save your entry.

## RESET PASSWORD TO FACTORY DEFAULTS

The password can be reset to the factory defaults when required. The default factory password is 1234.

The entire setup can be reset to the factory defaults.

1. From the Set-Up menu, use the Down arrow to highlight Fact Deflts.
2. Press the Checkmark two times to reset the ice machine. The display will return to the Set-Up menu.

| <b>Setting</b>          | <b>Default</b>         |
|-------------------------|------------------------|
| Language                | English                |
| Time Configuration      | Mo/Day/Yr/24 Hour      |
| Units                   | Fahrenheit/Lbs/Gallons |
| Ice Clarity             | Off                    |
| LCD Brightness          | Level 2                |
| Password                | Off - Enter Password   |
| Default Password = 1234 |                        |
| Edit Password           | Off - Edit Password    |
| Clean Minder            | Off                    |
| AuCS RunTime            | Off                    |
| Air Filter Minder       | Off                    |
| Water Filter Minder     | Auto                   |
| LuminIce Bulb Minder    | No                     |
| Ice Bin Sensor          | None                   |

## Set-Up Menu

From the Main menu, use the Down arrow to navigate to Set-Up and press the Checkmark. Select and customize machine settings on this menu. Press the Left arrow to return to previous screens.

- Set-Up
- Language
- Time & Date
- Time Configuration
- Units
- Ice Clarity
- LCD Bright
- Password On
- Edit Password
- Clean Minder
- AuCS RunTime
- Air Filter
- Water Filter
- LUMINICE
- Ice Bin Sensor
- USB Setup
- Exit

### Set-Up Menu

## LANGUAGE

1. From the Set-Up menu, use the Down arrow to highlight Language.
2. Press the Checkmark. You can choose to view the display in a language other than English, by highlighting your choice and pressing the Checkmark. Selecting one language will deselect the others.
3. When the check reflects your preference, use the Down arrow to navigate to Exit and press the Checkmark. The display will return to the Set-Up menu.

## TIME & DATE

When the ice machine is installed, the correct time and date needs to be set for its location.

|   |   |   |   |   |   |   |   |   |   |  |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|--|---|---|---|---|---|
| [ | M | o | / | D | a | y | / | Y | r |  | ( | ✓ | ) | ] | ▼ |
|   | D | a | y | / | M | o | / | Y | r |  | ( |   | ) |   |   |
|   | 1 | 2 |   | H | o | u | r |   |   |  | ( |   | ) |   |   |
|   | 2 | 4 |   | H | o | u | r |   |   |  | ( | ✓ | ) |   | ▼ |

### Set the Time and Date

1. Press the Menu button.
2. Press the Down arrow until Set-Up is highlighted [bracketed].
3. Press the Checkmark. The Set-Up menu will be displayed and Time & Date will be highlighted [bracketed].

4. Press the Checkmark. The date will appear on the first line of the display (Mo/Day/Yr) and the time will appear on the second line (24 Hour). The month will have a blinking cursor.
5. Using the Up or Down arrow, adjust the month, if necessary.
6. When the correct month appears, use the Right arrow to move the blinking cursor to day.
7. Using the Up or Down arrow, adjust the day, if necessary.
8. When the correct day appears, use the Right arrow to move the blinking cursor to year.
9. Using the Up or Down arrow, adjust the year, if necessary.
10. When the correct year appears, press the Checkmark. Use the Right arrow to move the blinking cursor to hour.
11. Using the Up or Down arrow, adjust the hour, if necessary.
12. When the correct hour appears, use the Right arrow to move the blinking cursor to minutes.
13. Using the Up or Down arrow, adjust the minutes, if necessary.
14. When the correct minutes appear, press the Checkmark twice.

## **TIME CONFIGURATION**

1. From the Set-Up menu, use the Down arrow to highlight Time Config.
2. Press the Checkmark. On this screen, you can choose whether the date will be displayed as Mo/Day/Yr or Day/Mo/Yr by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
3. You can also choose whether the time will be displayed as 12 Hour or 24 Hour by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
4. When the two checks reflect your preference, use the Down arrow to navigate to Exit and press the Checkmark. The display will return to the Set-Up menu.

## **UNITS**

1. From the Set-Up menu, use the Down arrow to highlight Units.
2. Press the Checkmark. On this screen, you can choose whether the ice machine will display measurements in Celsius or Fahrenheit, kilograms or pounds, and gallons or liters by highlighting your choice of each pair and pressing the Checkmark. Selecting one of each pair will deselect the other. Make sure to navigate with the Down arrow to make all three choices.
3. When the three checks reflect your preferences, use the Down arrow to navigate to Exit and press the Checkmark. The display will return to the Set-Up menu.

## **ICE CLARITY**

In areas with poor potable water quality, the ice machine may produce cloudier ice. Setting Ice Clarity to ON will add additional water during the freeze cycle to dilute the water that contains a high content of dissolved solids in the water trough. This feature decreases production and increases water usage. A water filter is recommended to produce the highest quality ice while maintaining the least expensive mode of operation.

1. From the Set-Up menu, use the Down arrow to highlight Ice Clarity.
2. Press the Checkmark. On this screen, you can choose to turn the ice clarity feature ON or OFF by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
3. When the check reflects your preference, use the Down arrow to navigate to Exit and press the Checkmark. The display will return to the Set-Up menu.

## **LCD BRIGHTNESS**

Here, the brightness of the LCD display can be adjusted.

1. From the Set-Up menu, use the Down arrow to highlight LCD Bright.
2. Press the Checkmark. You will see one of four checkmarks indicating the brightness levels of the display. Level 1 is one checkmark, level 2 is two checkmarks, Level 3 is three checkmarks, etc.
3. Use the Up and Down arrows to select your preference.
4. When the checkmarks reflect your preference, press the Checkmark. The display will return to the Set-Up menu.

## **PASSWORD ON**

A password can be added to prevent unauthorized changes to ice machine settings.

1. From the Set-Up menu, use the Down arrow to highlight Password On.
2. Enter the password and press the Checkmark.
3. Press the Left arrow to return to previous screens and to the Set-Up menu.

## **EDIT PASSWORD**

The password can be changed on this screen

1. From the Set-Up menu, use the Down arrow to highlight Edit Password.
2. Press the Checkmark and confirm current password.
3. Enter new password and press the Checkmark.
4. Press the Left arrow to return to previous screens and to the Set-Up menu.

## **CLEAN MINDER**

Clean Minder is a feature that displays a cleaning reminder at a set time interval.

1. From the Set-Up menu, use the Down arrow to highlight Clean Minder.
2. Press the Checkmark. On this screen, you can choose to turn the reminder ON or OFF by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
3. You can also choose the time interval from this screen by highlighting Set Interval and pressing the Checkmark.
4. Press the Left arrow to return to previous screens and to the Set-Up menu.



## **IAUCS RUNTIME**

Automatic Cleaning System is an optional accessory and will perform a cleaning cycle at a set time interval.

1. From the Set-Up menu, use the Down arrow to highlight AuCS RunTime.
2. Press the Checkmark. On this screen, you can choose to turn the feature ON or OFF by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
3. You can also choose the time interval from this screen by highlighting Set Interval and pressing the Checkmark.
4. Press the Left arrow to return to previous screens and to the Set-Up menu.

## **AIR FILTER**

The ice machine has a feature that displays a clean air filter reminder at a set time interval.

1. From the Set-Up menu, use the Down arrow to highlight Air Filter.
2. Press the Checkmark. On this screen, you can choose to turn the reminder to AUTO or OFF by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
3. You can also choose the time interval from this screen by highlighting Set Interval and pressing the Checkmark.
4. Press the Left arrow to return to previous screens and to the Set-Up menu.

## **WATER FILTER**

The ice machine has a feature that displays a replace water filter reminder at a set time interval.

1. From the Set-Up menu, use the Down arrow to highlight Water Filter.
2. Press the Checkmark. You can record the filter type on this screen by highlighting Filter Type and pressing the Checkmark. After making your selection (AR10,000, AR20,000, AR40,000), scroll down to exit and press the Checkmark.
3. You can also choose to turn the reminder to AUTO, NONE or OFF by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
  - Selecting Auto sets the reminder based on water usage for the selected filter.
  - Selecting None will turn off the reminder.
  - Selecting Off sets the timer to the selected reminder time (2 weeks to 6 months).
4. You can further choose the time interval from this screen by highlighting Set Interval and pressing the Checkmark.
5. Press the Left arrow to return to previous screens and to the Set-Up menu.

## **LUMINICE™ REMINDER**

The LuminIce™ growth inhibitor recirculates the air in the ice machine foodzone over a UV bulb. This process will inhibit the growth of common micro-organisms on all exposed foodzone surfaces.

The Bulb Minder is a feature that displays a reminder to change its bulb every 12 months.

1. From the Set-Up menu, use the Down arrow to highlight LuminIce Minder.
2. Press the Checkmark. On this screen, you can choose to turn the reminder to AUTO or OFF by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
3. When the check reflects your preference, use the Down arrow to navigate to Exit and press the Checkmark. The display will return to the Set-Up menu.

## **ICE BIN LEVEL SENSOR**

Ice bin sensor is an optional accessory that allows the ice level in the bin to be set to one of three different levels. The bin level can be set seasonally to match usage, which results in lower energy costs and fresher ice.

1. From the Set-Up menu, use the Down arrow to highlight Ice Bin Sensor.
2. Press the Checkmark. On this screen, you can choose to set the ice level to Low, Medium or High by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.

When the check reflects your preference, use the Down arrow to navigate to Exit and press the Checkmark. The display will return to the Set-Up menu.

## **USB SETUP**

Refer to “Upgrading Firmware with a Flash Drive” and “Exporting Data to a Flash Drive” for more information on this setting. Flash drives must be correctly sized and formatted - 2 gigabytes or smaller, Fat 32 file system, 512 allocation units - Refer to page 93 for full specification and formatting details.

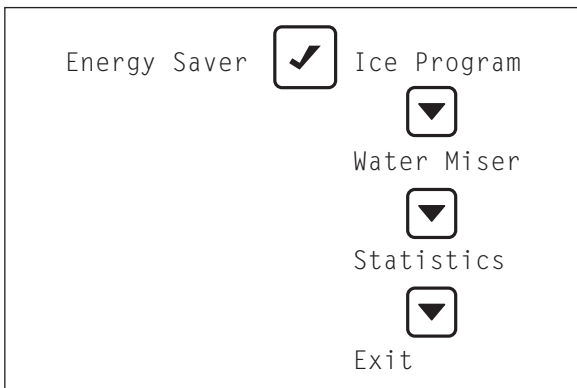
## **FACTORY DEFAULTS**

The entire setup can be reset to factory defaults listed on page 67.

1. From the Set-Up menu, use the Down arrow to highlight Fact Default.
2. Press the Checkmark two times to reset the ice machine. The display will return to the Set-Up menu.

## Energy Saver Menu

From the Main menu, use the Down arrow to navigate to Energy Saver and press the Checkmark. Set up an energy saving ice program, enable the Water Miser and view usage statistics from this menu. Press the Left arrow to return to previous screens.



### Energy Saver Menu

## ICE PROGRAM

To save energy and water, the ice machine can be programmed to only power up during time periods that the ice will be used or when the bin level is being depleted by heavy use.

1. In the Energy Saver menu, ensure that Ice Program is highlighted.
2. Press the Checkmark. On this screen, you can choose to turn on the time program (Time Prog) bin level program (Bin Level) or ice usage program (Ice Program) by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other. If one of them is selected and you wish to turn both off, highlight the choice and press Checkmark again.
3. If none of the programs are selected, highlighting Settings and pressing the Checkmark will select the times, bin level or pounds of ice per day. If one of the programs is selected, highlight Settings and press the Checkmark to choose the times or bin levels.  
NOTE: For details on how to use the cursor for the time program, refer to "Display Panel Navigation" in this section.
4. Select Exit to return to previous screens and again to the Energy Saver menu.

## **WATER MISER**

Water Miser is a feature that depending on water quality can reduce water usage by eliminating flush cycles.

1. From the Energy Saver menu, use the Down arrow to highlight Water Miser.
2. Press the Checkmark. On this screen, you can choose to turn the Water Miser ON or OFF by highlighting your choice and pressing the Checkmark. Selecting one will deselect the other.
3. Use the Down arrow to navigate to Exit and press the Checkmark to return to the Energy Saver menu.

## **STATISTICS**

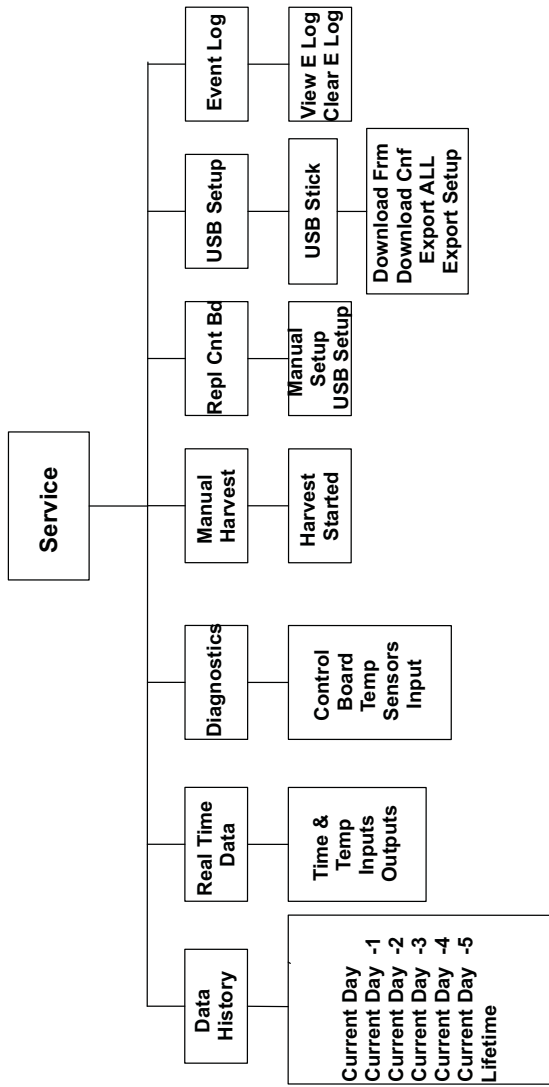
1. From the Energy Saver menu, use the Down arrow to highlight Statistics.
2. Press the Checkmark. Choose to view ice usage, or potable water and energy statistics by highlighting your choice and pressing the Checkmark.
3. Press the Left arrow to return to previous screens and to the Energy Saver menu.

## Service Menu

From the Main menu, use the Down arrow to navigate to Service and press the Checkmark. This menu is intended for the use of trained service personnel. Below is an overview of the service menu. The following pages list the navigation options available by drilling into the menus with the Right arrow.

|         |                                     |                          |                                     |  |
|---------|-------------------------------------|--------------------------|-------------------------------------|--|
| Service | <input checked="" type="checkbox"/> | Data History             | <input checked="" type="checkbox"/> | 00000000<br>00000000<br>00000000<br>00000000<br>00000000<br>00000000<br>Lifetime<br>Exit |
|         |                                     | <input type="checkbox"/> | <input type="checkbox"/>            |  |
|         |                                     | RealTime Data            | <input checked="" type="checkbox"/> | Time & Temp<br>Inputs<br>Outputs<br>Exit   |
|         |                                     | <input type="checkbox"/> | <input type="checkbox"/>            |  |
|         |                                     | Diagnostics              | <input checked="" type="checkbox"/> | Control Board<br>Temp Sensors<br>Inputs<br>Exit  |
|         |                                     | <input type="checkbox"/> | <input type="checkbox"/>            |  |
|         |                                     | Man Harvest              | <input checked="" type="checkbox"/> | Hrvst Started<br>Exit  |
|         |                                     | <input type="checkbox"/> | <input type="checkbox"/>            |  |
|         |                                     | Repl Cntl Bd             | <input checked="" type="checkbox"/> | Manual Setup<br>USB Setup<br>Exit  |
|         |                                     | <input type="checkbox"/> | <input type="checkbox"/>            |  |
|         |                                     | USB Setup                | <input checked="" type="checkbox"/> | USB Stick<br>Exit  |
|         |                                     | <input type="checkbox"/> | <input type="checkbox"/>            |  |
|         |                                     | Event Log                | <input checked="" type="checkbox"/> | View ELog<br>Clear ELog<br>Exit  |
|         |                                     | <input type="checkbox"/> | <input type="checkbox"/>            |  |
|         |                                     | Exit                     |                                     |  |





## DATA HISTORY

Press the Checkmark with Data History highlighted to view a list of eight-digit dates (Current, Current + 1 ... Current + 5), along with Lifetime (be sure to use the Down arrow to reveal all the available information).

For each of the dates, use the Checkmark to view:

- Minimum Freeze
- Maximum Freeze
- Minimum Harvest
- Maximum Harvest
- Maximum Temperature Delta T3 - T4
- Delta
- T3
- T4
- RunTime
- Ice Production
- Cycle Count
- Potable Water
- Clean Cycles
- Exit

For Lifetime, use the Checkmark to view:

- Install Date
- Control Board Replacement Date
- Control Board DOM (Date Of Manufacture)
- RunTime
- Cycle Count
- Potable Water
- Clean Cycles
- Exit

## REAL TIME DATA

Press the Checkmark with Real Time Data highlighted to get readings on Time & Temp, Inputs and Outputs (be sure to use the Down arrow to reveal all the available information).

Use the Checkmark to view:

Time and Temperature

- Status Off/On - Displays stage of cycle
- Time
- T1 Thermistor Temperature
- T2 Thermistor Temperature
- T3 Thermistor Temperature
- T4 Thermistor Temperature
- T3 & T4 Delta Temperature
- 100 hz
- 120 hz
- Exit

Inputs

- Status Off/On - Displays stage of cycle
- Curtain Switch 1
- Curtain Switch 2
- LPCO Switch
- HPCO Switch
- Bin Level - Low (Optional Bin Level Probe) Status
- Bin Level - Medium (Optional Bin Level Probe) Status
- Bin Level High (Optional Bin Level Probe) Status
- Sensing Ice No/Yes
- Water Level Low No/Yes
- Water Level High No/Yes
- Exit

## Outputs

- Status Off/On - Displays stage of cycle
- Water Pump Off/On
- Hot Gas Valve 1 Off/On
- Hot Gas Valve 2 Off/On
- Air Pump Off/On
- Water Valve Off/On
- Dump Valve Off/On
- Compressor Control Off/On
- AuCS Relay Off/On
- Ionic Cln Off/On
- Exit

## DIAGNOSTICS

Press the Checkmark with Diagnostics highlighted to enter screens where you can run diagnostics on the control board, sensors and switches.

### Control Board

- Self Check
- Enable Relays
- Exit

### Temperature Sensors

- T1 Thermistor Temperature
- T2 Thermistor Temperature
- T3 Thermistor Temperature
- T4 Thermistor Temperature
- Exit

### Inputs

- Curtain Switch 1 Closed/Open
- Curtain Switch 2 Closed/Open
- LPCO Switch Closed/Open
- HPCO Switch Closed/Open
- Bin Level - Low (Optional Bin Level Probe) Closed/Open
- Bin Level - Medium (Optional Bin Level Probe) Closed/Open
- Bin Level - High (Optional Bin Level Probe) Closed/Open
- Sensing Ice No/Yes
- Water Level Low No/Yes
- Water Level High No/Yes
- Exit

## **MANUAL HARVEST**

Press the Checkmark with Manual Harvest highlighted to initiate a manual harvest.

- Manual Harvest
- Harvest Started
- Exit

## **REPLACE CONTROL BOARD**

Press the Checkmark with Replace Control Board highlighted to program the replacement control board. The data can be copied from the defective control board (refer to "Exporting Data to a Flash Drive" on page 97), or entered manually through the Indigo interface.

- Manual Setup
  - Board Install Date
  - Input Model Number
  - Input Serial Number
  - Condenser/condensing unit serial number
- USB Setup
  - Insert Drive
  - Press Checkmark and wait for completion
- Exit

## **USB SETUP**

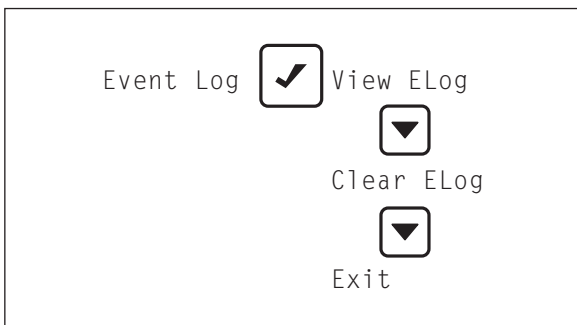
- USB Stick
  - Download Firmware  
Insert drive and wait for completion
  - Download Configuration  
Insert drive and wait for completion
  - Export All  
Insert drive and wait for completion
  - Export Setup  
Insert drive and wait for completion
- Exit

## EVENT LOG MENU

From the Service menu, use the Down arrow to navigate to Event Log and press the Checkmark.

Ensure View ELog is highlighted and press the Checkmark to see the first event code, when it occurred and how many times. Use the Down arrow to view information on subsequent event codes. For more information on event codes, see "Service Menu". Use the Left arrow to return to the Event Log menu.

To clear the event log: In the Event Log Menu, use the Down arrow to highlight Clear ELog and press the Checkmark. Press the Left arrow to return to previous screens.



**Event Log Menu**

## EVENT LOG

Refer to the following table for Event Code descriptions.

| <b>Code</b> | <b>Description</b>   |
|-------------|--|
| E01         | Long Freeze Cycle  |
| E02         | Long Harvest Cycle   |
| E03         | Input Power Loss   |
| E04         | High Condenser Temperature   |
| E05         | High Pressure Control Opened   |
| E06         | Spare  |
| E07         | Starving TXV Single Evaporator or Low On Charge  |
| E08         | TXV Fault Single or Dual Circuit Evaporators   |
| E09         | Flooding Evaporator Fault Single Evaporator, Single Circuit  |
| E10         | Flooding Evaporator Fault Dual TXV, Dual Circuit   |
| E11         | Refrigeration Fault  |
| E12         | Curtain Switch Fault - E Board = Open more than 12 hours, G Board after Revision 4.017 = Open more than 24 hours |
| E13         | Spare  |
| E14         | Spare  |
| E15         | Fan Cycle Control Fault - Lo Liquid Line Temperature   |
| E16         | Remote Condensing Unit Fault (ICVD Only)   |
| E17         | Spare  |
| E18         | Spare  |
| E19         | Ice Thickness Probe Fault  |
| E20         | Water System Fault   |
| E21         | T1 Temperature Sensor Issue  |
| E22         | T2 Temperature Sensor Issue  |
| E23         | T3 Temperature Sensor Issue  |
| E24         | T4 Temperature Sensor Issue  |
| E25         | Bin Level Probe Low Sensor Fault   |
| E26         | Bin Level Probe Medium Sensor Fault  |
| E27         | Bin Level Probe High Sensor Fault  |
| E28         | AuCS   |
| E29         | USB Communication Fault  |
| E30         | USB Download Fault   |
| E31         | Safe Mode  |
| E32         | RS485 Communication Fault  |
| E33         | KeyBoard Fault   |
| E34         | Display Fault  |



## Event Log Detail

| Detail Event Log Service Definition |                                     |   |
|-------------------------------------|-------------------------------------|---|
| E-Log                               | Display Text                        | Error Description   |
| E01                                 | <b>Long Freeze</b>                  | Long Freeze   |
| E02                                 | <b>Long Harvest</b>                 | Long Harvest  |
| E03                                 | <b>Power Loss</b>                   | Power Supply (Event Log only - No Alert)  |
| E04                                 | <b>Hi Cnd Temp or Wtr Cnd Fault</b> | Air Condenser High temp. or water Condenser High temperature<br>G Board Rev 4.017 - Alert only after 10 consecutive trips   |
| E05                                 | <b>HPC Fault</b>                    | High Pressure Cutout (HPC)  |
| E06                                 |                                     | Spare   |
| E07                                 | <b>Starving TXV</b>                 | Starving Evaporator for single TXV or low on charge<br>G Board Rev 4.017 - Event Log only no alert  |
| E08                                 | <b>TXV Fault</b>                    | Air/Water Only<br>TXV malfunction in dual circuit/<br>single evaps (TXV Fault)  |
| E09                                 | <b>Flood Evap 1</b>                 | Flooding evaporator for single circuit<br>single evaporator (flooding evap)   |
| E10                                 | <b>Flood Evap 2</b>                 | Flooding evaporator for dual TXV<br>dual circuit / single evaporator<br>(Flooding Evap)   |
|                                     |                                     | <b>Definition</b>   |
|                                     |                                     | 6 consecutive 60 Minute Freeze cycles = shut down and flash the SL#1 light on board   |
|                                     |                                     | 3 consecutive - 3.5 Minute Harvests logs SL#2 in memory, but runs until 500 long harvest cycles occur.  |
|                                     |                                     | When power is interrupted to the ice machine the control board will log the event in the ELOG and stamp the loss of power on power-up.  |
|                                     |                                     | 1). Liquid Line Temperature too High for Self-contained Air Cooled Ice machine = Air Cooled Condenser Fault   |
|                                     |                                     | 2). Liquid Line Temperature too High for Self-contained Water Cooled ice machine = Water Cooled Condenser Fault   |
|                                     |                                     | The high pressure cutout switch (HPCO) opened 3 times in 4 hour period  |
|                                     |                                     | 10 consecutive occurrences where the Difference of the Average evaporator inlet (T3) and outlet (T4) is greater than 12°F in the last 1 minute of the freeze cycle (ELOG-E07) |
|                                     |                                     | 10 consecutive occurrences where the Difference of the Average evaporator inlet (T3) and outlet (T4) is greater than 12°F in the last 1 minute of the freeze cycle (ELOG-E07) |
|                                     |                                     | Average compressor discharge line temperature last 6 seconds of Prechill +50°F (T1) compared to average of first 6 minutes of freeze cycle (T2), is less than 1.05°F          |
|                                     |                                     | Average compressor discharge line temperature last 6 seconds of Prechill +50°F (T1) compared to average of first 6 minutes of freeze cycle (T2), is less than 1.05°F          |

## Detail Event Log Service Definition

| E-Log Display Text | Error Description  | Definition  |
|--------------------|--|---|
| E11                | Refrigeration System (Refrig Fault)<br>Air & Water-cooled Only | The compressor discharge temperature did not increase by at least 10 F, and the evaporator temperature did not decrease by at least 10 F - Measured from Refrigeration Start up or Prechill until 2 minutes into the Freeze cycle. G Board Rev 4.017 - Event Log only no alert  |
| E12                | Curtain Switch open for more than 24 hours (Curtain Fault)     | The ice machine is set to ice making and remains in bin full condition for more than 24 hours.<br>The curtain switch is open or curtain is off. G Board Rev 4.017 = 24 hrs - E Board = 12 hrs   |
| E13                | Spare  |   |
| E14                | Spare  |   |
| E15                | Low amb control fault during low amb                           | If the liquid line temperature drops below 60 F for any period exceeding continuous 1 minute during the freeze cycle. G Board Rev 4.017 - Event Log only no alert   |
| E16                | Remote Condenser Fault<br>ICVD Condensing Unit only            | If the liquid line temperature drops below 40 F, or exceeds 140 F for more than 1 continuous minute during the freeze cycle. G Board Rev 4.017 - Event Log only no alert  |
| E17                | Spare  |   |
| E18                | Spare  |   |
| E19                | Ice Probe (ITP)  | The monitored Frequencies is out of the appropriate range (Probe unplugged or problem with microphone). G Board Rev 4.017 - Event Log only no alert<br>Any of the following:<br>1) Sensing high water probe and not low water probe = Water fault.<br>2) The Evaporator outlet temperature is less than -10°F 6.5 to 7.5 Minutes into freeze.<br>3) The Low Water probe is satisfied at the end of harvest.<br>4) Low or High water probe satisfied at end of freeze cycle. G Board Rev 4.017 - Event Log only no alert |
| E20                | Water System Fault   |   |

## Detail Event Log Service Definition

| E-Log | Display Text         | Error Description                                    | Definition  |
|-------|----------------------|--|---|
| E21   | <b>T1 Fault</b>      | T1 Sensor  | Each thermistor reading is monitored continuously using six second average values. During Pre-chill a thermistor had a six second average thermistor values fall outside of the valid temperature range.  |
| E22   | <b>T2 Fault</b>      | T2 Sensor  |   |
| E23   | <b>T3 Fault</b>      | T3 Sensor  |   |
| E24   | <b>T4 Fault</b>      | T4 Sensor  |   |
| E25   | <b>Bin Prb Fault</b> | Bin Low Sens   | Each thermistor reading is monitored continuously using six second average values. A thermistor had a six second average value outside of the valid range for more than 10 continuous minutes   |
| E26   | <b>Bin Prb Fault</b> | Bin Med Sens   |   |
| E27   | <b>Bin Prb Fault</b> | Bin Hi Sens  |   |
| E28   | <b>AUCS</b>          | AUCS (Aucs not Present) (Event Log only - No alarm)  | When the AUCS clean option is selected from the menu, the control checks for the presence of the AUCS board and if the AUCS is not connected it will signal an Event "AUCS". This will be cleared as soon as the hardware is detected.                            |
| E29   | <b>USB COMM</b>      | USB Comm (Event Log only - No Alarm)                 | USB Communication error, no USB drive in port or defective USB drive  |
| E30   | <b>USB DNLD</b>      | USB download error (dInd) Event Log only - No alarm) | USB Download error related to USB drive or a defective USB drive  |
| E31   | <b>Safe Mode</b>     | Safe Mode (Event Log only - No alarm)                | Safe mode allows the ice machine to operate for a period of time in the event of a WLP or ITP sensor failure. The controller allows the machine to operate based on historical information collected and model data information stored in the controllers memory. |

## **USB FLASH DRIVE SPECIFICATIONS AND FORMATTING**

Updating firmware on Indigo™ model ice machines requires a properly formatted 2 GB or smaller USB flash drive. All USB flash drives must be formatted before use to remove any software programs or files currently on the flash drive.

### **USB Flash Drive Specifications:**

- USB 2 Version
- 2 GB or less capacity
- Fat32 File System
- 512 MB File Allocation Unit

### **USB Flash Drive Formatting:**

Procedure to format a USB flash drive varies with operating system software.

### **Windows 7 or Windows Vista Computers:**

1. Insert USB flash drive; your computer may indicate:
  - “Found New Hardware” follow the prompts to install the USB flash drive
  - USB flash drive may auto play - Close auto play window
2. Press Windows Key and E key simultaneously to access windows explorer.
3. Right click on your USB Flash Drive.
4. Left click on “Format”.
5. Verify or select the settings below:
  - USB flash drive capacity - 2 GB or less
  - File System - Fat32
  - Allocation Unit Size - Must be 512 MB
  - Volume Label is Optional - Rename if desired
  - Deselect “Perform A Quick Format” (no checkmark)

6. Left click on "Start" - You will receive a warning - "Formatting will remove all data" left click "OK". A "Format Complete" box will display when formatting is finished. Close the pop up and windows explorer.

### **Windows XP Computers:**

1. Insert USB flash drive; your computer may indicate:
  - "Found New Hardware" follow the prompts to install the USB flash drive
  - USB flash drive may auto launch - Close auto launch window.
2. To access Disk Management:
  - Left click on the Windows Start Button
  - Left click on "Run"
  - Type compmgmt.msc and left click on "OK"
  - Left click on "Disk Management".
3. Verify USB flash drive capacity is 2 GB or less
4. Right click on the USB flash drive, then left click on "Format" from the drop down list.
5. Verify or select the settings below:
  - Volume Label is Optional - Rename if desired
  - File System - Fat32
  - Allocation Unit Size must be 512 MB
  - Deselect "Perform A Quick Format" (no checkmark)
6. Left click on "OK" you will receive a warning - "Formatting will remove all data" left click on "OK", wait until formatting is complete and "status" indicates "Healthy", then close the disk management window.

## UPGRADING FIRMWARE WITH A FLASH DRIVE

### Important

The flash drive must be formatted before using, All files and software on the flash drive are removed during the formatting process. Refer to page 93 USB Flash Drive Specifications and Formatting.

1. Drag and drop the files from website or email onto a flash drive.
2. Ensure that the ice machine's power is on.
3. Press the Menu button.
4. Press the Down arrow until Service is highlighted.
5. Press the Checkmark. The Service menu will be displayed.

USB Setup



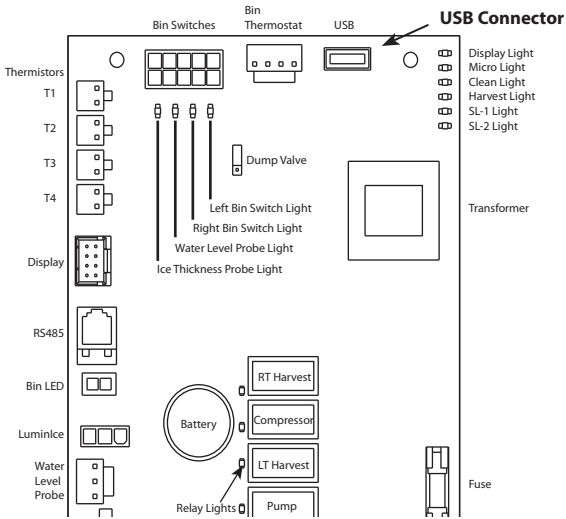
USB Stick



Download Frm



6. Press the Down arrow until USB Setup is highlighted.
7. Press the Checkmark. USB Stick will appear highlighted.
8. Press the Checkmark again. A submenu with Download Frm (Download Firmware) appears.
9. Ensure that Download Frm is highlighted and press the Checkmark. A display of instructions will appear.



## Control Board

10. Follow the on-screen instructions:

- A. Insert Drive (Insert the flash drive into the USB port on the ice machine's control board.)
- B. Press Check (Press the Checkmark.) Do not remove flash drive, touch display buttons or remove power while firmware is updating.
- C. The display will return to the home screen in the off mode.

11. Reboot control board by removing power for 15 seconds and reapplying power.

12. Verify the new firmware version loaded by navigating to Menu/Machine information/Main Software Version and verify the firmware version number.

## EXPORTING DATA TO A FLASH DRIVE

Data can be copied from the control board memory to a flash drive and used to transfer setup and/or cycle data to a replacement control board or to transfer setup information to multiple ice machines. Data may also be requested by service department personnel for analysis or as an aid to troubleshooting. The data files are small and can be attached to an email.

### Important

The flash drive must be formatted before using. Refer to page 93 USB Flash Drive Specifications and Formatting. All files and data are deleted during the formatting process.

1. Ensure that the ice machine's power is on.
2. Press the Menu button.
3. Press the Down arrow until Service is highlighted.
4. Press the Checkmark. The Service menu will be displayed.

USB Setup



USB Stick



Export All



5. Press the Down arrow until USB Setup is highlighted.



6. Press the Checkmark. USB Stick will appear highlighted. Press the Checkmark again. A submenu with Export ALL and Export Setup appears.

NOTE:

There are four files stored in ice machine memory:

- Asset Data - ASDATAoo.CSV
- Operating Data - OPDATAoo.CSV
- Real Time Data - RTDATAoo.CSV
- Ice Machine Settings - Settino.CSV

Select only "Ice Machine Settings" file when multiple machines will be programmed with the same user specified settings. Select "Export All" if you are installing a replacement board.

7. Highlight Export ALL or Export Setup, depending on your requirements, and press the Checkmark. A display of instructions will appear.
8. Follow these on-screen instructions to:
  - A. Insert Drive (Insert the flash drive into the USB port on the ice machine's control board.)
  - B. Press Check (Press the Checkmark.)
  - C. Wait For Comp (Wait approximately 5 to 10 minutes for the download to complete.)
  - D. Depending on software version either Export Complete, Success or the Home screen will appear.

## Operational Checks

### GENERAL

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

To ensure proper operation, always follow the Operational Checks:

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

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

### **Important**

**Refrigeration compressors must be operated for a minimum break in period of 24 hours before full ice production will be reached.**

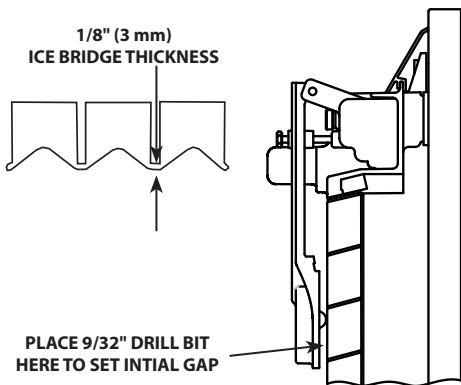
## ICE THICKNESS CHECK

After a harvest cycle, inspect the ice cubes in the ice storage bin. The ice thickness probe is factory-set to maintain the ice bridge thickness at 1/8" (3 mm).

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

1. Inspect the bridge connecting the cubes. It should be about 1/8" (3 mm) thick.
2. If adjustment is necessary, turn the ice thickness probe adjustment screw clockwise to increase bridge thickness, counterclockwise to decrease bridge thickness. As a starting point place a 9/32" (7 mm) drill bit between the ice thickness probe and the evaporator. Make final adjustments to achieve a 1/8" (3 mm) thick bridge.

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



### Ice Thickness Check

3. Make sure the ice thickness probe wire doesn't restrict movement of the probe.

## Sequence of Operation

### SELF CONTAINED AIR OR WATER COOLED

NOTE: The power button must be depressed and the water curtain/ice dampers must be in place on the evaporator before the ice machine will start.

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

##### 1. Water Purge

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

##### 2. Refrigeration System Equalization and Start-Up

The harvest valve(s) and air pump(s) energize to equalize high and low side refrigeration pressure.

After 5 seconds the contactor energizes the compressor and supplies power to the condenser fan motor. After 5 seconds the harvest valve(s) and air pump(s) de-energize.

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

## **Freeze Sequence**

### **3. Prechill**

The compressor is on for 30 seconds (60 seconds initial cycle) to lower the temperature of the evaporator(s) before the water pump is energized. The water fill valve will energize and remain on until water touches the low and high, water level probes.

### **4. Freeze**

#### **Water Pump**

The water pump(s) energizes and water flows over the evaporator. The water pump is energized throughout the freeze cycle.

#### **Water Inlet Valve**

The water inlet valve energized in prechill and can energize up to two times in the freeze cycle. The control board will prevent the water fill valve from energizing after two 6 minute water fill time limits.

After water contacts the low and high water probes the water fill valve de-energizes. Ice builds on the evaporator and the water level drops. When water loses contact with the high water probe, the water fill valve energizes until water contacts the high water probe again.

#### **Ice Thickness Probe**

The freeze cycle continues until the six minute freeze lock expires and enough ice has formed to send a signal from the ice thickness probe to the control board.

During the first 6 minutes of the freeze cycle the ice thickness probe microphone samples ambient noise. 6 minutes into the freeze cycle 4 baseline readings are recorded. Ice formation on the evaporator will change the readings; when two of the four baseline readings are exceeded a harvest cycle starts.

## **Harvest Sequence**

### **5. Water Purge**

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

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

### **6. Harvest**

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

The sliding sheet of cubes opens the water curtain/ice damper and bin switch.

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

## **Automatic Shut-Off**

### **7. Automatic Shut-Off**

When the storage bin is full at the end of a harvest sequence, the sheet of cubes fails to clear the water curtain/ice damper and will hold it open. After the water curtain/ice damper is held open for 30 seconds, the ice machine shuts off. The ice machine remains off for 3 minutes before it can automatically restart.

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

## Control Board Timers

The control board has the following non-adjustable timers:

- The ice machine is locked into the freeze cycle for 6 minutes before a harvest cycle can be initiated. This can be overridden by initiating a manual harvest. Refer to "Manual Harvest" on page 87
- The maximum freeze time is 60 minutes at which time the control board automatically initiates a harvest sequence.
- The maximum harvest time is 3.5 minutes. The control board automatically initiates a freeze sequence when these times are exceeded.
- The maximum water fill is 12 minutes.

## ENERGIZED PARTS CHART SELF CONTAINED MODELS

### Self Contained Air & Water-Cooled Models

| Ice Making Sequence of Operation                                      | Water Pump | Harvest Valve(s) | Air Pump(s)* | Water Inlet Valve                 | Water Dump Valve | Contacting Coil | Compressor | Condenser Fan Motor | Length of Time   |
|---|------------|------------------|--------------|-----------------------------------|------------------|-----------------|------------|---------------------|--|
| <b>Start-Up</b><br>1. Water Purge<br>2. Refrigeration System Start-up | On         | Off              | Off          | Off                               | On               | Off             | Off        | Off                 | 45 Seconds   |
|   | Off        | On               | On           | Off                               | Off              | Off             | Off        | Off                 | 5 Seconds  |
| A. Pressure Equalization  | Off        | On               | On           | Off                               | Off              | On              | On         | On                  | 5 Seconds  |
| B. Compressor Startup   | Off        | On               | On           | Off                               | Off              | On              | On         | On                  | 5 Seconds  |
| <b>Freeze Sequence</b><br>3. Prechill                                 | Off        | Off              | Off          | May Cycle On/Off during pre-chill | Off              | On              | On         | May Cycle On/Off    | Initial Start-Up is 120 Seconds<br>30 Seconds thereafter |



### Self Contained Air & Water-Cooled Models (Continued)

| Ice Making Sequence of Operation | Water Pump | Harvest Valve(s) | Air Pump(s)* | Water Inlet Valve                 | Water Dump Valve | Contacting Coil | Compressor | Condenser Fan Motor | Length of Time   |
|----------------------------------|------------|------------------|--------------|-----------------------------------|------------------|-----------------|------------|---------------------|--|
| 4. Freeze                        | On         | Off              | Off          | Cycles Off then On two more times | Off              | On              | On         | May Cycle On/Off    | Until Ice Contact w/ Ice Thickness Probe                           |
| <b>Harvest Sequence</b>          | On         | On               | On           | Off                               | On               | On              | On         | May Cycle On/Off    | Factory Set at 45 Seconds  |
| 5. Water Purge<br>6. Harvest     | Off        | On               | On           | Off                               | Off              | On              | On         | May Cycle On/Off    | Bin Switch Activation  |
| 7. Automatic Shut-Off            | Off        | Off              | Off          | Off                               | Off              | Off             | Off        | Off                 | Until 3 Minute Delay Expires and Bin Switch Re-closes<br>Re-closes |
| * NOT USED ON ALL MODELS         |            |                  |              |                                   |                  |                 |            |                     |  |

## **REMOTE CONDENSER**

NOTE: The power button must be depressed and the water curtain/ice dampers must be in place on the evaporator before the ice machine will start.

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

#### **1. Water Purge**

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

#### **2. Refrigeration System Equalization and Start-Up**

The harvest valve, air pump(s) and harvest pressure regulating (HPR) solenoid valves energize to equalize high and low side refrigeration pressure.

After 5 seconds the liquid line solenoid valve energizes and the contactor energizes the compressor and condenser fan motor.

## **Freeze Sequence**

### **3. Prechill**

The compressor is on for 30 seconds (60 seconds initial cycle) to lower the temperature of the evaporator(s) before the water pump is energized. The water fill valve will energize and remain on until water touches the low and high water level probes.

### **4. Freeze**

#### **Water Pump**

The water pump(s) energizes and water flows over the evaporator. The water pump is energized throughout the freeze cycle.

#### **Water Inlet Valve**

The water inlet valve energized in prechill and can energize up to two times in the freeze cycle. The control board will prevent the water fill valve from energizing after two 6 minute water fill time limits.

After water contacts the low and high water probes the water fill valve de-energizes. Ice builds on the evaporator and the water level drops. When water loses contact with the high water probe, the water fill valve energizes until water contacts the high water probe again.

#### **Ice Thickness Probe**

The freeze cycle continues until the six minute freeze lock expires and enough ice has formed to send a signal from the ice thickness probe to the control board.

During the first 6 minutes of the freeze cycle the ice thickness probe microphone samples ambient noise. 6 minutes into the freeze cycle 4 baseline readings are recorded. Ice formation on the evaporator will change the readings; when two of the four baseline readings are exceeded a harvest cycle starts.

## **Harvest Sequence**

### **5. Water Purge**

The air pump (when used) the harvest valve(s) and harvest pressure regulating valve (HPR) energize to divert hot refrigerant gas to the evaporator.

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

### **6. Harvest**

The harvest valve, air pump(s) and harvest pressure regulating (HPR) solenoid valves remain energized and the refrigerant gas warms the evaporator causing the cubes to slide, as a sheet, off the evaporator and into the storage bin. The sliding sheet of cubes opens the water curtain/ice damper and bin switch. The momentary opening and re-closing of the bin switch terminates the harvest sequence and returns the ice machine to the freeze sequence (Step 3 - 4.)

## **Automatic Shut-Off**

### **7. Automatic Shut-Off**

When the storage bin is full at the end of a harvest sequence, the sheet of cubes fails to clear the water curtain/ice damper and will hold it open. After the water curtain/ice damper is held open for 30 seconds, the ice machine shuts off. The ice machine remains off for 3 minutes before it can automatically restart.

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

# ENERGIZED PARTS CHART REMOTE MODELS

## Remote Air-Cooled Condenser Models Energized Parts Chart

| Ice Making Sequence of Operation                              | Water Pump | Harvest Valve(s) | Air Pump(s)* | Water Inlet Valve                 | Water Dump Valve | Contactor Coil Liquid Line Solenoid | Compressor | Condenser Fan Motor | Length of Time  |
|---|------------|------------------|--------------|-----------------------------------|------------------|-------------------------------------|------------|---------------------|---|
| <b>Initial Start-Up</b><br>1. Water Purge<br>2. Refrigeration | On         | Off              | Off          | Off                               | On               | Off                                 | Off        | Off                 | 45 Seconds  |
|   | Off        | On               | On           | Off                               | Off              | Off                                 | Off        | Off                 | 5 Seconds   |
| A. Equalization   | Off        | On               | On           | Off                               | Off              | Off                                 | Off        | Off                 | 5 Seconds   |
| B. Compressor Startup   | Off        | On               | On           | Off                               | Off              | On                                  | On         | On                  | 5 Seconds   |
| <b>Freeze Sequence</b><br>3. Prechill                         | Off        | Off              | Off          | May Cycle On/Off during pre-chill | Off              | On                                  | On         | On                  | Initial Start-Up is 60 Seconds<br>30 Seconds thereafter |

**Remote Air-Cooled Condenser Models  
Energized Parts Chart (Continued)**

| <b>Ice Making Sequence of Operation</b> | <b>Water Pump</b> | <b>Harvest Valve(s)</b> | <b>Air Pump(s)*</b> | <b>Water Inlet Valve</b>                             | <b>Water Dump Valve</b> | <b>Contactors<br/>Coil Liquid<br/>Line Solenoid</b> | <b>Compressor</b> | <b>Condenser<br/>Fan Motor</b> | <b>Length of<br/>Time</b>  |
|---|-------------------|-------------------------|---------------------|--|-------------------------|---|-------------------|--------------------------------|--|
| 4. Freeze                               | <b>On</b>         | <b>Off</b>              | <b>Off</b>          | <b>Cycles Off<br/>then On<br/>two more<br/>times</b> | <b>Off</b>              | <b>On</b>   | <b>On</b>         | <b>On/</b>                     | <i>Until Ice<br/>Contact w/<br/>Ice Thickness<br/>Probe</i>              |
| <b>Harvest Sequence</b>                 | <b>On</b>         | <b>On</b>               | <b>On</b>           | <b>Off</b>   | <b>On</b>               | <b>On</b>   | <b>On</b>         | <b>On</b>                      | <i>Factory Set at<br/>45 Seconds</i>                                     |
| 5. Water Purge<br>6. Harvest            | <b>Off</b>        | <b>On</b>               | <b>On</b>           | <b>Off</b>   | <b>Off</b>              | <b>On</b>   | <b>On</b>         | <b>On</b>                      | <i>Bin Switch<br/>Activation</i>   |
| 7. Automatic<br>Shut-Off                | <b>Off</b>        | <b>Off</b>              | <b>Off</b>          | <b>Off</b>   | <b>Off</b>              | <b>Off</b>  | <b>Off</b>        | <b>Off</b>                     | <i>Until 3 Minute<br/>Delay Expires<br/>and Bin Switch<br/>Re-closes</i> |

\* NOT USED ON ALL MODELS

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# Troubleshooting

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## Safety Limits

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

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 Limit 1** - If the freeze time reaches 60 minutes, the control board automatically initiates a harvest cycle. If 6 consecutive 60-minute freeze cycles occur, the ice machine stops
- **Safety Limit 2** - If the harvest time reaches 3.5 minutes, the control board automatically returns the ice machine to the freeze cycle. If 500 consecutive 3.5 minute harvest cycles occur, the ice machine stops.

## SAFE OPERATION MODE

Allows the ice machine to operate up to 72 hours if the ice thickness probe (E19 fault) and/or water level probe sensors fail (E20 fault).

- When the control board starts the safe mode an alert is flashed on the LCD display to notify the end-user they have a production problem.
- The control board automatically initiates and monitors the safe mode. The control will automatically exit the safe mode if a normal signal is received from the input.
- After 72 hours the control board will enter a standby mode and turn off

NOTE: The control board needs a five cycle history to operate safe mode. If five cycles have never been successfully completed the ice machine will shut-off.



## **ANALYZING WHY A SAFETY LIMIT STOPPED THE ICE MACHINE**

Safety limits are designed to stop the ice machine prior to major component failures, most often a minor problem or something external to the ice machine. This may be difficult to diagnose, as many external problems occur intermittently.

Example: An ice machine stops intermittently on safety limit #1 (long freeze times). The problem could be a low ambient temperature at night, a water pressure drop, the water is turned off one night a week, etc.

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

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

## **SAFETY LIMIT #1**

Freeze time exceeds 60 minutes for 6 consecutive freeze cycles.

### *Possible cause checklist*

#### ***Improper Installation***

- Refer to "Installation/Visual Inspection Checklist" on page 135

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

- Dirty/defective water level probe
- 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 fill valve
- Dirty/defective water dump valve
- Defective water pump
- Loss of water from sump area

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

- Low incoming voltage
- Ice thickness probe out of adjustment
- Harvest cycle not initiated electrically
- Contactor not energizing
- Compressor electrically non-operational
- Defective fan cycling control
- Defective fan motor

#### ***Miscellaneous***

- Non-Manitowoc components
- Improper refrigerant charge
- Defective head pressure control
- Defective harvest valve
- Defective compressor
- TXV starving or flooding (check bulb mounting)
- Non-condensable in refrigeration system
- Plugged or restricted high side refrigerant lines or component
- Restricted air flow/dirty condenser fins
- High inlet air temperature
- Condenser discharge air recirculation

## **SAFETY LIMIT #2**

Harvest time exceeds 3.5 minutes for 500 consecutive harvest cycles

### *Possible Cause Checklist*

#### ***Improper Installation***

- Refer to "Installation/Visual Inspection Checklist" page 135

#### ***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
- Clogged water distribution tube

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

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

#### ***Refrigeration System***

- Non-Manitowoc components
- Improper refrigerant charge
- Defective head pressure control valve
- Defective harvest valve
- TXV flooding (check bulb mounting)
- Defective fan cycling control
- Water cooled only - Water regulating valve is incorrectly adjusted or will not close during harvest cycle.

## Troubleshooting By Symptom

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

### SYMPTOM #1

#### **Ice Machine Stops Running**

**Ice machine is in Ice Making cycle**

**or**

**Has a History of Shutting Down**

- Refer to Ice Machine Stops Running Flow Chart

### SYMPTOM #2

#### **Ice Machine has a Long Freeze Cycle.**

**Ice Formation is Thick**

**or**

**Thin Ice Fill on Inlet or Outlet of Evaporator**

**or**

**Low Production**

Safety Limit #1 (possible)

- Refer to Freeze Cycle Refrigeration System Operational Analysis Table

### SYMPTOM #3

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

Safety Limit #2 (possible)

- Refer to Refrigeration Harvest Flow Chart

### SYMPTOM #4

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

- Refer to Ice Meltout Flow Chart

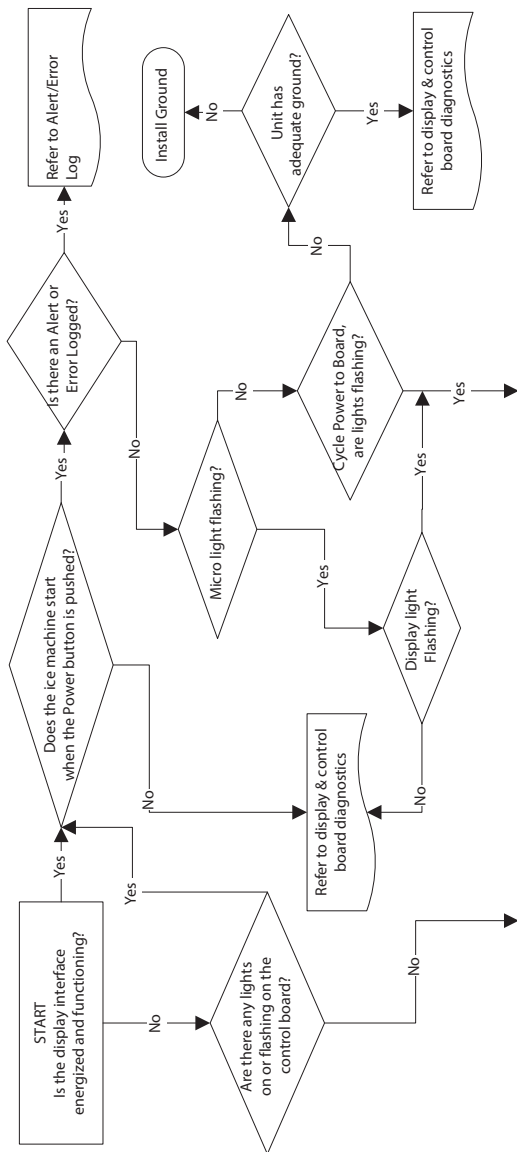
## **RESET TO FACTORY DEFAULTS**

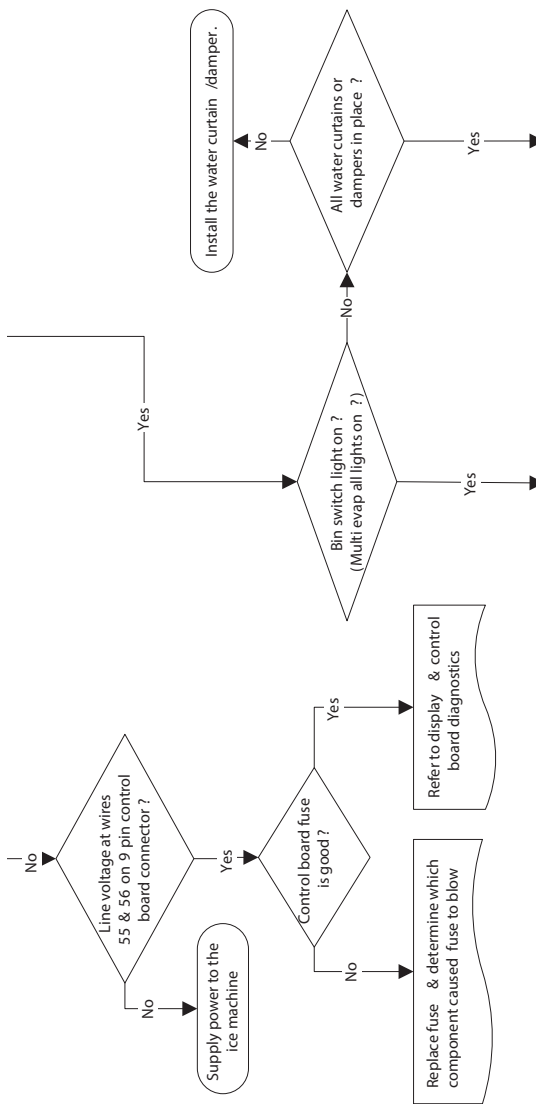
Before starting troubleshooting procedures, reset the control board to factory defaults to prevent mis-diagnosis. Before resetting to factory defaults do one of the following:

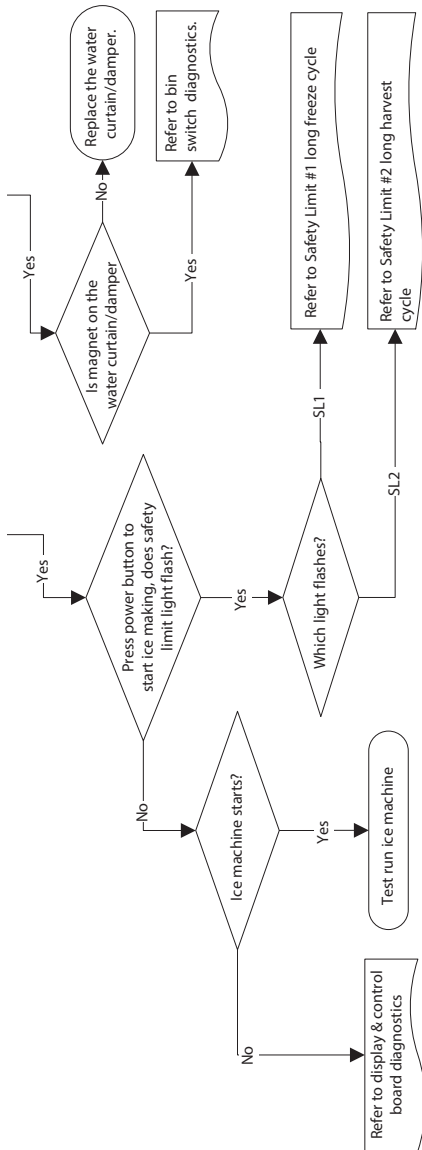
- A. Copy settings to a usb device and flash settings into the control board when diagnostics are complete.
- B. Write down any customer settings so they can be re-entered when diagnostics are complete.

This procedure also resets the password to the factory default. The default factory password is 1234. To reset the ice machine to factory defaults refer to "Password Entry" on page 65.

## SYMPTOM #1 ICE MACHINE WILL NOT RUN









## **SYMPTOM #2 - LOW PRODUCTION, LONG FREEZE CYCLE**

**Ice Machine has a Long Freeze Cycle.**

**Ice Formation is Thick**

**or**

**Thin on Inlet or Outlet of Evaporator**

**or**

**Low Production**

### **How to Use the Freeze Cycle Refrigeration System Operational Analysis Table**

#### GENERAL

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

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

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

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

## PROCEDURE

### **Step 1 Complete the “Operational Analysis” column.**

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

While analyzing each item separately, you may find an “external problem” causing a good refrigerant component to appear bad. Correct problems as they are found. If the operational problem is found, it is not necessary to complete the remaining procedures.

### **Step 2 Enter Checkmarks (✓).**

Each time the actual findings of an item in the “Operational Analysis” column matches the published findings on the table, enter a Checkmark.

Example: Freeze cycle suction pressure is determined to be low. Enter a Checkmark in the “low” column.

### **Step 3 Add the Checkmarks listed under each of the four columns. Note the column number with the highest total and proceed to “Final Analysis.”**

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

## Before Beginning Service

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

Ask these questions before beginning service:

- When does the ice machine malfunction? (night, day, all the time, only during the Freeze cycle, etc.)
- When do you notice low ice production? (one day a week, every day, on weekends, etc.)
- Can you describe exactly what the ice machine seems to be doing?
- Has anyone been working on the ice machine?
- During “store shutdown,” is the circuit breaker, water supply or air temperature altered?
- Is there any reason why incoming water pressure might rise or drop substantially?

**SYMPTOM #2 - FREEZE CYCLE REFRIGERATION SYSTEM OPERATIONAL ANALYSIS TABLES**  
**SINGLE EVAPORATOR, SINGLE EXPANSION VALVE**  
**SELF CONTAINED AIR, WATER & REMOTE CONDENSER**

|  | <b>1</b>   | <b>2</b>   | <b>3</b>  | <b>4</b>  |
|--|--|--|---|---|
| <b>Operational Analysis</b><br><b>Ice Production</b><br>Reference "Ice Production Check" on page 133 |  | Air-Temperature Entering Condenser _____<br>Water Temperature Entering Ice Machine _____<br>Published 24 hour ice production _____<br>Calculated (actual) ice production _____<br>NOTE: The ice machine is operating properly if the ice fill patterns is normal and ice production is within 10% of charted capacity. |   |   |
| <b>Installation and Water System</b><br>Reference "Water System Checklist" on page 136               | All installation and water related problems must be corrected before proceeding with chart.                  |  |   |   |
| <b>Ice Formation Pattern</b><br>Reference "Ice Formation Pattern" on page 137                        | Ice formation is extremely thin on outlet of evaporator<br>-or-<br>No ice formation on the entire evaporator | Ice formation is extremely thin on outlet of evaporator<br>-or-<br>No ice formation on entire evaporator   | Ice formation normal<br>-or-<br>Ice formation is extremely thin on inlet of evaporator<br>-or-<br>No ice formation on entire evaporator | Ice formation normal<br>-or-<br>No ice formation on entire evaporator |

**SINGLE EVAPORATOR, SINGLE EXPANSION VALVE  
SELF CONTAINED AIR, WATER & REMOTE CONDENSER**

| Operational Analysis                   |  | 1  | 2  | 3                               | 4                               |
|--|--|--|--|---------------------------------|---------------------------------|
| <b>Freeze Cycle Discharge Pressure</b> |  | If discharge pressure is High or Low refer to freeze cycle high or low discharge pressure problem checklist page 140 to eliminate problems and/or components not listed on this table before proceeding. |  |                                 |                                 |
| 1 minute into cycle                    |  |  |  |                                 |                                 |
| Middle                                 |  |  |  |                                 |                                 |
| End                                    |  |  |  |                                 |                                 |
| <b>Freeze Cycle Suction Pressure</b>   |  | If suction pressure is High or Low refer to freeze cycle high or low suction pressure problem checklist page 144 to eliminate problems and/or components not listed on this table before proceeding.     |  |                                 |                                 |
| 1 minute                               |  |  |  |                                 |                                 |
| Middle                                 |  |  |  |                                 |                                 |
| End                                    |  | Suction pressure is <b>High</b>  | Suction pressure is <b>Low or Normal</b> | Suction pressure is <b>High</b> | Suction pressure is <b>High</b> |

**SINGLE EVAPORATOR, SINGLE EXPANSION VALVE  
SELF CONTAINED AIR, WATER & REMOTE CONDENSER**

|   | 1  | 2  | 3   | 4   |
|---|--|--|---|---|
| <p><b>Operational Analysis</b></p> <p>Wait 5 minutes into the freeze cycle.</p> <p>Compare temperatures of <b>evaporator inlet</b> and <b>evaporator outlet</b>.</p> <p><b>Inlet T3</b> _____ ° F (°C)</p> <p><b>Outlet T4</b> _____ ° F (°C)</p> <p><b>Difference</b></p> <p><b>T3 &amp; T4</b> _____ ° F (°C)</p> <p>Reference "Comparing Evaporator Inlet and Outlet Temperatures - Self-contained &amp; Remote Condenser Single Expansion Valve Machines" on page 147</p> | <p>Inlet and outlet <b>within 7° F (4°C)</b> of each other</p> | <p>Inlet and outlet <b>not within 7° F (4°C)</b> of each other -and- Inlet is colder than outlet</p> | <p>Inlet and outlet <b>within 7°F (4°C)</b> of each other -or- Inlet and outlet <b>not within 7°F (4°C)</b> of each other -and- Inlet is warmer than outlet</p> | <p>Inlet and outlet <b>within 7°F (4°C)</b> of each other</p> |

## SINGLE EVAPORATOR, SINGLE EXPANSION VALVE SELF CONTAINED AIR, WATER & REMOTE CONDENSER

| Operational Analysis   | 1  | 2   | 3   | 4   |
|--|--|---|---|---|
| <p>Wait 5 minutes into the freeze cycle.<br/>Compare temperatures of <b>compressor discharge line</b> and <b>harvest valve inlet</b>.<br/>Reference "Harvest Valve Analysis" on page 148</p>                           | <p>The harvest valve inlet is <b>Hot</b> -and- approaches the temperature of a <b>Hot</b> compressor discharge line.</p> | <p>The harvest valve inlet is <b>Cool</b> enough to hold hand on -and- the compressor discharge line is <b>Hot</b>.</p> | <p>The harvest valve inlet is <b>Cool</b> enough to hold hand on -and- the compressor discharge line is <b>Cool</b> enough to hold hand on.</p> | <p>The harvest valve inlet is <b>Cool</b> enough to hold hand on -and- the compressor discharge line is <b>Hot</b>.</p> |
| <p><b>Discharge Line Temperature</b><br/>Record freeze cycle discharge line temperature at the end of the freeze cycle<br/><b>T2</b> _____ °F (°C)<br/>Reference "Discharge Line Temperature Analysis" on page 150</p> | <p>Discharge line temp. <b>150°F (65°C)</b> or <b>higher</b> at the end of the freeze cycle</p>                          | <p>Discharge line temp. <b>150°F (65°C)</b> at the end of the freeze cycle</p>  | <p>Discharge line temp. <b>less than 150°F (65°C)</b> at the end of the freeze cycle</p>  | <p>Discharge line temp. <b>150°F (65°C) or higher</b> at the end of the freeze cycle</p>                                |

**SINGLE EVAPORATOR, SINGLE EXPANSION VALVE  
SELF CONTAINED AIR, WATER & REMOTE CONDENSER**

|  | 1                            | 2                                      | 3                   | 4                 |
|--|------------------------------|--|---------------------|-------------------|
| <b>Operational Analysis</b>  |                              |  |                     |                   |
| <b>Final Analysis</b><br>Enter total number of boxes checked in each column.<br>Reference "Final Analysis - Self-contained Air, Water & Remote Condenser Models" on page 152 | <b>Harvest Valve Leaking</b> | <b>Low On Charge -Or- TXV Starving</b> | <b>TXV Flooding</b> | <b>Compressor</b> |

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



**SINGLE EVAPORATOR, DUAL EXPANSION VALVE  
SELF CONTAINED AIR, WATER & REMOTE CONDENSER**

|   | 1   | 2   | 3  | 4   |
|---|---|---|--|---|
| <b>Operational Analysis<br/>Ice Production</b>  | Air-Temperature Entering Condenser _____<br>Water Temperature Entering Ice Machine _____<br>Published 24 hour ice production _____<br>Calculated (actual) ice production _____<br><b>NOTE:</b> The ice machine is operating properly if the ice fill patterns is normal and ice production is within 10% of charted capacity. |   |  |   |
| <b>Installation and<br/>Water System</b>  | All installation and water related problems must be corrected before proceeding with table.   |   |  |   |
| <b>Ice Formation Pattern</b><br><br><b>Top or 1<br/>Side</b> _____<br><br><b>Bottom or 1<br/>Side</b> _____ | Ice formation is extremely thin on outlet of evaporator<br>-or-<br>No ice formation on one side or Top or Bottom of evaporator  | Ice formation is extremely thin on outlet of one side or Top or Bottom of evaporator<br>-or-<br>No ice formation on entire evaporator | Ice formation normal<br>-or-<br>Ice formation is extremely thin at inlet of one side or Top or Bottom of evaporator<br>-or-<br>No ice formation on entire evaporator | Ice formation normal<br>-or-<br>No ice formation on entire evaporator |

## SINGLE EVAPORATOR, DUAL EXPANSION VALVE SELF CONTAINED AIR, WATER & REMOTE CONDENSER

|   | 1  | 2   | 3  | 4   |
|---|--|---|--|---|
| <b>Operational Analysis</b>   |  |   |  |   |
| <b>Freeze Cycle Discharge Pressure</b>  | If discharge pressure is High or Low refer to freeze cycle high or low discharge pressure problem checklist page 140 to eliminate problems and/or components not listed on this table before proceeding. |   |  |   |
| <b>1 minute into cycle</b>  | <b>End</b>   |   |  |   |
| <b>Freeze Cycle Suction Pressure</b>  | If suction pressure is High or Low refer to freeze cycle high or low suction pressure problem checklist page 144 to eliminate problems and/or components not listed on this table before proceeding.     |   |  |   |
| <b>1 minute into cycle</b>  | <b>Middle</b>  | <b>End</b>  |  |   |
| <b>Wait 5 minutes into the freeze cycle. Compare temperatures of compressor discharge line and both harvest valve inlets.</b> | <b>High</b>  | <b>Low or Normal</b>  | <b>High</b>  | <b>High</b>   |
|   | The harvest valve inlet is <b>Hot</b> -and- approaches the temperature of a <b>Hot</b> compressor discharge line.  | The harvest valve inlet is <b>Cool</b> enough to hold hand on -and- the compressor discharge line is <b>Hot</b> . | The harvest valve inlet is <b>Cool</b> enough to hold hand on -and- the compressor discharge line is enough to hold hand on. | The harvest valve inlet is <b>Cool</b> enough to hold hand on -and- the compressor discharge line is <b>Hot</b> . |

**SINGLE EVAPORATOR, DUAL EXPANSION VALVE  
SELF CONTAINED AIR, WATER & REMOTE CONDENSER**

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

## Ice Production Check

The amount of ice a machine produces directly relates to the operating water and air temperatures. This means a condensing unit with a 70°F (21°C) outdoor ambient temperature and 50°F (10°C) water produces more ice than the same model condensing unit with a 90°F (32°C) outdoor ambient temperature and 70°F (21°C) water.

1. Determine the ice machine operating conditions:  
Air temp entering condenser: \_\_\_\_\_°  
Air temp around ice machine: \_\_\_\_\_°  
Water temp entering sump trough: \_\_\_\_\_°
2. Refer to the appropriate 24-Hour Ice Production Chart (starting on page 223). Use the operating conditions determined in step 1 to find published 24-Hour Ice Production: \_\_\_\_\_
  - Times are in minutes.  
Example: 1 min. 15 sec. converts to 1.25 min.  
(15 seconds ÷ 60 seconds = .25 minutes)
  - Weights are in pounds.  
Example: 2 lb. 6 oz. converts to 2.375 lb.  
(6 oz. ÷ 16 oz. = .375 lb.)
3. Perform an ice production check using the formula below.

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

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

4. Compare the results of step 3 with step 2. Ice production checks that are within 10% of the chart are considered normal. If they match closely, determine if:
  - Another ice machine is required.
  - More storage capacity is required.
  - Relocating the existing equipment to lower the load conditions is required.

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

## **Installation/Visual Inspection Checklist**

### ***Inadequate Clearances***

- Check all clearances on sides, back and top. Reference "Clearance Requirements" on page 31

### ***Ice machine is not level***

- Level the ice machine

### ***Condenser is dirty***

- Clean the condenser

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

- Install a new water filter

### ***Water drains are not run separately and/or are not vented***

- Run and vent drains according to the Installation Manual

### ***Line set is improperly installed***

- Reinstall according to the Installation Manual Reference "Lineset Applications" on page 34

## **Water System Checklist**

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

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

### ***Water area (evaporator) is dirty***

- Clean as needed

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

- Install water regulator or increase water pressure

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

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

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

- Install a new water filter

### ***Water dump valve leaking during the Freeze cycle***

- Clean/replace dump valve as needed

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

- See Installation Instructions

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

- Repair/replace as needed

### ***Water fill valve is stuck open or closed***

- Clean/replace as needed

### ***Water is leaking out of the sump trough area***

- Stop the water loss

### ***Uneven water flow across the evaporator***

- Clean the ice machine

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

- Remount/replace as needed

## Ice Formation Pattern

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

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

Any number of problems can cause improper ice formation.

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

### 1. Normal Ice Formation

Ice forms across the entire evaporator surface.

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

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

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



## 2. Extremely Thin at Evaporator Outlet

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

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

## 3. Extremely Thin at Evaporator Inlet

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

## 4. No Ice Formation

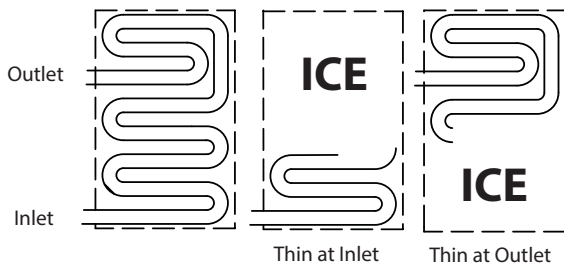
The ice machine operates for an extended period, but there is no ice formation at all on the evaporator.

## Evaporator Tubing Routing

Routing of the tubing on the back of the evaporator determines the ice fill pattern failure mode.

### One Evaporator, One TXV models

The evaporator outlet tubing does not exit directly at the top of the evaporator, but exits several inches below the top of the evaporator. Extremely Thin at the Evaporator Outlet will first be visible several inches below the top of the evaporator. Extremely Thin at Evaporator Inlet will first be visible at the bottom of the evaporator.

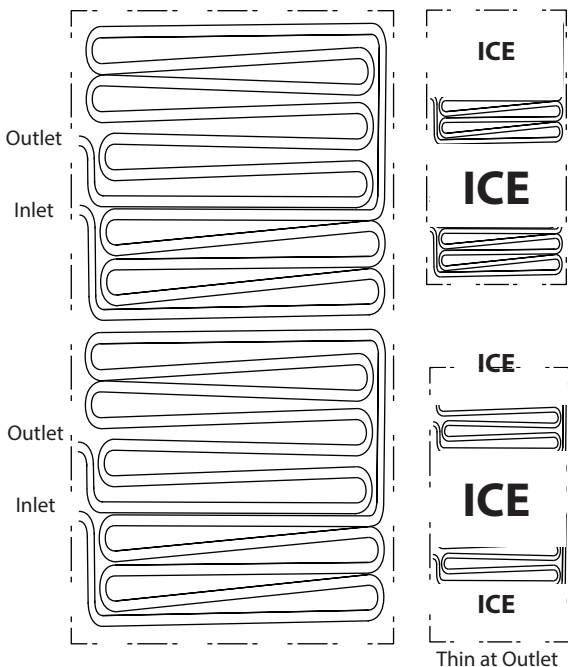


## One Evaporator, Two TXV 30" Models

Tubing routing for one evaporator with two TXV's is different. The evaporator has two inlets and outlets. Fill pattern varies depending on which circuit is affected,

**Extremely Thin at the Evaporator Outlet** will first be visible either 1/4 or 3/4 of the way down the evaporator.

**Extremely Thin at the Evaporator Inlet** will show at the bottom of the evaporator or 1/2 of the way down depending on the circuit affected.

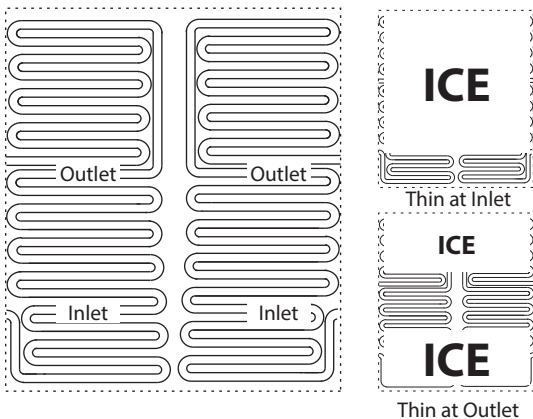


## One Evaporator, Two TXV 48" Models

Tubing routing for one evaporator with two TXV's is different. The evaporator has two inlets and outlets. Fill pattern varies depending on which circuit is affected,

**Extremely Thin at the Evaporator Outlet** will first be visible 1/3 of the way down the evaporator. Only one side of the evaporator may be affected depending on failure. A TXV failure will usually show on only one side, while low on refrigerant can affect one or both sides depending on the amount of refrigerant loss and ambient temperature.

**Extremely Thin at the Evaporator Inlet** will show at the bottom of the evaporator. Depending on the failure either the entire bottom of the evaporator or one side of the bottom of the evaporator may be affected.



## Analyzing Discharge Pressure in the Freeze Cycle

1. Determine the ice machine operating conditions:  
Air temp. entering condenser \_\_\_\_\_  
Air temp. around ice machine \_\_\_\_\_  
Water temp. entering sump trough \_\_\_\_\_
2. Refer to Operating Pressure table (starting on page 223) for ice machine being checked.

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

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

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

3. Perform an actual discharge pressure check.

**Freeze Cycle  
psig (kPa)**

1 Minute into the

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

Middle of Freeze Cycle \_\_\_\_\_

End of Freeze Cycle \_\_\_\_\_

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

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

## **Freeze Cycle Discharge Pressure High Checklist**

### ***Improper Installation***

- Refer to "Installation/Visual Inspection Checklist" (page 135)

### ***Air Condenser***

- Dirty condenser filter
- Dirty condenser fins
- High inlet air temperature
- Condenser discharge air recirculation
- Defective fan cycling control (page 185)
- Defective fan motor
- Defective head pressure control valve {Remote}

### ***Water Condenser***

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

### ***Other***

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

## **Freeze Cycle Discharge Pressure Low Checklist**

### ***Improper Installation***

- Refer to “Installation/Visual Inspection Checklist” (page 135)

### ***Air Cooled Condensers***

- Defective head pressure control valve, won't bypass (page 195)
- Defective fan cycle control, stuck closed (page 185)

### ***Water Cooled Condensers***

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

### ***Other***

- Undercharged
- Wrong type of refrigerant
- Non-Manitowoc components in system
- Liquid line/component restricted

## 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.

1. Determine the ice machine operating conditions:  
Air temp. entering condenser \_\_\_\_\_  
Air temp. around ice machine \_\_\_\_\_  
Water temp. entering sump trough \_\_\_\_\_
2. Refer to Operating Pressure table (starting on page 223) 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 suction pressure check.

### Freeze Cycle psig (kPa)

1 Minute into the

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

Middle of Freeze Cycle \_\_\_\_\_

End of Freeze Cycle \_\_\_\_\_

4. Compare the actual suction pressure (step 3) with the published suction pressure (step 2).

NOTE: The suction 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 suction pressure to be higher at the beginning of the Freeze cycle (when load is greatest), then drop throughout the Freeze cycle.

## **Suction Pressure High Checklist**

### ***Improper Installation***

- Refer to “Installation/Visual Inspection Checklist” page 135

### ***Discharge Pressure***

- Discharge pressure is too high and is affecting suction pressure – refer to “Freeze Cycle Discharge Pressure High Checklist” (page 142)

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

- Overcharged (also see “Freeze Cycle Discharge Pressure High Checklist” page 142)
- Wrong type of refrigerant
- Non condensable in system

### ***Components***

- Harvest valve leaking
- Harvest pressure solenoid valve leaking
- TXV flooding
- Defective compressor

### ***Other***

- Non-Manitowoc components in system



## **Suction Pressure Low Checklist**

### ***Improper Installation***

- Refer to "Installation/Visual Inspection Checklist" (page 135)

### ***Discharge Pressure***

- Discharge pressure is too low and is affecting low side – refer to "Freeze Cycle Discharge Pressure Low Checklist" (page 143)

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

- Undercharged
- Wrong type of refrigerant

### ***Other***

- Non-Manitowoc components in system
- Improper water supply over evaporator – refer to "Water System Checklist" (page 136)
- Restricted/plugged liquid line drier
- Restricted/plugged tubing in suction side or liquid line of refrigeration system
- TXV starving

## **Comparing Evaporator Inlet and Outlet Temperatures - Self-contained & Remote Condenser Single Expansion Valve Machines**

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

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

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

1. Navigate to Service / Real Time Data / Time & Temp / T3 & T4 Thermistors (See page 81 Service Menu Navigation for details).
2. Wait five minutes into the freeze cycle.
3. Record the evaporator inlet (T3) and outlet (T4) temperatures at 5 minutes into the freeze cycle. Determine the difference.
4. Record the information on the table.

## Harvest Valve Analysis

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

Use the following procedures to determine if a harvest valve is remaining partially open during the freeze cycle.

### SELF-CONTAINED OR REMOTE CONDENSER MODELS HARVEST VALVE ANALYSIS

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

#### **Important**

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

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

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

#### **⚠ Warning**

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

| <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 style="text-align: center;"><b>Cool &amp; Hot</b></p>        | <p style="text-align: center;"><b>Normal Operation</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 style="text-align: center;"><b>Hot &amp; Hot</b></p> | <p style="text-align: center;"><b>Leaking Harvest Valve</b></p> <p>The harvest valve inlet did not cool down during the freeze cycle due to continual leakage of compressor discharge gas through the valve.</p>  |
| <p>Both the inlet of the harvest valve and the compressor discharge line are cool enough to touch.</p> <p style="text-align: center;"><b>Cool &amp; Cool</b></p>        | <p style="text-align: center;"><b>Harvest Valve Not Leaking</b></p> <p>The compressor discharge line should not be cool to the touch 5 minutes into the freeze cycle. This symptom would not be caused by a harvest valve leaking.</p>  |

5. Record your findings on the table.

## **Discharge Line Temperature Analysis**

### GENERAL

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

Ambient air temperatures affect the discharge line temperature.

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

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

Regardless of ambient and water temperatures, the freeze cycle discharge line temperature will be higher than 150°F (66°C) at the end of the freeze cycle.

### PROCEDURE

1. Navigate to Service / Real Time Data / Time & Temp / T2 Thermistor (See page 81 Service Menu Navigation for details).
2. Observe the discharge line temperature (T2) for the last three minutes of the freeze cycle and record on the table.

## **Water Regulating Valve**

### ***Problem (Freeze Cycle)***

Valve not maintaining discharge pressure.

- Valve incorrectly set, dirty or defective. Adjust valve to correct discharge pressure for your model (refer to cycle times/24 hour productions charts), clean or replace valve.

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

- Water regulating valve incorrectly set or not opening
- Insufficient water volume - undersized/kinked lines, mineral or scale buildup in lines. Verify Head Pressure Control Valve operation before changing water regulating valve.

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

- Ice machine low on charge. Verify Total System Refrigerant Charge page 220.

## **Final Analysis - Self-contained Air, Water & Remote Condenser Models**

The column with the highest number of Checkmarks identifies the refrigeration problem.

### COLUMN 1 - HARVEST VALVE LEAKING

Replace the valve as required.

### COLUMN 2 - LOW CHARGE/TXV STARVING

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

1. Add refrigerant charge to verify a low charge (air and water self-contained only). Do not add more than 30% of nameplate refrigerant charge. If the problem is corrected, the ice machine is low on charge.

\*Do not add charge to remote models. The symptoms of a remote low on charge will result in a safety limit #1 in cool ambient temperatures. Check the liquid line temperature at the ice machine. The liquid line will be hot with a normal or below normal head pressure in freeze when the ice machine is low on refrigerant.

2. Find the refrigerant leak. The ice machine must operate with the nameplate charge. If the leak cannot be found, proper refrigerant procedures must still be followed Change the liquid line drier. Then, evacuate and weigh in the proper charge.
3. If the problem is not corrected by adding charge, the expansion valve is faulty.

### COLUMN 3 - TXV FLOODING OR REFRIGERANT OVERCHARGE

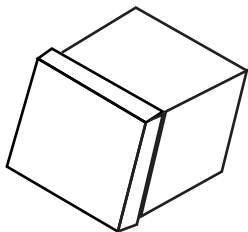
A loose or improperly mounted expansion valve bulb causes the expansion valve to flood. Check bulb mounting, insulation, etc., before changing the valve. Verify refrigerant amount is correct by weighing recovered refrigerant before replacing a TXV.

### COLUMN 4 - COMPRESSOR

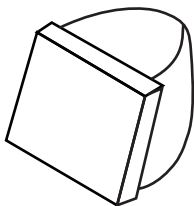
Replace the compressor. To receive warranty credit, the compressor ports must be properly sealed by crimping and soldering them closed.



## SYMPTOM #3 & #4 HARVEST PROBLEMS SELF-CONTAINED AIR, WATER & REMOTE CONDENSER MODELS



**Normal Ice Cube**



**Melted Out ice Cube**

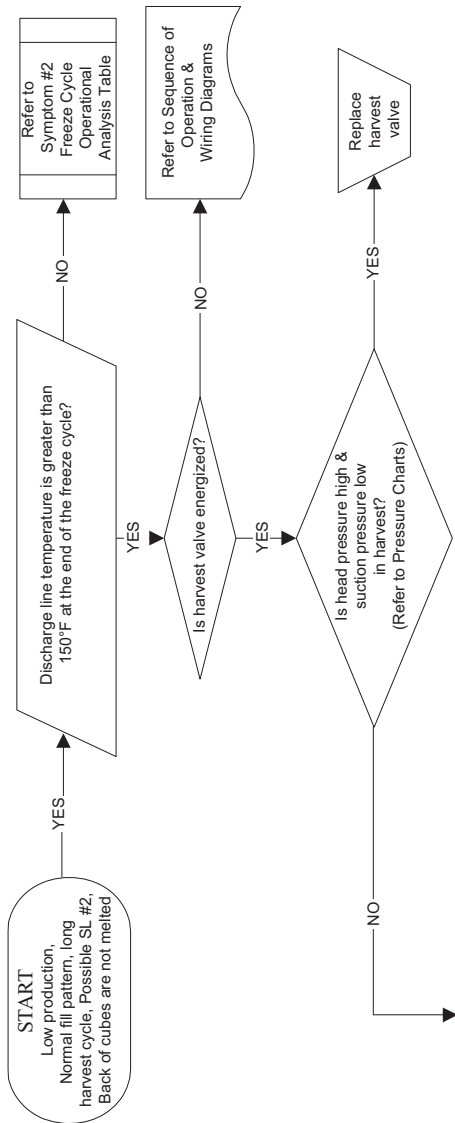
Definition of a harvest problem; At the end of a 3.5 minute harvest cycle the slab of ice is still contacting the evaporator. The slab of ice may or may not be removable by hand.

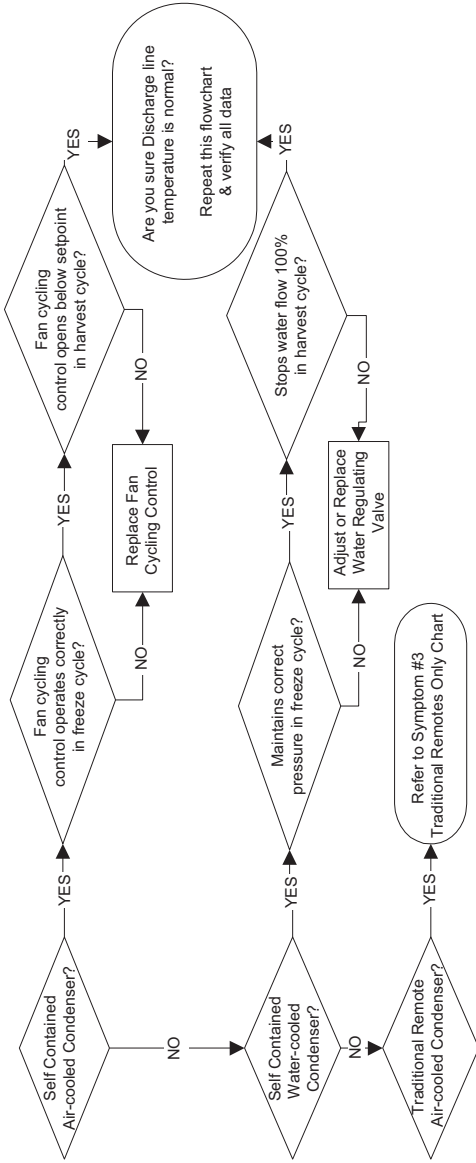
Harvest problems can be split into two symptoms.

- Symptom 3 - Normal sheet of cubes at the end of the harvest cycle. Ice is difficult to remove from the evaporator by hand. Once removed the back of the cubes are square and show no signs of melting. This indicates a refrigeration problem. The source of the problem could be in the freeze or harvest cycle. Use the appropriate flow chart (in Troubleshooting) to determine the cause of the problem.
- Symptom 4 - Melted sheet of cubes at the end of the harvest cycle. Ice can be removed rather easily by hand. The back of the cubes are misshapen and melted. This indicates something is preventing the ice slab from releasing. Follow the appropriate flow chart (in Troubleshooting) to determine the cause of the problem. A manual cleaning procedure must always be performed when this problem is encountered.

### SYMPTOM #3 SELF-CONTAINED AIR OR WATER-COOLED

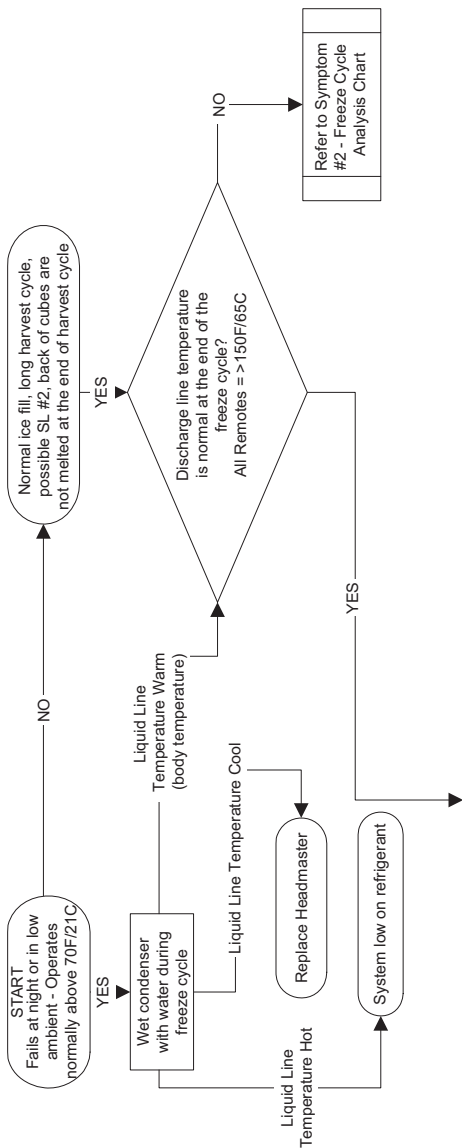
#### Ice Machine Will Not Harvest - Freeze Cycle is Normal and Ice Cubes are Not Melted After Harvest

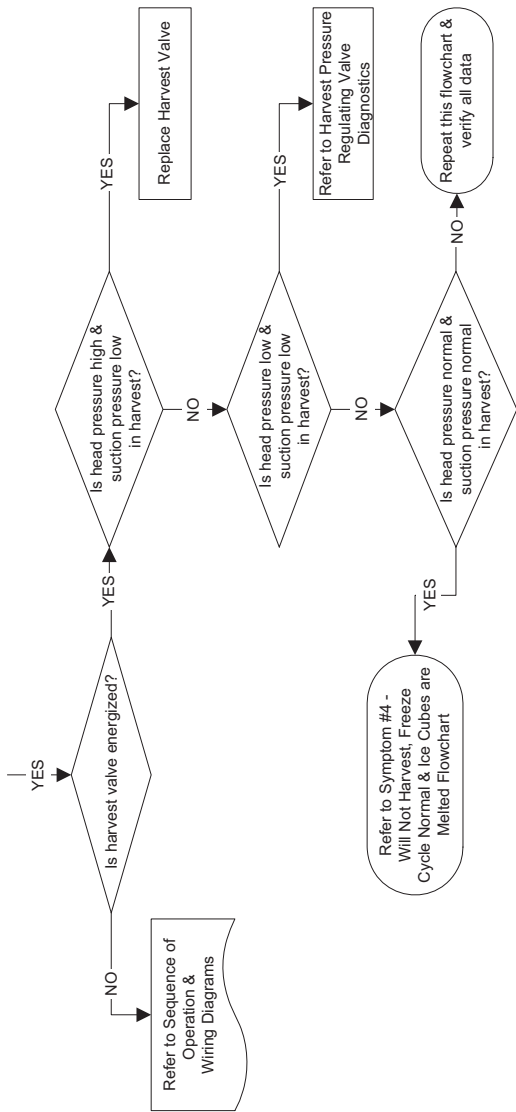




## SYMPTOM #3 - REMOTE CONDENSER

### Traditional Remote Ice Machine - Long Harvest/Low Production/Intermittent Safety Limit 2

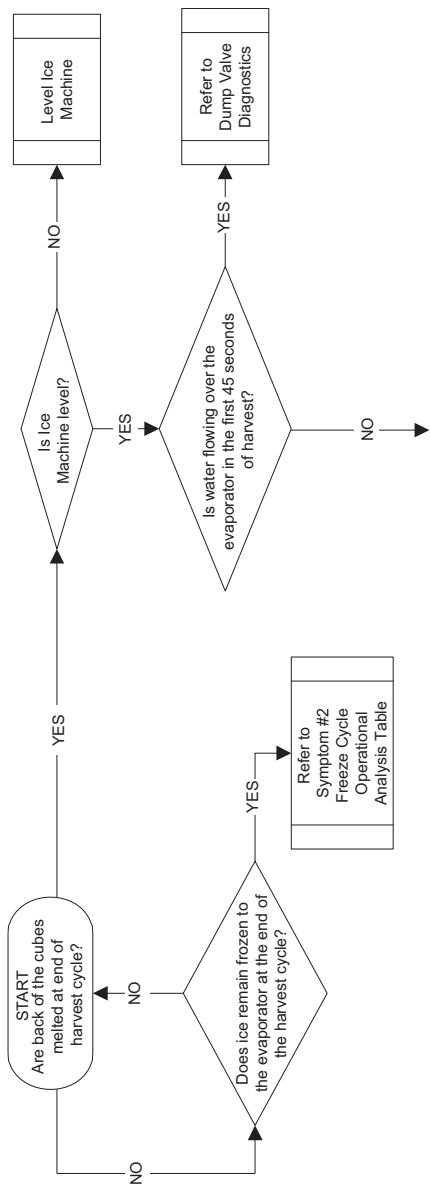


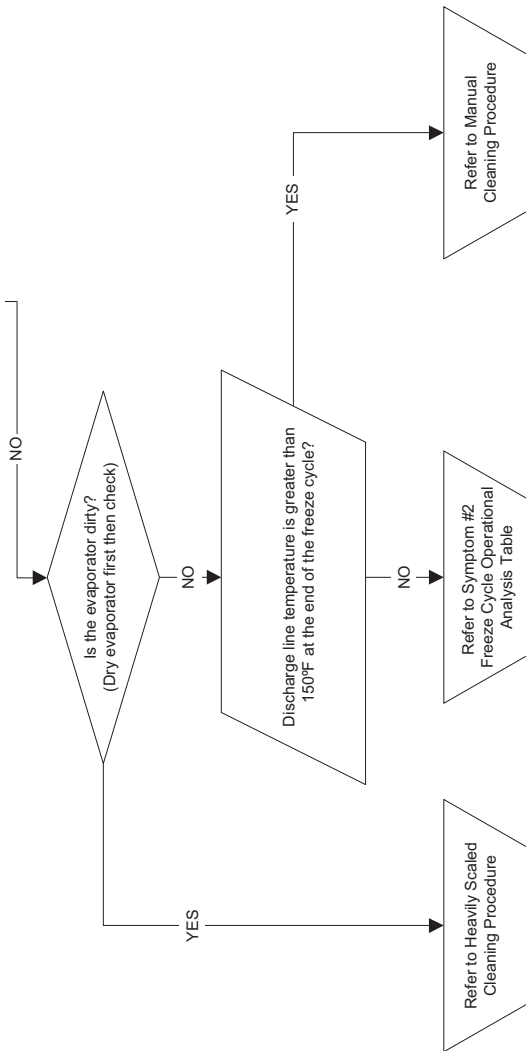


Single Evaporator Systems with Dual Harvest Valves: If one Harvest Valve is open and the other is restricted / stuck closed you may have normal harvest pressures. Look for ice not melting on one side of the evaporator.

## SYMPTOM #4 SELF-CONTAINED AIR, WATER-COOLED OR REMOTE

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





# Component Check Procedures

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## Electrical Components

### CONTROL BOARD, DISPLAY BOARD AND TOUCH PAD

#### FUNCTION

The control board, display board and touch pad provide user input and control the ice machine sequence of operation.

NOTE: Anytime power is supplied to wires #55 & #56 on the control board, the "Display" and "Micro" lights should flash like a heartbeat. The two green lights are located on the top right corner of the control board.

#### Display Diagnostics

Symptom - Micro light flashes and display light is off.

1. Disconnect both ends of the communication cable running between the control board and the back of the display module and inspect for bent or damaged pins. Reconnect after inspection.
2. Reboot ice machine by disconnecting power for a minimum of 15 seconds, reapplying power and checking micro light for normal flashing.
3. Press the power button on the display and watch the green Display light on the control board.
  - A. Display light flashes- Test run ice machine.
  - B. Display light is off - Replace communication cable first as a test, then replace display/touch pad assembly if required.



## Control Board Diagnostics

1. Micro light is not flashing a heartbeat.
2. Disconnect line voltage power supply to the ice machine and wait a minimum of 15 seconds, then reapply power.
  - A. Micro light flashes - continue with step 3.
  - B. Micro light is off - Replace control board.
3. Perform the following keystrokes on the display.
  - Press Menu, scroll down to Service and press right arrow
  - Scroll down to Diagnostics and press right arrow
  - Display reads Control Board, press right arrow
  - Display reads Self Check, press right arrow to start control board test

The control board performs a self test. As the test progresses the display will show Checkmarks at the top left of the display screen. When the fifth Checkmark appears the display will show "Status Failed" or "Status Passed".

- Status passed -The control board is functioning normally, continue with touch pad diagnostics on next page.
- Status failed - Replace control board.

## Touch Pad Diagnostics

Follow the control board diagnostics to "Status Passed". Perform the following keystrokes on the display.

- Display reads Status Passed, press the right arrow
- Display reads Pass Yes, press the right arrow
- Display reads Key Pad Test, press the right arrow
- 4. Test the functionality of all buttons on the touch pad.

NOTE: Pushing the power button will start and stop the ice machine. Testing it last will allow the ice machine to continue running a freeze cycle.

- As you press the buttons the first letter of the corresponding word will flash indicating the push button is operating correctly or the corresponding arrow or zero will flash.
- Press the right arrow 5 times rapidly to exit.

## CONTROL BOARD RELAY TEST

The control board can be set to energize all relays for 3.5 minutes. This allows testing to verify control board relays are closed and line voltage is available for ice machine components - Water pump, dump valve, water inlet valve, harvest valve(s), air compressor(s), contactor/compressor/fan motor - The fan cycle control must close to energize the fan motor.

1. Press power button to turn off ice machine.
2. Perform the following keystrokes on the display.
  - Press Menu, scroll down to Service and press the right arrow
  - Scroll down to Diagnostics, press the right arrow and select Diagnostics
  - Display reads Control Board, press right arrow
  - Scroll down to enbl relays and press right arrow to start control board test
3. The control board will energize all relays and the red light next to the relay. The red light indicates the relay coil is energized.
4. Test for line voltage at the individual components.
  - A. Line voltage is present and the component is non functional - Replace component
  - B. Voltage is not present at the component - Proceed to step 5
5. Refer to wiring diagram and determine wire location on the 9 pin molex connector for the component you are testing.
6. Check for line voltage at the control board 9 pin molex connector.
  - A. Line voltage at 9 pin connector - Repair wiring to component
  - B. No power at 9 pin connector - Replace control board

## PROGRAMMING A REPLACEMENT CONTROL BOARD

Indigo™ replacement control boards require the Model number to be entered to activate the appropriate look up tables for operation and diagnostic. This can be done two different ways, USB Setup or Manual Setup.

**USB Setup** - Applicable when the control board is operational and has a mechanical issue such as a sticking relay. The asset data is transferred to the replacement control board from the faulty control board. Refer to page 97 "Exporting Data To A Flash Drive" before installing the replacement board.

**Manual Setup** - Applicable when the control board is non-operational or data from the faulty board is suspect.

Install replacement control board and reapply power.

- G series (blue) control boards will go directly to the Replacement Control Board screen and pause for input - Select either "Manual" or "USB" setup option.
- E series (green) control boards require navigation to the Replacement Control Board (Repl Cntl Bd) screen.
  1. Press the Menu button.
  2. Press the Down arrow until Service is highlighted, then press the Checkmark.
  3. Scroll down to Replacement Control Board and press the Checkmark.
  4. Select "Manual Setup" and press the Checkmark.

Verify the date correctly auto populates.

- Yes - Go to step 5
- No - Press the right arrow to activate the cursor, then use up/down arrows to enter the correct date.

5. Scroll down until brackets are in the space below "Input Model #". Press the right arrow to activate the blinking cursor, then use the up/down arrows to select the first character in the model number. Use the right arrow to move to the next space. Add characters in this manner until the model number is complete. The model must include the dash and the last three numbers to indicate the electrical requirements ( example -261). Press the right arrow until the cursor disappears.
6. Scroll down until brackets are in the space below "Input Serial#". Press the right arrow to activate the blinking cursor, then use the up/down arrows to select the first character in the serial number. Use the right arrow to move to the next space. Add characters in this manner until the serial number is complete. Press the right arrow until the cursor disappears.
7. Scroll down and select exit, then press checkmark.
8. Reboot ice machine by disconnecting power for a minimum of 15 seconds, then reapply power.

## 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, 8 amp.

#### **⚠ Warning**

High (line) voltage is applied to the control board (terminals #55 and #56) at all times. Removing the control board fuse or pressing the On/Off button will not remove the power supplied to the control board.

### CHECK PROCEDURE

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

#### **⚠ Warning**

Disconnect electrical power to the entire ice machine before proceeding.

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

| <b>Reading</b> | <b>Result</b> |
|----------------|---------------|
| Open (OL)      | Replace fuse  |
| Closed (O)     | Fuse is good  |

## **BIN SWITCH**

### FUNCTION

Movement of the water curtain/ice dampers control bin switch operation. The bin switch has two main functions:

1. Terminating the Harvest cycle and returning the ice machine to the Freeze cycle. This occurs when the bin switch is opened and closed again within 30 seconds during the Harvest cycle.
2. Automatic ice machine shut-off.  
If the storage bin is full at the end of a Harvest cycle, the sheet of cubes fails to clear the water curtain/ice dampers and holds it open. After the water curtain/ice dampers are held open for 30 seconds, the ice machine shuts off. The ice machine remains off until enough ice is removed from the storage bin to allow the sheet of cubes to drop clear of the water curtain/ice dampers. As the water curtain/ice dampers swing back to the operating position, the bin switch closes and the ice machine restarts, provide the 3-minute delay has expired.

### **Important**

The water curtain/ice dampers must be ON (bin switch closed) to start ice making.

### SPECIFICATIONS

The bin switch is a magnetically operated reed switch. The magnet is attached to the lower right corner of the water curtain and both ends of ice dampers.

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

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

## **Diagnostics**

### SYMPTOMS

#### **Bin Switch Fails Open**

G Model control boards or E Model control boards with firmware version Rev.2.047 or higher.

- The ice machine will not start an ice making cycle and the display indicates "Full Bin".
- The ice machine displays "Full Bin Remove Ice" in the clean cycle.

E Control Boards with firmware versions prior to Rev.2.047

- The ice machine will not start an ice making cycle and the display indicates "Curtain Open".
- The ice machine will run in the clean cycle.

#### **Bin Switch Fails Closed**

- When running a "Long Harvest" alert is displayed and safety limit 2 indicated.
- May be off on a safety limit 2.
- The harvest cycle continues after ice opens and closes the ice damper (harvest cycle is 3.5 minutes).



## DIAGNOSTICS

1. Verify bin switch, curtain/damper and curtain/damper magnet are in place.
  - Press the Menu button.
  - Scroll down to Service and press right arrow.
  - Scroll down to Diagnostics and press right arrow
  - Scroll down to Inputs and press right arrow to display curtain switch readings (Curt SW1, Curt SW2, etc).
2. Open and close the ice damper(s) repeatedly while observing the display and control board lights.
  - A. Curtain switch cycles open/closed and control board light energizes/de-energizes - Bin switch is operating normally
  - B. Curtain switch remains closed and control board light remains on - Go to step 3
  - C. Curtain switch remains open and control board light remains off - Go to step 3
3. Disconnect bin switch wire from control board.
4. Jumper control board bin switch wire to ground, press the power button and observe the display and control board lights.
  - A. Curtain switch closes, control board light energizes and ice machine starts - Replace bin switch
  - B. Curtain switch remains open and control board light is off - Verify procedure was correctly followed - Replace control board.

## **WATER LEVEL CONTROL CIRCUITRY**

### FUNCTION

The water level probe controls the water level by sensing whether water is or is not contacting the water level probe. The water level probe has three sensing probes. Two probes are equal in length and are used to measure conductivity for diagnostics, ice clarity and water miser options. Factory default settings measure resistance from both long probes to the short probe.

### SPECIFICATIONS

#### **Freeze Cycle Water Level Setting**

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

#### **Water Inlet Valve Safety Shut-Off**

In the event of a water level probe failure, this feature limits the water inlet valve to 12.5 minutes. Regardless of the water level probe input, the control board automatically shuts off the water inlet valve if it remains on for 12.5 continuous minutes (30 seconds in prechill and two 6 minute periods in the freeze cycle).

## **Prechill & Freeze Cycle Operation**

The water inlet valve energizes and de-energizes in conjunction with the water level probe located in the water trough.

- The water inlet valve is ON when there is no water in contact with the water level probes.
- The water inlet valve turns OFF after water contacts the water level probes for 6 continuous seconds.
- The water inlet valve can cycle ON and OFF once in the prechill and up to two times in the freeze cycle.
- Maximum fill time is 12.5 minutes for single evaporator machines.

The water inlet valve energizes in the Prechill cycle and will de-energize if water touches the high level probe (in most instances the water trough can't fill in the prechill cycle and the water inlet valve will remain energized into the freeze cycle). The water inlet valve will remain energized until water contacts the high water probe. The water inlet valve will cycle ON, and then OFF one more time to refill the water trough. The water inlet valve is now OFF for the duration of the freeze cycle.

## **Diagnostics**

### SYMPTOMS

- Water trough overfills
- Water trough will not fill

### WATER TROUGH OVERFILLING DURING THE FREEZE CYCLE

**Step 1** Press the power button and turn off the ice machine.

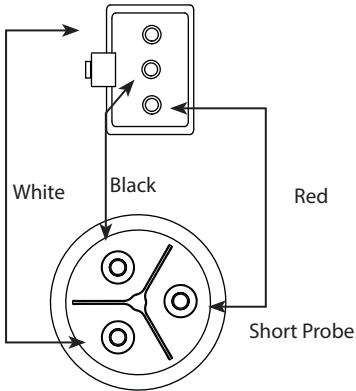
**Step 2** If water continues to flow with the ice machine off, disconnect power. If water continues to flow with power disconnected verify water pressure is below 80 psig before replacing the water inlet valve. If the water stops continue with next step.

**Step 3** Check water level probe mounting and verify secure wiring connections at the probe and control board.

**Step 4** Scroll to Service/Diagnostics/Inputs and press down arrow until Wtr Low and Wtr High are displayed.

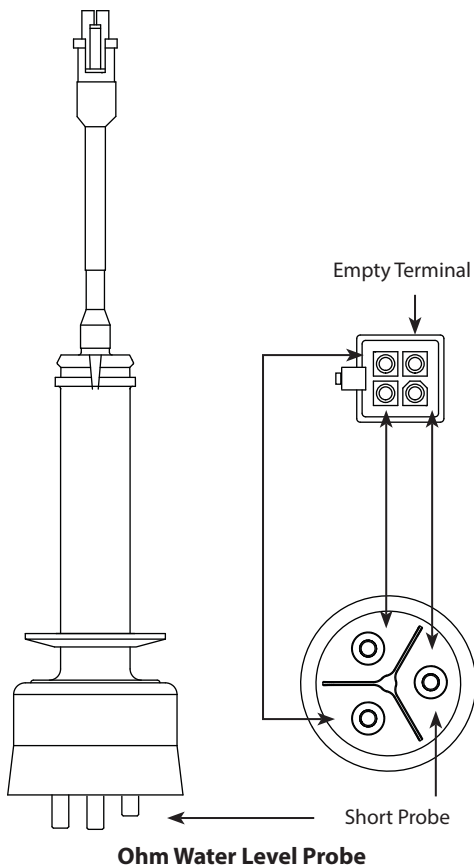
- No is displayed on both Wtr low and Wtr high - The control board is not receiving a sensing water signal - Go to next step.
- Yes is displayed - The control board is receiving a sensing water signal from the low and high probes - Replace the control board.

**Step 5** Disconnect the water level probe wiring harness from the control board and ohm harness and water level probe. Normal readings will show no resistance.



**Ohm water Level Probe and Wiring Harness**

**Step 6** When all ohm tests are normal, replace the control board. When any measurement fails, disconnect the wiring harness from the water level probe and ohm the water level probe with the wiring harness removed from the circuit. Results will determine whether the wiring harness or probe will need replacement.



## WATER TROUGH WILL NOT FILL

**Step 1** Verify water is supplied to the ice machine.

**Step 2** Scroll to Service/Diagnostics/Inputs and press down arrow until Wtr Low and Wtr High are displayed.

- A. Yes is displayed - Control board is receiving a sensing water signal. Proceed to step 3.
- B. No is displayed - Control board is not receiving a sensing water signal. Check for voltage at the water inlet valve coil.

**Step 3** Disconnect water level probe, observe LCD display text.

- A. No is displayed - Clean the water level probe and test interconnecting wiring.
- B. Yes is displayed - Replace the Control Board.

**Step 4** Ohm probe - Refer to previous page for procedure.

## WATER LEVEL PROBE CIRCUIT CHECK AT CONTROL BOARD

Wait until prechill cycle starts, then jumper water level probe connections (2 & 3) on the control board.

- A. Wtr High displays yes and the water stops. Repair wire or replace water level probe.
- B. Wtr High displays No and the water continues to flow. Replace control board.

## **ICE THICKNESS PROBE (INITIATES HARVEST)**

### FUNCTION

The ice thickness probe senses ice on the evaporator and signals the control board to start a harvest cycle.

### SPECIFICATIONS

#### **Freeze Time Lock-In Feature**

The ice machine control system incorporates a 6 minute freeze time lock-in feature. This prevents the ice machine from short cycling in and out of harvest.

#### **Maximum Freeze Time**

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

#### **Maximum Temperature**

Maximum temperature for the ice thickness probe is 120°F (49°C). Do not clean probe in a dishwasher or expose to temperatures above the maximum.

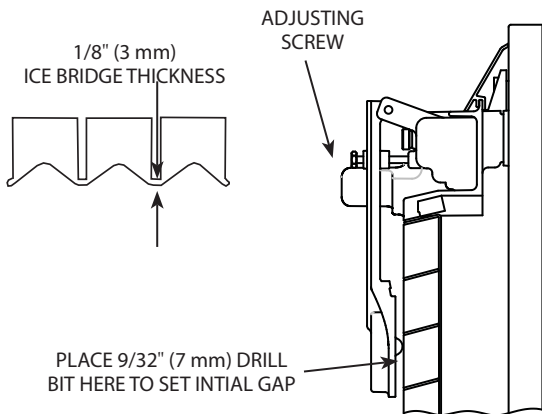


## Ice Thickness Check

The ice thickness probe is factory-set to maintain the ice bridge thickness at 1/8 in. (3 mm).

NOTE: Make sure the water curtain/splash shields are in place when performing this check. It prevents water from splashing out of the water trough. Remove the curtain/splash shield to make an adjustment, then replace immediately after the adjustment is made.

1. Inspect the bridge connecting the cubes. It should be about 1/8 in. (3 mm) thick.
2. If adjustment is necessary, turn the ice thickness probe adjustment screw clockwise to increase bridge thickness or counterclockwise to decrease bridge thickness. Set a 9/32" gap between the ice thickness probe and evaporator as a starting point. Then adjust to achieve 1/8" ice thickness.
3. Make sure the ice thickness probe wire and the bracket do not restrict movement of the probe.



## ICE THICKNESS ADJUSTMENT

## Diagnosics

### ICE MACHINE CYCLES INTO HARVEST BEFORE ICE CONTACTS THE ICE THICKNESS PROBE

#### Premature harvest symptoms

- Low ice production
- Thin ice in bin
- Freeze cycles are faster than published cycle times
  1. Turn off power and inspect ice thickness probe for physical damage. Look for bulging, cracks around the nipple or deformed pivot pins.
  2. Verify ice thickness probe gap is approximately 9/32" (7 mm)
  3. Make sure the ice thickness probe wire doesn't restrict movement.
  4. Perform Ice Thickness Probe tap test:
- Press the menu button, scroll down to Service, press the right arrow, scroll down to Real Time Data, press right arrow - With the brackets around Time & Temp press the right arrow - Scroll down until 100Hz & 120Hz are displayed. Slowly increasing and decreasing numbers typically in the 200Hz to 300Hz range will display to the right of 100Hz & 120Hz.
- Lift the Ice Thickness Probe and continuously tap the nipple while watching the numbers to the right of the 100Hz and 120Hz. There is a slight delay while tapping.

|             |   |
|-------------|---|
| <b>Pass</b> | Numbers increasing into the thousands indicates a properly working ice thickness probe and control board. |
| <b>Fail</b> | Numbers do not move or do not increase into the thousands - Ohm the ice thickness probe.                  |

## 5. Ohm Ice Thickness Probe

NOTE: Verify meter leads are properly connected to VOM with the red meter lead connected to positive & the black meter lead connected to negative

- Disconnect Ice Thickness Probe from control board
- Connect red meter lead to the red wire and the black meter lead to the black wire - Normal readings = 1.4 to 2.5 K $\Omega$ 's.
- Reverse leads - Connect black meter lead to the red wire, red meter lead to the black wire - Normal readings = 1.2 to 1.5 K $\Omega$ 's.

|             |  |
|-------------|--|
| <b>Pass</b> | Ohm values are within range - Check control board voltage at the ice thickness probe connection. |
| <b>Fail</b> | Replace ice thickness probe.   |

## 6. Check control board voltage

- Set VOM to DC voltage scale - Check voltage across the top and bottom pin - Normal readings = 3.25 to 3.35 VDC.

|             |                                 |
|-------------|---------------------------------|
| <b>Pass</b> | Control board voltage is normal |
| <b>Fail</b> | Replace control board           |

## ICE MACHINE DOES NOT CYCLE INTO HARVEST

### **Will not harvest symptoms**

- Low ice production
- Thick ice in bin
- Large sheet of ice on evaporator
- Harvest cycle doesn't start
- Freeze cycles are longer than published cycle times

If ice is on the evaporator initiate a manual harvest cycle by performing the following keystrokes.

- Press Menu
- Scroll down to Service and press right arrow
- Scroll down to Manual Harvest and press right arrow - A new freeze cycle will start after the manual harvest cycle is complete.

NOTE: Ice must be off the evaporator before starting the procedure.

1. Disconnect the ice thickness probe from the control board, then reboot the control board by disconnecting and reconnecting line voltage to the ice machine.
  2. Wait six minutes into the freeze cycle (timing starts when the water pump energizes).
- Ice Machine cycles into harvest normally - Perform steps 1 & 2 on page 179 to test ice thickness probe and control board.
  - Ice machine will not cycle into harvest - Replace control board.

## 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

| <b>Specifications</b>                                    |   |
|--|---|
| <b>Cut-Out</b>   | <b>Cut-In</b>                             |
| 450 psig $\pm$ 7<br>(3102 kPa $\pm$ 48 31 bar $\pm$ .48) | 300 psig $\pm$ 10<br>(2068 kPa 20.68 bar) |
| Automatic Reset  |   |

### SYMPTOM

Opening the HPCO will cause the control board to initiate a 60 minute delay. The display counts down from 60 minutes to 0 minutes, at which point the ice machine attempts a restart. If the HPCO is closed the ice machine will continue to run. If the HPCO remains open after the 60 minute delay or reopens when the compressor starts, the ice machine will start another 60 minute delay period.

1. Machine is off and the display indicates "Delay XX min, HPCO Active"
2. Machine is running and the display has an alert triangle - Press left arrow to display "HPC Fault".

## CHECK PROCEDURE

### **Symptom #1 Machine is off and the display indicates “Delay xx min, HPCO Active”.**

1. Leave all wiring connectors attached and perform testing within the 60 minute time delay period
2. Check for line voltage at P9 connector on control board (Two wire connector adjacent to 9 pin connector).
  - A. Line voltage present - HPCO switch has reset and closed.
  - B. No line voltage present - HPCO switch is open. Verify pressure - Below cut-in replace HPCO - Above cut-in find root cause problem.
3. Depending on timing either wait for the delay period to end or start a new freeze cycle by cycling the power button.
  - A. HPCO is open - Another 60 minute delay period starts.
  - B. HPCO closed - A 3.5 minute harvest cycle starts followed by an ice making cycle.
4. Run the system to see if the control trips at the rated pressure. If HPCO opens at a pressure significantly lower or higher than the control setting of 450 psig replace the HPCO.
5. If the control opens at the correct pressure find the root cause - Fan motor, dirty condenser, refrigeration system issue, etc. The ice machine will go to an initial start sequence if the HPCO is closed. If the HPCO is open, another 60 minute delay period starts. When the compressor relay closes the control board checks the HPCO.

**Symptom #2 Machine is running and the display has a flashing alert triangle and indicates “HPC Fault” after the left arrow is pressed**

1. Navigate to the event log on the Service menu. Scroll down to HPC Fault EO5. Open the event and view when and how often HPCO Fault has occurred.
2. If this is a one time event it may be intermittent and caused by conditions around the unit changing. For example: High ambient temperature, water turned off to condenser (water cooled unit) etc.
3. Run the system to see if the control trips at the rated pressure. If HPCO opens at a pressure significantly lower than the control setting of 450 psig replace the HPCO.
4. If the control opens at the correct pressure (+-10 lbs) find the root cause - Fan motor, dirty condenser, refrigeration system issue, etc.

## 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

| <b>Specifications</b>  |  |   |
|--|--|---|
| <b>Model</b>   | <b>Cut-In (Close)</b>                            | <b>Cut-Out (Open)</b>                             |
| I0300 / I0320 I0520 /<br>I0450 / I0500 / I0600<br>I0660 / I0850 / JC0995 | 250 ±5<br>(1723 kPa ±.34)<br>(17.23 bar ±.34)    | 200 ±5<br>(1517 kPa ±.34)<br>(15.17 bar ±.34)     |
| I1000<br>I1400 / I1800   | 275 psig ±5<br>(1896 kPa ±34)<br>(18.96 bar±.34) | 225 psig ±5<br>(1551 kPa ±34)<br>(15.51 bar ±.34) |

### CHECK PROCEDURE

1. Verify fan motor windings are not open or grounded, and fan spins freely.
2. Connect manifold gauges to ice machine.
3. Hook voltmeter in parallel across the fan cycle control, leaving wires attached.
4. Refer to chart below.

| <b>FCC Setpoint:</b> | <b>Reading Should Be:</b> | <b>Fan Should Be:</b> |
|----------------------|---------------------------|-----------------------|
| Above Cut-In         | 0 Volts                   | Running               |
| Below Cut-Out        | Line Voltage              | Off                   |



## THERMISTORS

### FUNCTION

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

### SPECIFICATIONS

| <b>Temperature of Thermistor</b> |             | <b>Resistance</b>      |
|----------------------------------|-------------|------------------------|
| <b>°C</b>                        | <b>°F</b>   | <b>K Ohms (x 1000)</b> |
| -30° - -20°                      | -22° - -4°  | 820.85 - 466.35        |
| -20° - -10°                      | -4° - 14°   | 466.35 - 269.05        |
| -10° - 0°                        | 14° - 32°   | 269.05 - 160.70        |
| 0° - 10°                         | 32° - 50°   | 160.70 - 98.930        |
| 10° - 20°                        | 50° - 68°   | 98.930 - 62.015        |
| 20° - 30°                        | 68° - 86°   | 62.015 - 39.695        |
| 30° - 40°                        | 86° - 104°  | 39.695 - 25.070        |
| 40° - 50°                        | 104° - 122° | 25.070 - 17.481        |
| 50° - 60°                        | 122° - 140° | 17.481 - 11.860        |
| 60° - 70°                        | 140° - 158° | 11.860 - 8.1900        |
| 70° - 80°                        | 158° - 176° | 8.1900 - 5.7530        |
| 80° - 90°                        | 176° - 194° | 5.7530 - 4.1015        |
| 90° - 100°                       | 194° - 212° | 4.1015 - 2.9735        |
| 100° - 110°                      | 212° - 230° | 2.9735 - 2.1885        |
| 110° - 120°                      | 230° - 248° | 2.1885 - 1.6290        |
| 120° - 130°                      | 248° - 266° | 1.6290 - 1.2245        |
| 130° - 140°                      | 266° - 284° | 1.2245 - 0.9319        |
| 140° - 150°                      | 284° - 302° | 0.9319 - 0.7183        |
| 150° - 160°                      | 302° - 320° | 0.7183 - 0.5624        |
| 160° - 170°                      | 320° - 338° | 0.5624 - 0.4448        |
| 170° - 180°                      | 338° - 356° | 0.4448 - 0.3530        |
| 180° - 190°                      | 356° - 374° | 0.3530 - 0.2831        |
| 190° - 200°                      | 374° - 392° | 0.2831 - 0.2273        |

## Thermistor Matrix

Four thermistors are located on the ice machine. They are labeled T1, T2, T3, T4.

| TEMPERATURE SENSOR LOCATION   |               |                                |  |                      |                       |                |                 |
|---|---------------|--------------------------------|--|----------------------|-----------------------|----------------|-----------------|
| Ice Machine Description   | Evaporator In | Evaporator Out for 1st circuit | Evaporator Out for 2nd circuit or 2nd Evaporator | Compressor Discharge | Condenser Liquid Line | Receiver Inlet | Receiver Outlet |
| 22" & 30"<br>1 Evaporator with 1 Circuit<br>IMH<br>Air-Cooled & Water-Cooled    | T3            | T4                             |  | T2                   | T1                    |                |                 |
| 30" & 48"<br>1 Evaporator with 2 Circuits<br>IMH<br>Air-Cooled & Water-Cooled   |               | T4                             | T3   | T2                   | T1                    |                |                 |
| 30"<br>1 Evaporator with 1 Circuit<br>RCU<br>Air-Cooled                         | T3            | T4                             |  | T2                   |                       | T1             |                 |
| 30" & 48"<br>1 Evaporator with 2 Circuits<br>RCU<br>Air-Cooled                  |               | T4                             | T3   | T2                   |                       | T1             |                 |
| QuietCube<br>1 Evaporator with 1 Circuit<br>RCU<br>Air-Cooled                   | T3            | T4                             |  |                      |                       | T1             | T2              |
| QuietCube<br>1 Evaporator with 2 Circuits or<br>2 Evaporators<br>RCU Air-Cooled |               | T4                             | T3   |                      |                       | T1             | T2              |

## SYMPTOM

Alert icon on the display is flashing and the alert indicates a T1, T2, T3, or T4 Fault.

## CHECK PROCEDURE

- Press the Menu button.
- Scroll down to Service and press right arrow.
- Scroll down to Diagnostics and press right arrow
- Scroll down to Temp Sensors and press right arrow to display thermistor temperature readings.

NOTE: An open thermistor will display -22°F (-30°C) and a shorted thermistor displays 475°F (246°C).

### **Thermistor Test**

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 Test**

1. Disconnect thermistor from control board - The display temperature reading, dropping to -22°F (-30°C) indicates the control board is good.
2. Short thermistor pins - The display temperature reading, climbing to 475°F (246°C) indicates the control board is good.

## **HARVEST ASSIST AIR PUMP**

### FUNCTION

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

### SPECIFICATIONS

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

### CHECK PROCEDURE

1. The air pump is wired in parallel with the harvest valve - Verify the ice machine is in the harvest cycle and the harvest valve is energized.
2. If there is voltage at the air pump connector, use a volt ohm meter to verify there is no continuity through the motor windings then replace motor.

## COMPRESSOR ELECTRICAL DIAGNOSTICS

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

### Check Resistance (Ohm) Values

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

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

### SINGLE PHASE COMPRESSORS

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

### THREE PHASE COMPRESSORS

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

### CHECK MOTOR WINDINGS TO GROUND

Check continuity between all three terminals and the compressor shell or copper refrigeration line. Scrape metal surface to get good contact. If continuity is present, the compressor windings are grounded and the compressor should be replaced.

### COMPRESSOR DRAWING LOCKED ROTOR

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

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

To determine which you have:

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

### COMPRESSOR DRAWING HIGH AMPS

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

## DIAGNOSING START COMPONENTS

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

### Capacitor

Visual evidence of capacitor failure can include a bulged terminal end or a ruptured membrane. Do not assume a capacitor is good if no visual evidence is present. A good test is to install a known good substitute capacitor. Use a capacitor tester when checking a suspect capacitor. Clip the bleed resistor off the capacitor terminals before testing.

### Relay

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

### RELAY OPERATION CHECK

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

## PTCR

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

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

### **Warning**

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

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



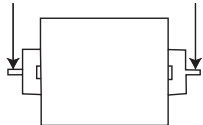
## PTCR Operation Check

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

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

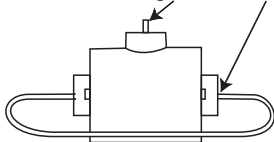
2. Wait at least 10 minutes for the PTCR to cool to room temperature.
3. Remove the PTCR from the ice machine.
4. Measure the resistance of the PTCR as shown. The resistance reading must be between:
  - Two Terminal PTCR Black = 24.5 to 45.5 ohms
  - Two Terminal PTCR Blue = 21 to 39 ohms
  - Three Terminal PTCR Tan = 10.5 to 19.5 ohms.

Measure Resistance At Ends



### Two Terminal PTCR

Measure Resistance @ Center and End



Leave Jumper Wire Attached

### Three Terminal PTCR

## Refrigeration Components

### HEAD PRESSURE CONTROL VALVE

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

### Refrigerant Charge Verification

The correct amount of refrigerant (name plate charge) is required to operate correctly at all ambient conditions.

An ice machine with an overcharge or undercharge of refrigerant may function properly at higher ambient temperatures and fails at lower ambient temperatures.

Symptoms of incorrect refrigerant amount are:

- Works during the day and malfunctions at night, and/or fails whenever the outdoor temperature drops.
- A Safety limit is stored in control board memory.

Refrigerant loss and ambient temperature are directly related to each other. As the ambient temperature drops, more refrigerant is stored in the condenser.

When the refrigerant charge and ambient temperature create an undercharge of refrigerant in the freeze cycle, the receiver dip tube will lose it’s liquid seal. Without liquid refrigerant to the TXV, the ice machine fails to make a full sheet of ice in 60 minutes and a safety limit #1 results.

NOTE: When a head pressure control valve is being replaced or refrigerant charge is suspected, verify the refrigerant charge is correct by recovering the refrigerant, weighing and comparing to the nameplate amount. Refer to Refrigerant Recovery/Evacuation” page 207 for recovery procedures.

## Freeze Cycle Operation All Models

The R404A head pressure control valve is non adjustable.

At ambient temperatures of approximately 70°F (21°C) or above, refrigerant flows through the valve from the condenser to the receiver inlet. At temperatures below this (or at higher temperatures if it is raining), the head pressure control dome's nitrogen charge closes the condenser port and opens the bypass port from the compressor discharge line.

In this modulating mode, the valve maintains minimum head pressure by building up liquid in the condenser and bypassing discharge gas directly to the receiver.

## Harvest Cycle Operation Remote Condenser Models

The head pressure control cycles into full bypass due to the pressure drop when the harvest valve opens. Refrigerant flows from the compressor to the evaporator through the harvest valve and the head pressure valve is out of the circuit.

## Diagnostics

### FREEZE CYCLE - REMOTE CONDENSER

1. Determine if the coil is clean.
2. Determine the air temperature entering the condenser.
3. Determine if the head pressure is high or low in relationship to the outside temperature. (Refer to the proper "Cycle Times/24-Hour Ice Production/ Refrigerant Pressure Charts" page 223).
4. Determine the temperature of the liquid line entering the receiver by feeling it. This line is normally warm; "body temperature."
5. Using the information gathered, refer to the chart.

NOTE: A head pressure control valve that will not bypass, will function properly with condenser air temperatures of approximately 70°F (21°C) or above. When the temperature drops below 70°F (21°C), the head pressure control valve fails to bypass and the ice machine malfunctions. Lower ambient conditions can be simulated by rinsing the condenser with cool water during the freeze cycle.

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

## Harvest Cycle

### REMOTE CONDENSER

The head pressure control cycles into full bypass due to the pressure drop when the harvest valve opens. Refrigerant flows from the compressor to the evaporator through the harvest valve and the head pressure valve is out of the circuit.

### ***Undercharge Symptoms***

- Safety limit #1 or Safety limit #2 in control board memory, a flashing triangle alert and after pressing left arrow Long Freeze or Long Harvest is displayed.
- Harvest cycle suction pressure is low.
- Harvest cycle discharge pressure is low.
- Liquid line entering receiver feels warm to hot in the freeze cycle.

### ***Overcharge Symptoms***

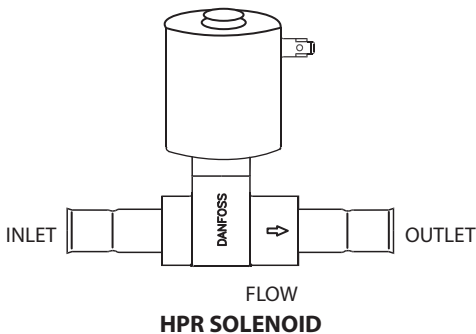
- Safety limit #2 in control board memory, a flashing triangle alert and after pressing left arrow Long Harvest is displayed.
- Harvest cycle discharge pressure is normal.
- Freeze cycle time, suction and discharge pressure are normal and the ice machine will not harvest. The sheet of ice cubes show little or no sign of melting when removed from the evaporator after the harvest cycle has been completed. (If the cubes are melted you have a release problem, clean the ice machine).

## HARVEST PRESSURE REGULATING (HPR) SYSTEM REMOTE CONDENSER ONLY

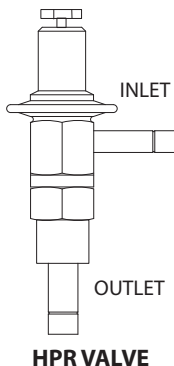
### GENERAL

The harvest pressure regulating (HPR) system includes:

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



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



## FREEZE CYCLE

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

## HARVEST CYCLE

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

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

In general, harvest cycle suction pressure rises, then stabilizes in the range of 70-100 psig (517-758 kPa). Exact pressures vary from model to model. Refer to cycle time/24 hour ice production and operational pressure charts.

## HPR DIAGNOSTICS

Steps 1 through 5 can be quickly verified without attaching a manifold gauge set or thermometer.

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

1. Liquid line warm?  
(Body temperature is normal)  
If liquid line is cooler than body temperature, refer to head pressure control valve diagnostics page 195.
2. Ice fill pattern normal?  
Refer to "Ice Formation Pattern" if ice fill is not normal page 137.

3. Freeze time normal?  
(Refer to Cycle Times/Refrigerant Pressures/24 Hour Ice Production Charts page 223)  
**Shorter freeze cycles** - Refer to head pressure control valve diagnostics page 195.  
**Longer freeze cycles** - Refer to water system checklist page 136, then refer to Refrigeration Diagnostic Procedures.
4. Harvest time is longer than normal and control board indicates safety limit #2?  
(Refer to Cycle Times/Refrigerant Pressures/24 Hour Ice Production Charts page 223)
5. Discharge line temperature is greater than 150°F (66°C) [I0850/I1000 Air/Water Only - 140°F (60°C)] at the end of the freeze cycle? (See Discharge Line Temperature Analysis on page 150)
6. Connect refrigeration manifold gauge set to the access valves on the front of the ice machine. Establish baseline by recording suction and discharge pressure and freeze & harvest cycle times. (Refer to **"Freeze Cycle Refrigeration System Operational Analysis Tables"** for data collection detail page 125).
7. Freeze cycle Head Pressure is in the range indicated in the cycle time/24 hour ice production and operational pressure chart?  
If the head pressure is low refer to head pressure control valve diagnostics page 195.
8. Freeze cycle Suction Pressure normal?  
Refer to analyzing suction pressure if suction pressure is high or low page 144.
9. Harvest cycle suction and discharge pressures are lower than indicated in the cycle times/refrigerant pressures/24 hour ice production chart?
10. Replace Harvest Pressure Regulating solenoid.



## **WATER REGULATING VALVE**

Water-Cooled Models Only

### FUNCTION

The water regulating valve maintains the freeze cycle discharge pressure.

### CHECK PROCEDURE

1. Determine if the head pressure is high or low (refer to cycle time/24 hour ice production and operational pressure chart for the model you are servicing).
2. Verify the condenser water meets specifications.
3. Adjust valve to increase or decrease discharge pressure.
4. Determine the temperature of the liquid line entering the receiver by feeling it. This line is normally warm; body temperature.
5. Using the information gathered, refer to the list for diagnosis.

### ***Problem (Freeze Cycle)***

#### ***Valve not maintaining discharge pressure.***

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

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

- Water regulating valve incorrectly set or not opening.

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

- Ice machine low on charge. Verify Total System Refrigerant Charge page 220.

## Refrigerant Recovery/Evacuation

### SELF-CONTAINED MODEL PROCEDURE

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

#### **Important**

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

#### **Important**

Replace the liquid line drier after recovering the refrigerant and before evacuating and recharging. Use only a Manitowoc (OEM) liquid line filter-drier to prevent voiding the warranty.

### Connections

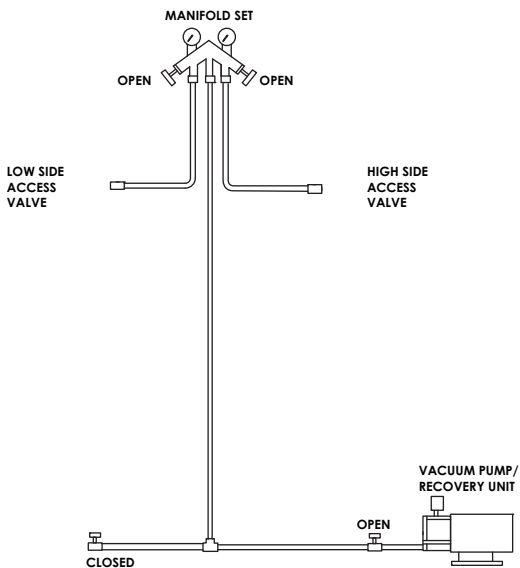
Manifold gauge sets must utilize low loss fittings to comply with U.S. Government rules and regulations.

Make these connections:

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

## Self-Contained Recovery/Evacuation

1. Press the power button and cycle the ice machine off.
2. Install manifold gauges, scale and recovery unit or two-stage vacuum pump and open high and low side on manifold gauges.



### RECOVERY/EVACUATION CONNECTIONS

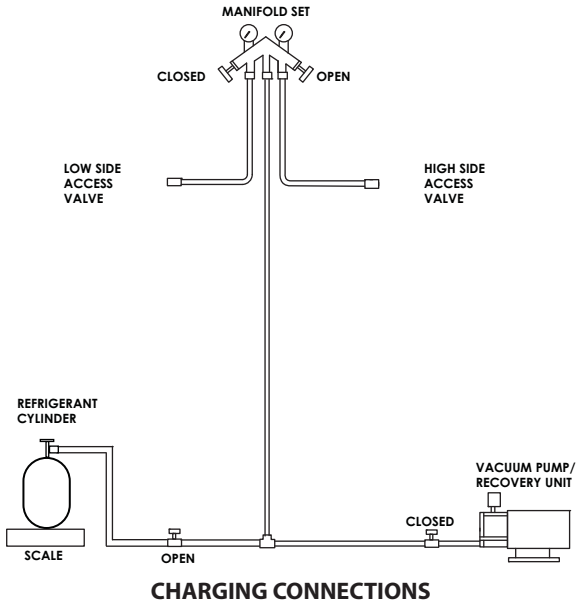
3. Perform recovery or evacuation:
  - A. Recovery: Operate the recovery unit as directed by the manufacturer's instructions.
  - B. Evacuation prior to recharging: Pull the system down to 500 microns. Then, allow the pump to run for an additional half hour. Turn off the pump and perform a standing vacuum leak check.
4. Follow the Charging Procedures.

## Self-Contained Charging Procedures

### Important

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

1. Be sure the ice machine is off.



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.
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. Close the high side on the manifold gauge set.
7. Press the power button.
8. Add any remaining refrigerant through the suction service valve (if necessary).

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

9. 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. Remove the high side low loss fitting from the access valve.
  - C. 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.
  - D. Allow the pressures to equalize while the ice machine is in the freeze cycle.
  - E. Remove the hoses from the ice machine and install the caps.

## REMOTE CONDENSER MODEL PROCEDURE

### Refrigerant Recovery/Evacuation

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

#### **Important**

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

#### **Important**

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

## CONNECTIONS

### **Important**

Recovery/evacuation of a remote system requires connections at four points for complete system evacuation.

Make these connections:

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

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

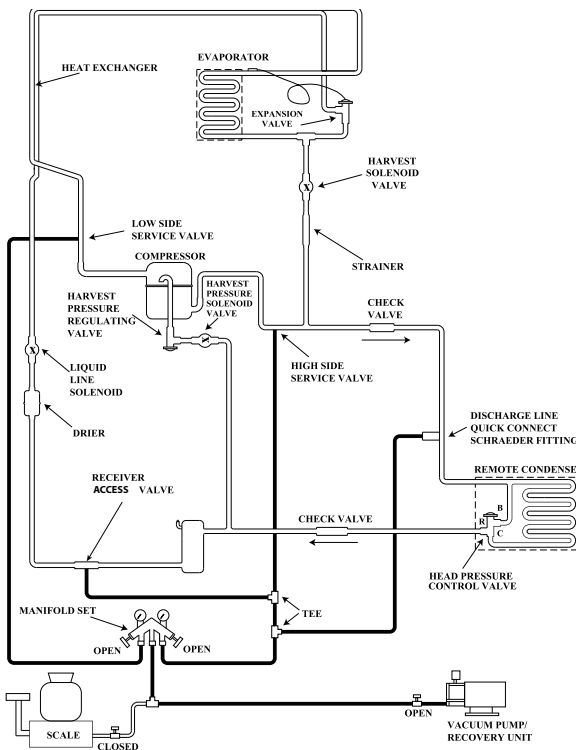
## REMOTE CONDENSER RECOVERY/EVACUATION

1. Press the power button to stop the ice machine.
2. Install manifold gauges, scale and recovery unit or two-stage vacuum pump.
3. Open high and low side on the 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 hour. Turn off the pump and perform a standing vacuum leak check.

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

5. Follow the Charging Procedures.





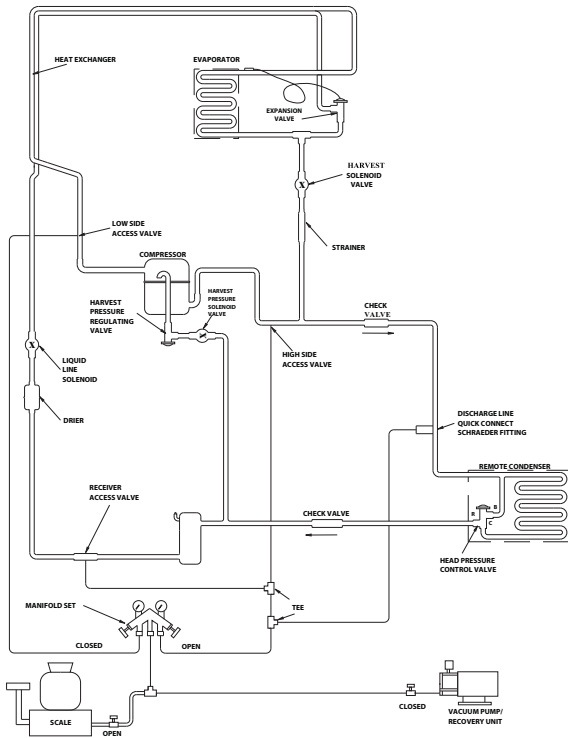
## REMOTE RECOVERY/EVACUATION CONNECTIONS

## Remote Charging Procedures

1. Close the vacuum pump valve and the low side manifold gauge valve.
2. Open the refrigerant cylinder and add the proper refrigerant charge (shown on nameplate) into the system high side (receiver outlet valve and discharge lines quick-connect fitting).
3. If the high side does not take the entire charge, close the high side on the manifold gauge set and start the ice machine. Add the remaining refrigerant through the low side (in vapor form) until the machine is fully charged.

NOTE: If an access valve core removal and installation tool is used on any of the Schrader valves, reinstall the cores before disconnecting the access tool and hose.

4. Remove the high side low loss fitting from the access valve.
5. 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.
6. Allow the pressures to equalize while the ice machine is in the freeze cycle.
7. Remove the low side hose from the access valve and install the caps.



## REMOTE CHARGING CONNECTIONS

# System Contamination Clean-Up

## General

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

### Important

Manitowoc Ice 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.

Check the chart on the next page 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<br>Refrigeration system open to atmosphere for longer than 15 minutes<br>Refrigeration test kit and/or acid oil test shows contamination<br>Leak in water cooled condenser<br>No burnout deposits in open compressor lines | Mild contamination cleanup procedure   |
| Mild Compressor Burnout symptoms<br>Oil appears clean but smells acrid<br>Refrigeration test kit or acid oil test shows harmful acid content<br>No burnout deposits in open compressor lines   | Mild contamination cleanup procedure   |
| Severe Compressor Burnout symptoms<br>Oil is discolored, acidic, and smells acrid<br>Burnout deposits found in the compressor, lines, and other components   | Severe contamination cleanup procedure |

## CLEANUP PROCEDURE

### Mild System Contamination

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

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

#### **Important**

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

4. Follow the normal evacuation procedure, except replace the evacuation step with the following:
  - A. Pull vacuum to 1000 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psig (35 kPa, 35 bar).
  - B. Pull vacuum to 500 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psig (35 kPa, 35 bar).
  - C. Change the vacuum pump oil.
  - D. Pull vacuum to 500 microns. Run the vacuum pump for 1/2 hour on self-contained models, 1 hour on remotes.

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

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

## Severe System Contamination

1. Remove the refrigerant charge.
2. Remove the compressor and inspect the refrigeration lines. If burnout deposits are found, install a new harvest valve, replace the manifold strainer, TXV and harvest pressure regulating valve.
3. Wipe away any burnout deposits from suction and discharge lines at compressor.
4. Sweep through the open system with dry nitrogen.

### Important

Refrigerant sweeps are not recommended, as they release CFCs into the atmosphere.

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

### Important

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

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 (35 kPa, .35 bar).
  - B. Change the vacuum pump oil.
  - C. Pull vacuum to 500 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psig (35 kPa, .35 bar).
  - D. Change the vacuum pump oil.
  - E. Pull vacuum to 500 microns. Run the vacuum pump for 1/2 hour on self-contained models, 1 hour on remotes.

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

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 1 psig (7 kPa, .7 bar), the filter-drier should be adequate for complete cleanup.
  - B. If the pressure drop exceeds 1 psig (7 kPa, .7 bar), change the suction line filter-drier and the liquid line drier. Repeat until the pressure drop is acceptable.
12. Operate the ice machine for 48-72 hours. Then remove the suction line drier and change the liquid line drier.
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 (air cooled only)
- Water regulating valve (water cooled only)
- High pressure cut-out control
- Low Pressure cut-out control
- High side service valve
- Low side service valve

### Important

This is a required in-warranty repair procedure.

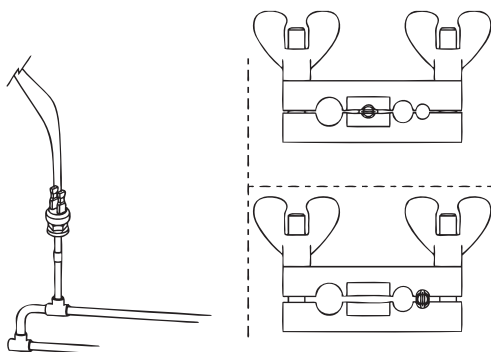
1. Disconnect power to the ice machine.
2. Follow all manufacturer's instructions supplied with the pinch-off tool. Position the pinch-off tool around the tubing as far from the pressure control as feasible. (See the figure on next page.) Clamp down on the tubing until the pinch-off is complete.

### Warning

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

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

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



### USING PINCH-OFF TOOL

## LIQUID LINE FILTER-DRIERS

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

The difference between a Manitowoc drier and an off-the-shelf drier is in filtration. A Manitowoc drier has dirt-retaining filtration, with fiberglass filters on both the inlet and outlet ends. This is very important because ice machines have a back-flushing action that takes place during every Harvest cycle.

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

The size of the filter-drier is important. The refrigerant charge is critical. Using an improperly sized filter-drier will cause the ice machine to be improperly charged with refrigerant.

### Important

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

## TOTAL SYSTEM REFRIGERANT CHARGE

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

| <b>Model</b> | <b>Air Cooled</b> | <b>Water Cooled</b> | <b>Remote</b> | <b>Additional Refrigerant for Line Sets 51'-100'</b> | <b>Maximum System Charge</b> |
|--------------|-------------------|---------------------|---------------|--|------------------------------|
| I0300        | 15 oz.            | 12 oz.              | NA            | NA   | NA                           |
| I0320        | 20 oz.            | 18 oz.              | NA            | NA   | NA                           |
| I0450        | 20 oz.            | 14 oz.              | NA            | NA   | NA                           |
| I0500        | 24 oz.            | 23 oz.              | 6 lb.         | 1.5 lb.  | 7.5 lb.                      |
| I0520        | 22 oz.            | 14 oz.              | NA            | NA   | NA                           |
| I0600        | 32 oz.            | 28 oz.              | 6.5 lb.       | 1.5 lb.  | 7.5 lb.                      |
| I0606        | 32 oz.            | 26 oz.              | 7 lb.         | 2 lb.  | 9 lb.                        |
| I0850        | 34 oz.            | 26 oz.              | 8.5 lb.       | 2 lb.  | 10.5 lb.                     |
| I0906        | 34 oz.            | 26 oz.              | 6.5 lb.       | 2 lb.  | 9.5 lb.                      |
| I1000        | 36 oz.            | 28 oz.              | 7 lb.         | 2 lb.  | 9 lb.                        |
| I1106        | 46 oz.            | 30 oz.              | 6.5 lb.       | 2 lb.  | 9.5 lb.                      |

| <b>Model</b> | <b>Air Cooled</b> | <b>Water Cooled</b> | <b>Remote</b> | <b>Additional Refrigerant for Line Sets 51'-100'</b> | <b>Maximum System Charge</b> |
|--------------|-------------------|---------------------|---------------|--|------------------------------|
| I1200        | 42 oz.            | 34 oz.              | NA            | NA   | NA                           |
| I1400        | 52 oz.            | 40 oz.              | 11 lb.        | 2 lb.  | 13 lb.                       |
| I1406        | 58 oz.            | 40 oz.              | 12 lb.        | 2 lb.  | 14 lb.                       |
| I1800        | 52 oz.            | 40 oz.              | 12.5 lb.      | 2 lb.  | 14.5 lb.                     |

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## Charts

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

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

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

- Production and cycle times are for dice cube - Half dice cube cycle times can be 2 - 3 minutes faster, depending on model and ambient temperature. Models ending in 6 (ie: ID0606A) are included in the model series cycle times & pressures.
- Regular cube production derate is 7%.
- 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.
- Refer to "Symptom #2 - Operational Analysis Table" page 125 for the list of data that must be collected for refrigeration diagnostics.
- Zero out manifold gauge set before obtaining pressure readings to avoid misdiagnosis.
- Discharge and suction pressure are highest at the beginning of the cycle. Suction pressure will drop throughout the cycle. Verify the pressures are within the range indicated.
- Record beginning of freeze cycle suction pressure one minute after water pump energizes.
- 50Hz dice and half dice production derate is 12%.
- 50Hz regular cube total production derate is 14%.

## I0300 SERIES

### I0300A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 9.6-11.5                | 10.8-12.9 | 12.3-14.6 | 1-2.5                        |
| 80/27                                       | 10.6-12.6               | 12.3-14.6 | 13.5-16.0 |                              |
| 90/32                                       | 11.8-14.0               | 13.9-16.4 | 15.0-17.7 |                              |
| 100/38                                      | 13.2-15.7               | 14.6-17.3 | 16.2-19.2 |                              |
| 110/43                                      | 15.0-17.7               | 15.8-18.7 | 17.7-20.9 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 310                                  | 280   | 250   |
| 80/27                                 | 285                                  | 250   | 230   |
| 90/32                                 | 260                                  | 225   | 210   |
| 100/38                                | 235                                  | 215   | 195   |
| 110/43                                | 210                                  | 200   | 180   |

1 Based on average ice slab weight of 2.40 - 2.80 lb.

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 195-245                       | 50-20                       | 135-160                       | 75-100                                   |
| 70/21                                      | 195-260                       | 50-20                       | 135-165                       | 80-110                                   |
| 80/27                                      | 220-290                       | 60-24                       | 150-170                       | 90-120                                   |
| 90/32                                      | 240-320                       | 60-25                       | 170-195                       | 115-135                                  |
| 100/38                                     | 285-370                       | 70-28                       | 200-220                       | 130-155                                  |
| 110/43                                     | 330-415                       | 78-32                       | 230-250                       | 150-175                                  |

1 Suction pressure drops gradually throughout the freeze cycle

## I0300W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                    | 10.0-11.9               | 11.1-13.2 | 12.3-14.6 | 1-2.5                        |
| 80/27                                    | 10.2-12.2               | 11.3-13.4 | 12.3-14.6 |                              |
| 90/32                                    | 10.4-12.4               | 11.8-14.0 | 12.6-15.0 |                              |
| 100/38                                   | 10.6-12.6               | 11.8-14.0 | 12.6-15.7 |                              |
| 110/43                                   | 10.8-12.9               | 11.8-14.0 | 12.9-15.3 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 300                                  | 275   | 250   |
| 80/27                                 | 295                                  | 270   | 250   |
| 90/32                                 | 290                                  | 260   | 245   |
| 100/38                                | 285                                  | 260   | 245   |
| 110/43                                | 280                                  | 260   | 240   |

1 Based on average ice slab weight of 2.40 - 2.80 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 220-230                       | 50-25                       | 130-170                       | 75-100                                   |
| 70/21                                      | 220-230                       | 50-28                       | 130-170                       | 85-100                                   |
| 80/27                                      | 225-245                       | 65-29                       | 130-180                       | 85-110                                   |
| 90/32                                      | 230-250                       | 65-30                       | 135-180                       | 85-115                                   |
| 100/38                                     | 230-260                       | 70-31                       | 145-190                       | 90-120                                   |
| 110/43                                     | 235-260                       | 70-31                       | 150-190                       | 90-120                                   |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 220 psig

3 Condenser Water Usage = 193 gal/100 lb ice @ 90°/70°F



## I0320 SERIES

### I0320A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 13.1-15.2               | 15.7-18.2 | 16.6-19.3 | 1-2.5                        |
| 80/27                                       | 15.7-18.2               | 17.3-20.1 | 18.9-21.9 |                              |
| 90/32                                       | 18.1-21.0               | 20.3-23.5 | 21.3-24.6 |                              |
| 100/38                                      | 21.3-24.6               | 23.0-26.6 | 24.3-28.1 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 335                                  | 285   | 270   |
| 80/27                                 | 285                                  | 260   | 240   |
| 90/32                                 | 250                                  | 225   | 215   |
| 100/38                                | 215                                  | 200   | 190   |

1 Based on average ice slab weight of 3.40 - 3.90 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I0320W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| <b>70/21</b>                             | 13.3-15.5               | 15.4-17.9 | 16.6-19.3 | 1-2.5                        |
| <b>80/27</b>                             | 13.8-16.1               | 16.0-18.6 | 17.3-20.1 |                              |
| <b>90/32</b>                             | 14.3-16.6               | 16.6-19.3 | 18.1-21.0 |                              |
| <b>100/38</b>                            | 14.8-17.2               | 17.3-20.1 | 18.9-21.9 |                              |
| <b>110/43</b>                            | 15.4-17.9               | 18.1-21.0 | 19.5-22.9 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| <b>70/21</b>                          | 330                                  | 290   | 270   |
| <b>80/27</b>                          | 320                                  | 280   | 260   |
| <b>90/32</b>                          | 310                                  | 270   | 250   |
| <b>100/38</b>                         | 300                                  | 260   | 240   |
| <b>110/43</b>                         | 290                                  | 250   | 230   |

1 Based on average ice slab weight of 3.40 - 3.90 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| <b>50/10</b>                               | 220-245                       | 60-33                       | 140-185                       | 85-105                                   |
| <b>70/21</b>                               | 220-250                       | 60-34                       | 140-190                       | 90-120                                   |
| <b>80/27</b>                               | 235-265                       | 75-38                       | 145-195                       | 90-145                                   |
| <b>90/32</b>                               | 250-300                       | 80-40                       | 145-200                       | 100-145                                  |
| <b>100/38</b>                              | 250-360                       | 85-41                       | 175-225                       | 110-150                                  |
| <b>110/43</b>                              | 250-380                       | 90-42                       | 200-240                       | 120-160                                  |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 220 psig

3 Condenser Water Usage = 193 gal/100 lb ice @ 90°/70°F

## I0450 SERIES

### I0450A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 10.2-11.9               | 11.1-12.9 | 12.1-14.1 | 1-2.5                        |
| 80/27                                       | 11.4-13.3               | 12.3-14.3 | 13.3-15.5 |                              |
| 90/32                                       | 12.5-14.5               | 13.8-16.1 | 14.8-17.2 |                              |
| 100/38                                      | 13.8-16.1               | 15.4-17.9 | 16.6-19.3 |                              |
| 110/43                                      | 16.3-18.9               | 17.7-20.5 | 19.3-22.4 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 420                                  | 390   | 360   |
| 80/27                                 | 380                                  | 355   | 330   |
| 90/32                                 | 350                                  | 320   | 300   |
| 100/38                                | 320                                  | 290   | 270   |
| 110/43                                | 275                                  | 255   | 235   |

1 Based on average ice slab weight of 3.40 - 3.90 lb.

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 195-255                       | 50-25                       | 125-185                       | 70-90                                    |
| 70/21                                      | 195-255                       | 60-25                       | 135-190                       | 80-110                                   |
| 80/27                                      | 220-275                       | 62-28                       | 135-195                       | 80-110                                   |
| 90/32                                      | 250-320                       | 70-31                       | 175-195                       | 85-115                                   |
| 100/38                                     | 290-370                       | 75-33                       | 190-215                       | 115-140                                  |
| 110/43                                     | 310-380                       | 80-33                       | 210-250                       | 120-170                                  |

1 Suction pressure drops gradually throughout the freeze cycle

## I0450W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| <b>70/21</b>                             | 9.9-11.6                | 11.1-12.9 | 12.1-14.1 | 1-2.5                        |
| <b>80/27</b>                             | 10.2-11.9               | 11.6-13.5 | 12.5-14.5 |                              |
| <b>90/32</b>                             | 10.3-12.0               | 12.1-14.1 | 12.9-15.0 |                              |
| <b>100/38</b>                            | 10.4-12.2               | 12.5-14.5 | 13.3-15.5 |                              |
| <b>110/43</b>                            | 10.7-12.5               | 12.9-15.0 | 14.3-16.6 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| <b>70/21</b>                          | 430                                  | 390   | 360   |
| <b>80/27</b>                          | 420                                  | 375   | 350   |
| <b>90/32</b>                          | 415                                  | 360   | 340   |
| <b>100/38</b>                         | 410                                  | 350   | 330   |
| <b>110/43</b>                         | 400                                  | 340   | 310   |

1 Based on average ice slab weight of 3.40 - 3.90 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| <b>50/10</b>                               | 220-230                       | 48-28                       | 130-160                       | 70-95                                    |
| <b>70/21</b>                               | 220-240                       | 52-28                       | 130-160                       | 75-100                                   |
| <b>80/27</b>                               | 230-240                       | 55-29                       | 130-160                       | 75-110                                   |
| <b>90/32</b>                               | 220-240                       | 55-30                       | 135-160                       | 80-115                                   |
| <b>100/38</b>                              | 235-240                       | 60-30                       | 170-205                       | 80-120                                   |
| <b>110/43</b>                              | 240-240                       | 60-30                       | 140-205                       | 80-120                                   |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 220 psig

3 Condenser Water Usage = 169 gal/100 lb ice @ 90°/70°F

## I0500 SERIES

### I0500A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 11.0-12.6               | 12.9-14.8 | 14.3-16.3 | 1-2.5                        |
| 80/27                                       | 12.4-14.3               | 14.9-17.0 | 15.1-17.2 |                              |
| 90/32                                       | 14.5-16.5               | 15.5-17.7 | 17.4-19.9 |                              |
| 100/38                                      | 16.2-18.5               | 17.7-20.2 | 19.9-22.7 |                              |
| 110/43                                      | 18.6-21.2               | 20.2-22.1 | 22.2-25.2 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| 70/21                                 | 530                                   | 460   | 420   |
| 80/27                                 | 475                                   | 405   | 400   |
| 90/32                                 | 415                                   | 390   | 350   |
| 100/38                                | 375                                   | 345   | 310   |
| 110/43                                | 330                                   | 305   | 280   |

1 Based on average ice slab weight of 4.60 - 5.20 lb.

2 230/50/1 is approximately 12% lower than 230/60/1

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 200-240                       | 50-28                       | 120-145                       | 70-100                                   |
| 70/21                                      | 205-245                       | 70-30                       | 120-150                       | 80-110                                   |
| 80/27                                      | 210-270                       | 70-31                       | 120-165                       | 80-110                                   |
| 90/32                                      | 270-325                       | 70-32                       | 120-190                       | 100-120                                  |
| 100/38                                     | 300-400                       | 90-34                       | 210-230                       | 130-150                                  |
| 110/43                                     | 330-425                       | 90-36                       | 220-240                       | 140-160                                  |

1 Suction pressure drops gradually throughout the freeze cycle

## I0500W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| <b>70/21</b>                             | 10.5-12.1               | 13.2-15.1 | 15.3-17.5 | 1-2.5                        |
| <b>80/27</b>                             | 11.9-13.6               | 13.7-15.7 | 15.5-17.7 |                              |
| <b>90/32</b>                             | 12.3-14.1               | 13.9-15.9 | 15.7-17.9 |                              |
| <b>100/38</b>                            | 12.6-14.4               | 14.3-16.3 | 16.2-18.5 |                              |
| <b>110/43</b>                            | 12.9-14.8               | 14.5-16.5 | 16.6-19.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| <b>70/21</b>                          | 550                                  | 450   | 395   |
| <b>80/27</b>                          | 495                                  | 435   | 390   |
| <b>90/32</b>                          | 480                                  | 430   | 385   |
| <b>100/38</b>                         | 470                                  | 420   | 375   |
| <b>110/43</b>                         | 460                                  | 415   | 365   |

1 Based on average ice slab weight of 4.60 - 5.20 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| <b>70/21</b>                               | 230-240                       | 60-33                       | 130-150                       | 95-120                                   |
| <b>80/27</b>                               | 230-240                       | 65-33                       | 130-160                       | 95-120                                   |
| <b>90/32</b>                               | 230-250                       | 70-33                       | 170-190                       | 95-120                                   |
| <b>100/38</b>                              | 235-250                       | 75-33                       | 170-190                       | 95-120                                   |
| <b>110/43</b>                              | 235-250                       | 75-33                       | 170-190                       | 95-120                                   |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 230 psig

3 Condenser Water Usage = 165 gal/100 lb ice @ 90°/70°F

## I0500N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| -20/-29 to<br>70/21                         | 12.3-14.1               | 12.7-14.7 | 13.7-15.8 | 0.75-2.0                     |
| 90/32                                       | 12.4-14.3               | 13.9-15.9 | 14.7-17.0 |                              |
| 100/38                                      | 12.8-14.9               | 14.1-16.3 | 15.2-17.7 |                              |
| 110/43                                      | 13.3-15.4               | 14.5-16.7 | 16.0-18.5 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| -20/-29 to 70/21                      | 480                                  | 445   | 415   |
| 90/32                                 | 455                                  | 430   | 390   |
| 100/38                                | 440                                  | 405   | 375   |
| 110/43                                | 425                                  | 395   | 360   |

1 Based on average ice slab weight of 4.60 - 5.20 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I0520 SERIES

### I0520A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 8.8-10.3                | 10.2-11.9 | 11.7-13.7 | 1-2.5                        |
| 80/27                                       | 9.9-11.6                | 11.4-13.3 | 13.8-16.1 |                              |
| 90/32                                       | 10.7-12.5               | 13.6-15.8 | 15.4-17.9 |                              |
| 100/38                                      | 12.5-14.5               | 14.8-17.2 | 16.6-19.3 |                              |
| 110/43                                      | 15.4-17.9               | 16.6-19.3 | 18.1-21.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 475                                  | 420   | 370   |
| 80/27                                 | 430                                  | 380   | 320   |
| 90/32                                 | 400                                  | 325   | 290   |
| 100/38                                | 350                                  | 300   | 270   |
| 110/43                                | 290                                  | 270   | 250   |

1 Based on average ice slab weight of 3.40 - 3.90 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle



## I0520W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                    | 9.1-10.7                | 10.9-12.7 | 11.7-13.7 | 1-2.5                        |
| 80/27                                    | 9.4-11.0                | 11.2-13.1 | 12.1-14.1 |                              |
| 90/32                                    | 9.6-11.3                | 11.6-13.5 | 12.5-14.5 |                              |
| 100/38                                   | 9.9-11.6                | 11.9-13.9 | 12.9-15.0 |                              |
| 110/43                                   | 10.2-11.9               | 12.3-14.3 | 13.3-15.5 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 460                                  | 395   | 370   |
| 80/27                                 | 450                                  | 385   | 360   |
| 90/32                                 | 440                                  | 375   | 350   |
| 100/38                                | 430                                  | 365   | 340   |
| 110/43                                | 420                                  | 355   | 330   |

1 Based on average ice slab weight of 3.4 - 3.9 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 70/21                                      | 230-250                       | 52-30                       | 160-190                       | 85-100                                   |
| 80/27                                      | 225-265                       | 56-30                       | 170-190                       | 90-110                                   |
| 90/32                                      | 225-270                       | 62-31                       | 170-195                       | 95-115                                   |
| 100/38                                     | 225-275                       | 65-32                       | 170-205                       | 100-102                                  |
| 110/43                                     | 235-280                       | 65-32                       | 170-205                       | 100-120                                  |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 220 psig

3 Condenser Water Usage = 190 gal/100 lb ice @ 90°/70°F

## I0600 SERIES

### I0600A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 7.6-9.0                 | 9.5-11.2  | 10.2-12.0 | 1-2.5                        |
| 80/27                                       | 8.8-10.4                | 9.9-11.7  | 10.5-12.3 |                              |
| 90/32                                       | 9.7-11.4                | 11.0-12.9 | 11.4-13.4 |                              |
| 100/38                                      | 11.1-13.1               | 12.3-14.4 | 12.8-15.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 650                                  | 540   | 505   |
| 80/27                                 | 575                                  | 520   | 495   |
| 90/32                                 | 530                                  | 475   | 460   |
| 100/38                                | 470                                  | 430   | 415   |

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

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I0600W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |          |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|----------|-----------|------------------------------|
|  | Water Temperature °F/°C |          |           |                              |
|  | 50/10                   | 70/21    | 90/32     |                              |
| 70/21                                    | 7.6-9.0                 | 9.0-10.6 | 9.7-11.4  | 1-2.5                        |
| 80/27                                    | 8.8-10.4                | 9.1-10.7 | 9.9-11.7  |                              |
| 90/32                                    | 9.6-10.6                | 9.1-10.7 | 9.9-11.7  |                              |
| 100/38                                   | 9.1-10.7                | 9.5-11.2 | 10.2-12.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 650                                  | 565   | 530   |
| 80/27                                 | 575                                  | 560   | 520   |
| 90/32                                 | 565                                  | 560   | 520   |
| 100/38                                | 560                                  | 540   | 505   |

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

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 240-250                       | 36-26                       | 140-190                       | 65-95                                    |
| 70/21                                      | 240-250                       | 36-26                       | 140-190                       | 65-95                                    |
| 80/27                                      | 240-250                       | 40-28                       | 150-195                       | 70-100                                   |
| 90/32                                      | 245-255                       | 40-29                       | 160-200                       | 70-100                                   |
| 100/38                                     | 245-260                       | 40-30                       | 170-205                       | 75-105                                   |
| 110/43                                     | 245-265                       | 40-30                       | 180-210                       | 80-110                                   |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 240 psig

3 Condenser Water Usage = 157 gal/100 lb ice @ 90°/70°F

## 10600N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| -20/-29 to<br>70/21                         | 7.9-9.4                 | 9.9-11.7  | 10.5-12.3 | 1-2.5                        |
| 80/27                                       | 9.0-10.6                | 9.9-11.7  | 10.7-12.6 |                              |
| 90/32                                       | 9.1-10.7                | 9.9-11.7  | 10.7-12.6 |                              |
| 100/38                                      | 9.9-11.7                | 10.9-12.8 | 11.7-13.7 |                              |
| 110/43                                      | 10.9-12.8               | 12.0-14.0 | 12.8-15.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| -20/-29 to 70/21                      | 630                                  | 520   | 495   |
| 80/27                                 | 565                                  | 520   | 485   |
| 90/32                                 | 560                                  | 520   | 485   |
| 100/38                                | 520                                  | 480   | 450   |
| 110/43                                | 480                                  | 440   | 415   |

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

2 Ratings with JC0895 condenser dice cubes

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| -20/-29 to<br>50/10                        | 210-240                       | 40-29                       | 130-190                       | 62-80                                    |
| 70/21                                      | 225-250                       | 50-30                       | 130-200                       | 75-95                                    |
| 80/27                                      | 245-275                       | 52-31                       | 130-200                       | 75-100                                   |
| 90/32                                      | 245-285                       | 52-32                       | 135-200                       | 80-100                                   |
| 100/38                                     | 260-315                       | 55-32                       | 140-200                       | 80-100                                   |
| 110/43                                     | 290-365                       | 60-34                       | 170-200                       | 85-100                                   |

1 Suction pressure drops gradually throughout the freeze cycle

## I0606A

### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 7.6-9.0                 | 9.5-11.2  | 10.2-12.0 | 1-2.5                        |
| 80/27                                       | 8.8-10.4                | 9.9-11.7  | 10.5-12.3 |                              |
| 90/32                                       | 9.7-11.4                | 11.0-12.9 | 11.4-13.4 |                              |
| 100/38                                      | 11.1-13.1               | 12.3-14.4 | 12.8-15.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 650                                  | 540   | 505   |
| 80/27                                 | 575                                  | 520   | 495   |
| 90/32                                 | 530                                  | 475   | 460   |
| 100/38                                | 470                                  | 430   | 415   |

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

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I0606W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |          |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|----------|-----------|------------------------------|
|  | Water Temperature °F/°C |          |           |                              |
|  | 50/10                   | 70/21    | 90/32     |                              |
| 70/21                                    | 7.6-9.0                 | 9.0-10.6 | 9.7-11.4  | 1-2.5                        |
| 80/27                                    | 8.8-10.4                | 9.1-10.7 | 9.9-11.7  |                              |
| 90/32                                    | 9.6-10.6                | 9.1-10.7 | 9.9-11.7  |                              |
| 100/38                                   | 9.1-10.7                | 9.5-11.2 | 10.2-12.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 650                                  | 565   | 530   |
| 80/27                                 | 575                                  | 560   | 520   |
| 90/32                                 | 565                                  | 560   | 520   |
| 100/38                                | 560                                  | 540   | 505   |

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

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 240-250                       | 36-26                       | 140-190                       | 65-95                                    |
| 70/21                                      | 240-250                       | 36-26                       | 140-190                       | 65-95                                    |
| 80/27                                      | 240-250                       | 40-28                       | 150-195                       | 70-100                                   |
| 90/32                                      | 245-255                       | 40-29                       | 160-200                       | 70-100                                   |
| 100/38                                     | 245-260                       | 40-30                       | 170-205                       | 75-105                                   |
| 110/43                                     | 245-265                       | 40-30                       | 180-210                       | 80-110                                   |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 240 psig

3 Condenser Water Usage = 157 gal/100 lb ice @ 90°/70°F

## I0606N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |            |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|------------|-----------|------------------------------|
|   | Water Temperature °F/°C |            |           |                              |
|   | 50/10                   | 70/21      | 90/32     |                              |
| -20/-29 to<br>70/21                         | 7.9-9.4                 | 9.9-11.7   | 10.5-12.3 | 1-2.5                        |
| 80/27                                       | 9.0-10.6                | 9.9-11.7   | 10.7-12.6 |                              |
| 90/32                                       | 9.1-10.7                | 9.9-11.7   | 10.7-12.6 |                              |
| 100/38                                      | 9.9-11.7                | 10.9-12.8  | 11.7-13.7 |                              |
| 110/43                                      | 10.9-12.8               | 12.30-14.0 | 12.8-15.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| -20/-29 to 70/21                      | 630                                   | 520   | 495   |
| 80/27                                 | 565                                   | 520   | 485   |
| 90/32                                 | 560                                   | 520   | 485   |
| 100/38                                | 520                                   | 480   | 450   |
| 110/43                                | 480                                   | 440   | 415   |

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

2 Ratings with JC0895 condenser dice cubes

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| -20/-29 to<br>50/10                        | 210-240                       | 40-29                       | 130-190                       | 62-80                                    |
| 70/21                                      | 225-250                       | 50-30                       | 130-200                       | 75-95                                    |
| 80/27                                      | 245-275                       | 52-31                       | 130-200                       | 75-100                                   |
| 90/32                                      | 245-285                       | 52-32                       | 135-200                       | 80-100                                   |
| 100/38                                     | 260-315                       | 55-32                       | 140-200                       | 80-100                                   |
| 110/43                                     | 290-365                       | 60-34                       | 170-200                       | 85-100                                   |

1 Suction pressure drops gradually throughout the freeze cycle

## I0850 SERIES

### I0850A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 9.0-10.4                | 9.8-11.2  | 10.5-12.1 | 1-2.5                        |
| 80/27                                       | 10.1-11.6               | 10.8-12.4 | 11.6-13.4 |                              |
| 90/32                                       | 11.3-13.0               | 12.9-14.8 | 12.9-14.8 |                              |
| 100/38                                      | 12.9-14.8               | 13.7-15.7 | 14.6-16.7 |                              |
| 110/43                                      | 14.9-17.0               | 15.8-18.0 | 16.5-18.8 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 785                                  | 735   | 690   |
| 80/27                                 | 715                                  | 675   | 630   |
| 90/32                                 | 645                                  | 575   | 575   |
| 100/38                                | 575                                  | 545   | 515   |
| 110/43                                | 505                                  | 480   | 460   |

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

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle



## I0850W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                    | 8.4-9.7                 | 9.5-10.9  | 10.7-12.3 | 1-2.5                        |
| 80/27                                    | 8.7-10.1                | 9.7-11.1  | 10.8-12.6 |                              |
| 90/32                                    | 9.1-10.5                | 11.4-13.1 | 11.0-12.8 |                              |
| 100/38                                   | 9.5-10.9                | 10.3-11.9 | 11.3-13.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 835                                  | 755   | 680   |
| 80/27                                 | 810                                  | 740   | 665   |
| 90/32                                 | 780                                  | 640   | 655   |
| 100/38                                | 755                                  | 700   | 645   |
| 110/43                                | 730                                  | 680   | 635   |

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

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 230-240                       | 45-28                       | 135-160                       | 70-85                                    |
| 70/21                                      | 230-240                       | 60-28                       | 135-160                       | 70-85                                    |
| 80/27                                      | 230-240                       | 65-28                       | 135-160                       | 70-85                                    |
| 90/32                                      | 240-250                       | 65-28                       | 135-160                       | 70-90                                    |
| 100/38                                     | 240-255                       | 70-30                       | 140-160                       | 75-95                                    |
| 110/43                                     | 240-265                       | 70-32                       | 140-160                       | 75-95                                    |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 230 psig

3 Condenser Water Usage = 150 gal/100 lb ice @ 90°/70°F

## I0850N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| -20/-29 to<br>70/21                         | 95-11.0                 | 11.0-12.6 | 12.0-13.7 | 0.75-2.0                     |
| 80/27                                       | 10.0-11.5               | 10.8-12.4 | 11.2-12.9 |                              |
| 90/32                                       | 11.3-13.0               | 12.1-13.8 | 13.4-15.4 |                              |
| 100/38                                      | 12.0-13.7               | 13.0-14.9 | 14.1-16.2 |                              |
| 110/43                                      | 12.8-14.6               | 13.8-15.8 | 14.9-17.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| -20/-29 to 70/21                      | 750                                  | 665   | 615   |
| 80/27                                 | 720                                  | 675   | 650   |
| 90/32                                 | 645                                  | 610   | 555   |
| 100/38                                | 615                                  | 570   | 530   |
| 110/43                                | 580                                  | 540   | 505   |

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

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I0906 SERIES

### I0906A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 8.7-10.3                | 10.2-12.1 | 10.8-12.8 | 1-2.5                        |
| 80/27                                       | 9.7-11.5                | 10.5-12.4 | 11.1-13.1 |                              |
| 90/32                                       | 10.5-12.4               | 11.9-14.1 | 12.2-14.5 |                              |
| 100/38                                      | 11.3-13.4               | 12.3-14.6 | 12.7-15.0 |                              |

<sup>1</sup> Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 875                                  | 765   | 725   |
| 80/27                                 | 800                                  | 745   | 710   |
| 90/32                                 | 745                                  | 665   | 650   |
| 100/38                                | 695                                  | 645   | 630   |

<sup>1</sup> Based on average ice slab weight of 6.2 - 7.2 lb.

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 220-255                       | 45-27                       | 125-140                       | 60-80                                    |
| 70/21                                      | 220-270                       | 45-30                       | 150-160                       | 75-90                                    |
| 80/27                                      | 230-300                       | 50-30                       | 150-160                       | 80-100                                   |
| 90/32                                      | 260-315                       | 55-32                       | 160-175                       | 90-115                                   |
| 100/38                                     | 300-395                       | 74-34                       | 180-220                       | 130-160                                  |
| 110/43                                     | 320-400                       | 78-34                       | 200-230                       | 130-160                                  |

<sup>1</sup> Suction pressure drops gradually throughout the freeze cycle

## I0906W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                    | 9.1-10.8                | 10.3-12.2 | 10.9-12.9 | 1-2.5                        |
| 80/27                                    | 10.2-12.1               | 10.4-12.3 | 11.1-13.1 |                              |
| 90/32                                    | 10.4-12.3               | 11.3-13.3 | 11.4-13.5 |                              |
| 100/38                                   | 11.6-12.5               | 11.6-13.7 | 11.9-14.1 |                              |
| 110/43                                   | 11.3-13.3               | 12.2-14.5 | 13.0-15.4 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 840                                  | 755   | 720   |
| 80/27                                 | 765                                  | 750   | 710   |
| 90/32                                 | 750                                  | 700   | 690   |
| 100/38                                | 740                                  | 680   | 665   |
| 110/43                                | 700                                  | 650   | 615   |

1 Based on average ice slab weight of 6.2 - 7.2 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 225-235                       | 45-28                       | 130-160                       | 75-90                                    |
| 70/21                                      | 225-235                       | 45-30                       | 130-160                       | 75-90                                    |
| 80/27                                      | 230-245                       | 50-30                       | 130-160                       | 75-90                                    |
| 90/32                                      | 225-235                       | 55-31                       | 130-160                       | 75-90                                    |
| 100/38                                     | 235-250                       | 55-32                       | 135-160                       | 75-95                                    |
| 110/43                                     | 235-265                       | 60-32                       | 140-160                       | 75-95                                    |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 230 psig

3 Condenser Water Usage = 141 gal/100 lb ice @ 90°/70°F

## I0906N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| -20/-29 to<br>70/21                         | 9.4-11.1                | 10.2-12.1 | 11.0-12.9 | 0.75-2.0                     |
| 80/27                                       | 9.8-11.6                | 10.4-12.3 | 11.3-13.3 |                              |
| 90/32                                       | 10.4-12.3               | 10.7-12.7 | 11.7-13.9 |                              |
| 100/38                                      | 10.9-12.9               | 11.6-13.7 | 12.2-14.5 |                              |
| 110/43                                      | 11.5-13.6               | 12.2-14.5 | 13.0-15.4 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| -20/-29 to 70/21                      | 820                                  | 765   | 720   |
| 80/27                                 | 790                                  | 750   | 700   |
| 90/32                                 | 750                                  | 730   | 675   |
| 100/38                                | 720                                  | 680   | 650   |
| 110/43                                | 685                                  | 650   | 615   |

1 Based on average ice slab weight of 6.2 - 7.2 lb.

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 240-260                       | 60-30                       | 120-145                       | 70-90                                    |
| 70/21                                      | 245-260                       | 60-30                       | 120-145                       | 75-90                                    |
| 80/27                                      | 245-270                       | 60-31                       | 120-145                       | 75-90                                    |
| 90/32                                      | 250-285                       | 60-32                       | 125-145                       | 75-95                                    |
| 100/38                                     | 285-350                       | 65-34                       | 135-165                       | 75-100                                   |
| 110/43                                     | 310-375                       | 70-36                       | 145-170                       | 75-100                                   |

1 Suction pressure drops gradually throughout the freeze cycle

## I1000 SERIES

### I1000A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 7.5-9.0                 | 8.2-9.8   | 8.8-10.4  | 0.75-2.0                     |
| 80/27                                       | 8.4-10.0                | 9.3-11.0  | 9.9-11.8  |                              |
| 90/32                                       | 9.5-11.3                | 10.6-12.6 | 11.4-13.5 |                              |
| 100/38                                      | 10.7-12.7               | 11.9-14.1 | 12.9-15.2 |                              |
| 110/43                                      | 12.2-14.5               | 13.4-15.8 | 14.7-17.4 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| 70/21                                 | 990                                   | 920   | 870   |
| 80/27                                 | 900                                   | 830   | 780   |
| 90/32                                 | 810                                   | 735   | 690   |
| 100/38                                | 730                                   | 665   | 620   |
| 110/43                                | 650                                   | 600   | 550   |

1 Based on average ice slab weight of 6.2 - 7.2 lb.

2 230/50/1 is approximately 12% lower than 230/60/1

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I1000W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |          |          | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|----------|----------|------------------------------|
|  | Water Temperature °F/°C |          |          |                              |
|  | 50/10                   | 70/21    | 90/32    |                              |
| 70/21                                    | 7.4-8.9                 | 8.5-10.1 | 9.4-11.1 | 0.75-2.0                     |
| 90/32                                    | 7.8-9.3                 | 8.9-10.6 | 9.7-11.5 |                              |
| 100/38                                   | 7.9-9.4                 | 9.1-10.8 | 9.8-11.6 |                              |
| 110/43                                   | 8.0-9.5                 | 8.0-10.9 | 9.9-11.8 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 1000                                 | 895   | 820   |
| 80/27                                 | 980                                  | 875   | 810   |
| 90/32                                 | 960                                  | 855   | 800   |
| 100/38                                | 950                                  | 845   | 790   |
| 110/43                                | 940                                  | 835   | 780   |

1 Based on average ice slab weight of 6.2 - 7.2 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 220 psig

3 Condenser Water Usage = 180 gal/100 lb ice @ 90°/70°F

## I1000N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 7.7-9.2                 | 8.6-10.3  | 9.5-11.3  | 0.75-2.0                     |
| 80/27                                       | 8.5-10.1                | 9.5-11.3  | 10.4-12.3 |                              |
| 90/32                                       | 9.5-11.3                | 10.6-12.6 | 11.4-13.5 |                              |
| 100/38                                      | 10.7-12.7               | 11.6-13.8 | 12.4-14.7 |                              |
| 110/43                                      | 12.2-14.5               | 12.7-15.0 | 13.6-16.1 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 960                                  | 870   | 800   |
| 80/27                                 | 880                                  | 800   | 740   |
| 90/32                                 | 800                                  | 725   | 680   |
| 100/38                                | 720                                  | 670   | 630   |
| 110/43                                | 640                                  | 620   | 580   |

1 Based on average ice slab weight of 6.2 - 7.2 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle



## I1006 SERIES

### I1006A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 7.5-9.0                 | 8.2-9.8   | 8.8-10.4  | 0.75-2.0                     |
| 80/27                                       | 8.4-10.0                | 9.3-11.0  | 9.9-11.8  |                              |
| 90/32                                       | 9.5-11.3                | 10.6-12.6 | 11.4-13.5 |                              |
| 100/38                                      | 10.7-12.7               | 11.9-14.1 | 12.9-15.2 |                              |
| 110/43                                      | 12.2-14.5               | 13.4-15.8 | 14.7-17.4 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| 70/21                                 | 990                                   | 920   | 870   |
| 80/27                                 | 900                                   | 830   | 780   |
| 90/32                                 | 810                                   | 735   | 690   |
| 100/38                                | 730                                   | 665   | 620   |
| 110/43                                | 650                                   | 600   | 550   |

1 Based on average ice slab weight of 6.2 - 7.2 lb.

2 230/50/1 is approximately 12% lower than 230/60/1

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I1006W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |          |          | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|----------|----------|------------------------------|
|  | Water Temperature °F/°C |          |          |                              |
|  | 50/10                   | 70/21    | 90/32    |                              |
| 70/21                                    | 7.4-8.9                 | 8.5-10.1 | 9.4-11.1 | 0.75-2.0                     |
| 90/32                                    | 7.8-9.3                 | 8.9-10.6 | 9.7-11.5 |                              |
| 100/38                                   | 7.9-9.4                 | 9.1-10.8 | 9.8-11.6 |                              |
| 110/43                                   | 8.0-9.5                 | 8.0-10.9 | 9.9-11.8 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 1000                                 | 895   | 820   |
| 80/27                                 | 980                                  | 875   | 810   |
| 90/32                                 | 960                                  | 855   | 800   |
| 100/38                                | 950                                  | 845   | 790   |
| 110/43                                | 940                                  | 835   | 780   |

1 Based on average ice slab weight of 6.2 - 7.2 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 220 psig

3 Condenser Water Usage = 180 gal/100 lb ice @ 90°/70°F

## I1006N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 7.7-9.2                 | 8.6-10.3  | 9.5-11.3  | 0.75-2.0                     |
| 80/27                                       | 8.5-10.1                | 9.5-11.3  | 10.4-12.3 |                              |
| 90/32                                       | 9.5-11.3                | 10.6-12.6 | 11.4-13.5 |                              |
| 100/38                                      | 10.7-12.7               | 11.6-13.8 | 12.4-14.7 |                              |
| 110/43                                      | 12.2-14.5               | 12.7-15.0 | 13.6-16.1 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 960                                  | 870   | 800   |
| 80/27                                 | 880                                  | 800   | 740   |
| 90/32                                 | 800                                  | 725   | 680   |
| 100/38                                | 720                                  | 670   | 630   |
| 110/43                                | 640                                  | 620   | 580   |

1 Based on average ice slab weight of 6.2 - 7.2 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I1200 SERIES

### I1200A

#### Self-Contained Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 8.3-9.2                 | 8.9-9.9   | 9.7-10.7  | 0.75-2.0                     |
| 80/27                                       | 9.2-10.2                | 9.9-10.9  | 10.6-11.8 |                              |
| 90/32                                       | 10.2-11.3               | 10.9-12.1 | 11.8-13.1 |                              |
| 100/38                                      | 11.4-12.6               | 12.3-13.5 | 13.3-14.7 |                              |
| 110/43                                      | 12.9-14.2               | 13.9-15.4 | 15.1-16.7 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| 70/21                                 | 1100                                  | 1035  | 965   |
| 80/27                                 | 1010                                  | 950   | 890   |
| 90/32                                 | 925                                   | 870   | 810   |
| 100/38                                | 840                                   | 785   | 730   |
| 110/43                                | 750                                   | 700   | 650   |

1 Based on average ice slab weight of 7.5 - 8.2 lb.

2 230/50/1 is approximately 12% lower than 230/60/1

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 195-255                       | 40-20                       | 135-155                       | 65-85                                    |
| 70/21                                      | 220-280                       | 50-22                       | 140-180                       | 70-90                                    |
| 80/27                                      | 240-300                       | 50-24                       | 155-180                       | 75-95                                    |
| 90/32                                      | 265-340                       | 55-25                       | 165-200                       | 85-100                                   |
| 100/38                                     | 310-390                       | 60-28                       | 200-215                       | 95-110                                   |
| 110/43                                     | 340-430                       | 60-30                       | 200-240                       | 105-125                                  |

1 Suction pressure drops gradually throughout the freeze cycle

## I1200W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                    | 7.8-8.6                 | 8.8-9.7   | 10.1-11.1 | 0.75-2.0                     |
| 80/27                                    | 8.9-9.9                 | 10.1-11.1 | 11.5-12.7 |                              |
| 90/32                                    | 9.0-10.0                | 10.5-11.6 | 11.6-12.8 |                              |
| 100/38                                   | 9.1-10.1                | 10.3-12.1 | 11.7-12.9 |                              |
| 110/43                                   | 9.2-10.2                | 11.1-12.2 | 11.8-13.0 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| 70/21                                 | 1165                                  | 1050  | 935   |
| 80/27                                 | 1040                                  | 935   | 830   |
| 90/32                                 | 1030                                  | 900   | 825   |
| 100/38                                | 1020                                  | 870   | 820   |
| 110/43                                | 1010                                  | 860   | 815   |

1 Based on average ice slab weight of 7.5 - 8.2 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 225-230                       | 40-20                       | 150-175                       | 70-85                                    |
| 70/21                                      | 225-230                       | 42-20                       | 150-185                       | 70-90                                    |
| 80/27                                      | 230-250                       | 44-22                       | 160-190                       | 80-95                                    |
| 90/32                                      | 240-270                       | 45-22                       | 170-195                       | 80-105                                   |
| 100/38                                     | 240-280                       | 50-22                       | 175-205                       | 85-110                                   |
| 110/43                                     | 240-280                       | 50-23                       | 180-215                       | 85-115                                   |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 220 psig

3 Condenser Water Usage = 169 gal/100 lb ice @ 90°/70°F

## I1400 SERIES

### I1400A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 8.3-9.5                 | 9.1-10.4  | 10.2-11.6 | 0.75-2.0                     |
| 80/27                                       | 9.1-10.4                | 9.9-11.3  | 11.2-12.8 |                              |
| 90/32                                       | 9.6-11.0                | 11.3-12.8 | 12.0-13.7 |                              |
| 100/38                                      | 10.7-12.2               | 12.6-14.3 | 13.6-15.4 |                              |
| 110/43                                      | 12.0-13.6               | 14.3-16.2 | 14.5-16.5 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| 70/21                                 | 1500                                  | 1395  | 1260  |
| 80/27                                 | 1395                                  | 1295  | 1160  |
| 90/32                                 | 1325                                  | 1155  | 1090  |
| 100/38                                | 1205                                  | 1050  | 980   |
| 110/43                                | 1095                                  | 935   | 920   |

1 Based on average ice slab weight of 10.25 - 11.50 lb.

2 230/50/1 is approximately 12% lower than 230/60/1

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I1400W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                    | 8.2-9.4                 | 9.9-11.3  | 10.5-12.0 | 0.75-2.0                     |
| 80/27                                    | 8.3-9.5                 | 10.0-11.4 | 10.6-12.1 |                              |
| 90/32                                    | 8.4-9.6                 | 10.1-11.5 | 10.7-12.2 |                              |
| 100/38                                   | 8.4-9.7                 | 10.2-11.6 | 10.7-12.2 |                              |
| 110/43                                   | 8.6-9.7                 | 10.3-11.7 | 10.8-12.3 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 1515                                 | 1295  | 1225  |
| 80/27                                 | 1505                                 | 1285  | 1215  |
| 90/32                                 | 1495                                 | 1275  | 1210  |
| 100/38                                | 1485                                 | 1265  | 1205  |
| 110/43                                | 1475                                 | 1255  | 1200  |

1 Based on average ice slab weight of 10.25 - 11.50 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 230 psig

3 Condenser Water Usage = 154 gal/100 lb ice @ 90°/70°F

## I1400N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 8.8-10.1                | 9.9-11.3  | 10.9-12.3 | 0.75-2.0                     |
| 80/27                                       | 9.0-10.2                | 10.1-11.5 | 11.0-12.5 |                              |
| 90/32                                       | 9.2-10.5                | 10.6-12.1 | 11.4-13.0 |                              |
| 100/38                                      | 9.9-11.3                | 11.6-13.2 | 12.6-14.3 |                              |
| 110/43                                      | 11.1-12.6               | 11.8-13.4 | 13.7-15.6 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 1430                                 | 1290  | 1200  |
| 80/27                                 | 1410                                 | 1270  | 1180  |
| 90/32                                 | 1380                                 | 1220  | 1140  |
| 100/38                                | 1290                                 | 1130  | 1050  |
| 110/43                                | 1175                                 | 1110  | 970   |

1 Based on average ice slab weight of 10.25- 11.50 lb.

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle



## I1406 SERIES

### I1406A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 11.0-12.6               | 12.1-14.0 | 13.2-14.6 | 0.75-2.0                     |
| 80/27                                       | 12.4-13.3               | 13.3-14.7 | 14.3-15.2 |                              |
| 90/32                                       | 13.2-14.6               | 14.0-15.5 | 15.1-16.9 |                              |
| 100/38                                      | 14.0-15.5               | 15.2-17.1 | 16.6-19.3 |                              |
| 110/43                                      | 15.6-17.3               | 16.5-20.0 | 19.3-21.4 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| 70/21                                 | 1530                                  | 1400  | 1160  |
| 80/27                                 | 1450                                  | 1370  | 1295  |
| 90/32                                 | 1305                                  | 1235  | 1000  |
| 100/38                                | 1235                                  | 1155  | 890   |
| 110/43                                | 1105                                  | 950   | 795   |

1 Based on average ice slab weight of 10.25 - 11.50 lb.

2 230/50/1 is approximately 12% lower than 230/60/1

#### OPERATING PRESSURES

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

1 Suction pressure drops gradually throughout the freeze cycle

## I1406W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                    | 11.0-12.9               | 12.1-14.2 | 13.3-14.6 | 0.75-2.0                     |
| 80/27                                    | 11.2-13.2               | 12.3-14.4 | 13.3-14.6 |                              |
| 90/32                                    | 11.4-13.4               | 12.7-15.0 | 13.6-16.0 |                              |
| 100/38                                   | 11.6-13.6               | 12.8-15.0 | 13.6-16.7 |                              |
| 110/43                                   | 11.8-13.9               | 12.8-15.0 |           |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 1495                                 | 1360  | 1200  |
| 80/27                                 | 1485                                 | 1340  | 1195  |
| 90/32                                 | 1390                                 | 1325  | 1195  |
| 100/38                                | 1380                                 | 1275  | 1170  |
| 110/43                                | 1370                                 | 1205  | 1140  |

1 Based on average ice slab weight of 10.25 - 11.50 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 240-250                       | 40-24                       | 155-185                       | 75-95                                    |
| 70/21                                      | 240-250                       | 40-26                       | 165-185                       | 75-95                                    |
| 80/27                                      | 240-250                       | 50-27                       | 165-185                       | 75-95                                    |
| 90/32                                      | 245-255                       | 50-27                       | 185-205                       | 85-105                                   |
| 100/38                                     | 245-260                       | 54-28                       | 205-225                       | 95-120                                   |
| 110/43                                     | 245-265                       | 60-29                       | 225-255                       | 105-130                                  |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 230 psig

3 Condenser Water Usage = 154 gal/100 lb ice @ 90°/70°F

## I1406N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 12.3-14.1               | 12.7-14.7 | 13.7-15.8 | 0.75-2.0                     |
| 80/27                                       | 12.3-14.2               | 12.8-14.9 | 14.0-16.1 |                              |
| 90/32                                       | 12.4-14.3               | 13.9-15.9 | 14.7-17.0 |                              |
| 100/38                                      | 12.8-14.9               | 14.1-16.3 | 15.3-17.7 |                              |
| 110/43                                      | 13.3-15.4               | 14.5-16.7 | 16.0-18.5 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 1490                                 | 1360  | 1240  |
| 80/27                                 | 1435                                 | 1325  | 1235  |
| 90/32                                 | 1355                                 | 1295  | 1230  |
| 100/38                                | 1290                                 | 1185  | 1100  |
| 110/43                                | 1160                                 | 1275  | 1000  |

1 Based on average ice slab weight of 10.25- 11.50 lb.

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 205-220                       | 50-32                       | 100-150                       | 75-100                                   |
| 70/21                                      | 225-260                       | 60-32                       | 110-160                       | 75-100                                   |
| 80/27                                      | 240-170                       | 60-32                       | 110-160                       | 75-100                                   |
| 90/32                                      | 250-270                       | 60-32                       | 120-160                       | 80-100                                   |
| 100/38                                     | 300-375                       | 85-35                       | 130-170                       | 80-100                                   |
| 110/43                                     | 310-375                       | 90-36                       | 130-170                       | 80-100                                   |

1 Suction pressure drops gradually throughout the freeze cycle

## I1800 SERIES

### I1800A

#### Self-Contained Air-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 8.8-10.1                | 9.6-11.0  | 10.5-11.9 | 0.75-2.0                     |
| 80/27                                       | 9.6-11.0                | 10.7-12.2 | 11.5-13.1 |                              |
| 90/32                                       | 10.4-11.8               | 11.8-13.4 | 12.6-14.3 |                              |
| 100/38                                      | 11.4-13.0               | 13.1-14.9 | 14.1-16.0 |                              |
| 110/43                                      | 12.8-14.5               | 14.9-16.9 | 16.1-18.2 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>12</sup> |       |       |
|---------------------------------------|---------------------------------------|-------|-------|
|                                       | 50/10                                 | 70/21 | 90/32 |
| 70/21                                 | 1840                                  | 1710  | 1590  |
| 80/27                                 | 1710                                  | 1560  | 1460  |
| 90/32                                 | 1600                                  | 1430  | 1350  |
| 100/38                                | 1470                                  | 1300  | 1220  |
| 110/43                                | 1330                                  | 1160  | 1080  |

1 Based on average ice slab weight of 13.20 - 14.80 lb.

2 230/50/1 is approximately 12% lower than 230/60/1

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 220-280                       | 40-24                       | 150-180                       | 70-90                                    |
| 70/21                                      | 220-280                       | 40-26                       | 160-180                       | 70-90                                    |
| 80/27                                      | 240-290                       | 50-27                       | 160-180                       | 70-90                                    |
| 90/32                                      | 260-330                       | 50-27                       | 180-200                       | 80-100                                   |
| 100/38                                     | 300-270                       | 54-28                       | 200-220                       | 90-115                                   |
| 110/43                                     | 330-410                       | 60-30                       | 220-250                       | 100-130                                  |

1 Suction pressure drops gradually throughout the freeze cycle

## I1800W

### Self-Contained Water-Cooled Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Around Ice<br>Machine °F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|--|-------------------------|-----------|-----------|------------------------------|
|  | Water Temperature °F/°C |           |           |                              |
|  | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                    | 8.8-10.0                | 9.8-11.2  | 11.0-12.5 | 0.75-2.0                     |
| 80/27                                    | 8.9-10.2                | 10.0-11.3 | 11.1-12.6 |                              |
| 90/32                                    | 9.0-10.3                | 10.1-11.5 | 11.2-12.7 |                              |
| 100/38                                   | 9.1-10.4                | 10.3-11.7 | 11.3-12.8 |                              |
| 110/43                                   | 9.2-10.5                | 10.5-11.9 | 11.3-12.9 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Around Ice<br>Machine °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 1850                                 | 1680  | 1520  |
| 80/27                                 | 1820                                 | 1660  | 1510  |
| 90/32                                 | 1810                                 | 1640  | 1500  |
| 100/38                                | 1780                                 | 1610  | 1490  |
| 110/43                                | 1790                                 | 1590  | 1480  |

1 Based on average ice slab weight of 13.20 - 14.80 lb.

#### OPERATING PRESSURES

| Air Temp<br>Around Ice<br>Machine<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 230-240                       | 45-25                       | 145-165                       | 65-80                                    |
| 70/21                                      | 220-280                       | 40-26                       | 160-180                       | 70-90                                    |
| 80/27                                      | 230-240                       | 45-25                       | 145-165                       | 65-80                                    |
| 90/32                                      | 240-270                       | 50-25                       | 150-190                       | 70-90                                    |
| 100/38                                     | 240-280                       | 55-25                       | 155-190                       | 70-90                                    |
| 110/43                                     | 240-280                       | 55-25                       | 155-190                       | 70-90                                    |

1 Suction pressure drops gradually throughout the freeze cycle

2 Water regulating valve set to maintain 230 psig

3 Condenser Water Usage = 181 gal/100 lb ice @ 90°/70°F

## I1800N

### Remote Air-Cooled Condenser Model

Characteristics vary depending on operating conditions.

#### CYCLE TIMES

Freeze Time + Harvest Time = Total Cycle Time

| Air Temp.<br>Entering<br>Condenser<br>°F/°C | Freeze Time             |           |           | Harvest<br>Time <sup>1</sup> |
|---|-------------------------|-----------|-----------|------------------------------|
|   | Water Temperature °F/°C |           |           |                              |
|   | 50/10                   | 70/21     | 90/32     |                              |
| 70/21                                       | 9.2-10.5                | 10.1-11.5 | 10.0-12.4 | 0.75-2.0                     |
| 80/27                                       | 9.6-11.0                | 10.6-12.1 | 11.5-13.0 |                              |
| 90/32                                       | 10.2-11.6               | 11.2-12.8 | 12.2-13.9 |                              |
| 100/38                                      | 11.0-12.5               | 12.1-13.8 | 13.3-15.1 |                              |
| 110/43                                      | 11.9-13.6               | 13.2-15.0 | 14.7-16.6 |                              |

1 Times in minutes

#### 24 HOUR ICE PRODUCTION

| Air Temp. Entering<br>Condenser °F/°C | Water Temperature °F/°C <sup>1</sup> |       |       |
|---------------------------------------|--------------------------------------|-------|-------|
|                                       | 50/10                                | 70/21 | 90/32 |
| 70/21                                 | 1775                                 | 1635  | 1535  |
| 80/27                                 | 1705                                 | 1565  | 1465  |
| 90/32                                 | 1625                                 | 1495  | 1385  |
| 100/38                                | 1525                                 | 1395  | 1285  |
| 110/43                                | 1415                                 | 1295  | 1175  |

1 Based on average ice slab weight of 13.20- 14.80 lb.

#### OPERATING PRESSURES

| Air Temp<br>Entering<br>Condenser<br>°F/°C | Freeze Cycle                  |                             | Harvest Cycle                 |  |
|--|-------------------------------|-----------------------------|-------------------------------|--|
|  | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG | Discharge<br>Pressure<br>PSIG | Suction<br>Pressure<br>PSIG <sup>1</sup> |
| 50/10                                      | 230-265                       | 38-24                       | 100-160                       | 70-85                                    |
| 70/21                                      | 240-265                       | 40-26                       | 110-170                       | 70-90                                    |
| 80/27                                      | 250-275                       | 45-28                       | 110-180                       | 70-95                                    |
| 90/32                                      | 250-300                       | 52-29                       | 110-180                       | 70-95                                    |
| 100/38                                     | 275-335                       | 55-31                       | 110-185                       | 75-100                                   |
| 110/43                                     | 310-385                       | 55-32                       | 120-190                       | 80-110                                   |

1 Suction pressure drops gradually throughout the freeze cycle

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# Diagrams

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## Wiring Diagrams

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

### **Warning**

Always disconnect power before working on electrical circuitry.

Some components are wired differently on energy efficient machines. Please verify your model number (page 19) to reference the correct diagrams.

### **WIRING DIAGRAM LEGEND**

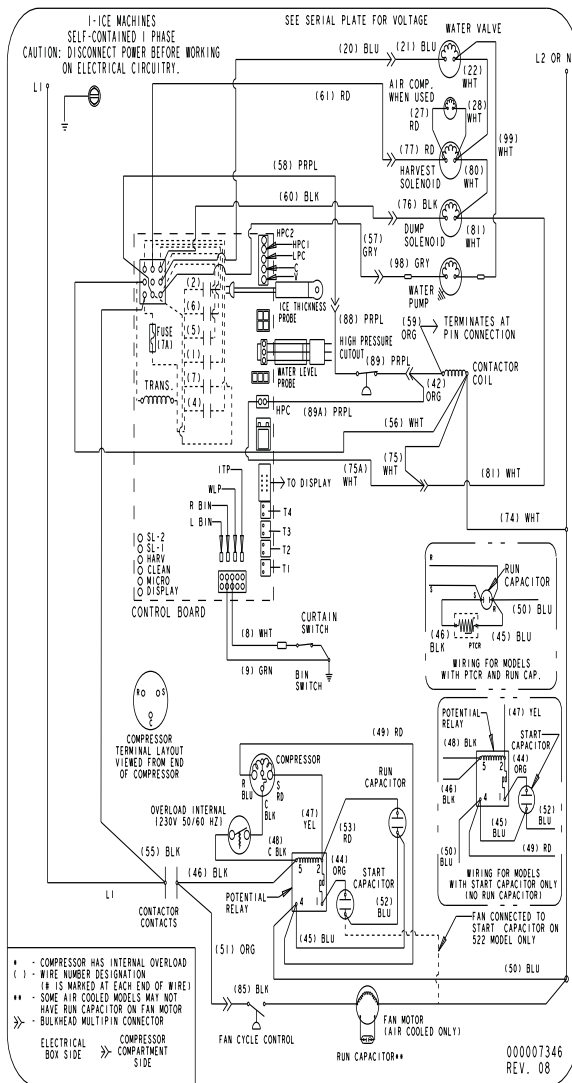
The following symbols are used on all of the wiring diagrams:

- \* Internal Compressor Overload  
(Some models have external compressor overloads)
- \*\* Fan Motor Run Capacitor  
(Some models do not incorporate fan motor run capacitor)
- ( ) Wire Number Designation  
(The number is marked at each end of the wire)
- >>— Multi-Pin Connection  
(Electrical Box Side) —>>—  
(Compressor Compartment Side)



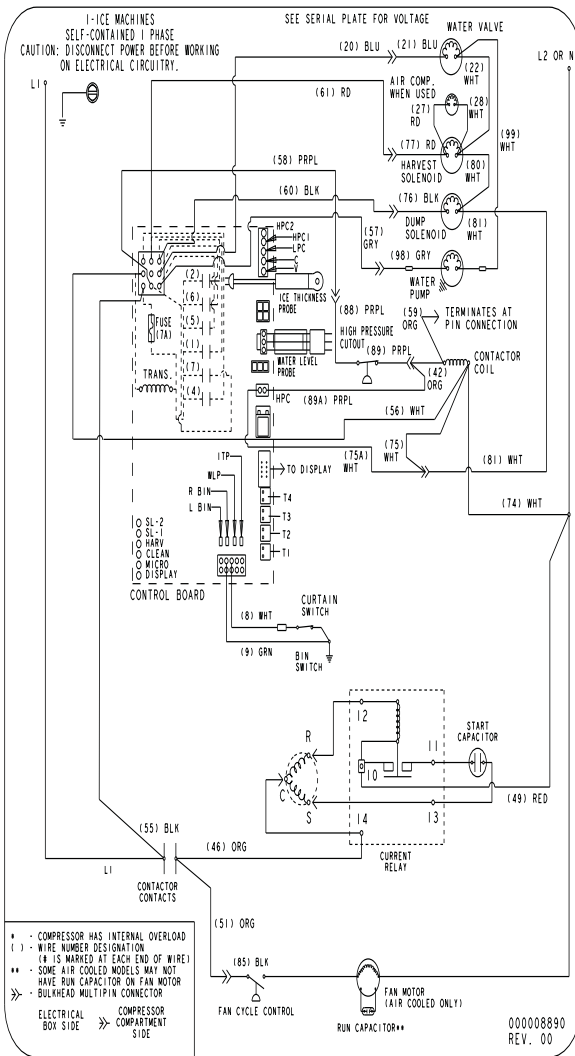
# I0300/I0450/I0500/I0520

## Self Contained Air & Water-cooled - 1 Ph



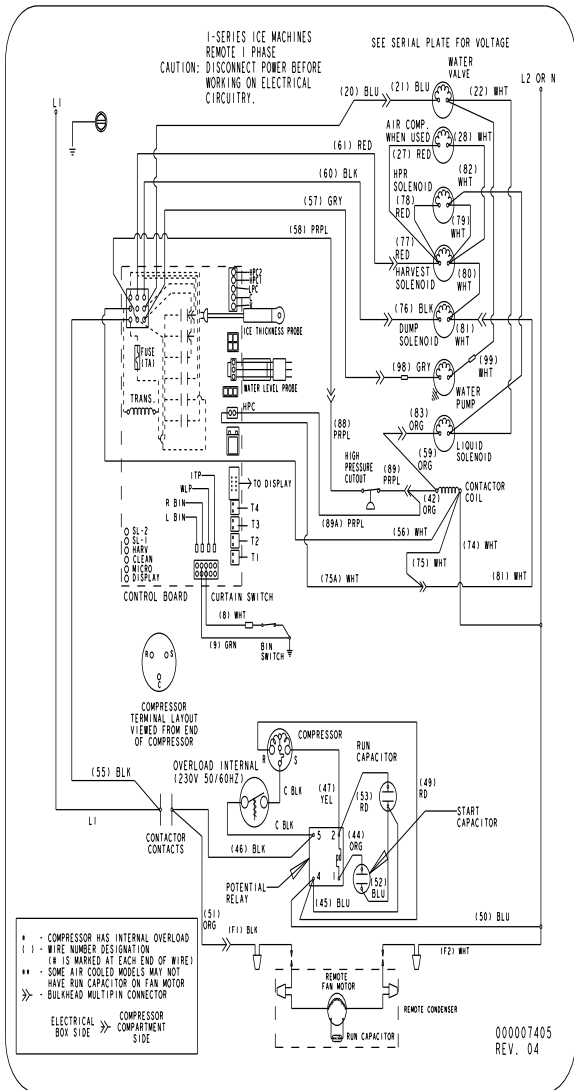
# I0320

## Self Contained Air & Water-cooled - 1 Ph



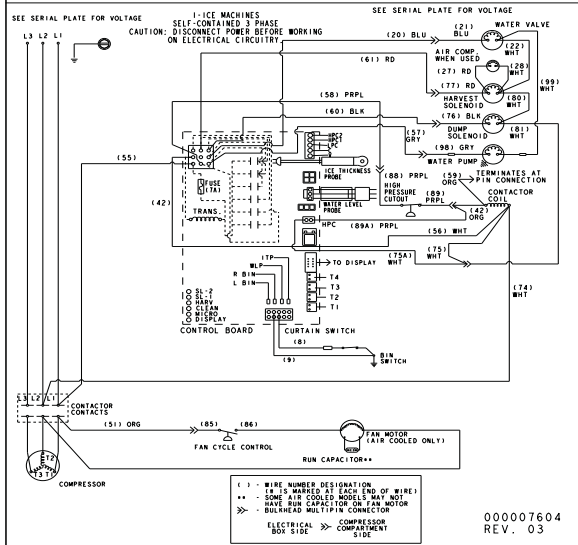
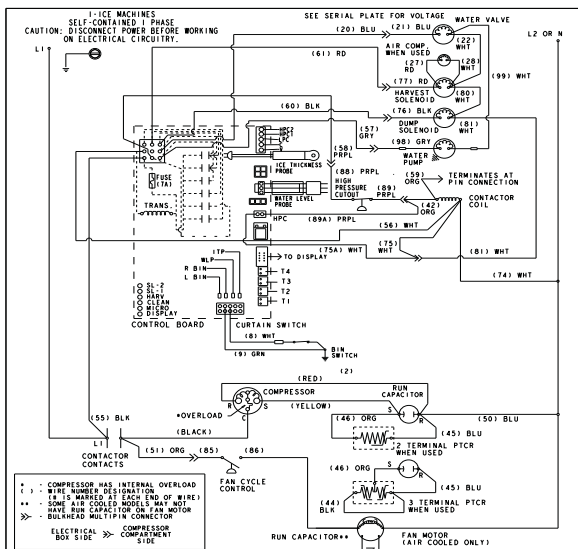
# I0500

## Remote Air-cooled - 1Ph



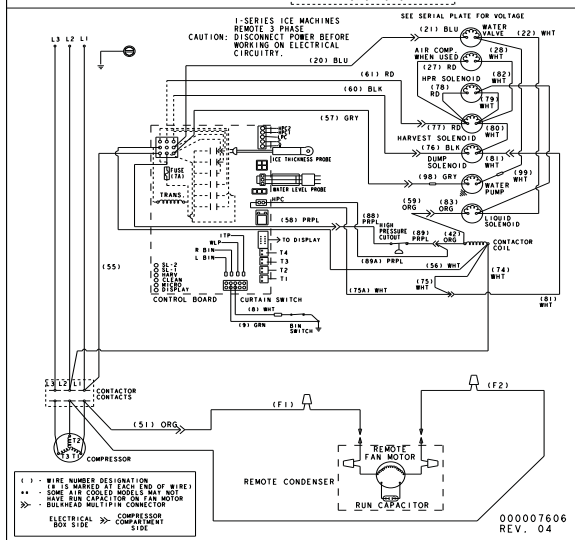
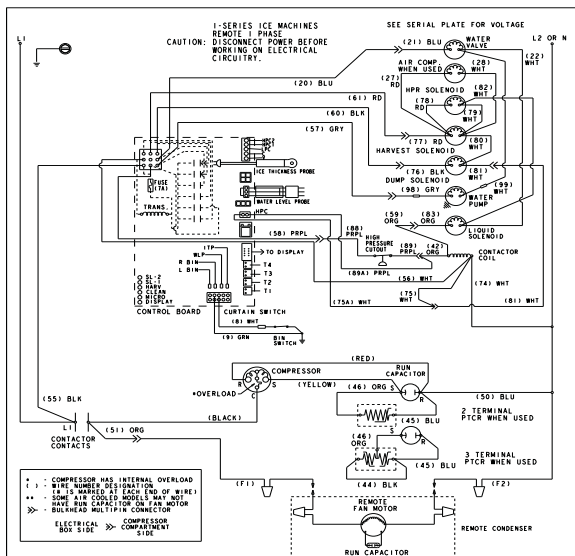
# I0600/I0850/I1000/I1200

## Self Contained Air & Water-cooled - 1 & 3 Ph



# I0600/I0850/I1000

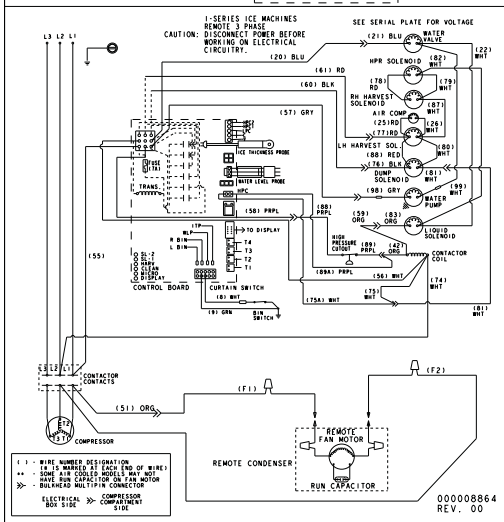
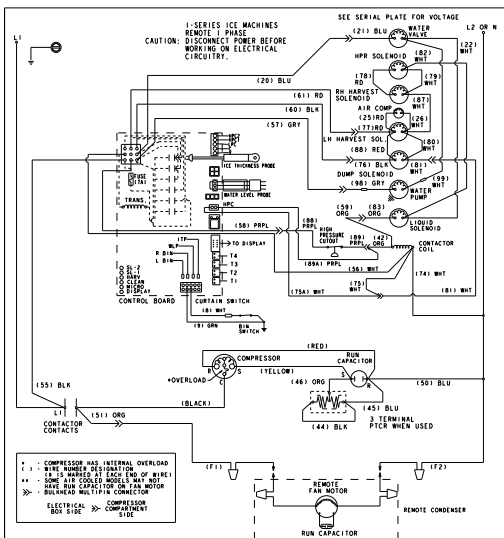
## Remote Condenser Air-cooled - 1 & 3 Ph



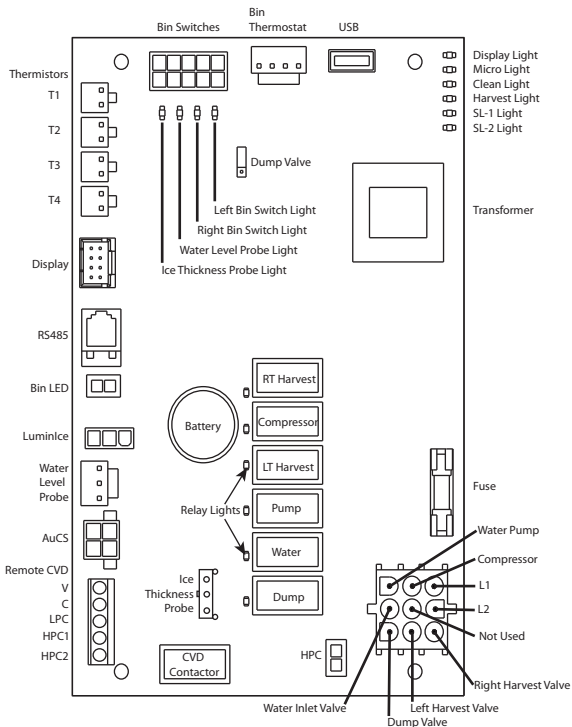


# I1400/I1800

## Remote Air-cooled - 1 & 3 Ph



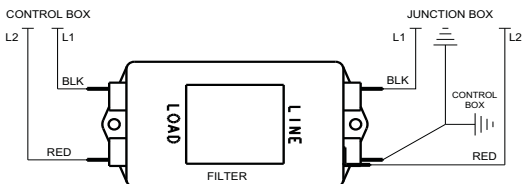
# Electronic Control Board





## ELECTRICAL NOISE FILTER

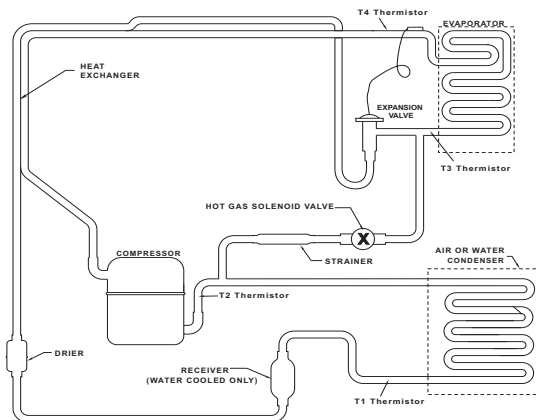
Filter is installed to the incoming line voltage power supply on Korean models.



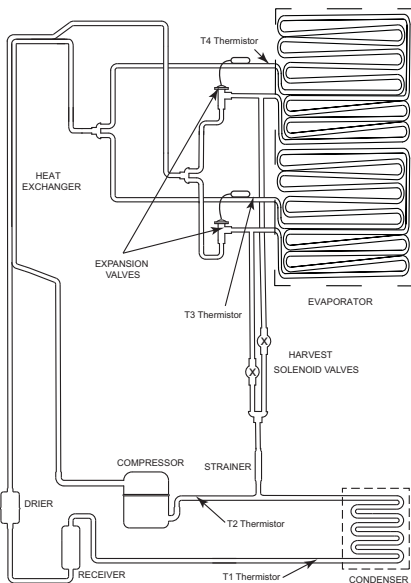
# Refrigeration Tubing Schematics

## SELF-CONTAINED AIR OR WATER-COOLED

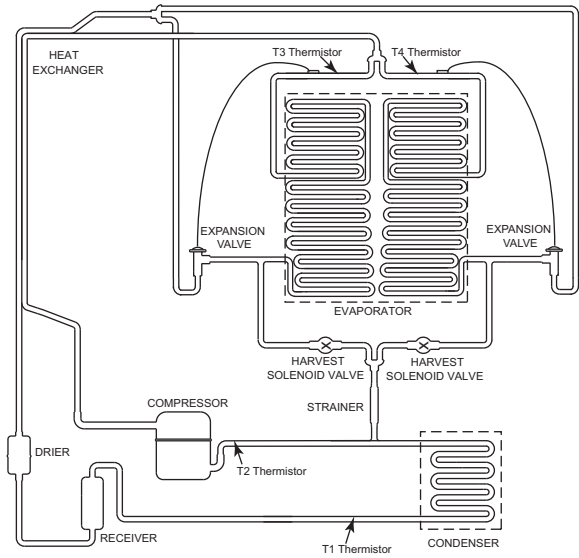
I0300/I0320/I0520/I0450/I0500/I0600/I0850/I1000



I1006

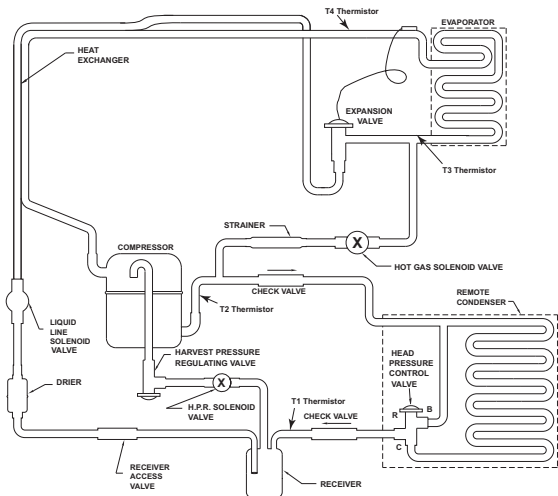


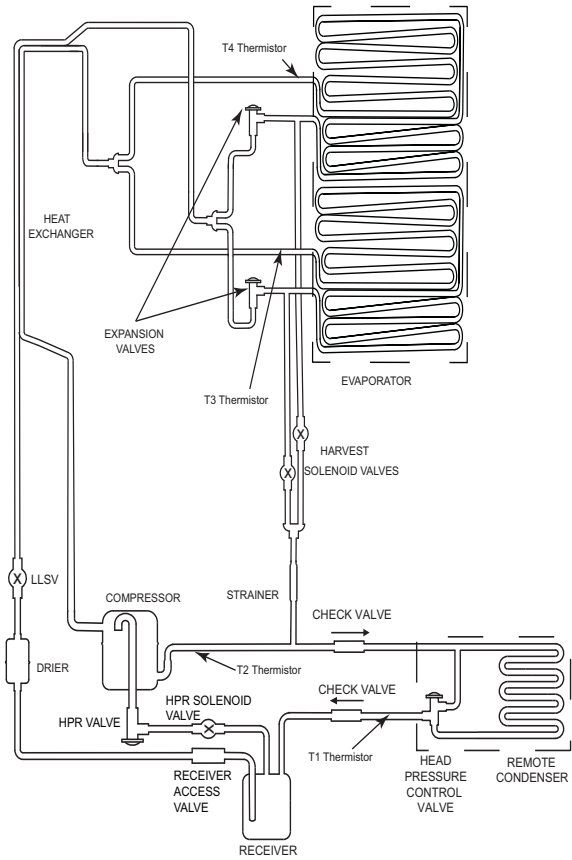
# I1400/I1800



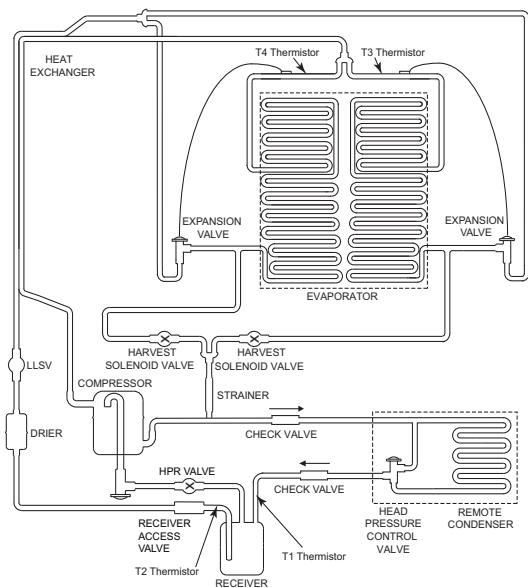
# REMOTE CONDENSER MODELS

I0500/I0600/I0850/I1000





# I1400/I1800



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