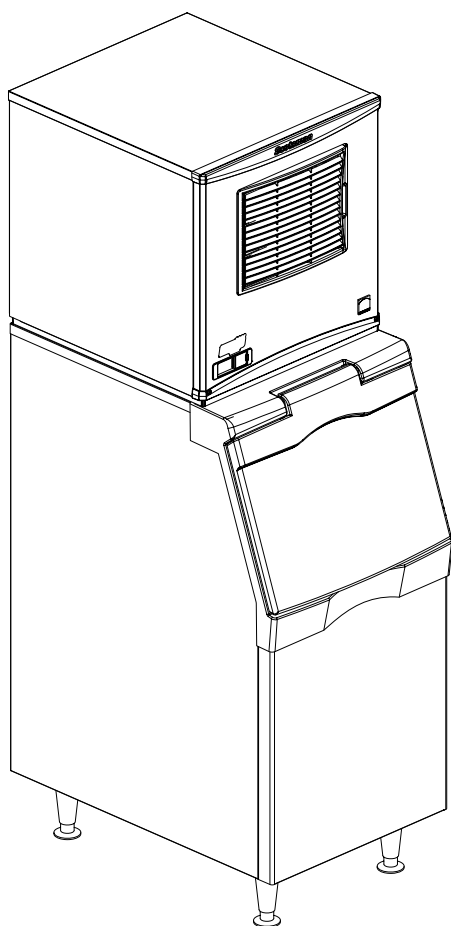




## Service Manual for Modular Flake and Nugget Ice Machines

### **Prodigy Plus A Series Models**

NH0422, NS0422, FS0522, NH0622, NS0622, FS0822,  
NH0922, NS0922, FS1222, NH1322, NS1322, FS1522



Introduction

These ice machines are the result of years of experience with flaked and nugget ice machines.

The latest in electronics has been coupled with the time tested Scotsman flaked ice system to provide reliable ice making and the features needed by customers.

The features include easily accessible air filters, simple conductivity water level sensing, evaporator clearing at shut down, photo-eye sensing bin control and the ability to add options.

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## **Installation:**

This machine is designed to be used indoors, in a controlled environment. Operation outside the limits listed here will void the warranty.

### **Air temperature limits**

|                  | Minimum         | Maximum        |
|------------------|-----------------|----------------|
| Ice maker        | 50°F. / 10°C.   | 100°F. / 38°C. |
| Remote condenser | -20°F. / -28°C. | 120°F. / 48°C. |

### **Water temperature limits**

|            | Minimum        | Maximum        |
|------------|----------------|----------------|
| All models | 40°F. / 4.4°C. | 100°F. / 38°C. |

### **Water pressure limits (potable)**

|            | Minimum          | Maximum          |
|------------|------------------|------------------|
| All models | 20 psi / 1.3 bar | 80 psi / 5.5 bar |

Water pressure limit to water cooled condenser is 150 PSI

### **Voltage limits**

|               | Minimum | Maximum |
|---------------|---------|---------|
| 115 volt      | 104     | 126     |
| 208-230 60 Hz | 198     | 253     |

Minimum conductivity (RO water)

- 10 microSiemens / CM

### **Water Quality (ice making circuit)**

- Potable

The quality of the water supplied to the ice machine

will have an impact on the time between cleanings and ultimately on the life of the product. Water can contain impurities either in suspension or in solution. Suspended solids can be filtered out. In solution or dissolved solids cannot be filtered, they must be diluted or treated. Water filters are recommended to remove suspended solids. Some filters have treatment in them for dissolved solids.

Check with a water treatment service for a recommendation.

RO water. This machine can be supplied with Reverse Osmosis water, but the water conductivity must be no less than 10 microSiemens/cm.

### **Potential for Airborne Contamination**

Installing an ice machine near a source of yeast or similar material can result in the need for more frequent sanitation cleanings due to the tendency of these materials to contaminate the machine.

Most water filters remove chlorine from the water supply to the machine which contributes to this situation. Testing has shown that using a filter that does not remove chlorine, such as the Scotsman Aqua Patrol, will greatly improve this situation.

### **Warranty Information**

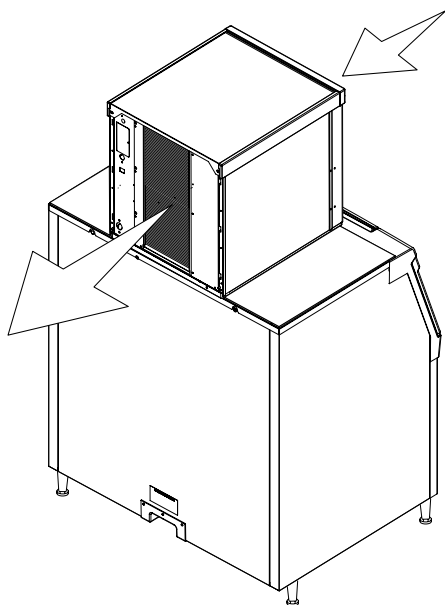
The warranty statement for this product is provided separately from this manual. Refer to it for applicable coverage. In general warranty covers defects in material or workmanship. It does not cover maintenance, corrections to installations, or situations when the machine is operated in circumstances that exceed the limitations printed above.

## **Location:**

While the machine will operate satisfactorily within the listed air and water temperature limits, it will produce more ice when those temperatures are nearer the lower limits. Avoid locations that are hot, dusty, greasy or confined. Air cooled models need plenty of room air to breathe. Air cooled models must have at least six inches of space at the back for air discharge; however, more space will allow better performance.

## **Airflow**

Air flows into the front of the cabinet and out the back. The air filters are on the outside of the front panel and are easily removed for cleaning.



## **Options**

Side air flow kits KPFS223 or KPFS227 are available for air cooled models. A filter kit for the remote condenser is KERCF

Ice is made until it fills the bin enough to block an infrared light beam inside the base of the machine. A field installed kit is available to adjust the maintained ice level lower. The kit number is KVS.

The standard controller has excellent diagnostic capabilities and communicates to the user through the AutoAlert light panel, seen through the front panel. Field installed kits are available that can log data and provide additional information when the front panel is removed. The kit numbers are KSB and KSB-NU. See page 21.

## **Bin compatibility**

All models have the same footprint: 22 inches wide by 24 inches deep. Confirm available space when replacing a prior model.

## **Bin & adapter list:**

- B322S – no adapter needed
- B330P or B530P or B530S – Use KBT27
- B842S – KBT39
- B948S – KBT38 for single unit
- B948S – KBT38-2X for two units side by side
- BH1100, BH1300 and BH1600 upright bins include filler panels to accommodate a single 22 inch wide ice machine. No adapter is needed.

## **Dispenser compatibility**

Only nugget ice models may be used with ice dispensers. Flaked ice is not dispensable.

- ID150 – use KBT42 and KDIL-PN-150, includes KVS, KNUGDIV and R629088514
- ID200 – use KBT43 and KNUGDIV and KVS
- ID250 – use KBT43 and KNUGDIV and KVS

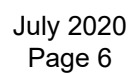
See sales literature for other brand model ice and beverage dispenser applications.

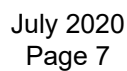
## **Other Bins & Applications:**

Note the drop zone and ultrasonic sensor locations in the illustrations on the next pages.

Scotsman ice systems are designed and manufactured with the highest regard for safety and performance. Scotsman assumes no liability of responsibility of any kind for products manufactured by Scotsman that have been altered in any way, including the use of any part and/or other components not specifically approved by Scotsman.

Scotsman reserves the right to make design changes and/or improvements at any time. Specifications and design are subject to change without notice.





## Unpacking & Install Prep

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### Place on Bin or Dispenser

If reusing an existing bin, be sure that the bin is in good shape and that the gasket tape on the top is not torn up. Water leaks, not covered by warranty, could result from a poor sealing surface. If installing a remote or a remote low side, a new bin is recommended due to the high cost to the user of replacing an old bin when a remote system is on top.

Install the correct adapter, following the directions supplied with that adapter.

Hoist the machine onto the adapter.

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Note: The machine is heavy! Use of a mechanical lift is recommended.

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Position the machine on the bin or adapter. Secure with straps from the hardware bag packed with the machine, or those supplied with the adapter.

Remove any plastic covering the stainless steel panels.

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Note: The standard machine set up includes visible on and off switches. Those can be covered up by changing the bezel in the front panel's trim strip. A cover-up bezel is included with the hardware bag.

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Remove any packaging, such as tape or foam blocks, that may be near the gear reducer or ice chute.

Level the bin and ice machine front to back and left to right by using the bin leg levelers.

### Panel Removal

1. Locate and loosen the two screws at the bottom of the front panel.
2. Pull the front panel out at the bottom until it clears.
3. Lower the front panel down and off the machine.
4. Remove two screws at the front of the top panel. Lift up the front of the top panel, push the top panel back an inch, then lift to remove.
5. Locate and loosen the screw holding each side panel to the base. Left side panel also has a screw holding it to the control box.
6. Pull the side panel forward to release it from the back panel.



## Water

The water supply for ice making must be cold, potable water. There is a single 3/8" male flare potable water connection on the back panel. Water cooled models also have a 3/8" FPT inlet connection for the water cooled condenser. Chilled water can also be used for this connection.

### Drain

There is one 3/4" FPT condensate drain fitting at the back of the cabinet. Water cooled models also have a 1/2" FPT discharge drain connection on the back panel.

### Tubing

Connect the potable water supply to the potable water fitting, 3/8" OD copper tubing or the equivalent is recommended.

Water filtration is recommended. If there is an existing filter, change the cartridge.

Connect the water cooled water supply to the condenser inlet.

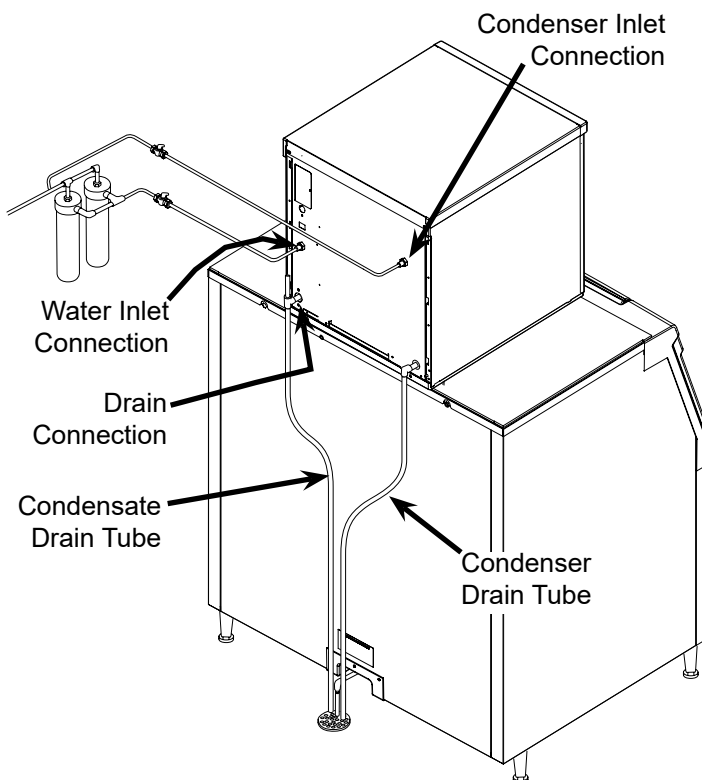
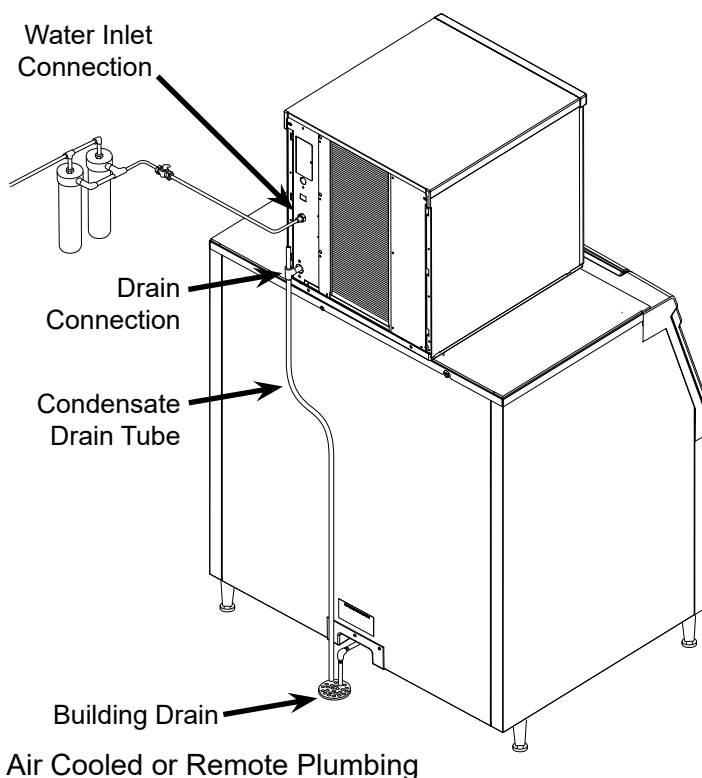
Note: Do NOT filter water to the water cooled condenser circuit.

Connect the drain tube to the condensate drain fitting.

Connect the water cooled condenser drain tube to the condenser outlet.

Do not Tee ice machine drains into the drain tube from the ice storage bin or dispenser. Back ups could contaminate and / or melt the ice in the bin or dispenser.

Follow all local and national codes for tubing, traps and air gaps.



## Electrical- All Models

The machine does not include a power cord, one must be field supplied or the machine hard wired to the electrical power supply. The junction box for the electrical connection is on the back panel.

Refer to the dataplate on the machine for minimum circuit ampacity and determine the proper wire size for the application. The dataplate (on the back of the cabinet) also includes the maximum fuse size.

Electrical power is connected to wires inside the junction box in the back of the cabinet. Use a strain relief and connect a ground wire to the ground screw.

Do not use an extension cord.

Follow all local and national codes.

| Model      | Series | Dimensions<br>w" x d" x h" | Voltage<br>Volts/Hz/Phase | Condenser<br>Type | Min Circuit<br>Ampacity | Max Fuse Size or HACR<br>Type Circuit Breaker |
|------------|--------|----------------------------|---------------------------|-------------------|-------------------------|-----------------------------------------------|
| NH0422A-1  | A      | 22 x 24 x 23               | 115/60/1                  | Air               | 12.9                    | 15                                            |
| NH0422W-1  | A      | 22 x 24 x 23               | 115/60/1                  | Water             | 12.1                    | 15                                            |
| NS0422A-1  | A      | 22 x 24 x 23               | 115/60/1                  | Air               | 12.9                    | 15                                            |
| NS0422W-1  | A      | 22 x 24 x 23               | 115/60/1                  | Water             | 12.1                    | 15                                            |
| FS0522A-1  | A      | 22 x 24 x 23               | 115/60/1                  | Air               | 12.9                    | 15                                            |
| FS0522W-1  | A      | 22 x 24 x 23               | 115/60/1                  | Water             | 12.1                    | 15                                            |
| NH0622A-1  | A      | 22 x 24 x 23               | 115/60/1                  | Air               | 16.0                    | 20                                            |
| NH0622W-1  | A      | 22 x 24 x 23               | 115/60/1                  | Water             | 14.4                    | 20                                            |
| NH0622R-1  | A      | 22 x 24 x 23               | 115/60/1                  | Remote            | 17.1                    | 20                                            |
| NS0622A-1  | A      | 22 x 24 x 23               | 115/60/1                  | Air               | 16.0                    | 20                                            |
| NS0622W-1  | A      | 22 x 24 x 23               | 115/60/1                  | Water             | 14.4                    | 20                                            |
| NS0622R-1  | A      | 22 x 24 x 23               | 115/60/1                  | Remote            | 17.1                    | 20                                            |
| FS0822A-1  | A      | 22 x 24 x 23               | 115/60/1                  | Air               | 16.0                    | 20                                            |
| FS0822W-1  | A      | 22 x 24 x 23               | 115/60/1                  | Water             | 14.4                    | 20                                            |
| FS0822R-1  | A      | 22 x 24 x 23               | 115/60/1                  | Remote            | 17.1                    | 20                                            |
| NH0622A-32 | A      | 22 x 24 x 23               | 208-230/60/1              | Air               | 8.8                     | 15                                            |
| NS0622A-32 | A      | 22 x 24 x 23               | 208-230/60/1              | Air               | 8.8                     | 15                                            |
| FS0822W-32 | A      | 22 x 24 x 23               | 208-230/60/1              | Water             | 7.6                     | 15                                            |
| NS0622A-6  | A      | 22 x 24 x 23               | 230/50/1                  | Air               | 7.9                     | 15                                            |

Table continued on following page

**Electrical- All Models**

| Model      | Series | Dimensions<br>w" x d" x h" | Voltage Volts/<br>Hz/Phase | Condenser<br>Type | Min Circuit<br>Ampacity | Max Fuse Size or HACR<br>Type Circuit Breaker |
|------------|--------|----------------------------|----------------------------|-------------------|-------------------------|-----------------------------------------------|
| NH0922A-1  | A      | 22 x 24 x 27               | 115/60/1                   | Air               | 24.0                    | 30                                            |
| NH0922R-1  | A      | 22 x 24 x 27               | 115/60/1                   | Remote            | 25.0                    | 30                                            |
| NS0922A-1  | A      | 22 x 24 x 27               | 115/60/1                   | Air               | 24.0                    | 30                                            |
| NS0922R-1  | A      | 22 x 24 x 27               | 115/60/1                   | Remote            | 25.0                    | 30                                            |
| NH0922A-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Air               | 11.9                    | 15                                            |
| NH0922W-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Water             | 10.7                    | 15                                            |
| NH0922R-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Remote            | 11.7                    | 15                                            |
| NS0922A-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Air               | 11.9                    | 15                                            |
| NS0922W-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Water             | 10.7                    | 15                                            |
| NS0922R-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Remote            | 11.7                    | 15                                            |
| FS1222A-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Air               | 11.9                    | 15                                            |
| FS1222W-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Water             | 10.7                    | 15                                            |
| FS1222R-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Remote            | 11.7                    | 15                                            |
| NS0922W-3  | A      | 22 x 24 x 27               | 208-230/60/3               | Water             | 8.0                     | 15                                            |
| FS1222A-3  | A      | 22 x 24 x 27               | 208-230/60/3               | Air               | 9.2                     | 15                                            |
| FS1222R-3  | A      | 22 x 24 x 27               | 208-230/60/3               | Remote            | 9.0                     | 15                                            |
| NH1322A-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Air               | 17.8                    | 20                                            |
| NH1322W-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Water             | 16.6                    | 20                                            |
| NH1322R-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Remote            | 17.6                    | 20                                            |
| NS1322A-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Air               | 17.8                    | 20                                            |
| NS1322W-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Water             | 16.6                    | 20                                            |
| NS1322R-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Remote            | 17.6                    | 20                                            |
| FS1522A-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Air               | 17.8                    | 20                                            |
| FS1522R-32 | A      | 22 x 24 x 27               | 208-230/60/1               | Air               | 17.6                    | 20                                            |
| NS1322W-3  | A      | 22 x 24 x 27               | 208-230/60/3               | Water             | 9.9                     | 15                                            |
| NH1322W-3  | A      | 22 x 24 x 27               | 208-230/60/3               | Water             | 9.9                     | 15                                            |

## Refrigeration - Remote Condenser Models

Remote condenser models have additional installation needs.

The correct remote condenser fan and coil must be connected to the ice making head. Liquid and discharge tubing connections are on the back of the ice machine cabinet. Tubing kits are available in several lengths to accommodate most installations. Order the one that just exceeds the length needed for the installation.

The kit numbers are:

BRTE10, BRTE25, BRTE40, BRTE75

There are limits as to how far away from the ice machine and where the remote condenser can be located. See page 10 for those limits.

The correct condenser must be used:

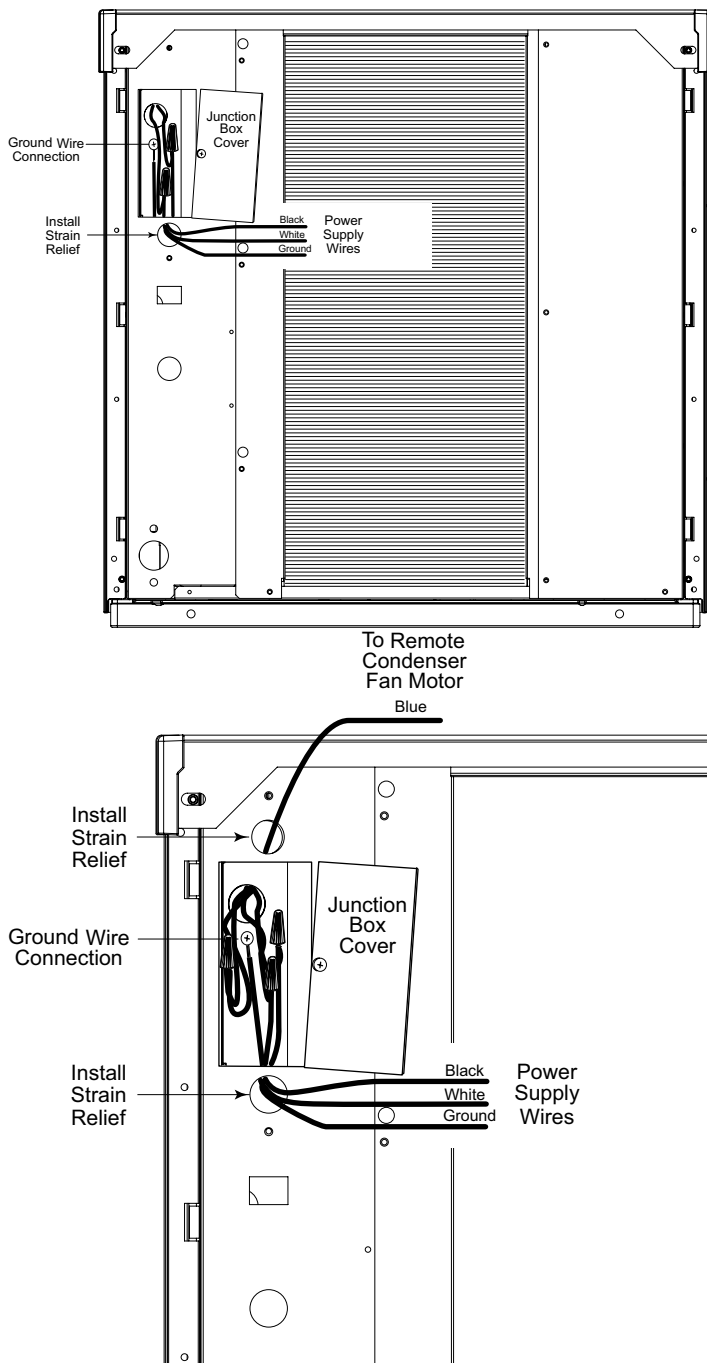
| Ice Machine Model                                             | Voltage | Condenser Model |
|---------------------------------------------------------------|---------|-----------------|
| NH0622R-1<br>NS0622R-1<br>FS0822R-1<br>NH0922R-1<br>NS0922R-1 | 115     | ERC111-1        |
| NH0922R-32<br>NS0922R-32<br>FS1222R-32<br>FS1222R-3           | 208-230 | ERC311-32       |
| NH1322R-32<br>NS1322R-32                                      | 208-230 | ERC311-32       |

Do not reuse condenser coils contaminated with mineral oil (used with R-502 for example). They will cause compressor failure and will void the warranty.

A headmaster is required for all remote condenser systems. Installation of headmaster kit KPFHM will be required if any of the following condensers are being used:

ERC101-1, ERC151-32, ERC201-32, ERC301-32, ERC402-32

Use of non-Scotsman condensers requires pre-approval from Scotsman Engineering.



## Remote Condenser Location - Limits

Use the following for planning the placement of the condenser relative to the ice machine

Location Limits - condenser location must not exceed ANY of the following limits:

- Maximum rise from the ice machine to the condenser is 35 physical feet
- Maximum drop from the ice machine to the condenser is 15 physical feet
- Physical line set maximum length is 100 feet.
- Calculated line set length maximum is 150.

Calculation Formula:

- Drop =  $dd \times 6.6$  (dd = distance in feet)
- Rise =  $rd \times 1.7$  (rd = distance in feet)
- Horizontal Run =  $hd \times 1$  (hd = distance in feet)
- Calculation: Drop(s) + Rise(s) + Horizontal
- Run =  $dd + rd + hd$  = Calculated Line Length

Configurations that do NOT meet these requirements must receive prior written authorization from Scotsman to maintain warranty.

Do NOT:

- Route a line set that rises, then falls, then rises.
- Route a line set that falls, then rises, then falls.

Calculation Example 1:

The condenser is to be located 5 feet below the ice machine and then 20 feet away horizontally.

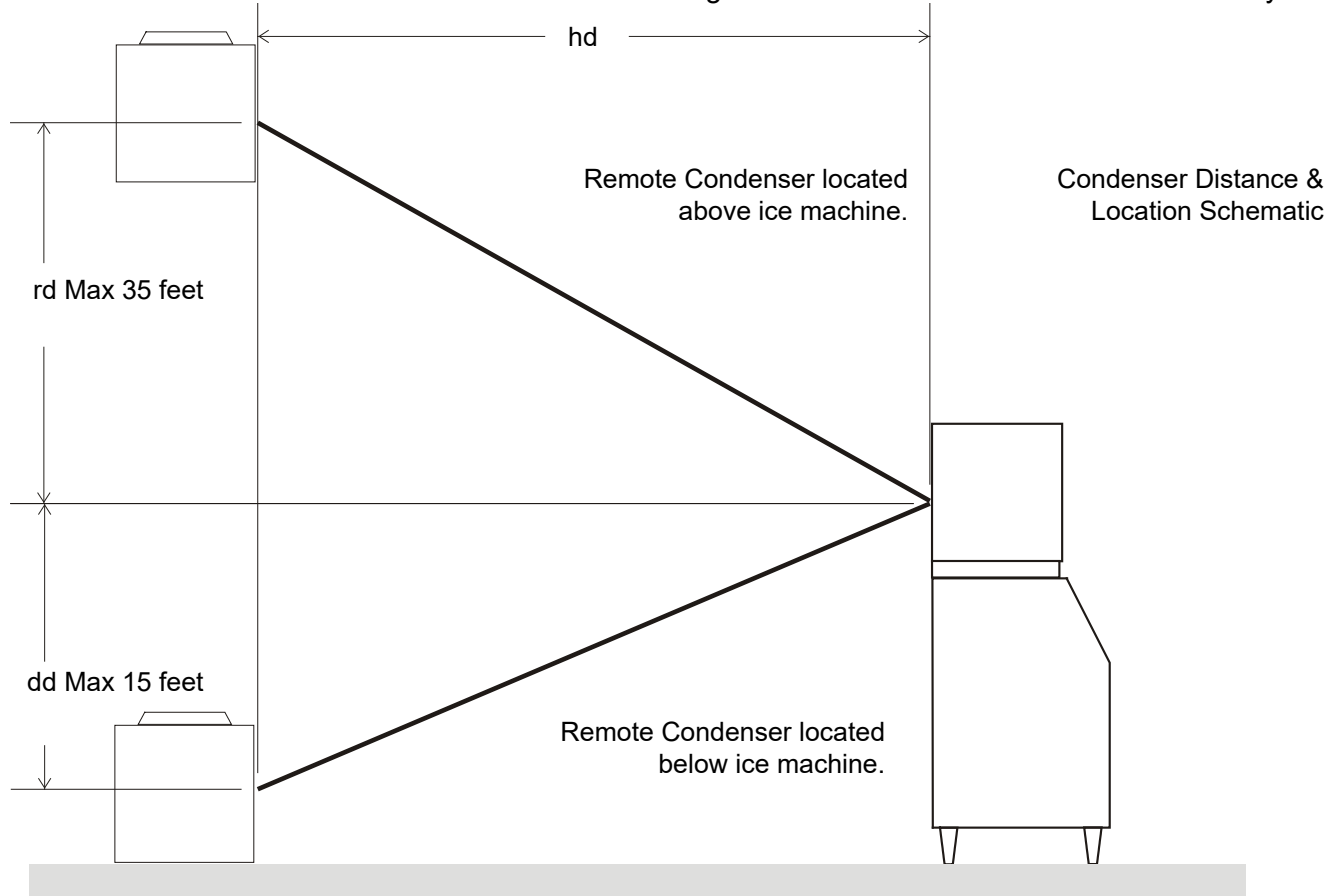
$5 \text{ feet} \times 6.6 = 33$ .  $33 + 20 = 53$ . This location would be acceptable

Calculation Example 2:

The condenser is to be located 35 feet above and then 100 feet away horizontally.  $35 \times 1.7 = 59.5$ .

$59.5 + 100 = 159.5$ . 159.5 is greater than the 150 maximum and is NOT acceptable.

Operating a machine with an unacceptable configuration is misuse and will void the warranty.



## For The Installer: Remote Condenser

Locate the condenser as near as possible to the interior location of the ice machine. Allow it plenty of space for air and cleaning: keep it a minimum of two feet away from a wall or other rooftop unit.

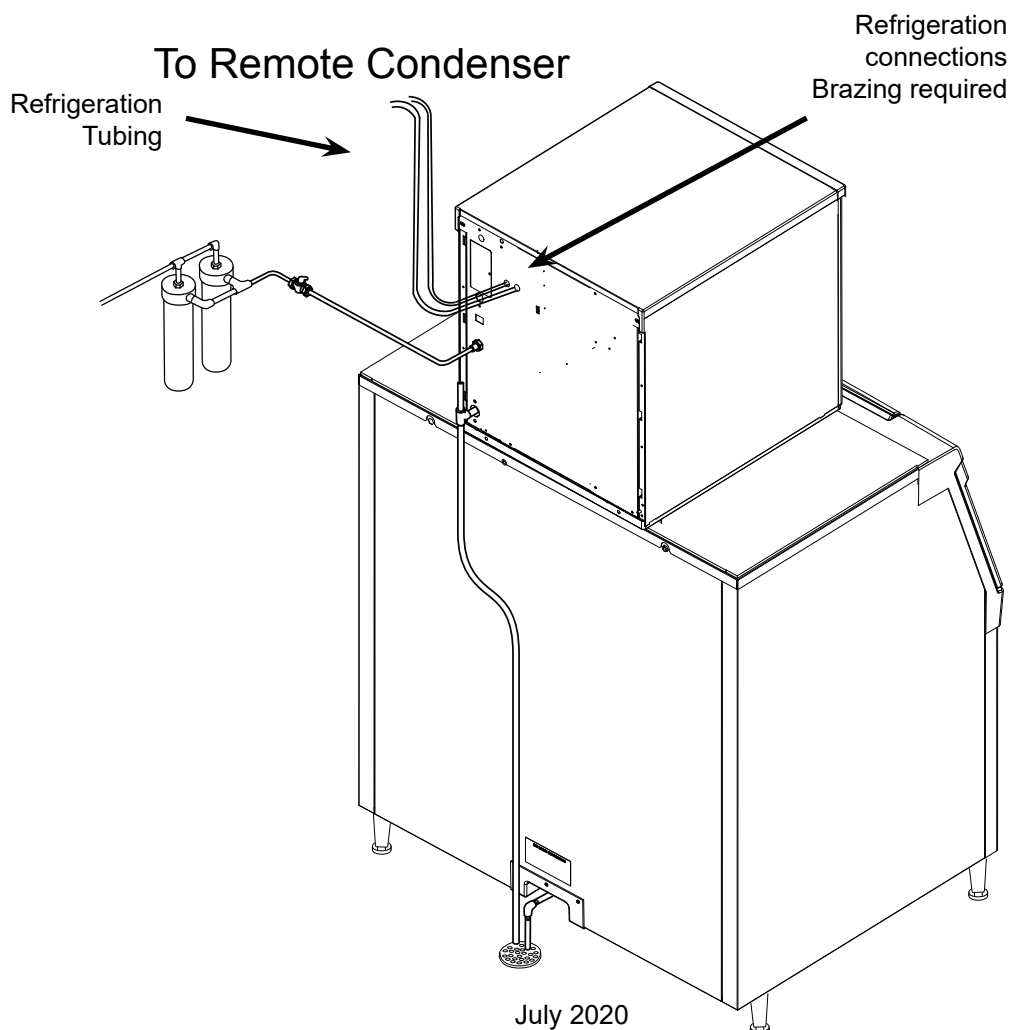
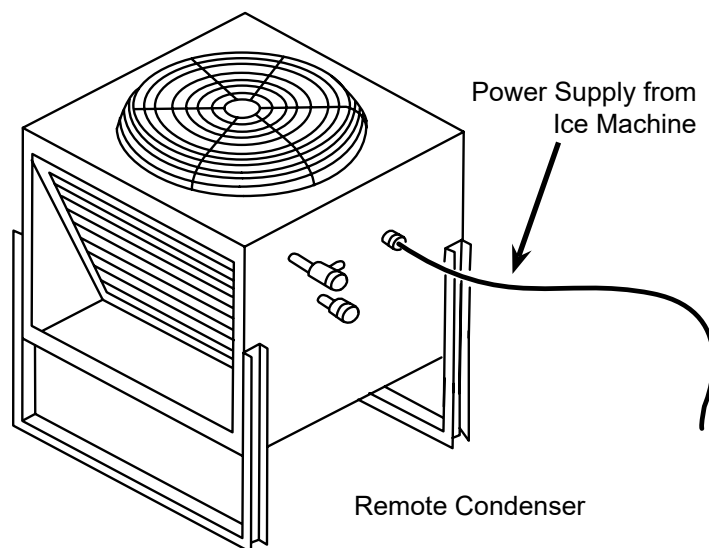
Note: The location of the condenser relative to the ice machine is LIMITED by the specification on the prior page.

Roof penetration. In many cases a roofing contractor will need to make and seal the hole in the roof for the line sets. The suggested hole diameter is 2 inches.

Meet all applicable building codes.

### Roof Attachment

Install and attach the remote condenser to the roof of the building, using the methods and practices of construction that conform to the local building codes, including having a roofing contractor secure the condenser to the roof



## Line Set Routing and Brazing (applies to remote units only)

Do not connect the refrigeration tubing until all routing and forming of the tubing is complete. See the Coupling Instructions for final connections.

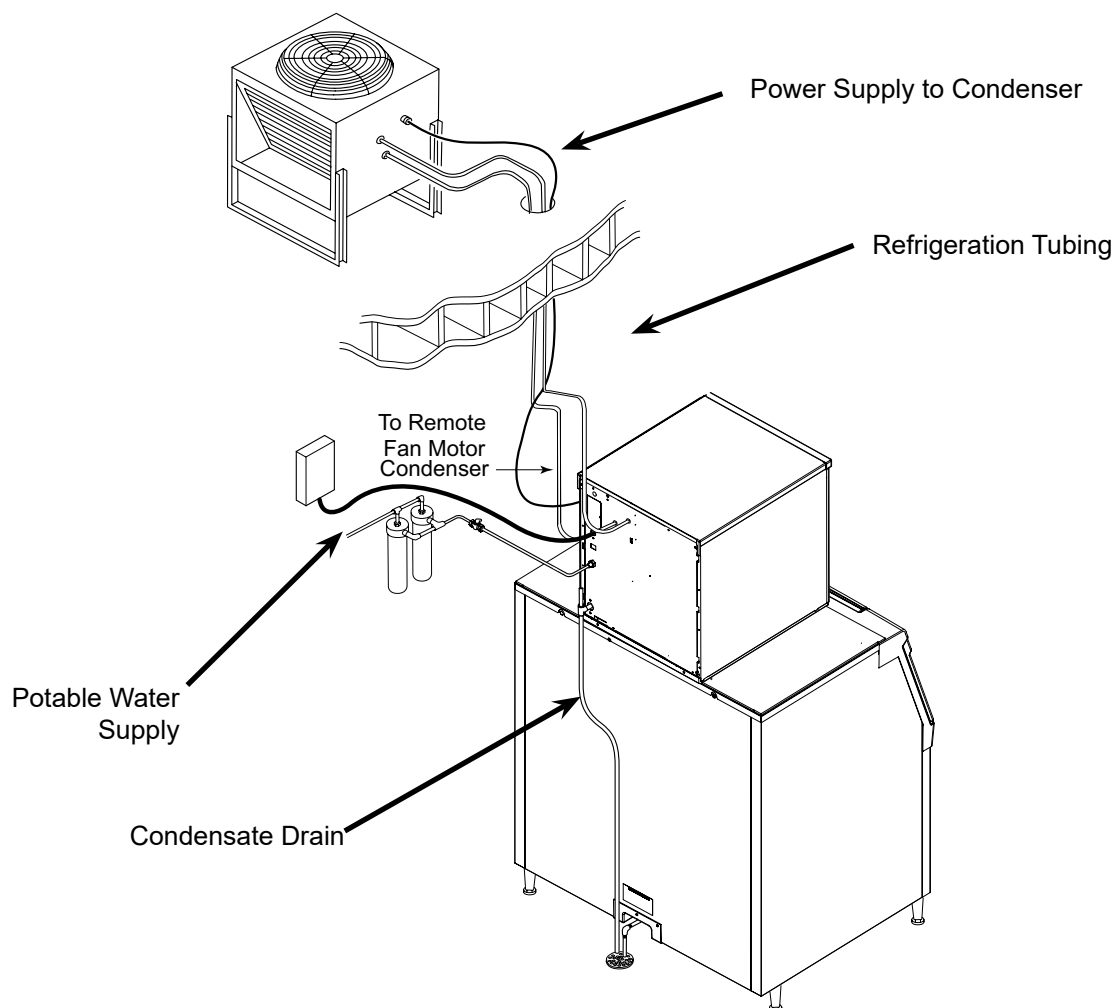
1. Each set of tubing lines contains a 3/8" diameter liquid line, and a 1/2" diameter discharge line. Both ends of each line are designed for field brazed connections.

Note: The openings in the building ceiling or wall, listed in the next step, are the minimum sizes recommended for passing the refrigerant lines through.

2. Have the roofing contractor cut a minimum hole for the refrigerant lines of 2". Check local codes, a separate hole may be required for the electrical power supply to the condenser.

Caution: Do NOT kink the refrigerant tubing while routing it.

3. Route the refrigerant tubes thru the roof opening. Follow straight line routing whenever possible. Excess tubing must be cut to proper length prior to connecting to the ice maker and condenser.
4. The tubing must be evacuated after connection to the ice maker or condenser before opening the ball valve.
5. Have the roofing contractor seal the holes in the roof per local codes



## Line Set Routing and Brazing

---

Do not connect the refrigerant tubing until all routing and forming of the tubing is complete. Final connections requires brazing, steps must be performed by an EPA certified type II or higher technician.

The Lineset of tubing contains a 3/8" diameter liquid line, and a 1/2" diameter discharge line.

---

Note: The openings in the building ceiling or wall, listed in the next step, are the minimum sizes recommended for passing the refrigerant lines through.

---

Have the roofing contractor cut a minimum hole for the refrigerant lines of 1 3/4". Check local codes, a separate hole may be required for the electrical power supply to the condenser.

Caution: Do NOT kink the refrigerant tubing while routing it.

### At Condenser:

1. Remove protective plugs from both connections and vent the nitrogen from the condenser.
  2. Remove the tubing access bracket to allow more room for brazing.
  3. Route the lineset tubes to there connection.
  4. Clean tubing ends and position into stubs.
- 

Note: Be sure tube and stubs are round, dress with swage tool if needed.

---

### At Head:

1. Remove the tubing access bracket to allow more room for brazing.
2. Confirm connection ball valves are fully closed.
3. Remove protective plugs from both connections.
4. Remove caps from access valve connections.
5. Remove cores from access valves.
6. Connect refrigeration hoses to access valves.
7. Connect dry nitrogen source to liquid line connection.
8. Shorten tubing to correct length, clean ends and insert them into valve stubs.

---

Note: Be sure tube and stubs are round, dress with swage tool if needed.

---

9. Add heat sink material to ball valve body.
10. Open nitrogen and flow 1 psi nitrogen into liquid line tube and braze the liquid line and suction line tubes to the valve stubs.
11. With nitrogen flowing braze the liquid and suction line connections.

### At Condenser:

1. Braze the liquid and suction line connections.

### At Head:

1. Remove nitrogen source.
  2. Return valve cores to access valves.
  3. Connect vacuum pump to **both** access valves and evacuate the tubing and head to at least a 300 micron level.
  4. Remove vacuum pump and add R-404A to all three tubes to provide a positive pressure.
  5. Leak check the all braze connections and repair any leaks.
  6. Open both valves to full open.
- 

Note: The full refrigerant charge is contained in the receiver of the ice machine.

---



## Water - Remote Models

The water supply for ice making must be cold, potable water. There is a single 3/8" male flare potable water connection on the back panel.

### Backflow

The design of the float valve and reservoir prevents potable water backflow by means of a 1" air gap between the reservoir's maximum water level and the float valve water inlet orifice.

### Drain

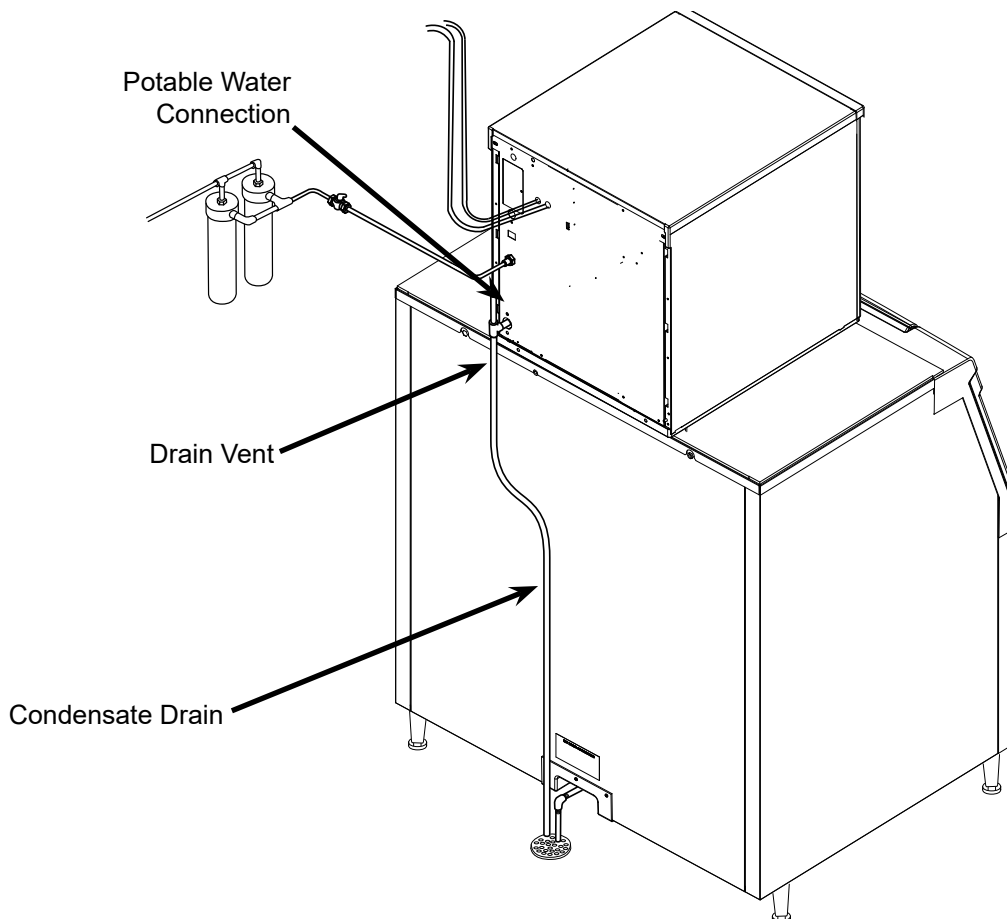
There is one 3/4" FPT condensate drain fitting at the back of the cabinet.

### Attach Tubing

1. Connect the potable water supply to the potable water fitting, 3/8" OD copper tubing or the equivalent is recommended.
2. Change the cartridge on the existing water filter (if any present).
3. Connect the drain tube to the condensate drain fitting. Use rigid tubing.
4. Vent the drain tubing between the ice machine and the building drain.

Do not Tee ice machine drains into the drain tube from the ice storage bin or dispenser. Back ups could contaminate and/or melt the ice in the bin or dispenser. Be sure to vent the bin drain.

Follow all local and national codes for tubing, traps and air gaps.



## Final Check List

After connections:

1. Wash out the bin. If desired, the interior of the bin could be sanitized.
2. Locate the ice scoop (if supplied) and have it available for use when needed.
3. Remote only: Switch on the electrical power to warm up the compressor. Do not start the machine for 4 hours.

Final Check List:

1. Is the unit located indoors in a controlled environment?
2. Is the unit located where it can receive adequate cooling air?
3. Has the correct electrical power been supplied to the machine?
4. Have all the water supply connections been made?
5. Have all the drain connections been made?
6. Has the unit been leveled?
7. Have all unpacking materials and tape been removed?
8. Has the protective covering on the exterior panels been removed?
9. Is the water pressure adequate?
10. Have the drain connections been checked for leaks?
11. Has the bin interior been wiped clean or sanitized?
12. Have any water filter cartridges been replaced?
13. Have all required kits and adapters been properly installed?

## Control and Machine Operation

Once started, the ice machine will automatically make ice until the bin or dispenser is full of ice. When ice level drops, the ice machine will resume making ice.

Caution: Do not place anything on top of the ice machine, including the ice scoop. Debris and moisture from objects on top of the machine can work their way into the cabinet and cause serious damage. Damage caused by foreign material is not covered by warranty.

There are four indicator lights at the front of the machine that provide information on the condition of the machine: **Power, Status, Water, De-scale & Sanitize.**



Note: If the De-Scale & Sanitize light is ON, following the cleaning process will clear the light for another cleaning time interval.

Two button switches are at the front – On and Off. To switch the machine OFF, push and release the Off button. The machine will shut off at the end of the next cycle. To switch the machine ON, push and release the On button. The machine will go through a start up process and then resume ice making.

## Lower Light and Switch Panel

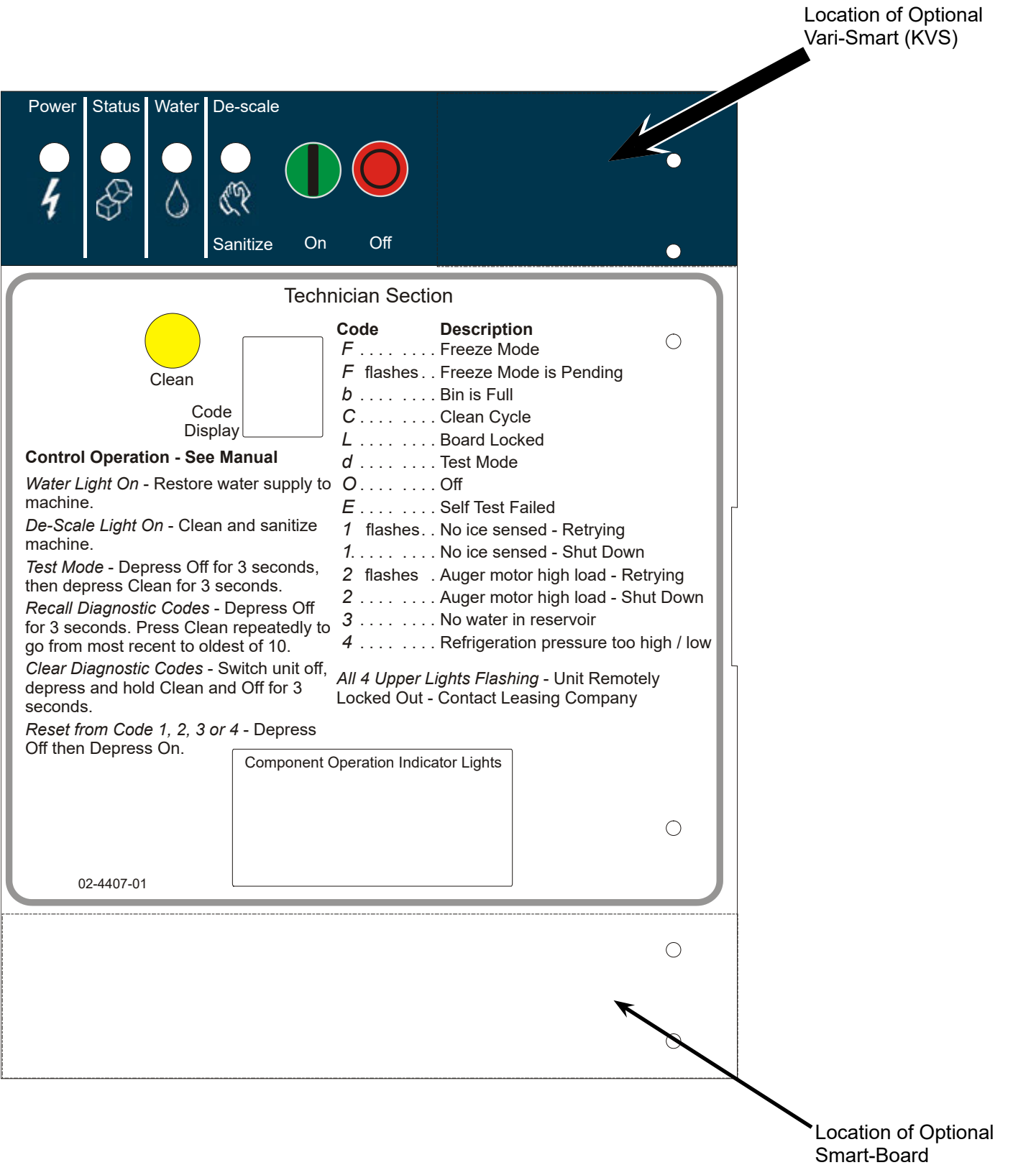
This user accessible panel provides important operational information and duplicates the lights and switches on the controller. It also allows access to the On and Off buttons that operate the ice machine.

Sometimes access to the switches should be limited to prevent unauthorized operation. For that purpose a fixed panel is shipped in the hardware package. The fixed panel cannot be opened.

To install the fixed panel:

1. Remove the front panel and remove the bezel.
2. Spread the bezel frame open and remove original door, insert fixed panel into bezel. Be sure it is in the closed position.
3. Return bezel to panel and install panel on unit.

Controller



AutoAlert and Display Code

The controller uses indicator lights to provide the user with information on Power, Status, Water or Time to Clean. These are known as the AutoAlert panel.



| Code Description                            |  |
|---------------------------------------------|--|
| ..... Freeze Mode                           |  |
| flashes . . Freeze Mode is Pending          |  |
| ..... Bin is Full                           |  |
| ..... Clean Cycle                           |  |
| ..... Board Locked                          |  |
| ..... Test Mode                             |  |
| ..... Off                                   |  |
| ..... Self Test Failed                      |  |
| flashes. . No ice sensed - Retrying         |  |
| ..... No ice sensed - Shut Down             |  |
| flashes . Auger motor high load - Retrying  |  |
| ..... Auger motor high load - Shut Down     |  |
| ..... No water in reservoir                 |  |
| ..... Refrigeration pressure too high / low |  |

Additionally a 7 segment display is under the front panel. It shows operational status or problem codes.

The Power light is on Green anytime the machine is supplied with electrical power.

The Status light is on Green when the machine has been switched to the ice making mode. It will also blink green if the unit has been equipped with an optional Smart-Board AND the Smart-Board has detected potential malfunction.

The Water light will blink Red if the water sensor does not detect water.

The De-Scale / Sanitize light will glow Yellow when the time to clean timer has reached its set time since the last cleaning. It also blinks during the first part of the cleaning mode

## Component Indicator Lights

---

The controller has six lights to indicate component operation:

### Bin Eyes Blocked

- This light is ON when the photo-electric ice sensors have been blocked by ice.

### Water Present

- This light is ON when the water sensor has water touching it.

### Comp

- This light is ON when the compressor is operating.

### Water Dispense

- Not used on this model., not listed on D series

### Auger

- This light is ON when the auger motor is operating.

### Ice Dispense

- Not used this model, not listed on D series

## Control Button Use

### Recall diagnostic code:

- Hold off button in for 3 seconds. Release.
- Press and release the Clean button to cycle through each of the last 10 error codes from most recent to oldest.

### Clear diagnostic code:

- Hold Clean and Off buttons in for 3 seconds to clear all prior codes.

### Reset control:

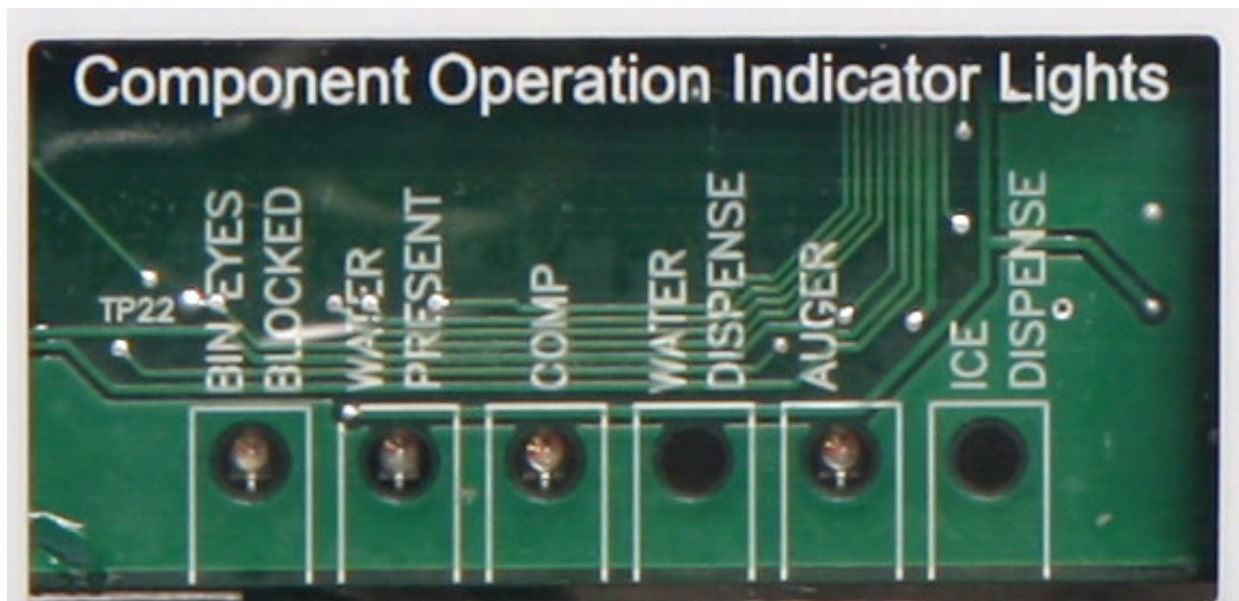
- Depress and release Off, then depress and release On

### Start Test Mode:

- Hold Off button in for 3 seconds. Release.
- Hold Clean button in for 3 seconds. Release.

### Lock / Unlock control:

- Hold On button in for 3 seconds, keep holding then press and release Off twice.



## Electrical Component Details

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### Compressor

- Operated by the compressor contactor.

### Contactors

- Operated by the controller. Line voltage coil. When energized the Compressor indicator light will be ON.

### Fan Motor(s)

- Operated by the contactor

### High pressure cut out

- All models have a high pressure cut out switch that signals the controller if the discharge pressure is too high. It is an automatic reset.

### Low pressure switch

- On remote models it controls the compressor contactor. Will close on pressure rise, pressure rises when liquid line valve opens.

### Opens at a lower pressure.

- Air and Water cooled models use a low pressure cut out.

### Liquid line valve

- Remote only. Opened by the controller to start ice making. Closed to shut unit off. Line voltage coil.

### Controller

- Senses water, ice making, discharge pressure, low side pressure, and auger amps. Controls compressor contactor, fan motor, and auger motor. Indicates status and component operation.

### Transformer

- 12 volt secondary, supplies power to controller only. The Power light will be ON when the transformer has provided 12 volts AC to the controller.

### Water Level Sensor

- Two probe conductivity sensor. When water touches it the Water Present light will be ON.

### Auger Motor

- Four pole, split phase motor that operates the gear reducer. When operating, the Auger indicator light will be ON. The gear reducer lowers the input speed from about 1500 RPM to about 11-13 RPM. Auger rotation is counter clockwise when viewed from above.

### Photo-electric eyes

- An LED emitter and photo transistor receiver set. Pulsed infrared light is continuously emitted and received to detect ice in the chute.

### Lower light and switch panel

- Duplicates controller lights and switches.

## Refrigeration

---

**Refrigerant:** R-404A

**Compressors:** Copeland, Embraco, or Tecumseh hermetic by model

**Expansion valve:** Adjustable, internally equalized.

**Condensers:** Air is forced draft type, water cooled is counterflow type.

**Air filters:** Surface mounted to panels. Filter media removable without removing panels.

**Fan blades:** Reduced vibration blades in most air cooled models.

**Remote Systems:** Head pressure control valve in condenser. Headmaster protected by filters (not filter driers). Controller pumps unit down by closing the liquid line valve. Pump down switch controls the compressor.

High pressure cut out. WC, RC, AC

Low pressure cut out, WC, AC

Pump down pressure switch, RC

**Evaporator:** Coil-wrapped stainless steel with a stainless steel, double-flight auger inside.

### Initial Start Up

1. Turn the water supply on.
2. Switch the electrical power on. Confirm voltage is correct for the model.
3. Push and release the On button. The machine will start in about two minutes.
4. Soon after starting, air cooled models will begin to blow warm air out the back of the cabinet and water cooled models will drain warm water from the condenser drain tube. Remote models will be discharging warm air from the remote condenser. After about 5 minutes, ice will begin to drop into the bin or dispenser.
5. Check the machine for unusual rattles. Tighten any loose screws, be sure no wires are rubbing moving parts. Check for tubes that rub.
6. Fill out the warranty registration form and either file it on line or mail it.
7. Notify the user of the maintenance requirements and whom to call for service.

### Change De-Scale Notification Interval

This feature is accessible only from standby  
(Status Light Off).

1. Press and hold Clean button for 3 seconds. This starts the Time to Clean Adjustment State and displays the current time to clean setting.
2. Press the clean button repeatedly to cycle through the 4 possible settings:
  - 1 year (8760 hours)
  - 0 (disabled)
  - 4 months (2920 hrs)
  - 6 months (4380 hours) (default)
3. Push Off to confirm the selection.

## Sequence of Operation

---

The ice machine's function is to continuously produce ice until the ice level control senses that there is enough ice in the bin or dispenser. There are three systems that operate in close coordination to make ice. They are the electrical system, the water system and the refrigeration system.

The electrical system includes the compressor, auger drive assembly, fan motor and control system (the auger drive assembly includes the gear reducer, auger and top bearing).

The water system includes the float valve, reservoir, inside of the evaporator and the drain tubing.

The refrigeration system includes the compressor, condenser, expansion valve and outside of the evaporator.

### Control System

As noted, the electrical system includes a control system. The control system consists of a controller and sensors. It automatically operates the machine to make ice only when needed. It also monitors the refrigeration system, water system and auger drive assembly for proper function.

Sensors are used to monitor the machine. A continuity probe water sensor is located near the float reservoir. A tube from the float tank allows water to touch the sensor's two stainless steel probes, making a connection between them. That signals to the controller the presence of water. The controller will not allow the machine to make ice unless this sensor's probes have continuity.

A set of photo-electric eyes (infrared emitter and receiver) is located at the base of the ice discharge chute. They are used to sense ice. As ice is made, it falls through the infrared beam from the emitter, causing the receiver to detect it. When ice has filled the bin, the top of the ice pile will continuously stop the beam, breaking the light to the receiver, and that signals to the controller that the bin is full

Additionally, the control system uses the photo-eyes to confirm ice making. As the machine makes ice, the falling ice causes breaks in the infrared beam. In operation, the first 6 minutes of ice making are ignored to give the machine time to start producing ice. After that, the controller will look for a minimum of one beam-break in 10 minutes. If this is not achieved, the control will shut the machine down for 10 minutes and add the incident to a strike counter. During the wait period, a 1 will be flashing in the code display.

After the 10 minute wait, the machine will restart. If no ice is sensed three times in a row, the machine will shut down on a no ice error and must be manually reset. The 1 in the code display will change from flashing to continuous.

If ice is detected within 10 minutes after any restart, the strike counter will be reset to zero, and the code display will show F, for freeze mode.

The auger drive motor amperage is monitored by the controller. If the auger motor is overloaded and is drawing too many amps, the controller will shut the machine off, and a 2 will be flashing in the code display. The controller will attempt a restart of the auger motor in 4 minutes. If during the first 60 seconds after restart the auger motor current stays within limits, the compressor is restarted and the machine returns to normal operation. If the auger motor's current is excessive within 60 seconds after the restart, the process will be repeated once more. If during that try the current is still excessive the machine shuts down and must be manually reset. The 2 in the code display will change from flashing to continuous.

### Water System

The water level in the evaporator is maintained by a float valve in a separate reservoir. As ice is made, and water is used, the water level in the reservoir drops, opening the float valve. The open valve adds water to the reservoir to resupply it.



## Refrigeration System

The refrigeration system is monitored by the high pressure cut out switch. If the refrigeration discharge pressure exceeds the pre-set point of the switch, it will open, causing the controller to shut the machine off. The discharge pressure control is an automatic reset switch, and after the discharge pressure drops, the controller will restart the unit. A 4 in the code display indicates high discharge pressure.

The refrigeration system is also monitored by the low pressure cut out switch. If the refrigeration low side pressure drops below a pre-set point, the switch will open. When that occurs, the controller will shut the machine off. The low pressure cut out switch is an automatic reset switch and after the low side pressure increases to the cut in point, the controller will restart the machine. A 4 will show in the code display to indicate low suction pressure.

Note: the low pressure control for a remote is a pump down switch, and when it opens the compressor stops and no change is noted by the controller

### Electrical Sequence

Pushing and releasing the On button starts the machine. The sequence of operation begins with water. Water must be sensed or the controller will not start the ice making process. If there is no water, a 3 will show in the code display. If there is water, and there is nothing blocking the infrared beam of the ice sensors, the controller will start the machine. A flashing F will show in the code display while the auger drive motor starts up. When it has started, the compressor will start and the flashing F will change to a continuous F. This continues until the ice level control senses a full bin, at that time the compressor is shut off, and the auger motor continues to operate for a short time to clear the evaporator of any left over ice. A lowercase "b" will show in the code display.

|                        | Indicator Lights & Their Meanings |                                                                            |               |                              |
|------------------------|-----------------------------------|----------------------------------------------------------------------------|---------------|------------------------------|
|                        | Power                             | Status                                                                     | Water         | De-Scale & Sanitize          |
| <b>Steady Green</b>    | Normal                            | Normal                                                                     | -             | -                            |
| <b>Blinking Green</b>  | Self Test Failure                 | Switching on or off. When Smart-Board used, machine attention recommended. | -             | -                            |
| <b>Blinking Red</b>    | -                                 | Diagnostic shut down                                                       | Lack of water | -                            |
| <b>Yellow</b>          | -                                 | -                                                                          | -             | Time to descale and sanitize |
| <b>Blinking Yellow</b> | -                                 | -                                                                          | -             | In Cleaning Mode             |
| <b>Light Off</b>       | No power                          | Switched to Off                                                            | Normal        | Normal                       |

## Water System

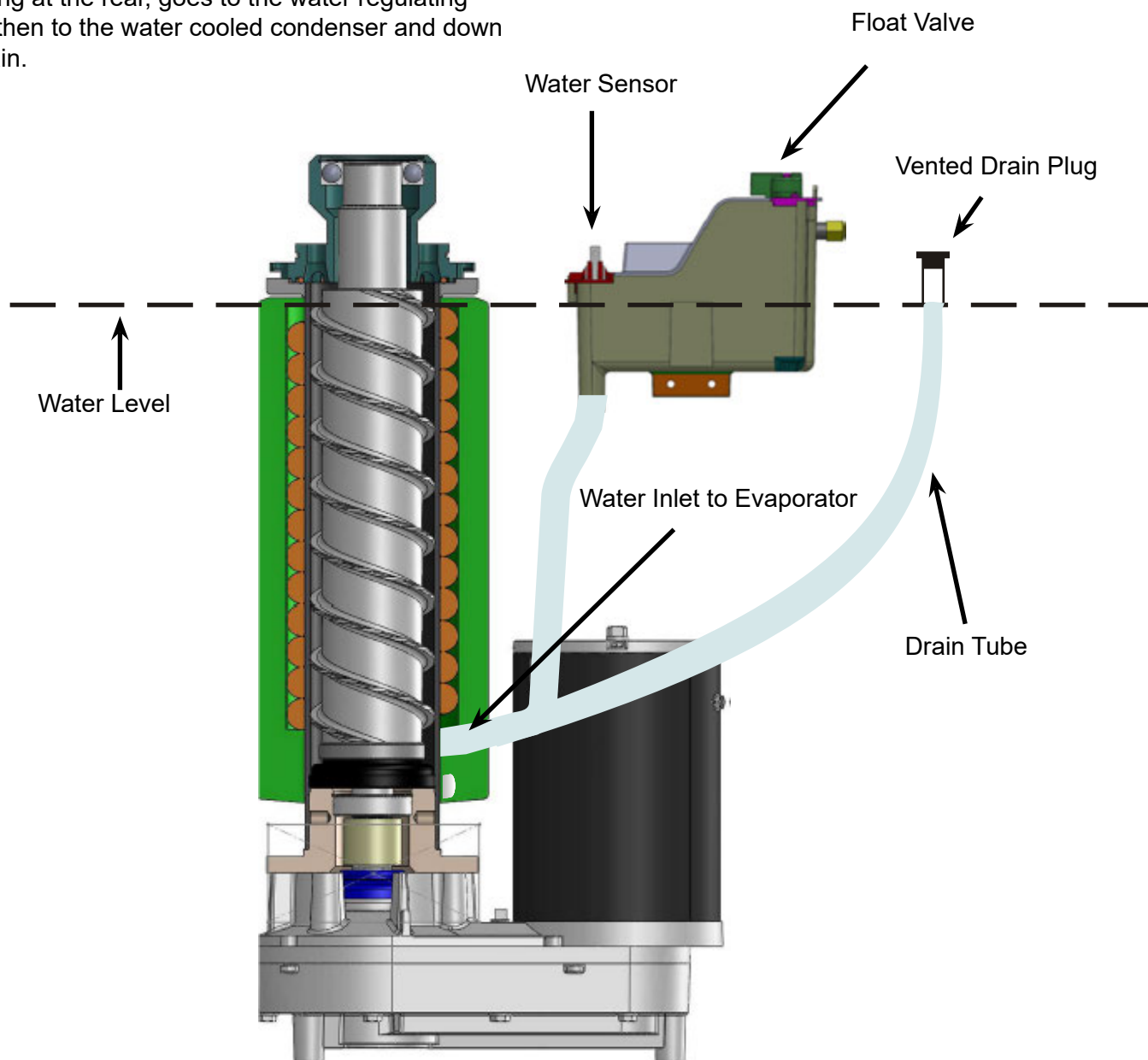
Water enters the machine through the 3/8" male flare at the rear of the cabinet, goes to the water reservoir which it enters through the float valve.

The float valve maintains a constant level of water in the reservoir and evaporator, as water flows out the bottom of the reservoir tank to fill the evaporator.

Reservoir overflow or evaporator condensation is routed to the drain. Water cooled models have a separate water circuit for the cooling water: it enters the fitting at the rear, goes to the water regulating valve, then to the water cooled condenser and down the drain.

**Water Level:** The correct water level should be checked when the machine is making ice. Check the water level in the reservoir and compare it to the horizontal line molded into the side of the reservoir.

The correct level should be between 1/8" above and 1/4" below the line. If needed, bend the float arm up or down to adjust the water level.



*Water System Schematic*

## Air Cooled Refrigeration

The compressor concentrates the heat from ice making into high pressure, hot discharge gas. The high pressure forces the gas to the water cooled condenser.

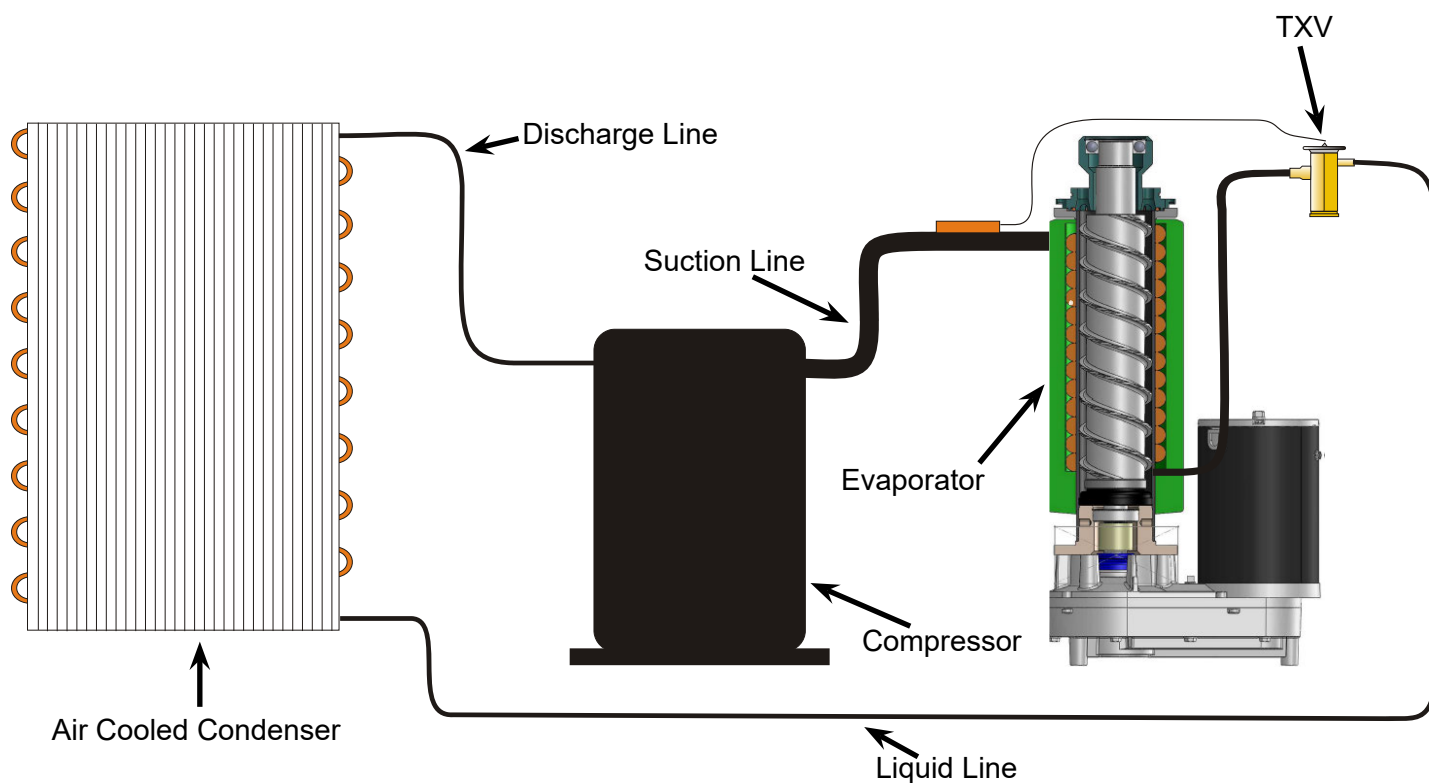
At the condenser, refrigerant gas flows through a serpentine tube that is connected to fins. Room air is forced by a fan motor through the fins. As the relatively cooler air comes in contact with the fins and tubing, heat flows from the hot refrigerant gas into the fins and tubing and into the cooler air passing over them. When the refrigerant cools, it condenses into a liquid.

From the condenser the high pressure liquid refrigerant flows through the liquid line to the metering device - a thermostatic expansion valve.

At the expansion valve, liquid refrigerant passes from a high pressure zone to one of relatively low pressure, and in the low pressure zone it evaporates.

The low pressure zone where the refrigerant evaporates is the evaporator. The evaporator is a vertical metal tube surrounded by a coil of tubing, which the refrigerant flows through. As refrigerant evaporates in the coil, it absorbs heat from the metal parts of the evaporator and the water inside it. As the auger inside the evaporator turns, ice is continuously forced out of the evaporator and make up water flows in.

From the evaporator, the refrigerant, carrying the heat from ice making, flows back to the compressor through the suction line, and the cycle continues



*Refrigeration Schematic*

## Water Cooled Refrigeration

The compressor concentrates the heat from ice making into high pressure, hot discharge gas. The high pressure forces the gas to the water cooled condenser.

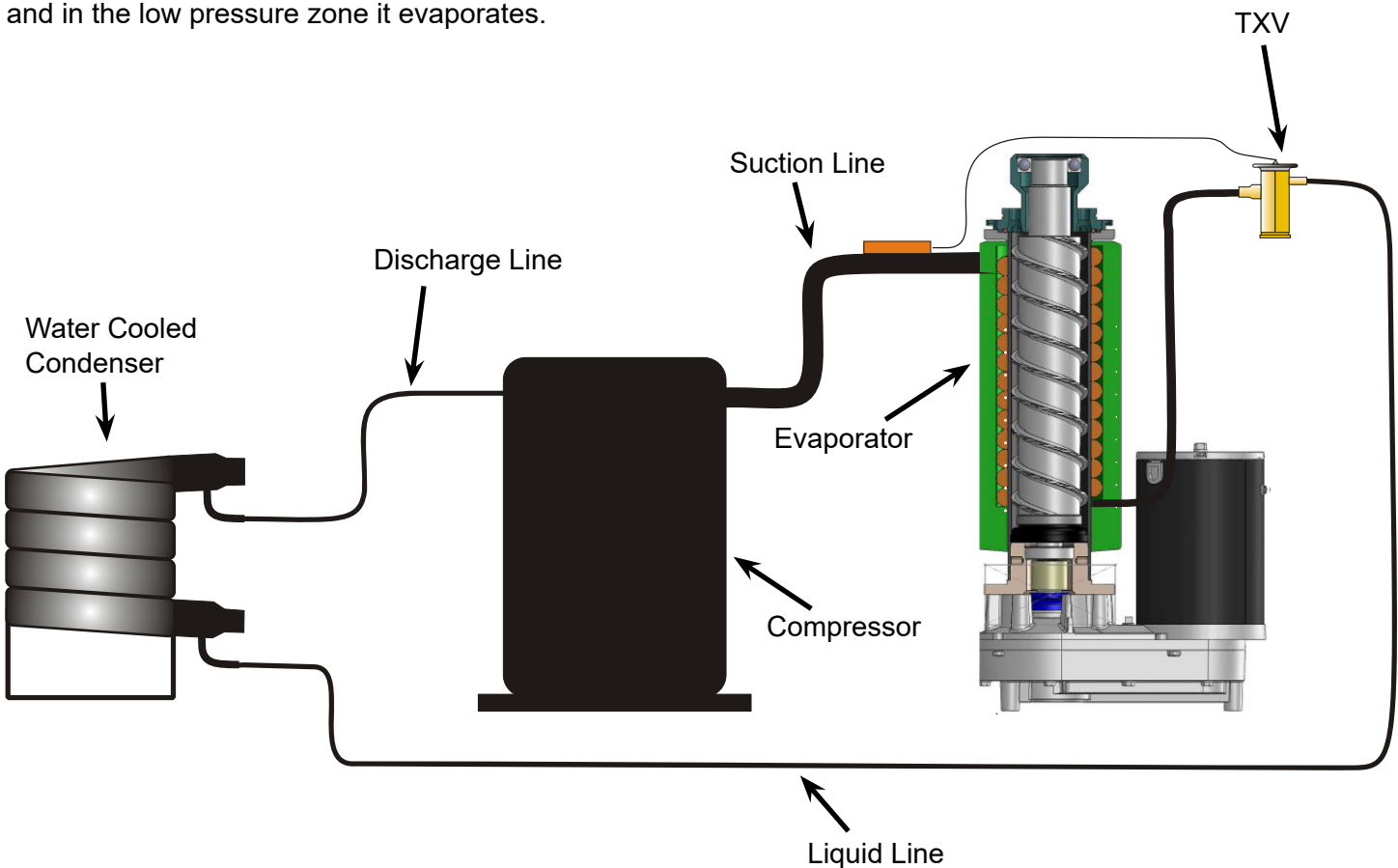
At the condenser, refrigerant gas and water flow through connected parallel tubes, but in opposite directions. Heat moves from the hotter discharge gas to the cooler water, and the refrigerant condenses into a liquid. The water flows out of the condenser warmed up to about 110°F. Water flow is controlled by a water regulating valve on the inlet of the condenser's water circuit.

From the condenser the high pressure liquid refrigerant flows through the liquid line to the metering device - a thermostatic expansion valve.

At the expansion valve, liquid refrigerant passes from a high pressure zone to one of relatively low pressure, and in the low pressure zone it evaporates.

The low pressure zone where the refrigerant evaporates is the evaporator. The evaporator is a vertical metal tube surrounded by a coil of tubing, where the refrigerant flows through. When the refrigerant evaporates in the coil, it absorbs heat from the metal parts of the evaporator and the water inside it. As the auger inside the evaporator turns, ice is continuously forced out of the evaporator and make up water flows in.

From the evaporator, the refrigerant, carrying the heat from ice making, flows back to the compressor through the suction line, and the cycle continues.



*Refrigeration Schematic*

## Remote Air Cooled Refrigeration

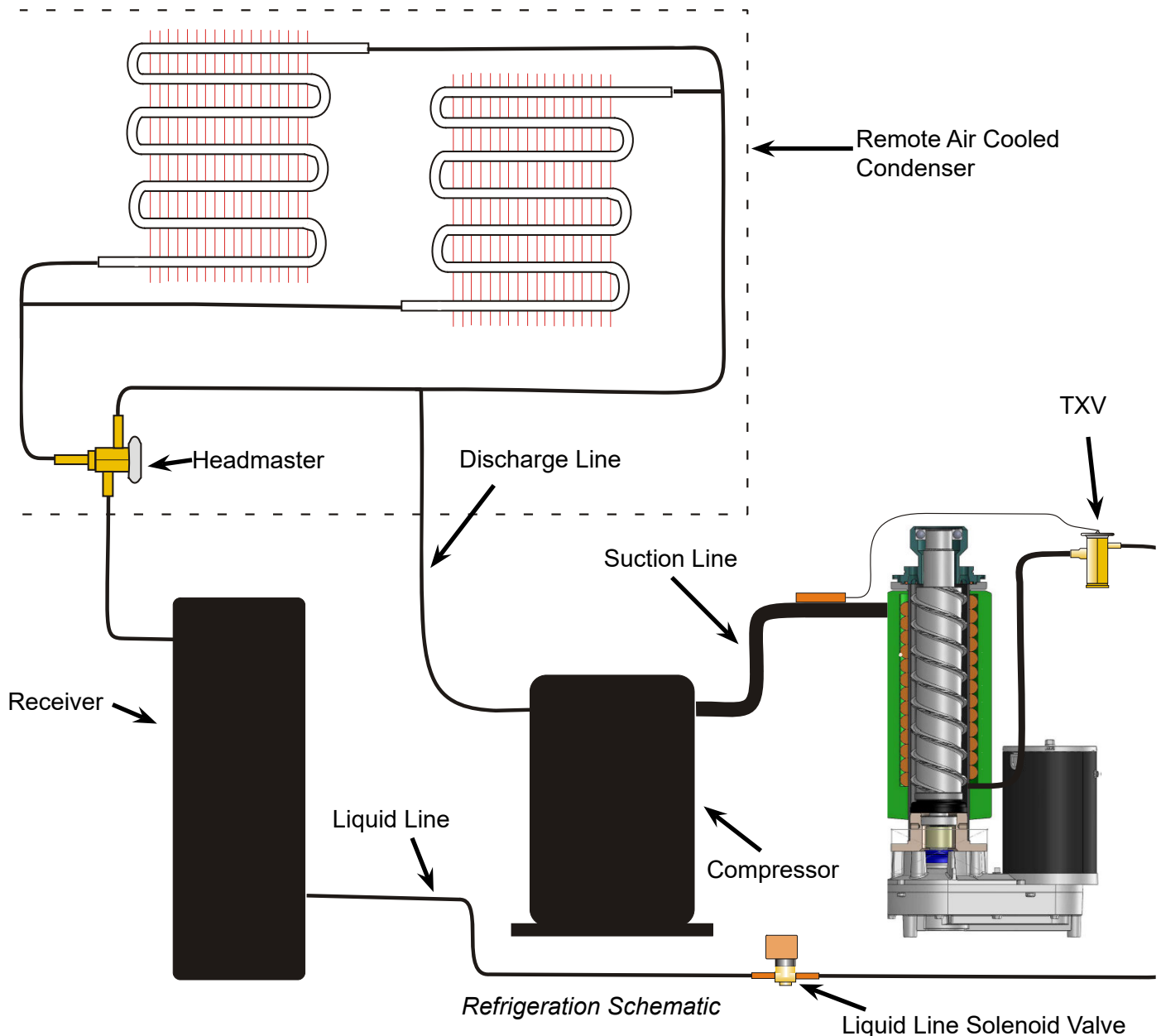
The compressor concentrates the heat from ice making into high pressure, hot discharge gas. The high pressure forces the gas to the remote condenser. At the remote condenser, the discharge gas will either enter the coils or bypass them through the headmaster. The head master maintains a minimum discharge pressure to keep flash gas out of the liquid line.

From the condenser, refrigerant flows to the receiver. It can be either liquid or gas, depending upon the modulation of the head master. From the receiver, liquid refrigerant flows to the thermostatic expansion valve. At the expansion valve, liquid refrigerant

passes from a high pressure zone to one of relatively low pressure, and in the low pressure zone it evaporates, absorbing heat.

From the evaporator, the refrigerant, carrying the heat from ice making, flows back to the compressor through the suction line, and the cycle continues.

When enough ice has been made, the control system closes the liquid line solenoid valve and the machine pumps down, forcing refrigerant out of the low side until the pump down pressure switch stops the compressor.



## How Ice Is Made

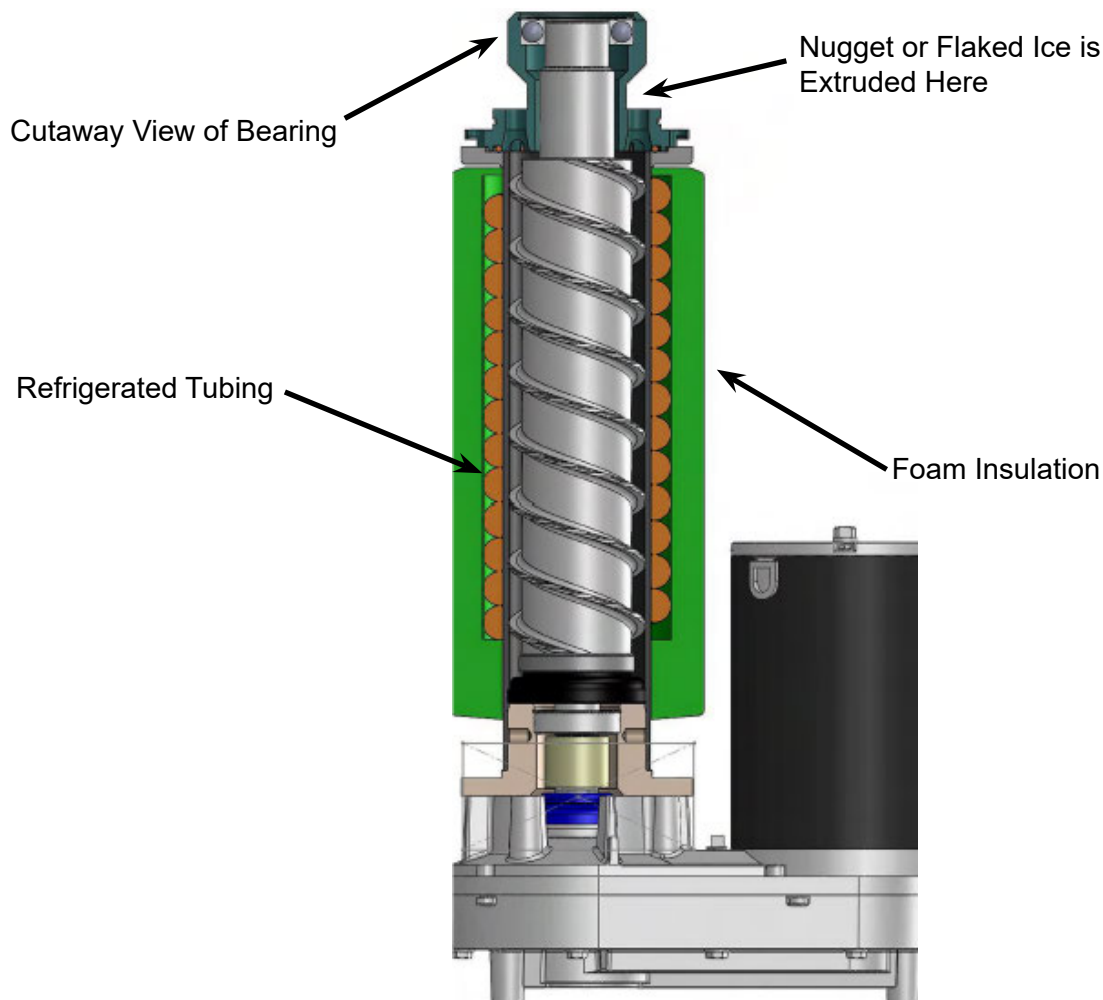
Refrigeration effect is applied to the water between the auger and the evaporator. When that water's temperature drops to its freezing point, ice crystals form throughout it. A continually rotating auger moves the ice up the evaporator tube. At this point the ice is a soft ribbon that fills the space between the auger and evaporator.

At the top of the evaporator tube, ice emerges from the water and is forced or extruded through relatively small openings. This has the effect of squeezing out excess water and compressing the ice together into a useable form.

Ice flowing from the openings is forced to one side, breaking it into smaller lengths. An ice sweep moves them to the chute.

Flaked ice machines have 6 oblong and curved slots that ice flows from, and they produce a softer, wetter ice form.

Soft nugget ice machines have 16 round holes and hard nugget ice machines have 8 round holes that form the nugget, which is more heavily compressed and contains less water than freshly made flaked ice.



## Technical Information

### Pressure Switches

|                                  | Cut IN (PSIG) | Cut OUT (PSIG) |
|----------------------------------|---------------|----------------|
| High pressure switch, AC, WC, RC | 350           | 450            |
| Low pressure switch, AC or WC    | 30            | 15             |
| Low pressure pump down (remote)  | 30            | 15             |

### Compressor Amp Draw

| Model                  | Voltage          | Brand    | Amps        |
|------------------------|------------------|----------|-------------|
| NH0422, NS0422, FS0522 | 115              | Tecumseh | 5.9 - 6.1   |
| NH0622, NS0622, FS0822 | 115              | Copeland | 7.1 - 7.4   |
| NH0622, NS0622, FS0822 | 230 single phase | Copeland |             |
| NH0922, NS0922, FS1222 | 115              | Copeland | 10.7 - 10.9 |
| NH0922, NS0922, FS1222 | 230 single phase | Copeland | 4.4 - 5.0   |
| NH0922, NS0922, FS1222 | 230 three phase  | Copeland | 3.6 - 3.8   |
| NH1322, NS1322, FS1522 | 230 single phase | Copeland | 6.9 - 7.2   |
| NH1322, NS1322, FS1522 | 230 three phase  | Copeland |             |

### Auger Drive Motor Amps

| Model                  | Ice Machine Voltage       | Auger Motor Amps | Control Cut Out Amps |
|------------------------|---------------------------|------------------|----------------------|
| NH0422, NS0422, FS0522 | 115                       | 1.8 - 2.2        | 3                    |
| NH0622, NS0622, FS0822 | 115                       | 1.8 - 2.2        | 3                    |
| NH0622, NS0622, FS0822 | 230 single phase          | 0.9 - 1.1        | 2                    |
| NH0922, NS0922, FS1222 | 115                       | 1.8 - 2.2        | 3                    |
| NH0922, NS0922, FS1222 | 230 single or three phase | 0.9 - 1.1        | 2                    |
| NH1322, NS1322, FS1522 | 230 single or three phase | 0.9 - 1.1        | 2                    |

## Heat Load, Charge and Condenser GPM

### Heat Load - Average heat load for air conditioning unit sizing

| Model                  | BTUH  |
|------------------------|-------|
| NH0422, NS0422, FS0522 | 5000  |
| NH0622, NS0622, FS0822 | 7100  |
| NH0922, NS0922, FS1222 | 10500 |
| NH1322, NS1322, FS1522 | 16000 |

### Refrigerant Charge

| Model                           | R-404A (oz) |
|---------------------------------|-------------|
| NH0422A, NS0422A, FS0522A       | 14          |
| NH0422W, NS0422W, FS0522W       | 14          |
| NH0622A, NS0622A, FS0822A       | 14          |
| NH0622W, NS0622W, FS0822W       | 11          |
| NH0622R, NS0622R, FS0822R       | 192         |
| NH0922A, NS0922A, FS1222A       | 22          |
| NH0922W, NS0922W, FS1222W       | 28          |
| NH0922R, NS0922R, FS1222R       | 192         |
| NH0922A, NS0922A, FS1222A (-32) | 22          |
| NH0922W, NS0922W, FS1222W (-32) | 28          |
| NH0922A, NS0922A, FS1222A (-3)  | 22          |
| NH0922W, NS0922W, FS1222W (-3)  | 28          |
| NH1322A, NS1322A, FS1522A       | 34          |
| NH1322W, NS1322W, FS1522W       | 28          |
| NH1322R, NS1322R, FS1522R       | 192         |

### Water Cooled Water Use - Condenser Only

| Model                  | GPM @ Supply Water Temp | GPM @ test ambient |
|------------------------|-------------------------|--------------------|
| NH0422, NS0422, FS0522 | .14 @ 50°F water        | .23 @ 70°F water   |
| NH0622, NS0622, FS0822 | .21 @ 50°F water        | .40 @ 70°F water   |
| NH0922, NS0922, FS1222 | .68 @ 50°F water        | .76 @ 70°F water   |
| NH1322, NS1322, FS1522 | .32 @ 50°F water        | .59 @ 70°F water   |



## **Refrigeration System Pressures**

Refrigeration system pressures of continuous flow ice machines do not vary a great deal while in operation. They will vary by model, condenser type and ambient. Typical superheat range for all models is between 8 and 12 degrees F.

|                  | 70/50          |                  | 90/70          |                  |
|------------------|----------------|------------------|----------------|------------------|
| Model            | Suction (PSIG) | Discharge (PSIG) | Suction (PSIG) | Discharge (PSIG) |
| NH0422A, NS0422A | 37-39          | 235-245          | 45-46          | 255-265          |
| NH0422W, NS0422W | 38-40          | 240-250          | 38-42          | 240-250          |
| FS0522A          | 37-39          | 235-245          | 40-42          | 250-260          |
| FS0522W          | 37-39          | 240-250          | 39-41          | 240-250          |
| NH0622A, NS0622A | 28-31          | 235-245          | 35-40          | 275-285          |
| NH0622W, NS0622W | 29-32          | 240-250          | 30-34          | 240-250          |
| NH0622R, NS0622R | 35-37          | 240-250          | 36-38          | 250-260          |
| FS0822A          | 28-31          | 235-245          | 34-39          | 285-295          |
| FS0822W          | 29-32          | 240-250          | 30-34          | 240-250          |
| FS0822R          | 35-37          | 240-250          | 36-38          | 250-260          |
| NH0922A, NS0922A | 22-25          | 205-215          | 32-33          | 280-290          |
| NH0922W, NS0922W | 22-25          | 240-250          | 31-33          | 240-250          |
| NH0922R, NS0922R | 28-30          | 240-250          | 31-32          | 245-255          |
| FS1222A          | 22-25          | 205-215          | 31-33          | 280-290          |
| FS1222W          | 22-25          | 240-250          | 30-33          | 240-250          |
| FS1222R          | 28-30          | 240-250          | 31-32          | 245-255          |
| NH1322A, NS1322A | 22-25          | 205-215          | 30-32          | 295-305          |
| NH1322W, NS1322W | 26-28          | 240-250          | 25-28          | 240-250          |
| NH1322R, NS1322R | 29-30          | 230-240          | 30-31          | 245-255          |
| FS1522A          | 22-25          | 205-215          | 28-32          | 295-305          |
| FS1522W          | 26-28          | 240-250          | 25-28          | 240-250          |

## Maintenance

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This ice machine needs five types of maintenance:

- Air cooled and remote models need their air filters or condenser coils cleaned regularly.
- All models need scale removed from the water system.
- All models require regular sanitization.
- All models require sensor cleaning.
- All models require a top bearing check.

Maintenance Frequency:

Air filters: At least twice a year, but in dusty or greasy air, monthly.

Scale removal: At least twice a year, in some water conditions it might be every 3 months. The yellow De-Scale & Sanitize light will switch on after a set period of time as a reminder. The default time period is 6 months of power up time.

Sanitizing: Every time the scale is removed or as often as needed to maintain a sanitary unit.

Sensor Cleaning: Every time the scale is removed.

Top bearing check: At least twice a year or every time the scale is removed. During the course of normal operation, some material buildup on top of the bearing is normal and should be wiped away during maintenance.

### Maintenance: Air filters

1. Pull air filter(s) from panel.
2. Wash the dust and grease off the filter(s).
3. Return it(them) to their original position(s).

Do not operate the machine without the filter in place except during cleaning.

### Maintenance: Air cooled condenser

If the machine has been operated without a filter the air cooled condenser fins will need to be cleaned.

They are located under the fan blades. The services of a refrigeration technician will be required to clean the condenser.

### Maintenance: Remote air cooled condenser

The condenser fins will occasionally need to be cleaned of leaves, grease or other dirt. Check the coil every time the ice machine is cleaned.

### Maintenance: Exterior Panels

The front and side panels are durable stainless steel. Fingerprints, dust and grease will require cleaning with a good quality stainless steel cleaner

Note: If using a sanitizer or a cleaner that contains chlorine on the panels, after use be sure to wash the panels with clean water to remove chlorine residue.

### Maintenance: Water filters

If the machine has been connected to water filters, check the cartridges for the date they were replaced or for the pressure on the gauge. Change cartridges if they've been installed more than 6 months or if the pressure drops too much during ice making.

## Maintenance: Scale Removal and Sanitation

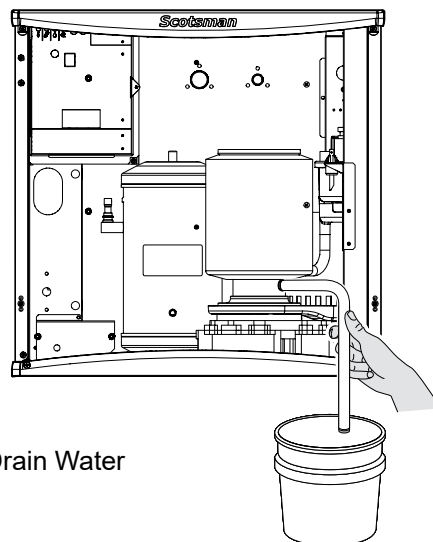
Note: Following this procedure will reset the de-scale and sanitize light.

1. Remove front panel.
2. Push and release the Off button.
3. Remove ice from bin or dispenser.
4. Turn the water supply to the float valve OFF.
5. Drain the water and evaporator by disconnecting the leg of the hose connected to the water sensor and draining it into the bin. Return the hose to its original position.
6. Remove the water reservoir cover.
7. Mix a solution of 8 ounces of Scotsman Clear One Scale Remover and 3 quarts of 95-115 degree F. potable water.

| Model:                                                         | Scotsman Clear One | Water  |
|----------------------------------------------------------------|--------------------|--------|
| NS0422, NS0622, NS0922, NS1322, FS0522, FS0822, FS1222, FS1522 | 8 oz.              | 3 qts. |
| NH0422, NH0622, NH0922, NH1322                                 | 3 oz.              | 3 qts. |

|                                                                                     |                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>WARNING</b></p> <p>Ice machine scale remover contains acids. Acids can cause burns. If concentrated cleaner comes in contact with skin, flush with water. If swallowed, do NOT induce vomiting. Give large amounts of water or milk. Call Physician immediately. Keep out of the reach of children.</p> |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

8. Pour the scale remover solution into the reservoir. Use a small cup for pouring.
9. Push and release the Clean button: the auger drive motor and light are on, C is displayed and the De-scale light blinks. After 20 minutes the compressor will start.
10. Operate the machine and pour the scale remover into the reservoir until it is all gone. Keep the reservoir full. When all the scale remover solution has been used, turn the water supply back on. After 20 minutes of ice making the compressor and auger motor will shut off.



Drain Water

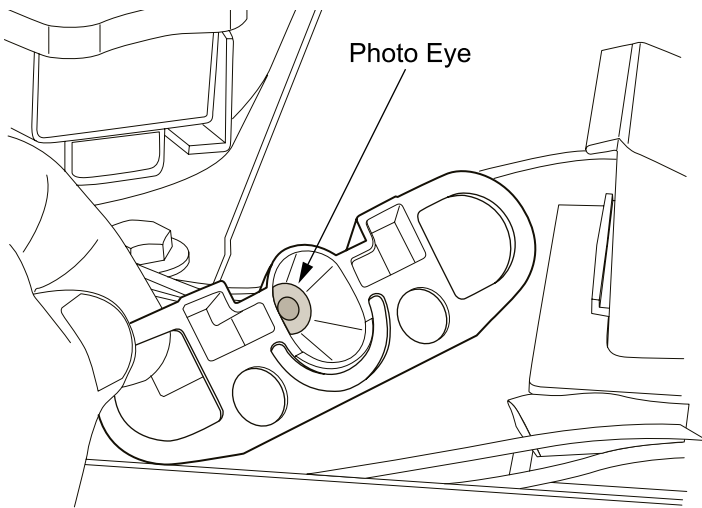
11. Turn the water supply to the ice machine OFF.
12. Drain the water reservoir and evaporator by disconnecting the leg of the hose connected to the water sensor and draining it into the bin or a bucket. Return the hose to its original position. Discard or melt all ice made during the previous step.
13. Create a solution of sanitizer. Mix 4oz/118ml of NuCalgon IMS and 2.5gal/9.5L of (90°F/32°C to 110°F/43°C) potable water to create a 200 ppm solution.
14. Pour the sanitizing solution into the reservoir.
15. Push and release the On button.
16. Switch the water supply to the ice machine on.
17. Operate the machine for 20 minutes.
18. Push and release the Off button.
19. Wash the reservoir cover in the remaining sanitizing solution.
20. Return the reservoir cover to its normal position.
21. Melt or discard all ice made during the sanitizing process.
22. Wash the inside of the ice storage bin with the sanitizing solution.
23. Push and release the On button.
24. Return the front panel to its original position and secure with the original screws.

## Maintenance: Sensors

### Photo Eyes

The control that senses bin full and empty is a photo-electric eye, therefore it must be kept clean so it can “see”. At least twice a year, remove the ice level sensors from the base of the ice chute, and wipe the inside clean, as illustrated.

1. Remove front panel.
2. Pull photo eye holders forward to release them.
3. Wipe clean as needed. Do not scratch the photo-eye portion.
4. Return the eye holders to their normal positions and return the front panel to its original position.



**Note:** Eye holders must be mounted properly. They snap into a centered position and are properly located when the wires are routed to the back and the left eye is the one with 2 wires at the connector.

### Check Gear Reducer Lubricant

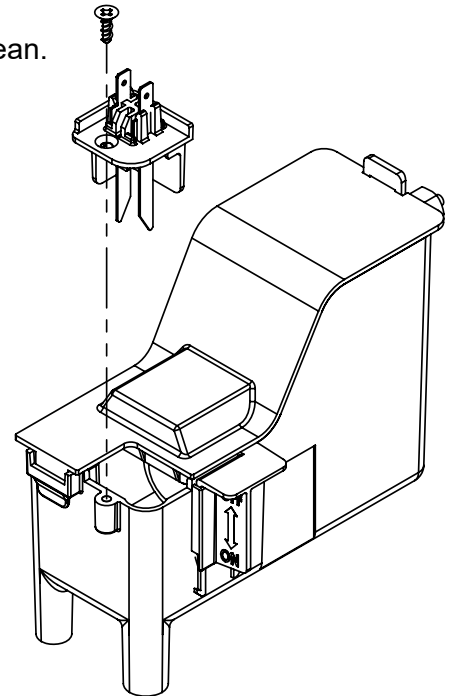
Although there is no normal access to the gear reducer lubricant, it can be checked without removal and complete disassembly.

Remove red vented plug from gearbox. Using a flathead screwdriver, check the oil level using the vent hole between the motor and the freezer. About 3/8" of oil should be on the tip of the screwdriver blade. Any more and there may be water in the gear case, any less and it may be low. The correct oil charge is 14 ounces. See picture to right.

### Water Level

The ice machine senses water by probe located in the water reservoir. At least twice a year, the probes should be wiped clean of mineral build-up.

1. Shut off the water supply.
2. Remove front panel.
3. Remove the Phillips head screw and remove the water level sensor from the reservoir.
4. Wipe probes clean.



### Vent Hole



## Service Diagnosis - Air Cooled

| Symptom                 | Probable Cause                                                     | Possible Correction                                                                                                                        |
|-------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| No ice                  | No power                                                           | Check that ice machine has power. If power light is out, check transformer.                                                                |
|                         | Code 3: No water                                                   | Restore water, check filters, water level and sensor                                                                                       |
|                         | Status light is off                                                | Push and release ON switch                                                                                                                 |
|                         | Code 1: No ice sensed                                              | Check for ice flow down chute. if very slow or no ice being made, check for refrig. system failure                                         |
|                         |                                                                    | Check auger motor for power, if no power, check controller component indicator light. If there is power to the motor, check motor windings |
|                         | Code 2: Auger motor draws too many amps, controller shut unit off. | Check for damage to gear reducer or auger bearings.                                                                                        |
|                         |                                                                    | Check for restriction between reservoir and evaporator                                                                                     |
|                         | Bin Eyes Blocked light is On                                       | Ice is in the chute.                                                                                                                       |
|                         |                                                                    | No ice in the chute. Check position of sensors, check sensors for scale build up                                                           |
|                         | Code 4: Refrigeration system over or under pressure                | Check for proper operation of the fan and motor; check for proper flow of water into evaporator; check for proper refrigerant charge       |
|                         | Everything is in operation, but no refrigeration effect            | Check compressor                                                                                                                           |
|                         |                                                                    | Check TXV superheat                                                                                                                        |
|                         |                                                                    | Check refrigerant charge                                                                                                                   |
| Low ice making capacity | Optional bin thermostat is open                                    | Check thermostat or jumper wire on blue wires to #5 & #6                                                                                   |
|                         | Optional ultrasonic system senses false bin full                   | Check sensor for proper installation and operation                                                                                         |
|                         | Scale build up                                                     | Remove scale from evaporator and water system                                                                                              |
|                         | Air filter dirty                                                   | Clean air filter                                                                                                                           |
|                         | Condenser fins dirty                                               | Clean condenser                                                                                                                            |
|                         | Restricted water to evaporator                                     | Check for air bubble in hose, change reservoir if found                                                                                    |
|                         | Expansion valve superheat incorrect                                | Check superheat                                                                                                                            |

## Service Diagnosis - Water Cooled

| Symptom                 | Probable Cause                                                     | Possible Correction                                                                                                                        |
|-------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| No ice                  | No power                                                           | If power light is out and there is power to the unit, check transformer.                                                                   |
|                         | Code 3: No water                                                   | Restore water, check filters, water level and sensor                                                                                       |
|                         | Status light is off                                                | Push and release ON switch                                                                                                                 |
|                         | Code 1: No ice sensed                                              | Check for ice flow down chute. if very slow or no ice being made, check for refrigeration system failure                                   |
|                         |                                                                    | Check auger motor for power, if no power, check controller component indicator light. If there is power to the motor, check motor windings |
|                         | Code 2: Auger motor draws too many amps, controller shut unit off. | Check for damage to gear reducer or auger bearings.                                                                                        |
|                         | Bin Eyes Blocked light is On                                       | Ice is in the chute.                                                                                                                       |
|                         |                                                                    | No ice in the chute. Check position of sensors, check sensors for scale build up                                                           |
|                         | Code 4: Refrigeration system over or under pressure                | Check water flow to condenser; check for proper flow of water into evaporator; check refrigerant charge                                    |
|                         | Everything is in operation, but no refrigeration effect            | Check water regulating valve                                                                                                               |
|                         |                                                                    | Check TXV superheat                                                                                                                        |
|                         |                                                                    | Check refrigerant charge                                                                                                                   |
|                         | Optional bin thermostat is open                                    | Check thermostat or jumper wire on blue wires to #5 & #6                                                                                   |
| Low ice making capacity | Optional ultrasonic system set too low                             | Adjust selector switch to a higher position                                                                                                |
|                         | Optional ultrasonic system senses false bin full                   | Check sensor for proper installation and operation                                                                                         |
|                         | Scale build up                                                     | Remove scale from evaporator and water system                                                                                              |
|                         | Restricted water to evaporator                                     | Check for air bubble in hose, change reservoir if found                                                                                    |
|                         | High discharge pressure                                            | Check water regulating valve                                                                                                               |
|                         | Expansion valve superheat incorrect                                | Check superheat                                                                                                                            |

## Service Diagnosis - Remote Air Cooled

| Symptom | Probable Cause                                                      | Possible Correction                                                                                                                                        |
|---------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No ice  | No power                                                            | If ice machine has power and power light is out, check transformer.                                                                                        |
|         | Code 3: No water                                                    | Restore water, check filters, water level and sensor                                                                                                       |
|         | Status light is off                                                 | Push and release ON switch                                                                                                                                 |
|         | Code 1: No ice sensed                                               | Check for ice flow down chute. if very slow or no ice being made, check for refrigeration system failure                                                   |
|         |                                                                     | Auger motor working, compressor off. Check liquid line valve and pump down switch                                                                          |
|         |                                                                     | Check auger motor for power, if no power, check controller component indicator light. If there is power to the motor, check motor windings or start switch |
|         | Code 2: Auger motor draws too many amps, controller shuts unit off. | Check liquid line valve for leak through, causing auger to freeze in place                                                                                 |
|         |                                                                     | Check for damage to gear reducer or auger bearings.                                                                                                        |
|         | Bin Eyes Blocked light is On                                        | Ice is in the chute.                                                                                                                                       |
|         |                                                                     | No ice in the chute. Check position of sensors, check sensors for scale build up                                                                           |
|         | Code 4: High discharge pressure                                     | Check remote condenser fan motor                                                                                                                           |
|         | Everything is in operation, but no refrigeration effect             | Check liquid line valve                                                                                                                                    |
|         |                                                                     | Check compressor                                                                                                                                           |
|         |                                                                     | Check TXV superheat                                                                                                                                        |
|         |                                                                     | Check refrigerant charge                                                                                                                                   |
|         | Optional ultrasonic system set too low                              | Adjust selector switch to a higher position                                                                                                                |
|         | Optional bin thermostat is open                                     | Check thermostat or jumper wire on blue wires to #5 & #6                                                                                                   |
|         | Optional ultrasonic system senses false bin full                    | Check sensor for proper installation and operation                                                                                                         |

## Service Diagnosis - Remote Air Cooled

| Symptom                 | Probable Cause                          | Possible Correction                                                                                                                            |
|-------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Low ice making capacity | Scale build up                          | Remove scale from evaporator and water system                                                                                                  |
|                         | Restricted water to evaporator          | Check for air bubble in hose to evaporator. If there is an air bubble AND the reservoir has a water sensor IN the bowl, replace the reservoir. |
|                         | High discharge pressure                 | Check remote condenser                                                                                                                         |
|                         |                                         | Check headmaster                                                                                                                               |
|                         | Expansion valve superheat incorrect     | Check superheat                                                                                                                                |
|                         | Compressor cycles on and off frequently | Check liquid line valve for leak through                                                                                                       |
|                         |                                         | May be normal, pump down switch will operate compressor as pump down switch closes and opens                                                   |



## Service Diagnosis - Refrigeration System Failure

| Symptom                         | Probable Cause                        | Possible Correction                                                                                                                                                                                         |
|---------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Compressor is not operating     | Contactor not pulled in               | Check voltage to coil of contactor, if correct, check coil of contactor                                                                                                                                     |
|                                 |                                       | Check if Low or High pressure cut outs open, Code 4 in code display                                                                                                                                         |
|                                 |                                       | Check if remote pump down switch not closed - if open, check low side pressure and liquid line valve                                                                                                        |
|                                 |                                       | Check for control board relay not supplying power to contactor                                                                                                                                              |
|                                 | Compressor overheated                 | Check for low refrigerant charge                                                                                                                                                                            |
|                                 |                                       | Check for high TXV superheat                                                                                                                                                                                |
|                                 |                                       | Check for high amp draw, possible start relay keeping start winding powered                                                                                                                                 |
|                                 | Compressor overload open              | Check for overheating, or over amp draw                                                                                                                                                                     |
|                                 | Compressor will not start             | Check start relay and start capacitor                                                                                                                                                                       |
|                                 |                                       | Check voltage at compressor                                                                                                                                                                                 |
|                                 |                                       | Check voltage at contactor                                                                                                                                                                                  |
|                                 |                                       | Check compressor windings                                                                                                                                                                                   |
| Compressor on, no refrigeration | Low charge                            | Check system charge                                                                                                                                                                                         |
|                                 | Condenser dirty                       | Check condenser                                                                                                                                                                                             |
|                                 | Remote - liquid line valve restricted | Check liquid line valve                                                                                                                                                                                     |
|                                 | TXV not metering                      | Check superheat                                                                                                                                                                                             |
|                                 | Auger not turning                     | Check gear reducer                                                                                                                                                                                          |
|                                 | Remote headmaster in bypass mode      | Check headmaster                                                                                                                                                                                            |
|                                 | Inefficient compressor                | Check compressor amp draw, if normal not likely inefficient                                                                                                                                                 |
|                                 | Compressor internal relief open       | Check suction and discharge pressure. Relief valve opens at a pressure differential between 450 and 550 and will not re-close until differential between suction and discharge is reduced to less than 450. |
|                                 |                                       |                                                                                                                                                                                                             |

## Service Diagnosis - Optional Ice Level Controls

### Vari-Smart (KVS)

| Symptom                                       | Probable Cause                                | Possible Correction                                                                                |
|-----------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------|
| No ice, bin full light is ON                  | Adjustment knob set too low                   | Rotate knob to first position, knob's arrow pointing to the left of the L in Lower (on the label)  |
|                                               | Obstruction beneath sensor                    | Check for and clear any item that might be below the sensor                                        |
|                                               | Sensor recessed                               | Check sensor, sensor must be flush in its holder and not recessed.                                 |
| No ice, b in code display, no bin thermostat  | Chute thermostat is open                      | Check chute thermostat                                                                             |
| No ice, power light on, bin full light is OFF | Photo-eye in chute blocked                    | Check controller display code. If a b, check for blockage or scale build up on photo eyes in chute |
|                                               |                                               | Check for photo eye failure                                                                        |
|                                               | Optional Smart-Board is controlling ice level | Check Smart-Board settings.                                                                        |
| Ice level too high                            | Adjustment knob set to maximum fill           | Check if knob's arrow points to label arrow.                                                       |
|                                               | Sensor wire disconnected                      | Check for proper connection of sensor wire to VS control board                                     |

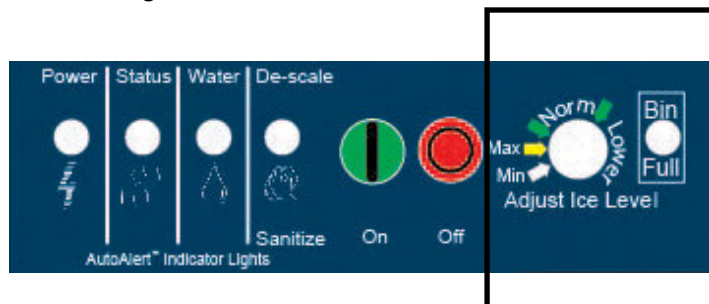
### Bin Thermostat (KDIL-N)

| Symptom                                 | Probable Cause           | Possible Correction                                                                             |
|-----------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------|
| No ice, b in code display               | Bin stat is open         | Check for ice on bin thermostat capillary tube                                                  |
|                                         |                          | Check for cold ambient in bin                                                                   |
|                                         |                          | Check continuity of bin thermostat when capillary tube is warm, replaced if does not close      |
| Unit overfills, shuts off on photo-eyes | Bin stat is stuck closed | Check position of bin thermostat capillary tube.                                                |
|                                         |                          | Check continuity of bin thermostat when ice is on the capillary tube, replaced if does not open |

## Options

### Vari-Smart

Optional adjustable ice level control (KVS). When this option is present there is an adjustment post and an additional indicator light to the right of the four indicator lights mentioned earlier.



The ultrasonic ice level control allows the user to control the point that the ice machine will stop making ice before the bin or dispenser is full.

Reasons for this include:

- Seasonal changes in ice used
- Planning to sanitize the bin
- Faster turnover for fresher ice
- Certain dispenser applications where maximum ice level is not desired

Use of adjustable ice level control

There are several positions the ice level can be set to, including Off or Max (knob and label indicators lined up), where it fills the bin until the standard bin control shuts the machine off. See the kit's instructions for complete details.

Rotate the adjustment post to the desired ice level.

The machine will fill up to that level and when it shuts off the indicator light next to the adjustment post will be On.

Note: The maximum fill position is when the arrow on the knob points to the arrow on the label.

### Dispenser applications - Nugget ice only:

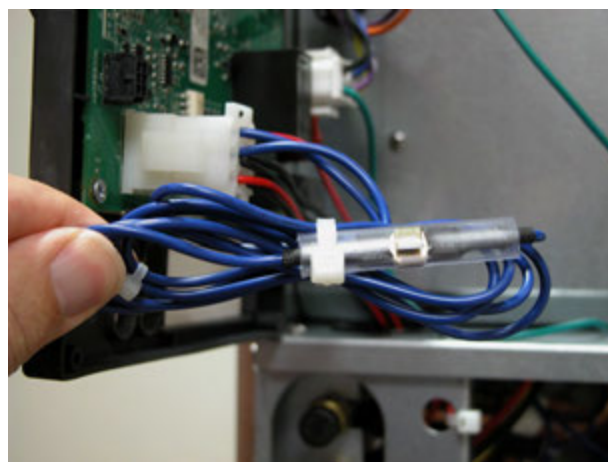
Set the adjustment knob arrow to the Norm area between the green arrows. Select either the first or second positions as a starting point and adjust as needed.

### Bin Stat

Another bin control method available on these machines is a bin thermostat (KDIL-N).

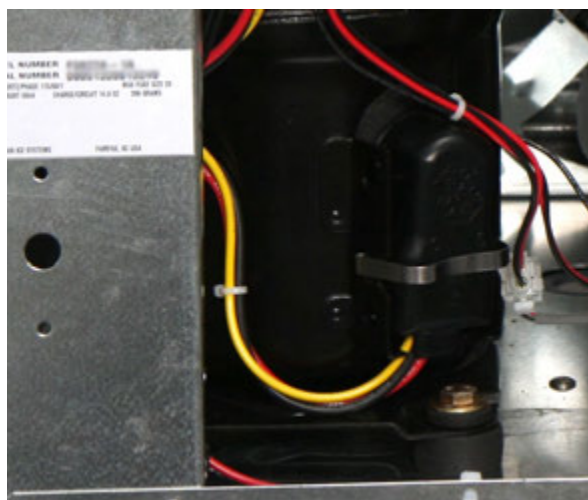
Type: Opens on temperature fall.

Connects: To blue wires to controller, in place of the jumper connecting the blue wires between terminals 5 and 6.



Use: In certain ice dispenser kits or whenever a permanently lowered ice level is desired and a KVS is not suitable.

Mounts: To the control box support post.



Result when open: Machine shuts down, b in code display.

Results when closed: Machine makes ice until either the circuit opens or the photo-eyes are blocked by ice.

Circuit voltage type: Low

## Repair Procedures: Bearing And Extruder

### Extruder:

1. Remove panels and disconnect electrical power.
2. Turn off the water to the machine, and unclip the evaporator drain hose, pull it down and drain the evaporator into the bin or a container.
3. Push back bail clamp and remove ice chute cover.
4. Unscrew and remove ice sweep.
5. Remove ice chute body and insulation collar.
6. The extruder/bearing assembly may now be removed:
  - a. Unscrew 4 allen (1/4") head screws holding extruder to evaporator and remove extruder

Note: The extruder may be removed from the evaporator without disturbing the auger and should be avoided unless the water seal is being replaced..

7. Reverse to reassemble:
  - Inspect and replace parts as needed, including ice chute o-ring
  - Torque all 4 allen head cap screws to 12.5 ft-lbs.
6. Service the bearing. Check for rust, rough spots, excessive play, or damage to bearing seals..

### Auger:

1. Go thru the process of removing the extruder.
2. The auger may now be easily removed by hand

Note: If the auger is stuck, a slide hammer can be used. Thread the slide hammer into the threaded hole on top of the auger where the sweep goes. The size of that hole is 1/2"-13



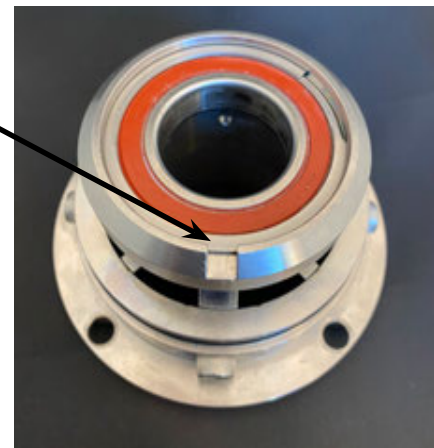
### Top Bearing:

1. Go through steps 1-4 of removing the extruder
2. Inspect the bearing for any rust, rough spots, excessive play, or damage to the bearing seals.
3. If bearing replacement is required, finish steps 5 and 6 to remove the extruder.
4. Remove the clip holding the bearing.
5. Tap out the old bearing. Bearing removal may require a press. Replacement of full extruder and bearing assembly is available and would not require a press.
6. Use the old bearing as something to press on and drive the new bearing into the extruder.
7. Reinstall the clip.

### Bottom Bearing:

1. Go thru the process of removing the auger.
2. Remove the 4 allen (1/4") head screws at the bottom of the evaporator.
3. Remove the bolts holding the bearing retainer to the gear reducer.
4. Separate the gear reducer, evaporator and bearing retainer.
5. Remove the clip.
6. Tap out the old bearing. May require a press.
7. Use the old bearing as something to press the new bearing on and drive the new bearing into the extruder.
8. Reverse to reassemble:
  - Torque all 4 allen head screws to 12.5 ft-lbs.

Retaining Clip



## Auger and Evaporator Inspection

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The auger must be carefully inspected for wear and scale. The wear areas are the top bearing surface, drive junction and the edges of the flights. The edges of the auger have horizontal serrations and there are highly machined areas in between. If the auger has contacted the evaporator wall, it will have very rough flight edges and should be replaced.

Scale forms on the auger during normal ice making. If scale is still on the auger after cleaning in the ice machine, the scale can be removed using ice machine cleaner and a nylon scrub pad.

Inspect the auger, the critical areas of the auger are:

1. The auger body. It should be clean and shining. Sometimes an auger will appear clean when wet, but after it is dry it will appear stained. Scrub the auger with ice machine cleaner and hot water.

---

Caution: Ice machine cleaner is an acid. Handle it with extreme care, keep out of the reach of children.

---

2. The water seal area. Because the auger has been removed, the water seal will have to be replaced. Remove the water seal top half from the auger, and remove any sealant or debris from the shoulder of the auger where the water seal was.

Inspect the evaporator's interior. The interior is stainless steel that should be bright and shiny when dry. If it isn't the scale on the surface must be removed. To remove scale:

1. Remove the water seal; it will have to be replaced.
2. Use a nylon brush and scrub the interior of the evaporator vertically to remove any scale.
3. Clean up any debris from the top of the gear reducer.



Example of a clean auger



Example of Scale Build Up on Evaporator Wall



## Water Seal

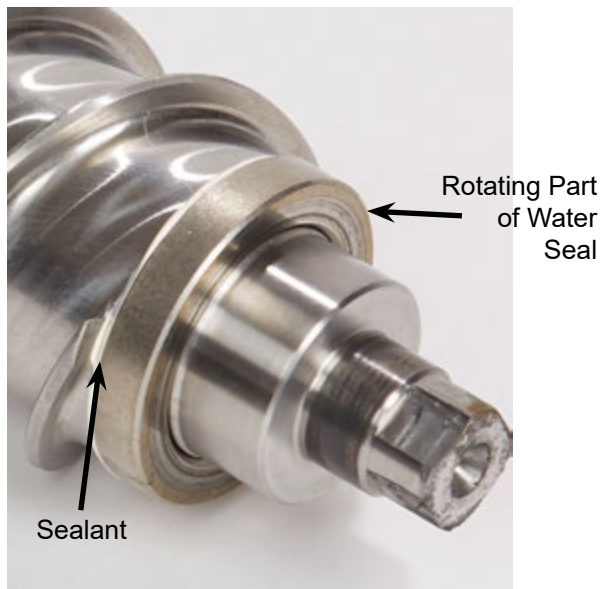
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1. Go through all steps to remove the auger.
  2. Remove the 4 allen head screws at the bottom of the evaporator.
  3. Lift the evaporator up and off the bottom bearing retainer.
  4. Push the water seal up on one side until it twists, grab it and pull it out.
  5. Remove the rotating half from the bottom of the auger.
  6. Clean the auger shoulder and add a very thin bead of food grade sealant to the bottom of the auger. (732 RTV or Scotsman part number 19-0529-01)
  7. Carefully push the new rotating half of the water seal up against the sealant as far as possible. It should seat tightly and straightly against the auger shoulder. Do not put fingerprints on the sealing surface.
  8. Wet the outside edge of the stationary half of the water seal and insert it into the bottom of the evaporator.
  9. Slip the evaporator onto the bottom bearing retainer, the bearing retainer will push the water seal up into the correct position.
- 

Note: The bottom bearing should have been replaced at this time. (see page 44)

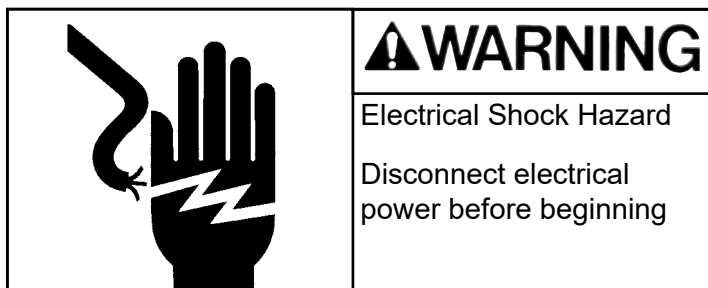
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10. Secure the evaporator to the bearing retainer with the original socket head screws. Be sure they are tight.



## Repair Procedures: The Gear Reducer

Note: The high speed non-metallic fiber gear is the only internal part that is a service part and can be replaced individually. If any other parts of the gear reducer are damaged or it is discovered that water has infiltrated the gear reducer, the entire assembly will need to be replaced.



5. After the gear case is together, replace all cap screws.

6. Check oil level. Remove red vented plug from gearbox. Using a flathead screwdriver, check the oil level using the vent hole between the motor and the freezer. About 3/8" of oil should be on the tip of the screwdriver blade. Any more and there may be water in the gear case, any less and it may be low. The correct oil charge is 14 ounces.

7. Bench test the gear reducer, check for oil leaks, noise, and amp draw.

1. Remove the electrical wires from the gear drive motor.

2. Unscrew the 4 1/2" hex head cap screws holding the evaporator adapter to the gear reducer.

3. Remove the gear reducer from the ice machine. It is recommended to support the evaporator assembly to ensure no damage to refrigerant lines.

To Inspect the gear reducer:

1. Remove the cap screws holding the gear reducer case halves together and pry the two cases apart.

2. To lift off the cover, lift up until you can feel internal contact, then pull the cover towards the output gear end, and then lift the cover (with drive motor attached) up and away from the gear reducer case.

3. Inspect the oil, gears, and bearings. If the oil level and condition is acceptable, quickly check the gears and bearings. They are likely to be fine if the oil is.

If there is evidence of water in the oil (rusty bearings and gears; the oil having a creamy white appearance; oil level too high) carefully inspect the bearings and gears. If in doubt about the condition of a part, replace it. The oil quantity is 14 fluid ounces, do not overfill.

4. After inspecting gear reducer and replacing high speed non-metallic fiber gear if required, reassemble the gear case and cover.

## Repair Procedures: Replace the Evaporator

---

(Assuming all the steps for removal of the thrust bearing, extruder, auger, and water seal have been performed.)

1. Recover the refrigerant from the ice maker.
2. Unsweat the refrigerant connections:
  - a) At the thermostatic expansion valve outlet.  
Heat sink the TXV body when unsweating or resweating the adjacent tubing.
  - b) At the suction line at the joint about 3" from the evaporator.
3. Remove the evaporator.
4. Unsweat the drier from the liquid line.
5. After installing a new water seal in the new evaporator (see "To Replace the Water Seal") sweat in the new evaporator at the old tubing connections.
6. Install an new drier in the liquid line.
7. Evacuate the system until dehydrated, then weigh in the nameplate charge. Check for leaks.
8. Install auger, extruder, extruder bearing assembly, and ice discharge chute in reverse order of disassembly.

### To Reassemble the Evaporator and Auger

1. After the gear reducer has been inspected, fasten the evaporator to the gear reducer. Torque the bolts to 110 inch pounds.
2. Lower the auger into the evaporator barrel, slightly turning it to match up with the drive end. Do Not Drop Into the Evaporator.
3. Complete the reassembly by reversing the disassembly for the extruder & bearing assembly.

## Repair Procedures: Thermostatic Expansion Valve

1. Remove front panel.
2. If the machine was in operation, push and release the off button to shut it down.
3. Disconnect electrical power.
4. Recover refrigerant.
5. Remove insulation covering expansion valve and bulb.
6. Remove strap securing bulb to suction line.
7. Unsweat the expansion valve from the liquid line. Remove it.
8. Unsweat the drier from the liquid line. Remove it.
9. Connect nitrogen to discharge access valve.
10. Immediately place new valve in ice machine.
11. Open nitrogen bottle and braze expansion valve inlet and outlet joints together. Braze new drier into system.
12. Shut off nitrogen, shut access valves.
13. Evacuate to at least 300 microns.
14. Weigh in the nameplate charge. Check for leaks.
15. Attach bulb to suction line. Position at 4 or 8 o'clock on the tube. Secure tightly but do not crush the bulb with the strap.
16. Attach valve and bulb insulation.
17. Reconnect electrical power.
18. Return all panels to their original positions.



# **SCOTSMAN ICE SYSTEMS**

101 Corporate Woods Parkway

Vernon Hills, IL 60061

800-726-8762

[www.scotsman-ice.com](http://www.scotsman-ice.com)