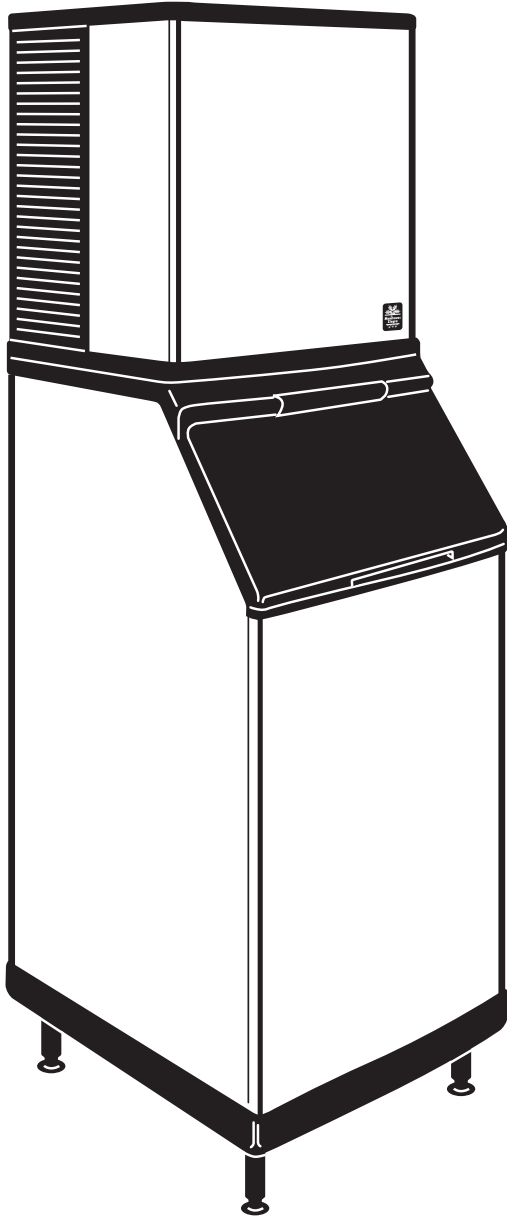




Manitowoc[®]



Flake / Chippet Model Ice Machines

**Flake Models QF0400/QF0800/
QF2200/QF2300**

Chippet Models QC0700

Service Manual

Revised 8/2003

Part Number 80-1214-3
07/03

Safety Notices

As you work on a Flake / Chippet Series Ice Machine, be sure to pay close attention to the safety notices in this manual. Disregarding the notices may lead to serious injury and/or damage to the ice machine.

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



Warning

PERSONAL INJURY POTENTIAL

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



Warning

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



Caution

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

Procedural Notices

As you work on a Flake / Chippet Series Ice Machine, be sure to read the procedural notices in this manual. These notices supply helpful information which may assist you as you work.

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

Important

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

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

Read These Before Proceeding:



Caution

Proper installation, care and maintenance are essential for maximum ice production and trouble-free operation of your Manitowoc Ice Machine. Read and understand this manual. It contains valuable care and maintenance information. If you encounter problems not covered by this manual, do not proceed, contact Manitowoc Ice, Inc. We will be happy to provide assistance.

Important

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

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

Revised 8/2003

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Section 1

General Information

Model Numbers

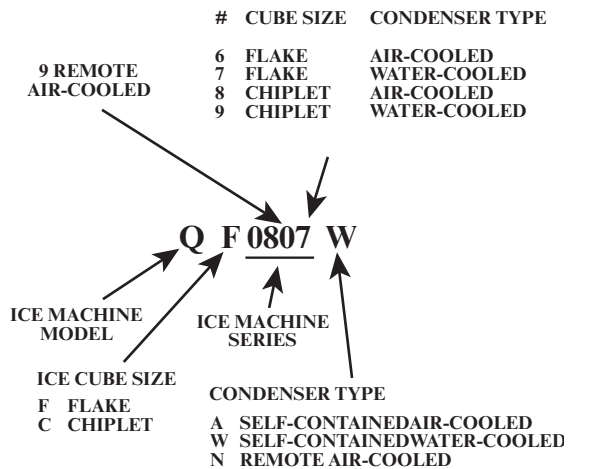
This manual covers the following models:

	Flake Ice	Chiplet Ice	Condensing Unit
Undercounter Self-Contained Air-Cooled	QF0406A	NA	NA
Self-Contained Air-Cooled	QF0806A	QC0708A	NA
Self-Contained Water Cooled	QF0807W	QC0709W	NA
Remote Air-Cooled	QF2296N	NA	RFC2085
	QF2396N	NA	RFC2385

Warning
PERSONAL INJURY POTENTIAL

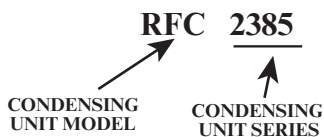
Do not operate equipment that has been misused, abused, neglected, damaged, or altered/modified from that of original manufactured specifications.

How to Read a Model Number



SV3106

Remote Condensing Unit



SV3107

Accessories

BIN CASTER

Replaces standard legs.

ICE BAGGER

Maximize profits from bagged ice sales with this convenient accessory. This sturdy unit rests on the bin door frame, and adapts for left or right side filling.

ARCTIC PURE™ WATER FILTER SYSTEM

Engineered specifically for Manitowoc ice machines, This water filter is an efficient, dependable, and affordable method of inhibiting scale formation, filtering sediment, and removing chlorine taste and odor.

MANITOWOC CLEANER AND SANITIZER

Manitowoc Ice Machine Cleaner and Sanitizer are available in convenient 16 oz. (473 ml) and 1 gal (3.78 l) bottles. These are the only cleaner and sanitizer approved for use with Manitowoc products.

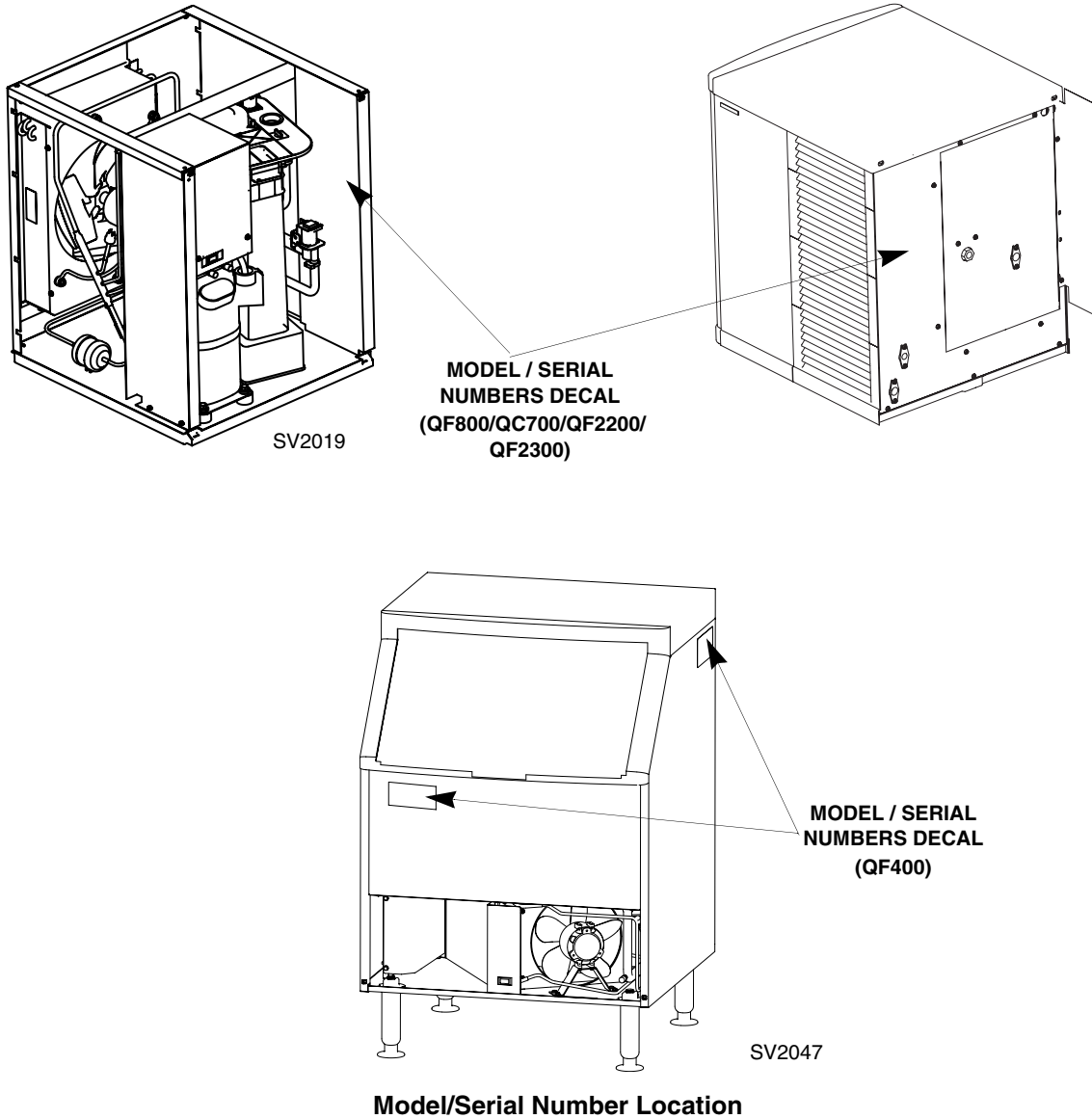
Cleaner Part Number		Sanitizer Part Number	
16 oz.	94-0456-3	16 oz.	94-0565-3
1 gallon	94-0580-3	1 gallon	94-0581-3

NOTE: The Manitowoc Automatic Cleaning System (AuCS) accessory cannot be used with Flake/Chiplet Ice Machines.

Model/Serial Number Location

These numbers are required when requesting information from your local Manitowoc distributor, service representative, or Manitowoc Ice, Inc.

The model and serial number are listed on the OWNER WARRANTY REGISTRATION CARD. They are also listed on the MODEL/SERIAL NUMBER DECAL affixed to the ice machine head section and condensing unit. Both model/serial numbers must be referenced to obtain warranty or service information.



Owner Warranty Registration Card

GENERAL

Warranty coverage begins the day the ice machine is installed.

Important

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

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

Warranty Coverage

GENERAL

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

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

Important

This product is intended exclusively for commercial application. No warranty is extended for personal, family, or household purposes.

PARTS

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

LABOR

1. Labor required to repair or replace defective components is covered for two (2) years from the date of original installation.

EXCLUSIONS

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

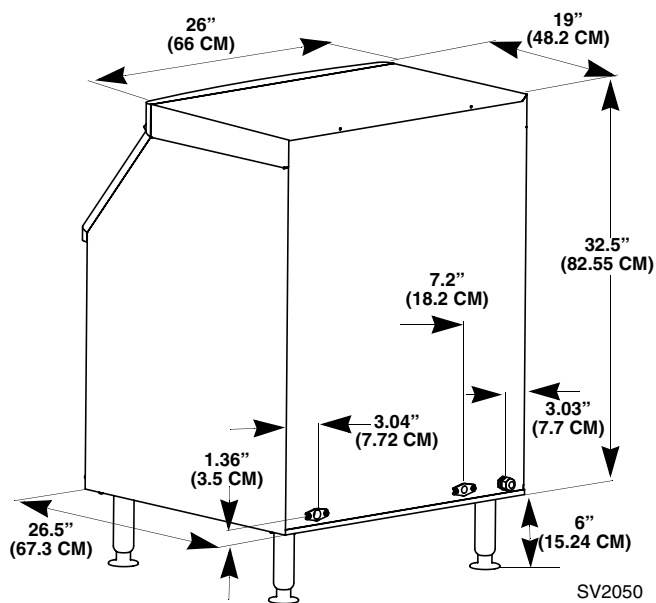
1. **Normal maintenance**, adjustments and cleaning as outlined in this manual.
2. Repairs due to unauthorized modifications to the ice machine or use of non-standard parts without prior written approval from Manitowoc Ice, Inc.
3. Damage caused by improper installation of the ice machine, electrical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

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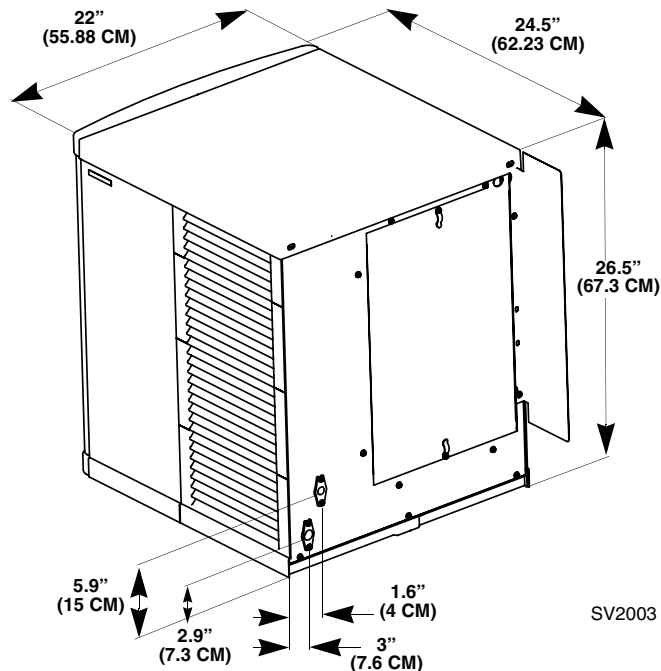
Section 2 Installation Instructions

Ice Machine Dimensions

QF400 AIR COOLED ICE MACHINE



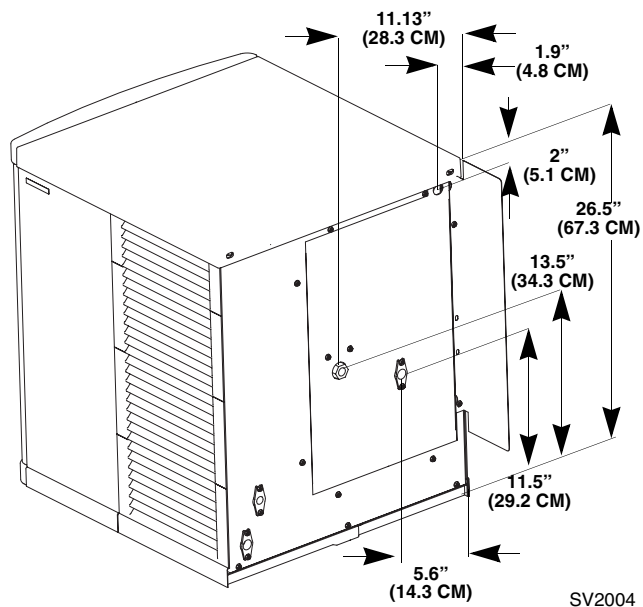
QC700/QF800 AIR COOLED ICE MACHINE



Important

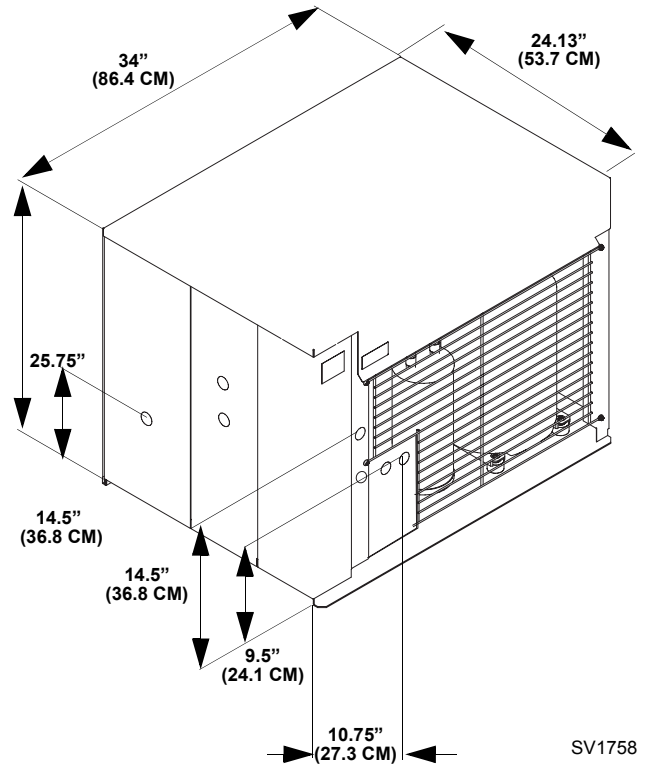
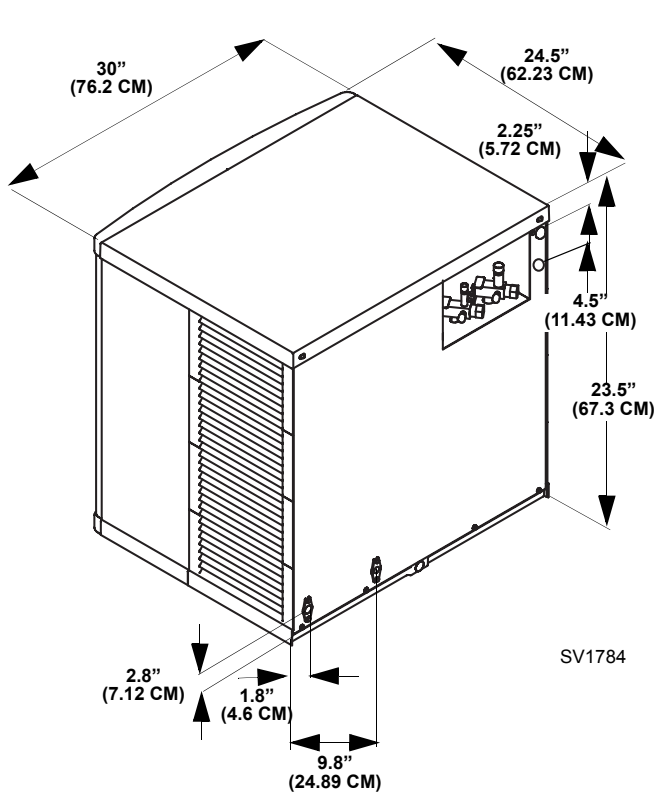
Failure to follow these installation guidelines may affect warranty coverage.

QC700/QF800 WATER COOLED ICE MACHINE



Ice Machine Head Section and Remote Condensing Unit Dimensions

QF2200/QF2300 AND RFC2085/RFC2385 REMOTE CONDENSING UNIT



Location of Ice Machine

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

- The location must be free of airborne and other contaminants.
- The air temperature must be at least 45°F (7°C), but must not exceed 110°F (43.4°C).
- The water temperature must be at least 45°F (7°C), but must not exceed 90°F (32.2°C).
- The location must not be near heat-generating equipment or in direct sunlight.
- The location must be capable of supporting the weight of the ice machine and a full bin of ice.
- The location must allow enough clearance for water, drain and electrical connections in the **rear of the ice machine**.
- The location must not obstruct airflow through or around the ice machine. QF400 airflow is in and out of the front of the ice machine. Refer to below for clearance requirements.

Ice Machine Head Section Clearance Requirements

QF400	Self-Contained Air-Cooled	Self-Contained Water-Cooled
Top/Sides	5" (12.7 mm)	NA
Back	5" (12.7 mm)	NA

QC700/QF800	Self-Contained Air-Cooled	Self-Contained Water-Cooled
Top/Sides	8" (20.3 mm)	5" (12.7 mm)
Back	5" (12.7 mm)	5" (12.7 mm)

QF2200/QF2300	Self-Contained Air-Cooled	Remote Air-Cooled
Top/Sides	8" (20.3 mm)	5" (12.7 mm)
Back	5" (12.7 mm)	5" (12.7 mm)

⚠ Caution

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

Ice Machine Heat of Rejection

Series Condensing Unit	Heat of Rejection*
QF400	4000
QF700	7800
QF800	7800
QF2200/RFC2085	21000
QF2300/RFC2385	21000
*B.T.U. / Hour	

Ice machines, like other refrigeration equipment, reject heat through the condenser. It is helpful to know the amount of heat rejected by the ice machine when sizing the air conditioning equipment where self-contained air-cooled ice machines are installed. QF2200/QF2300 ice machines add an insignificant amount of load to a conditioned space.

Location of Remote Condensing Unit

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

- The air temperature must be at least -20°F (-28.9°C) but must not exceed 120°F (49°C).
- The location must not allow exhaust fan heat and/or grease to enter the condenser.
- The location must not obstruct airflow through or around the condensing unit. Refer to the chart below for clearance requirements.

CONDENSING UNIT CLEARANCE REQUIREMENTS

Ice Machine Condensing Unit	
Top/Sides	There is no minimum clearance required, although 6" (12.7 cm) is recommended for efficient operation and servicing only.
Front/Back	4' (1.2)

Leveling the Ice Storage Bin

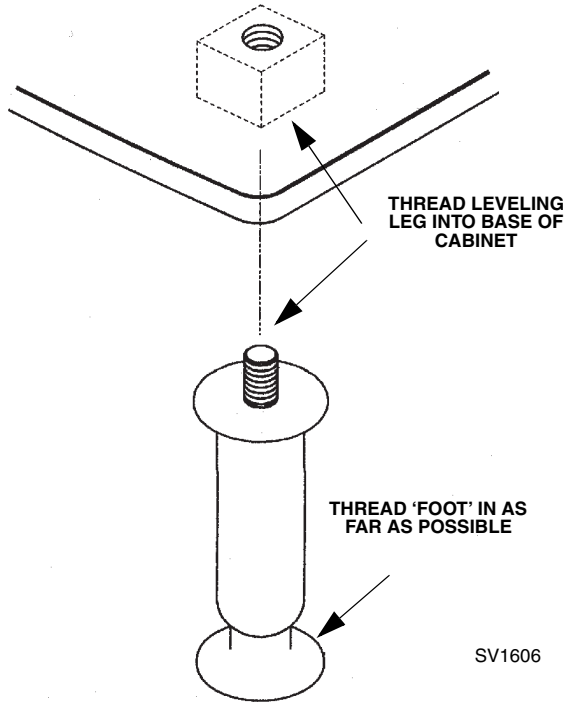
1. Screw the leveling legs onto the bottom of the bin.
2. Screw the foot of each leg in as far as possible.

⚠ Caution

The legs must be screwed in tightly to prevent them from bending.

3. Move the bin into its final position.
4. Level the bin to assure that the bin door closes and seals properly. Use a level on top of the bin. Turn each foot as necessary to level the bin.

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



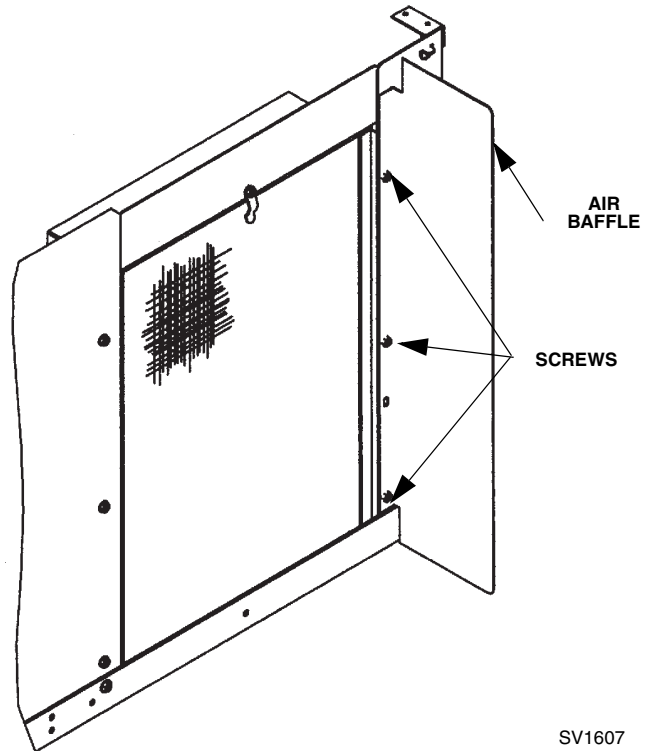
Leveling Leg and Foot

Condenser Air Baffle

(QC700/QF800 Air-Cooled Ice Machines Only)

The air-cooled baffle prevents condenser air from recirculating. To install:

1. Remove the back panel screws next to the condenser.
2. Align the mounting holes in the air baffle with the screw holes and reinstall the screws.



Air Baffle

Electrical Service

GENERAL

 **Warning**

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

VOLTAGE

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

 **Warning**

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

FUSE/CIRCUIT BREAKER

A separate fuse/circuit breaker must be provided for each ice machine. Circuit breakers must be H.A.C.R. rated (does not apply in Canada).

QF400 115/60/1 ice machines are factory pre-wired with a power cord and 5-15P plug confirmation.

QF400 230/50/1 ice machines are factory pre-wired with a power cord, no plug is supplied.

QF2200/QF2300 with Remote Condensing Unit the ice machine head section and remote condensing unit are wired independent of each other. A separate dedicated fuse/circuit breaker must be provided for each section. Circuit breakers must be H.A.C.R. rated (does not apply in Canada).

MINIMUM CIRCUIT AMPACITY

QC700/QF800/QF2200/QF2300 Only

The minimum circuit ampacity is used to help select the wire size of the electrical supply. (Minimum circuit ampacity is not the ice machine's running amp load.) The wire size (or gauge) is also dependent upon location, materials used, length of run, etc., so it must be determined by a qualified electrician.

Electrical Requirements

Ice Machine Head Section

Ice Machine	Voltage Phase Cycle	Air-Cooled			Remote Air-Cooled		Water Cooled	
		Maximum Fuse/Circuit Breaker	Minimum Circuit Amps	Total Circuit Amps	Maximum Fuse/Circuit Breaker	Minimum Circuit Amps	Maximum Fuse/Circuit Breaker	Minimum Circuit Amps
QF400	115/1/60	15	NA	9.8	NA	NA	NA	NA
	230/1/50	15	NA	4.2	NA	NA	NA	NA
QC700	115/1/60	30	18.9	NA	NA	NA	30	17.9
	230/1/50	20	8.8	NA	NA	NA	20	8.4
	230/1/60	15	8.7	NA	NA	NA	15	8.3
QF800	115/1/60	30	18.9	NA	NA	NA	30	17.9
	230/1/50	20	8.8	NA	NA	NA	20	8.4
	230/1/60	15	8.7	NA	NA	NA	15	8.3
QF2200	115/1/60	NA	NA	NA	15	4.3	NA	NA
	230/1/50	NA	NA	NA	NA	NA	NA	NA
	230/1/60	NA	NA	NA	NA	NA	NA	NA
QF2300	115/1/60	NA	NA	NA	15	5.5*	NA	NA
	230/1/50	NA	NA	NA	NA	NA	NA	NA
	230/1/60	NA	NA	NA	NA	NA	NA	NA

Interconnecting wiring (115/60/1) is required between the ice machine and condensing unit to energize the contactor coil.

* Indicates preliminary data

Remote Condensing Unit

Condensing Unit	Voltage Phase Cycle	Maximum Fuse/Circuit Breaker	Minimum Circuit Amps
RFC2085	208-230/1/60	30	15.6
	208-230/3/60	20	11.2
RFC2385	208-230/1/60	30	18.5*
	208-230/3/60	20	11.2*

* Indicates preliminary data

For United Kingdom Only

As the colours of the wires in the mains lead of the appliance may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

- The wire which is coloured green and yellow must be connected to the terminal in the plug which is marked with the letter E or by the earth ground symbol ⏏ or coloured green or green and yellow.
- The wire coloured blue must be connected to the terminal which is marked with the letter N or coloured black.
- The wire coloured brown must be connected to the terminal which is marked with the letter L or coloured red.

Ice Machine Head Section Electrical Wiring Connections

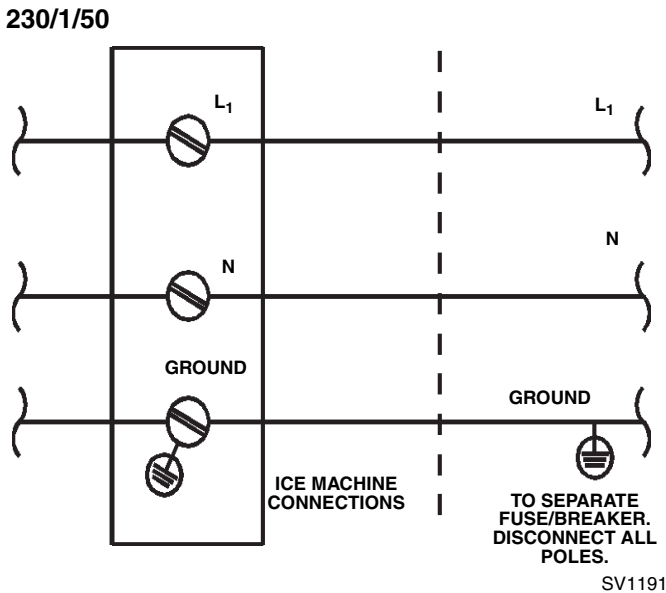
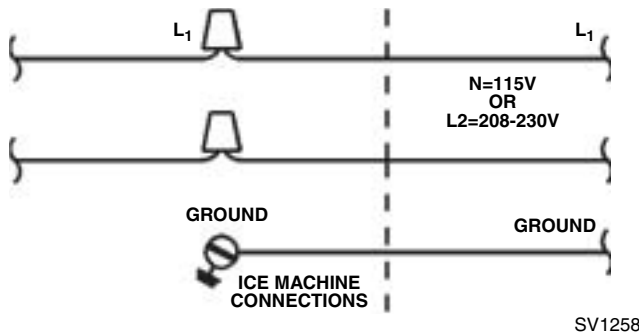
Warning

These diagrams are not intended to show proper wire routing, wire sizing, disconnects, etc., only the correct wire connections.

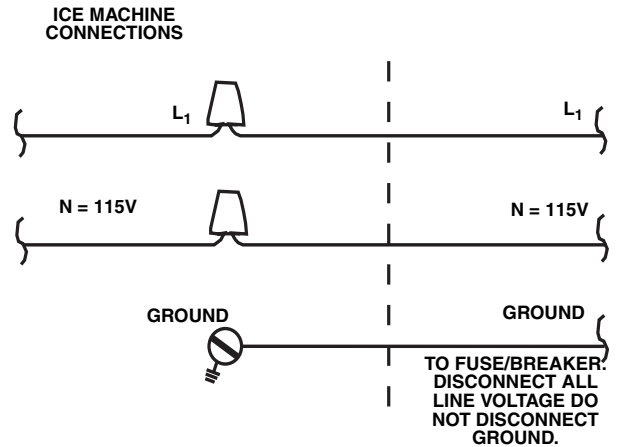
All electrical work, including wire routing and grounding, must conform to local, state and national electrical codes.

Though wire nuts are shown in the drawings, the ice machine field wiring connections may use either wire nuts or screw terminals.

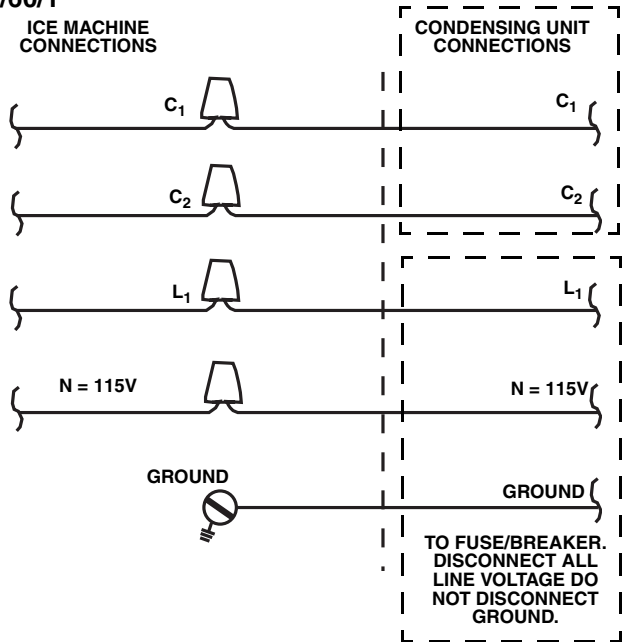
QC700/QF800 ICE MACHINE HEAD SECTION
 115/1/60 or 208-230/1/60



QF2200 ICE MACHINE HEAD SECTION
 115/60/1



QF2300 ICE MACHINE HEAD SECTION
 115/60/1



Remote Electrical Wiring Connections

Warning

These diagrams are not intended to show proper wire routing, wire sizing, disconnects, etc., only the correct wire connections.

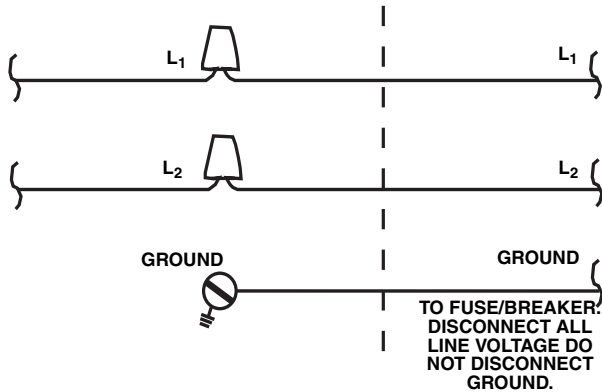
All electrical work, including wire routing and grounding, must conform to local, state and national electrical codes.

Though wire nuts are shown in the drawings, the ice machine field wiring connections may use either wire nuts or screw terminals.

RFC2085 REMOTE CONDENSING UNIT

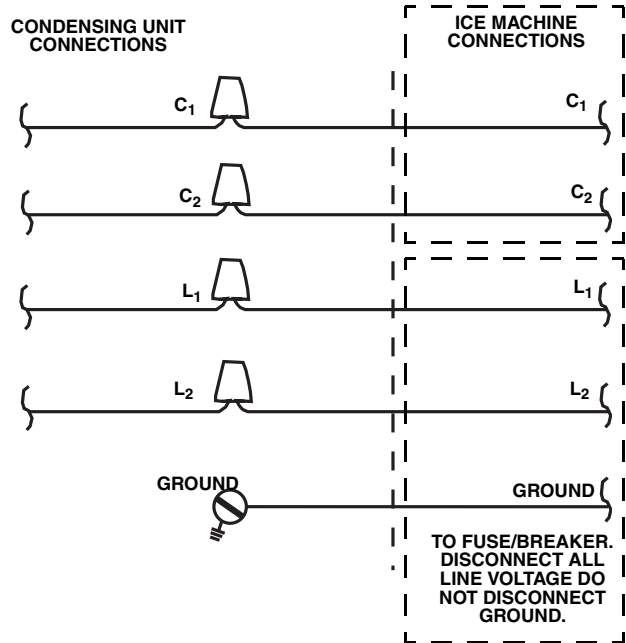
208-230/1/60

CONDENSING UNIT CONNECTIONS



RFC2385 REMOTE CONDENSING UNIT

208-230/1/60



Ice Machine Head Section Water Supply and Drains

POTABLE WATER SUPPLY

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

Important

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

POTABLE WATER INLET LINES

Follow these guidelines to install water inlet lines:

- Do not connect the ice machine to a hot water supply. Be sure all hot water restrictors installed for other equipment are working. (Check valves on sink faucets, dishwashers, etc.)
- If water pressure exceeds the maximum (80 psig 551.5 kPA) recommended pressure, obtain a water pressure regulator from your Manitowoc distributor.
- Install a water shut-off valve and union for both the ice making and condenser water lines.

DRAIN CONNECTIONS

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

- Drain lines must have a 1.5 inch drop per 5 feet of run (2.5 cm per meter), and must not create traps.
- The floor drain must be large enough to accommodate drainage from all drains.
- Run separate bin and water-cooled condenser drain lines. Insulate them to prevent condensation.
- Vent the bin and ice machine drain to the atmosphere. The ice machine drain requires an 18" vent. Do not vent the condenser drain on water-cooled models.
- Drains must have a union or other suitable means to allow in place disconnection from the ice machine when servicing is required.
- Insulate water inlet lines and drain lines to prevent condensation.

Cooling Tower Applications (Water-Cooled Models)

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

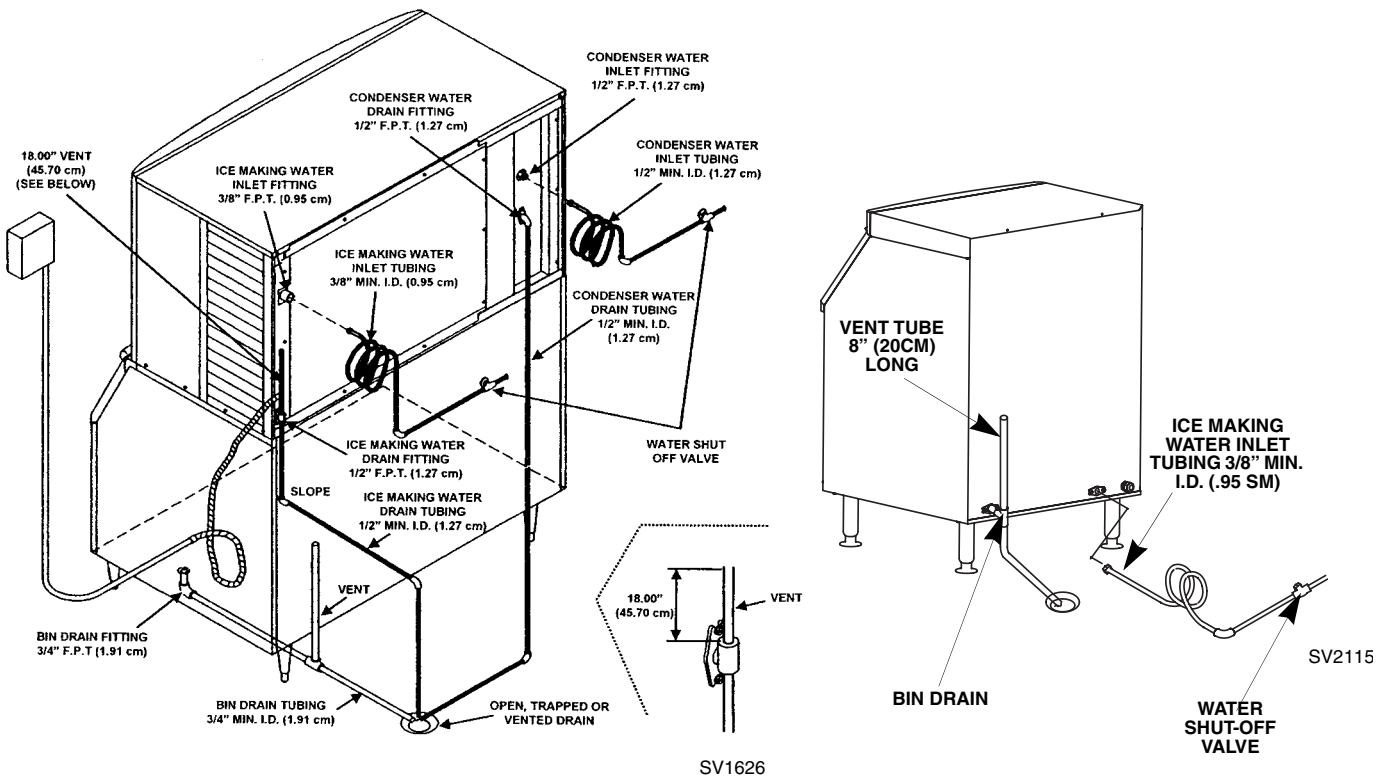
It is necessary to know the amount of heat rejection, and the pressure drop through the condenser and water valves (inlet and outlet) when using a cooling tower on an ice machine.

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

WATER SUPPLY AND DRAIN LINE SIZING/CONNECTIONS

⚠ Caution
Plumbing must conform to state and local codes.

Location	Water Temperature	Water Pressure	Ice Machine Fitting	Tubing Size Up to Ice Machine Fitting
Ice Making Water Inlet	45°F (6°C) Min. 90°F (32.2°C) Max.	20 psi (137.9 kPa) Min. 80 psi (551.5 kPa) Max.	3/8" Female Pipe Thread	3/8" (9.5 mm) minimum inside diameter
Condenser Water Inlet	33°F (0.6°C) Min. 90°F (32.2°C) Max.	20 psi (137.9 kPa) Min. 150 psi (1034.2 kPa) Max.	1/2" Female Pipe Thread	1/2" (12.7 mm) minimum inside diameter
Condenser Water Drain	---	---	1/2" Female Pipe Thread	1/2" (12.7 mm) minimum inside diameter
Bin Drain	---	---	1/2" Female Pipe Thread	1/2" (12.7 mm) minimum inside diameter



Typical Water Supply Drain Installation

Refrigeration System Installation

(QF2200/RFC2085 AND QF2300/RFC2385 ONLY)

QuietQube® Ice Machine	Remote Single Circuit Condenser	Line Set*
QF2200	RFC2085	RC-20
QF2300	RFC2385	RC-30 RC-50

Line Set	Suction Line	Liquid Line	Insulation Thickness
RC 20/30/50	3/4 inch (19.1 mm)	1/2 inch (12.7 mm)	1/2" (13mm) Suction Line 1/4" (7mm) Liquid Line

USAGE WITH NON-MANITOWOC CONDENSING UNITS

Manitowoc Condensing Units are specifically designed for usage with a Manitowoc Flake/Chiptlet Ice Machine Head Sections. Manitowoc Flake/Chiptlet Ice Machines will not operate with non-Manitowoc condensing units.

Warning

Installation of a Remote Condensing Unit may require the use of special equipment for placement. Trained and qualified personnel are required for proper rigging and lifting.

Caution

The 60-month compressor warranty (including the 24-month labor replacement warranty) will not apply if the Manitowoc Ice Machine and remote Manitowoc Condensing Unit are not installed according to specifications. This warranty also will not apply if the refrigeration system is modified with a condenser, heat reclaim device, or other parts or assemblies not manufactured by Manitowoc Ice, Inc.

Factory Equipment Refrigeration Amounts

ICE MACHINE HEAD SECTION

Each ice machine head section ships from the factory with a R-404A refrigerant charge appropriate for line sets up to 50' in length (12.5 lbs.). The serial tag on the ice machine indicates the refrigerant charge. Additional refrigerant must be added for line set lengths between 50' and 100' (1.5 lbs.).

Caution

Never add more than nameplate charge to the refrigeration system for any application.

Warning

Potential Personal Injury Situation

The ice machine head section contains the refrigerant charge. Installation and brazing of the line sets must be performed by a properly trained and EPA certified refrigeration technician aware of the **dangers of dealing with refrigerant** charged equipment.

REMOTE CONDENSING UNIT

Each condensing unit ships from the factory pressurized with 50/50 nitrogen helium mixture that must be removed during the installation process (approximately 20 psig).

REFRIGERATION LINE SETS/TRAPS KIT

Refrigeration Rated Tubing and Trap Kits are shipped capped with atmospheric pressure.

Refrigeration Line Set Installation

GENERAL

Refrigeration line set installations consist of vertical and horizontal line set distances between the ice machine and the condensing unit. The following guidelines, drawings and calculation methods must be followed to assure proper oil return and condensing unit/ice machine operation

Warning

The following instructions are provided as a general overview of a typical installation. Refer to the Installation, Use and Care Manual for step by step installation instructions.

Warning

Disconnect electrical power to the ice machine head section and the remote condensing unit before proceeding.

Warning

The ice machine head section contains refrigerant charge. The ice machine head section contains three (3) refrigeration valves that **must remain closed** until proper installation of the line set is completed.

Step 1 Verify Ice Machine and Remote Condensing Unit Locations Are Within Guidelines.

Prior to installation of the ice machine head section and remote condensing unit be sure that the distance between them is within the line set routing guidelines outlined in this manual.

Roof/Wall Penetration

If required, cut a 3-inch (76.2 mm) circular hole in the wall or roof for routing of refrigeration tubing. A qualified person must perform all roof penetrations.

Step 2 Route Refrigeration Tubing

Properly route refrigeration tubing between the ice machine head section and the remote condensing unit.

A. LINE SET LENGTH

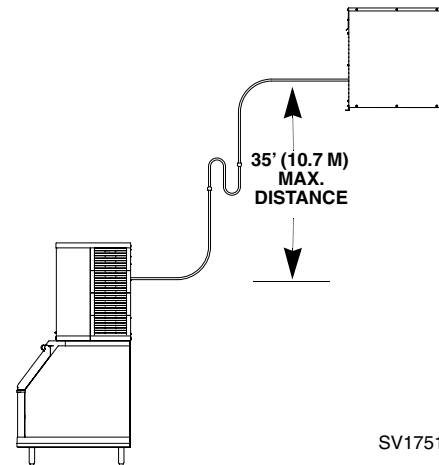
100 feet (30.5 m) Length: The maximum measured length the line set can be.

The receiver is designed to hold a charge sufficient to operate the ice machine in ambient temperatures between -20°F (-28.9°C) and 120°F (49°C), with line set lengths of up to 100 feet (30.5 m).

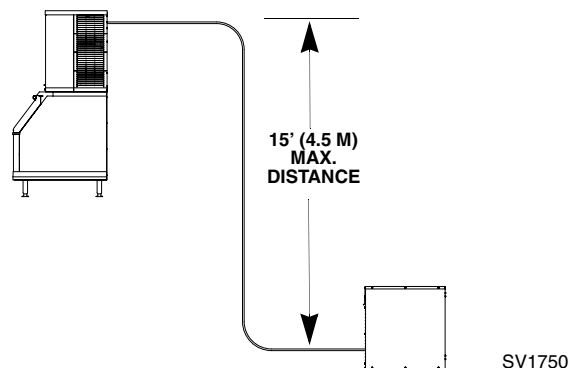
Important

The ice machines will not function with line sets greater than 100 feet (30.5 m). Do not attempt to go beyond this distance and add refrigerant charge to compensate!

B. LINE SET RISE OR DROP



35 feet (10.7 m) Rise: The maximum distance the remote condensing unit can be above the ice machine.



15 feet (4.5 m) Drop: The maximum distance the remote condensing unit can be below the ice machine.

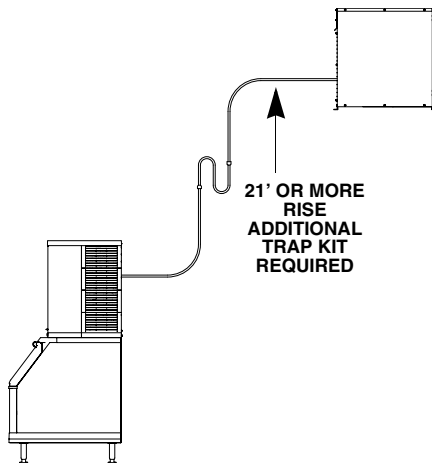
C. SUCTION LINE OIL TRAPS

⚠ Caution

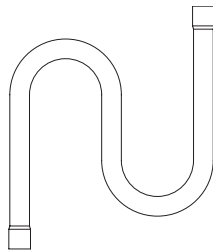
Do not form unwanted traps in refrigeration lines. Never coil excess refrigeration tubing.

0 to 20 feet (0 to 6.1 m) Rise: The ice machine head section has one oil trap built in which allows for a maximum condenser rise of 20 feet (6.1 m) without additional traps in the suction line.

21 to 35 feet (6.4 to 10.7 m) Rise: The suction line requires an additional Oil Trap (“S” type) to be installed. Install the trap as close as possible to midpoint between the ice machine head section and remote condensing unit. S-Trap Kits are available from Manitowoc (refer to chart).



SV1751



SV1760

Manitowoc S-Trap Kit

Model	S-Trap Kit Number	Tubing Size
QF2200 QF2300	K00166	3/4 inch (19.1 mm)

Service Loop

A service loop in the line set permits easy access to the ice machine for cleaning and service.

- **The supplied service loop is an installation requirement.**
- A service loop is not considered an oil trap.
- The service loop is not included when calculating length, rise or drop of the tubing run.
- Do not use hard rigid copper for the service loop.

⚠ Caution

If a line set has a rise followed by a drop, another rise cannot be made. Likewise, if a line set has a drop followed by a rise, another drop cannot be made.

Step 3 Lengthening or Reducing Line Set Lengths

⚠ Caution

Do not form unwanted traps in refrigeration lines. Never coil excess refrigeration tubing.

When the line set required shortening or lengthening, do so before connecting the line set to the ice machine head section or the remote condensing unit.

Continued on Next Page...

Step 4 Connecting the line set.

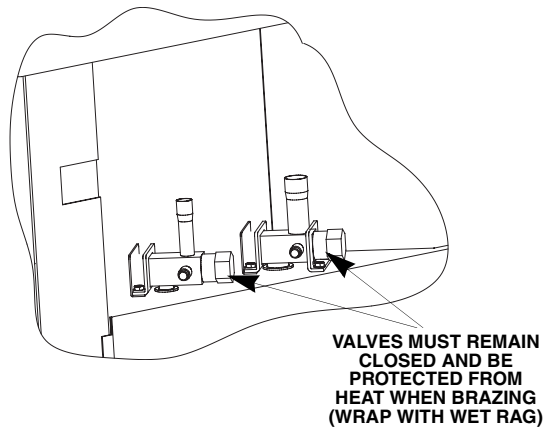
To prevent oxidation of the copper, purge line set and condensing unit with dry nitrogen while brazing.

Connect The Line Set To The Ice Machine Head Section

Warning

The ice machine head section contains refrigerant charge. The ice machine head section contains three (3) refrigeration valves that **must remain closed** until proper installation of the line sets is completed.

The line set shut off valves at the back of the ice machine must remain closed and be protected from heat during the brazing process. Wrap the valves in a wet rag or other type of heat sink prior to brazing. Cool braze joint with water immediately after brazing to prevent heat migration to the valve.



SV1757

Warning

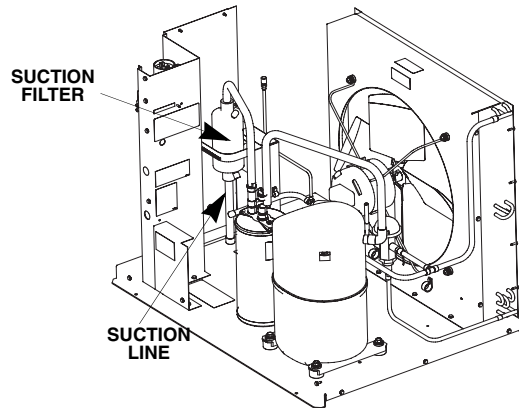
The condensing unit ships from the factory pressurized with a 50/50 mixture of nitrogen/helium. Bleed off pressure from both suction and liquid line access ports prior to cutting into refrigeration lines.

Connect The Line Set To The Remote Condensing Unit

The compressor oil rapidly absorbs moisture. **Be prepared** to complete line set installation and start your evacuation process in order to minimize the time the compressor is exposed to the atmosphere. (Maximum amount of time the system can be exposed to the atmosphere is 15 minutes).

The line set can be routed for entry through the front or left side of the condensing unit.

- Remove knockout for preferred location.
- Insert supplied plastic bushings in knockout holes to prevent tubing from contacting sheet metal.
- Use the supplied 90° elbows to route tubing.
- Cut the tubing ends of the suction and liquid lines and braze the line sets to the condensing unit.



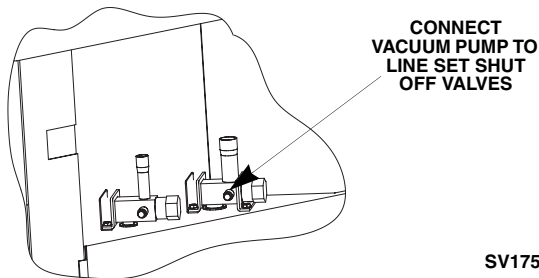
MINIMIZE THE TIME THE REFRIGERATION SYSTEM IS EXPOSED TO THE ATMOSPHERE (15 MINUTES MAXIMUM)

SV2100

Step 5 Pressure Test and Evacuate The Line Set and Remote Condensing Unit

Schrader valve core removal tools that allow for removal and installation of the valve cores without removing manifold gauge set hoses are recommended to decrease the evacuation time.

Leave the line set shut off valves closed (front seated). Pressure test the line sets and remote condensing unit with 150 psig of dry nitrogen. Add nitrogen at the line set shut off valves located at the back of the ice machine. Complete the pressure test, verify no leaks are present and remove the nitrogen from the system before connecting the vacuum pump. Connect a vacuum pump to both of the line set shut off valves located at the back of the ice machine head section. Evacuate to 500 microns (or less). To completely evacuate the Remote condensing unit, continue the evacuation for 30 minutes after reaching the 500 micron point.

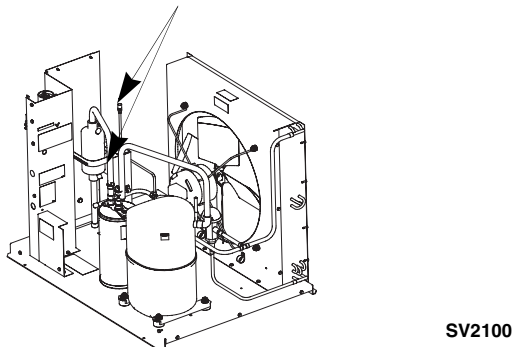


If required, the line set and condensing unit can be evacuated from the schrader valves located in the remote condensing unit. Schrader valve core removal tools (that allow for putting the cores back in without removing vacuum pump hoses) must be used if evacuating from the condensing unit side.

Isolate the vacuum pump from the line set shut off valves and/or condensing unit access ports prior to proceeding. Open refrigeration system shut off valves.

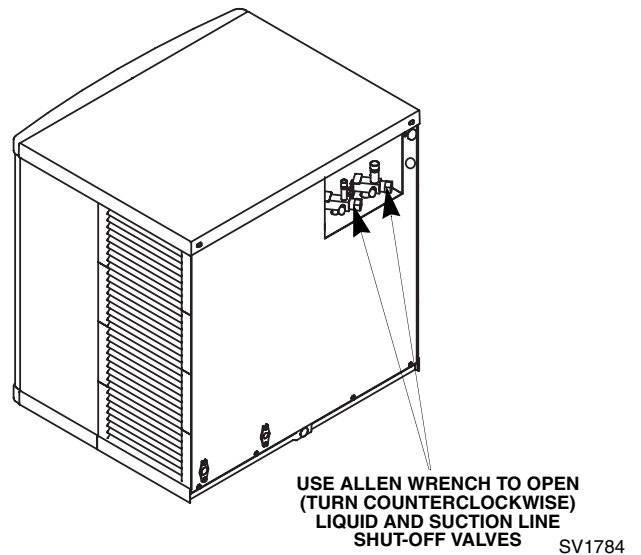
The suction line, liquid line and receiver service valves are closed during shipment and installation.

ALTERNATE CONNECTIONS AT CONDENSING UNIT SCHRADER VALVES



Step 6 Open The Valves Prior To Starting The Ice Machine.

- A. Slowly backseat (open-turn counterclockwise) the suction line shut off valve.
- B. Slowly backseat (open-turn counterclockwise) the liquid line shut off valve.
- C. Slowly backseat (open-turn counterclockwise) the receiver service valve.



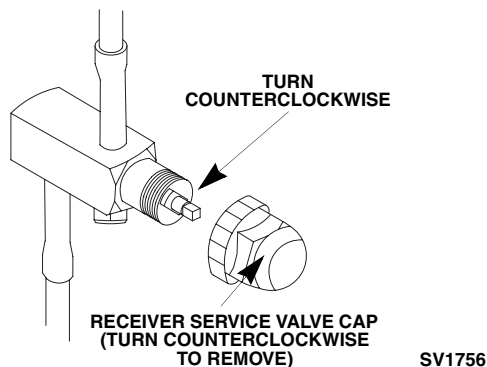
OPEN SUCTION AND LIQUID LINE SHUT OFF VALVES

Verify O-ring in schrader valve caps are intact and reinstall on shut off valves to prevent refrigerant leakage. Replace shut off valve access caps and torque to the following specifications.

Torque Value's

Stem	18-20 ft. lbs.
Caps	12-15 ft. lbs.
Schrader Core	1.5-3 in. lbs.

Replace cap on receiver service valve and tighten.



Open Receiver Service Valve

There is a liquid line solenoid valve at the outlet of the receiver; refrigerant will not flow to the condensing unit until the ice machine head section is started. Connect power to both the ice machine head section and the Remote condensing unit. Place the ICE/OFF/CLEAN toggle switch into the ICE position, this will allow refrigerant to enter the line set and condensing unit.

Important

All refrigeration valve caps must be reinstalled to prevent future refrigeration leaks.

Step 7 Leak Check The Refrigeration System

Leak check the new line set connections at the ice machine head section, condensing unit and S trap as well as all factory joints throughout the entire system. Disconnect power to the remote condensing unit. Place the ICE/OFF/CLEAN toggle switch into the ICE position. This allows the low side and high side pressures to equalize. Place the ICE/OFF/CLEAN toggle switch in the OFF position. Connect power to the remote condensing unit and allow system to pump down.

Step 8 Insulation Requirements

To prevent condensation the entire suction line including the shut-off valve must be insulated. All insulation must be airtight and sealed at both ends.

The following insulation requirements prevent condensation at 90°F (32.2°C) ambient 70% Relative Humidity. If higher humidity is expected, increase insulation thickness.

The entire line set, including the suction service valve located on the back of the ice machine requires:

Suction Line	Liquid Line	Min. Insulation Thickness
3/4 inch (19.1 mm)	1/2 inch (12.7 mm)	1/2" (13mm) Suction Line 1/4" (7mm) Liquid Line

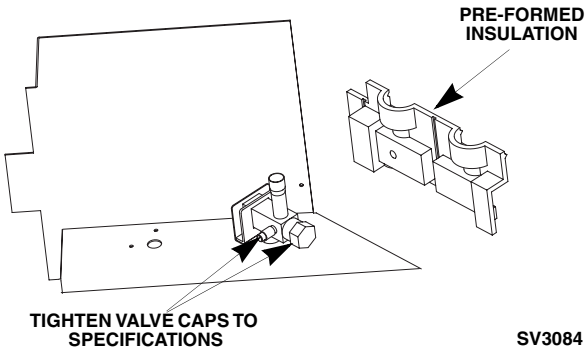
Important

To prevent condensation the entire suction line including the shut off valve must be insulated. All insulation must be airtight and sealed at both ends. The minimum requirements are for conditions at or below 70% humidity and 90°F (32.2°C) ambient. When higher humidity will be experienced, insulation wall thickness will need to be increased.

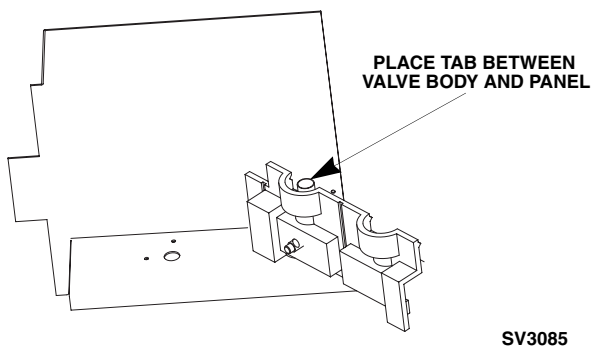
Suction Shut Off Valve Insulation

The pre-formed suction shut-off valve insulation is located in the plastic bag taped to the water curtain.

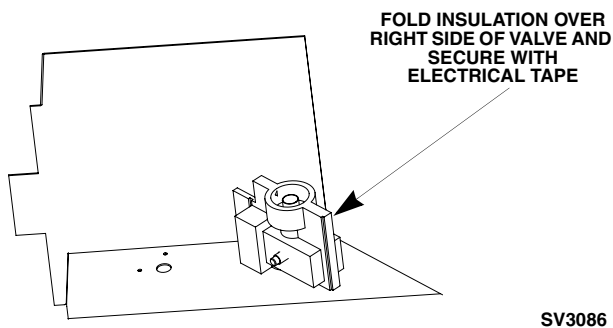
- A. Verify valve and schrader caps are tightened to specifications (see Step 6).



- B. Place insulation over schrader valve cap and left side of valve. Position the tab between the mounting bracket and rear panel.



- C. Fold insulation and hold against right hand side of valve while securing with electrical tape. Seal the line set insulation to the shut off valve insulation with electrical tape.



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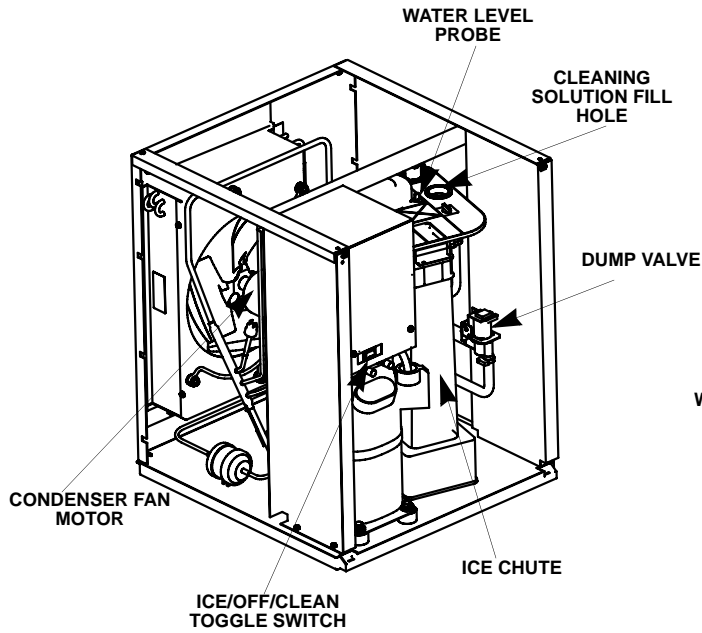
Section 3

Ice Machine Operation

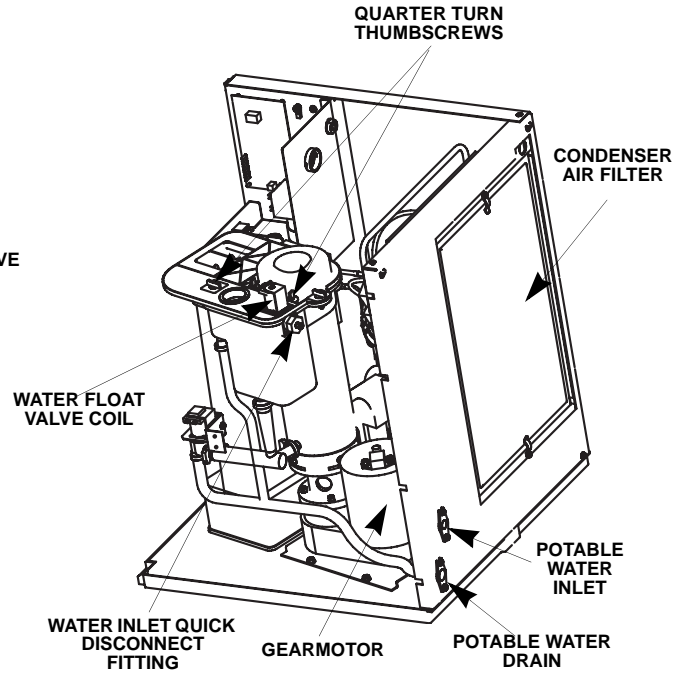
Component Identification

ICE MACHINE HEAD SECTION

QC700/QF800

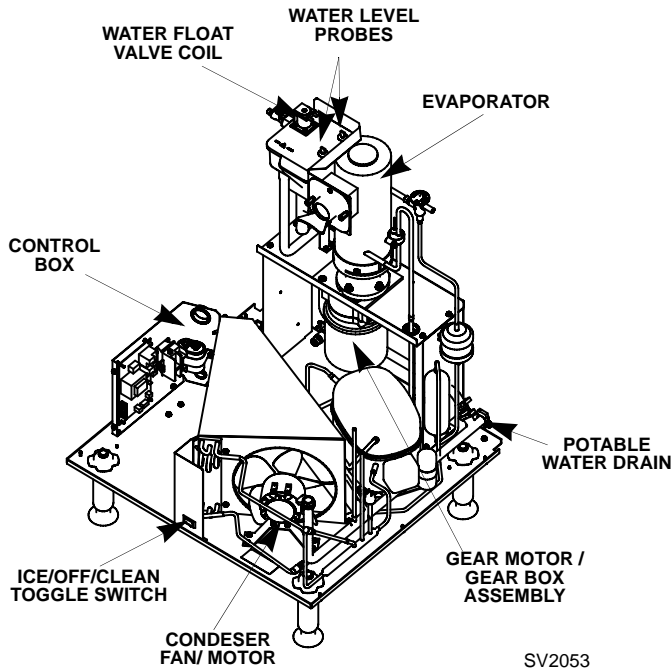


SV2019

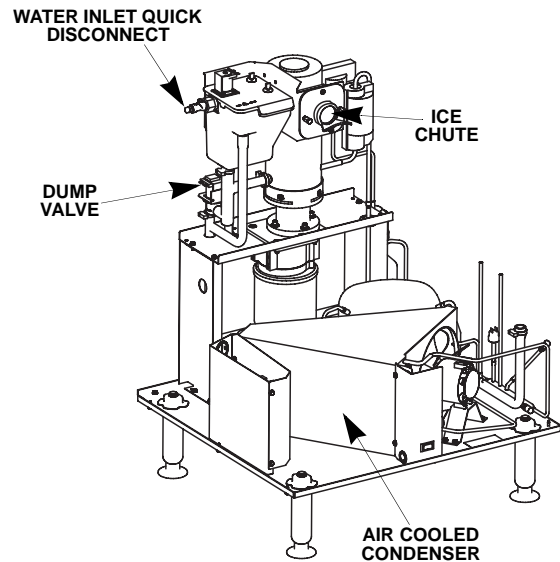


SV2022

QF400

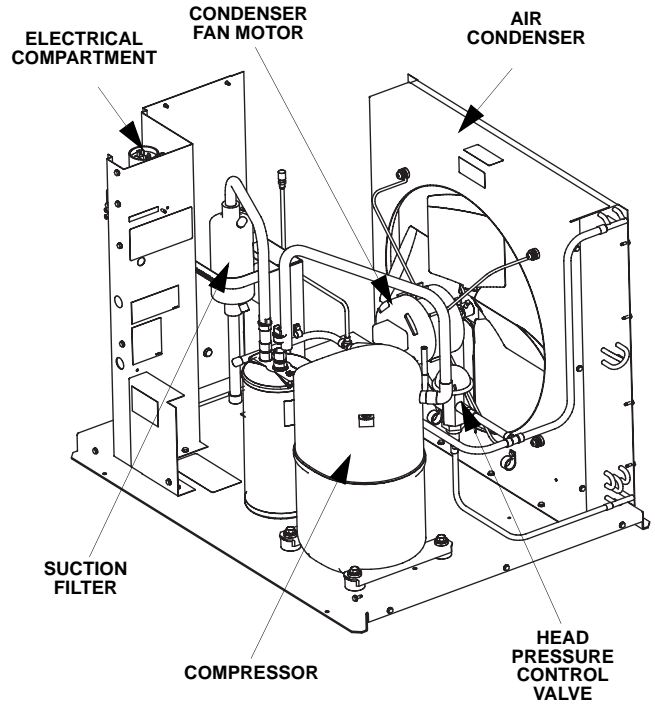
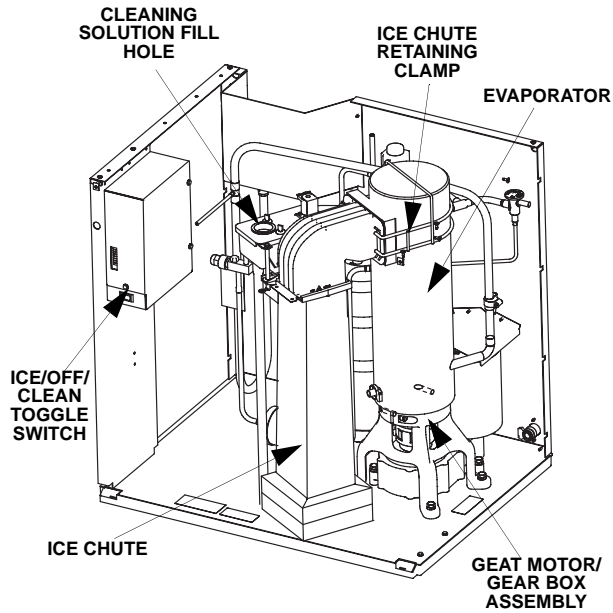


SV2053



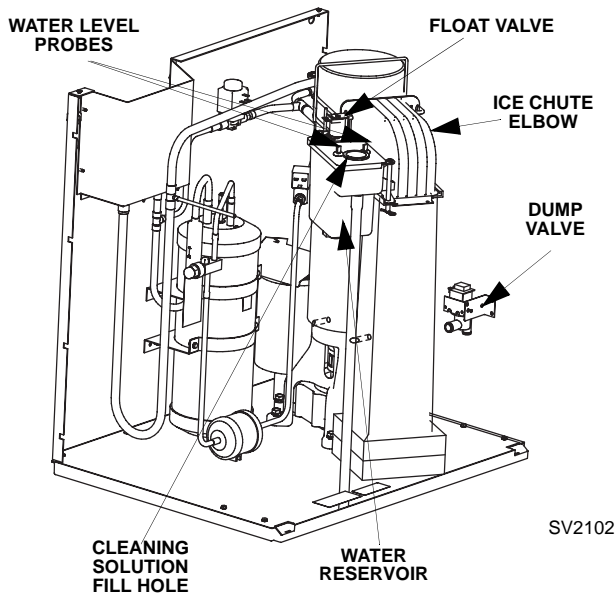
SV2044

QF2300



SV2100

RFC2385 Remote Condensing Unit



SV2102

Operational Checks

GENERAL

Manitowoc ice machines are factory-operated and adjusted before shipment. Normally, a newly installed ice machine does not require any adjustment.

To ensure proper operation, always follow the Operational Checks:

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

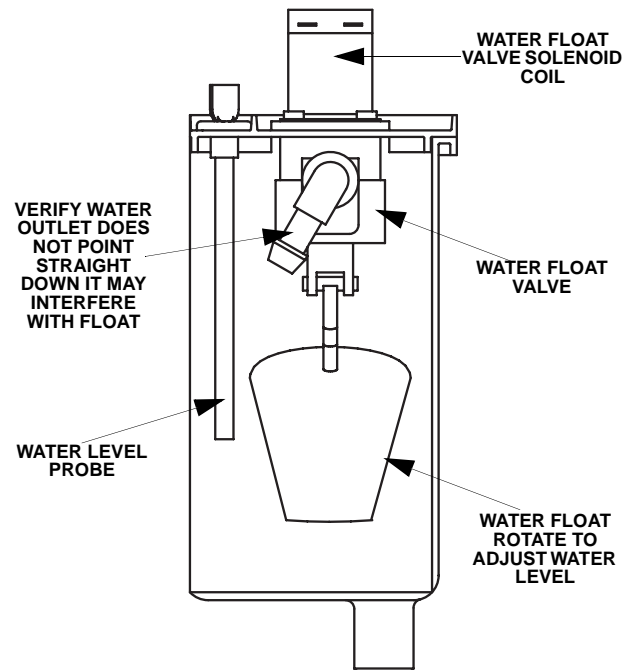
NOTE: Routine adjustments and maintenance procedures outlined in this manual are not covered by the warranty.

WATER LEVEL CHECK

The float valve maintains the correct water level. The water level must allow the water level probes to maintain water contact throughout the freeze cycle. The water level is factory set and normally will not require adjustment. Check the water level during the freeze cycle. The water level is correct if the water level indicator light is energized (compressor is running) and no water is entering the overflow tube. (Check for overflow water exiting the ice machine drain line at the floor drain).

If adjustments are necessary:

- Rotate float clockwise to increase water level
- Rotate float counterclockwise to decrease water level
- Verify the outlet for the water float valve is at a 20 to 30 degree angle to prevent contact with the float.



SV2029

Interior Cleaning and Sanitizing

GENERAL

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

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

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

Caution

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

Caution

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

Warning

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

Manitowoc Ice Machines have three separate cleaning procedures.

Preventative Maintenance Cleaning Procedure

Procedure starts on Page 3-6

Perform this procedure as required for your water conditions.

- Allows cleaning the ice machine without removing all of the ice from the bin
- Removes mineral deposits from areas or surfaces that are in direct contact with water during the freeze cycle (reservoir, evaporator, auger, drain lines).

Cleaning/Sanitizing Procedure

Procedure starts on Page 3-8

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

- All ice must be removed from the bin
- The ice machine and bin must be disassembled cleaned and sanitized
- The ice machine produces ice with the cleaner and sanitizer solutions
- All ice produced during the cleaning and sanitizing procedure must be discarded

Heavily Scaled Cleaning Procedure

Procedure starts on Page 3-10

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

- Grinding, popping or squealing noises from the evaporator
- Grinding noise from gearbox
- Ice machine trips speed sensor

NOTE: A Cleaning/Sanitizing Procedure must be performed after this procedure.

EXTERIOR CLEANING

Remove dust and dirt off exterior surfaces with mild household dish-washing detergent and warm water. Wipe dry with a clean, soft cloth.

CLEANING THE CONDENSER

Warning
 Disconnect electric power to the ice machine and the remote condenser at the electric service switch before cleaning the condenser.

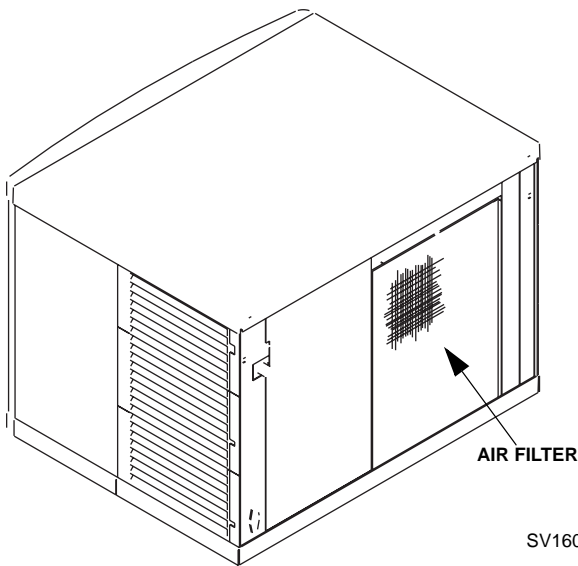
Air-Cooled Condenser

(SELF-CONTAINED AND REMOTE MODELS)

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

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

1. The washable aluminum filter on self-contained ice machines is designed to catch dust, dirt, lint and grease. This helps keep the condenser clean. Clean the filter with a mild soap and water solution.

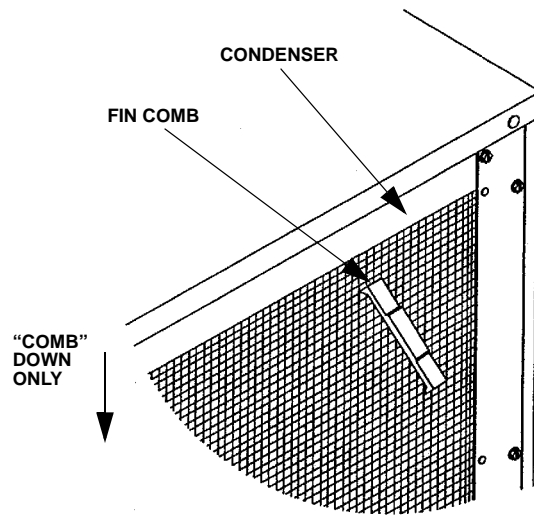


SV1608

Self-Contained Air-Cooled Filter

2. Clean the outside of the condenser (bottom of a remote condenser) with a soft brush or a vacuum with a brush attachment. Clean from top to bottom, not side to side. Be careful not to bend the condenser fins.

3. Shine a flashlight through the condenser to check for dirt between the fins. If dirt remains:
 - A. Blow compressed air through the condenser fins from the inside. Be careful not to bend the fan blades.
 - B. Use a commercial condenser coil cleaner. Follow the directions and cautions supplied with the cleaner.
4. Straighten any bent condenser fins with a fin comb.



SV1515

Straighten Bent Condenser Fins

5. Carefully wipe off the fan blades and motor with a soft cloth. Do not bend the fan blades. If the fan blades are excessively dirty, wash with warm, soapy water and rinse thoroughly.

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

MANITOWOC'S CLEANING TECHNOLOGY

Manitowoc Flake/Chiptlet Ice Machines include technology that allows the initiation and completion of a cleaning or sanitizing cycle at the flip of a switch. This cycle will permit cleaning of all surfaces that come in contact with the water distribution system. Periodic maintenance must be performed that includes sanitizing the bin and adjacent surface areas, which are not contacted by the water distribution system.

Depending on local water conditions Manitowoc recommends initiating preventative maintenance cleaning procedures between the 6 month cleanings.

This preventive maintenance removes mineral build-up from the evaporator, which results in peak efficiency and lower operating costs.

This technology will also allow initiation and completion of a clean or sanitize cycle, after which the ice machine automatically starts ice making again.

Refer to the cleaning/sanitizing procedure for complete details.

PREVENTATIVE MAINTENANCE CLEANING PROCEDURE QC700/QF800/QF2300

Use Ice machine cleaner part number 000000084 only. This cleaner is used to remove lime scale or other mineral deposits. It is not used to remove algae or slime. Refer to "Cleaning/Sanitizing Procedure" for removal of algae and slime. To initiate a cleaning cycle using Manitowoc's Cleaning Technology use the following procedure.

Step 1 Remove front and top covers and set the toggle switch to the OFF position.

Step 2 To start a cleaning cycle, move the toggle switch to the CLEAN position. Water will flow through the water dump valve and down the drain. The flush, gear motor, speed, dump valve and water solenoid lights will energize to indicate the ice machine is in the clean mode.

Step 3 Remove the 1 1/2" yellow plug from the top cover of the water reservoir. Wait about one minute or until the dump valve light de-energizes, then add the proper amount of Manitowoc Ice Machine Cleaner and re-install plug.

Step 4 .The ice machine will automatically time out four flush and rinse cycles, and then stop. The flush light remains energized until the toggle switch is moved to the OFF position. This entire cycle lasts approximately 11 minutes.

Model	Amount of Cleaner Part Number 000000084
QC700/QF800/QF2300	3 ounces (90 ml)

NOTE: Periodic cleaning must be performed on adjacent surface areas not contacted by the water distribution system.

Manitowoc recommends disassembling, cleaning and sanitizing the ice machine and bin/dispenser every six months.

NOTE: The ice machine may be set to start and finish a cleaning procedure, and then automatically start ice making again. Wait about one minute into the cleaning cycle (until the dump valve light de-energizes), then move the switch from CLEAN to ICE position.

When the cleaning cycle is complete, the flush light will de-energize and ice making will start automatically

PREVENTATIVE MAINTENANCE CLEANING PROCEDURE QF400

Use Ice machine cleaner part number 000000084 only. This cleaner is used to remove lime scale or other mineral deposits. It is not used to remove algae or slime. Refer to "Cleaning/Sanitizing Procedure" for removal of algae and slime. To initiate a cleaning cycle using Manitowoc's Cleaning Technology use the following procedure.

Step 1 Set the toggle switch to the OFF position. Open the bin door and remove the 2 thumbscrews and white plastic panel.

Step 2 To start a cleaning cycle, move the toggle switch to the CLEAN position. Water will flow through the water dump valve and down the drain. The flush, gear motor, speed, dump valve and water solenoid lights will energize to indicate the ice machine is in the clean mode.

Step 3 Wait about one minute or until the dump valve light de-energizes. Lift the front cover on the water reservoir and add the proper amount of Manitowoc Ice Machine Cleaner.

Model	Amount of Cleaner Part Number 000000084
QF400	3 ounces (90 ml)

Step 4 The ice machine will automatically time out four flush and rinse cycles, and then stop. The flush light remains energized until the toggle switch is moved to the OFF position. This entire cycle lasts approximately 11 minutes.

NOTE: Periodic cleaning must be performed on adjacent surface areas not contacted by the water distribution system.

Manitowoc recommends disassembling, cleaning and sanitizing the ice machine and bin/dispenser every six months.

NOTE: The ice machine may be set to start and finish a cleaning procedure, and then automatically start ice making again. Wait about one minute into the cleaning cycle (until the dump valve light de-energizes), then move the switch from CLEAN to ICE position.

When the cleaning cycle is complete, the flush light will de-energize and ice making will start automatically

CLEANING/SANITIZING PROCEDURE QC700/QF800/QF2300

Use Ice machine cleaner part number 000000084.

Use Ice machine sanitizer part number 94-0565-3.

Step 1 Remove front and top covers and set the toggle switch to the OFF position.

Step 2 Remove all ice from the bin.

Step 3 Disconnect water supply line at float valve quick disconnect by depressing stainless steel lever.

Step 4 Remove the top cover from water reservoir.

Step 5 Remove the water level probes from the top cover and with the wires attached, place the water level probes (stand upright) inside the water reservoir.

Step 6 Follow the chart and premix cleaner and water.

Amount of Water	Amount of Cleaner Part Number 000000084
1 gallon (3.8 Liters)	3 ounces (90 ml)

Step 7 To start cleaning, move the toggle switch to the ICE position.

Step 8 Wait about 45 seconds until the dump valve light de-energizes. Fill the evaporator and reservoir with cleaning solution. The ice machine will make ice with the cleaning solution and deposit the ice in the bin. Add the remaining cleaner/water solution when the water level in the reservoir drops.

NOTE: Do not allow the water level to drop below the water level probes. The ice machine will discontinue the cycle when the water level probes open (lose water contact) for more than 30 seconds.

Step 9 After all of the cleaner/water solution has been added reconnect the water supply line to the float valve. Continue the freeze cycle for 10 minutes to remove the cleaning solution from the water circuit.

Step 10 Place the toggle switch in the Off position.

Step 11 Disassemble the ice machine and hand clean all parts (refer to disassembly for cleaning/sanitizing).

Step 12 Hand sanitize all parts (refer to disassembly for cleaning/sanitizing for procedure).

Step 13 Remove and discard all ice produced during the cleaning process.

Step 14 Reassemble ice machine.

Step 15 Disconnect water supply line at float valve quick disconnect by depressing stainless steel lever.

Step 16 Remove the top cover from water reservoir.

Step 17 Remove the water level probes from the top cover and with the wires attached, place the water level probes (stand upright) inside the water reservoir.

Step 18 Refer to chart and premix water and sanitizer.

Amount of Water	Amount of Sanitizer
6 Gallons (23L) Cool Water	4 ounces (120 ml)

Step 19 To start sanitizing, move the toggle switch to the ICE position.

Step 20 Wait about 45 seconds until the dump valve light de-energizes. Fill the evaporator and reservoir with sanitizer/water solution. The ice machine will make ice with the sanitizer/water solution and deposit the ice in the bin. Add the remaining sanitizer/water solution when the water level in the reservoir drops.

NOTE: Do not allow the water level to drop below the water level probes. The ice machine will discontinue the cycle when the water level probes open (lose water contact) for more than 30 seconds.

Step 21 After all of the sanitizer/water solution has been added to the reservoir, reconnect the water supply line at the float valve quick disconnect.

Continue the sanitize cycle for 10 minutes to remove the sanitizing solution from the water circuit.

Step 22 Place the toggle switch in the Off position, then disassemble the ice machine and hand sanitize all parts (refer to disassembly for cleaning/sanitizing for procedure).

Step 23 Remove and discard all ice produced in the sanitizing process, then reassemble the ice machine and reconnect the water supply.

CLEANING/SANITIZING PROCEDURE QF400

Use Ice machine cleaner part number 000000084.

Use Ice machine sanitizer part number 94-0565-3.

Step 1 Set the toggle switch to the OFF position and remove all ice from the bin.

Step 2 Remove the 2 thumbscrews and white plastic panel.

Step 3 Disconnect water supply line at float valve quick disconnect by depressing stainless steel lever.

Step 4 Remove the top cover from water reservoir.

Step 5 Remove the water level probes from the top cover and with the wires attached, place the water level probes (stand upright) inside the water reservoir.

Step 6 Follow the chart and premix cleaner and water.

Amount of Water	Amount of Cleaner Part Number 000000084
1 gallon (3.8 Liters)	3 ounces (90 ml)

Step 7 To start cleaning, move the toggle switch to the ICE position.

Step 8 Wait about 45 seconds until the dump valve light de-energizes. Fill the evaporator and reservoir with cleaning solution. The ice machine will make ice with the cleaning solution and deposit the ice in the bin. Add the remaining cleaner/water solution when the water level in the reservoir drops.

NOTE: Do not allow the water level to drop below the water level probes. The ice machine will discontinue the cycle when the water level probes open (lose water contact) for more than 30 seconds.

Step 9 After all of the cleaner/water solution has been added reconnect the water supply line to the float valve. Continue the freeze cycle for 10 minutes to remove the cleaning solution from the water circuit.

Step 10 Place the toggle switch in the Off position.

Step 11 Disassemble the ice machine and hand clean all parts (refer to disassembly for cleaning/sanitizing).

Step 12 Hand sanitize all parts (refer to disassembly for cleaning/sanitizing for procedure).

Step 13 Remove and discard all ice produced during the cleaning process.

Step 14 Reassemble ice machine.

Step 15 Disconnect water supply line at float valve quick disconnect by depressing stainless steel lever.

Step 16 Remove the top cover from water reservoir.

Step 17 Remove the water level probes from the top cover and with the wires attached, place the water level probes (stand upright) inside the water reservoir.

Step 18 Refer to chart and premix water and sanitizer.

Amount of Water	Amount of Sanitizer
6 Gallons (23L) Cool Water	4 ounces (120 ml)

Step 19 To start sanitizing, move the toggle switch to the ICE position.

Step 20 Wait about 45 seconds until the dump valve light de-energizes. Fill the evaporator and reservoir with sanitizer/water solution. The ice machine will make ice with the sanitizer/water solution and deposit the ice in the bin. Add the remaining sanitizer/water solution when the water level in the reservoir drops.

NOTE: Do not allow the water level to drop below the water level probes. The ice machine will discontinue the cycle when the water level probes open (lose water contact) for more than 30 seconds.

Step 21 After all of the sanitizer/water solution has been added to the reservoir, reconnect the water supply line at the float valve quick disconnect.

Continue the sanitize cycle for 10 minutes to remove the sanitizing solution from the water circuit.

Step 22 Place the toggle switch in the Off position, then disassemble the ice machine and hand sanitize all parts (refer to disassembly for cleaning/sanitizing for procedure).

Step 23 Remove and discard all ice produced in the sanitizing process, then reassemble the ice machine and reconnect the water supply.

PROCEDURE TO CLEAN HEAVILY SCALED FLAKE/CHIPLET ICE MACHINES QF400/QC700/QF800/QF2300

Step 1 Remove front and top covers, set the toggle switch to the OFF position. Remove all ice from the bin.

Step 2 Remove front and top covers and set the toggle switch to the OFF position.

Step 3 Disconnect water supply line at float valve quick disconnect by depressing stainless steel lever.

Step 4 Refer to chart below:

Premix cleaner with lukewarm water in a non-metallic container.

Model	Water Reservoir Capacity	Mix Cleaner and Water Use Ice machine cleaner part number 000000084 only	
		Cleaner	Water
QF400	48 oz (1.4 L)	32 oz (0.94 L)	16 oz (0.5 L)
QF800/ QC700	48 oz (1.4 L)	32 oz (0.94 L)	16 oz (0.5 L)
QF2300	72 oz (2.1 L)	48 oz (1.4 L)	24 oz (0.7 L)

Step 5 Remove all water from the evaporator and water reservoir. Start an ice making cycle by moving the toggle switch to the ICE position. Water will flow through the water dump valve and down the drain for 45 seconds. After 45 seconds move the toggle switch to the OFF position. Remove the plug from the top cover of the water reservoir. Add the entire cleaner/water solution and re-install the plug.

Leave the cleaner/water solution in the evaporator for a minimum of 4 hours.

Step 6 Move the toggle switch from OFF to ICE. The cleaner/water solution will flow through the water dump valve and down the drain for 45 seconds.

Step 7 Move the toggle switch to the OFF position, then follow the standard cleaning and sanitizing procedures for the model ice machine you are cleaning.

REMOVAL OF PARTS FOR CLEANING/SANITIZING

⚠ Warning

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

⚠ Warning

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

⚠ Caution

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

1. Turn off the water supply to the ice machine at the water service valve or disconnect water supply line at float valve quick disconnect by depressing stainless steel lever and pulling the fitting off.
2. Remove the components listed on the following pages for cleaning and sanitizing.

3. Soak the removed part(s) in a properly mixed solution of cleaner and water.

Solution Type	Water	Mixed With
Cleaner	1 gal. (4 l)	16 oz (500 ml) cleaner Part Number 000000084

4. Use a soft-bristle brush or sponge (NOT a wire brush) to carefully clean the parts.
5. Use the solution and a brush or sponge to clean all disassembled components and the inside of the bin.
6. Rinse all cleaned parts with clear water.
7. Mix a solution of sanitizer and water.

Solution Type	Water	Mixed With
Sanitizer	3 gal. (11.4 l)	2 oz (60 ml) sanitizer Part Number 94-0565-3

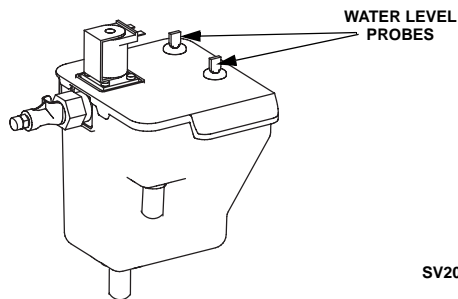
8. Soak the parts in the sanitizer /water solution for 10 minutes. Use the sanitizer/water solution and a sponge to sanitize all removed components and the inside of the bin. Do not rinse the sanitized parts.
9. Install the removed parts in the ice machine.
10. Turn on the water and electrical supply.

Water Level Probe Removal

QF400/QC700/QF800/QF2300

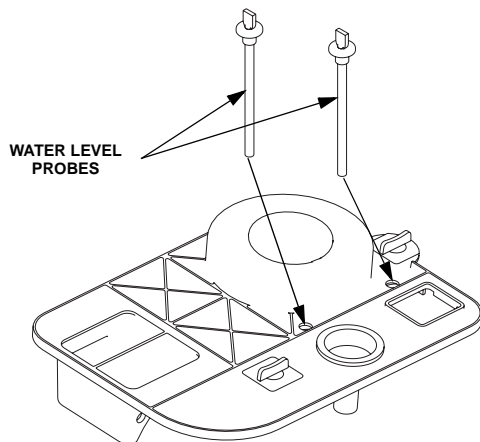
Water Level Probe Removal

1. Place the toggle switch in the OFF position, turn off the water supply and disconnect electrical power to the ice machine.
2. Disconnect water supply line at float valve quick disconnect by depressing stainless steel lever.
3. Pull up on water level probes to remove.
4. Disconnect wires from water level probes or control board.



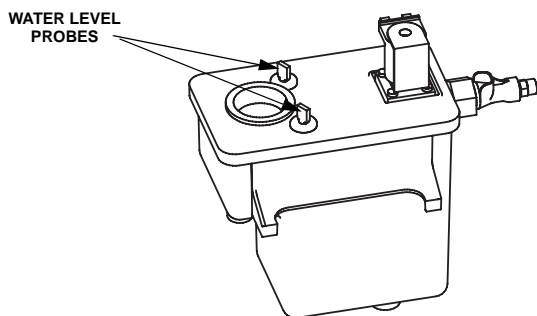
QF400

SV2043



QC700/QF800

SV2028

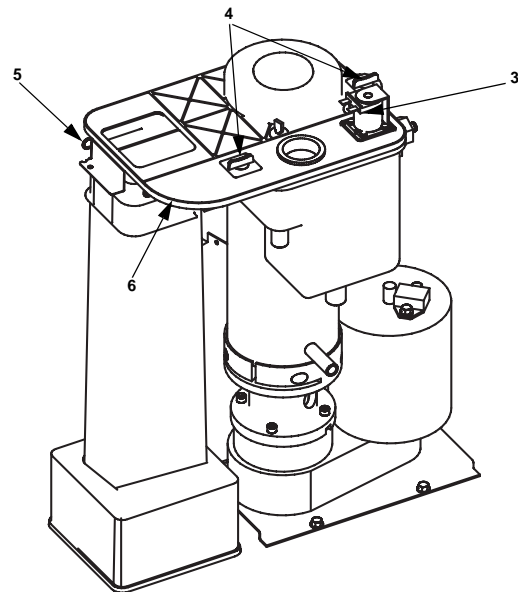


QF2300

SV1791

Water Reservoir Cover Removal

1. Place the toggle switch in the OFF position, turn off the water supply and disconnect electrical power to the ice machine.
2. Remove water level probes.
3. Remove water float valve coil.
4. Depress coil and rotate 1/4 turn counterclockwise.
5. With coil wires attached, lift coil off enclosure tube.
6. QF0800/QC0700 ONLY Rotate quarter turn fasteners counterclockwise.
7. QF0800/QC0700 ONLY Remove cotter key and pin from ice chute.
8. Remove top cover from float reservoir.

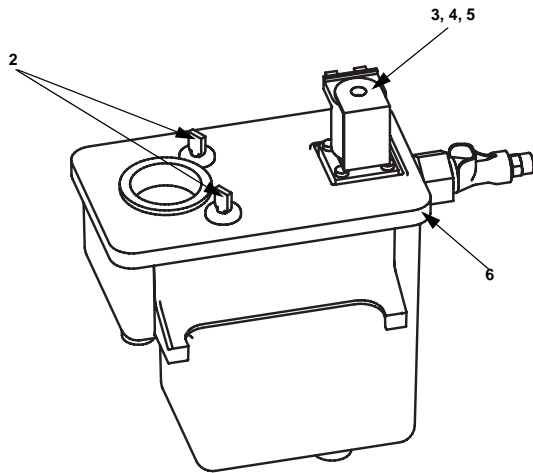


QC700/QF800 Shown

SV2030

Water Reservoir Cover Removal**QF2300**

1. Place the toggle switch in the OFF position, turn off the water supply and disconnect electrical power to the ice machine.
2. Remove water level probes.
3. Remove water float valve coil.
4. Depress coil and rotate 1/4 turn counterclockwise.
5. With coil wires attached, lift coil off enclosure tube.
6. Remove top cover from float reservoir.

**QF2300 Shown**

SV1791

Float Valve Removal

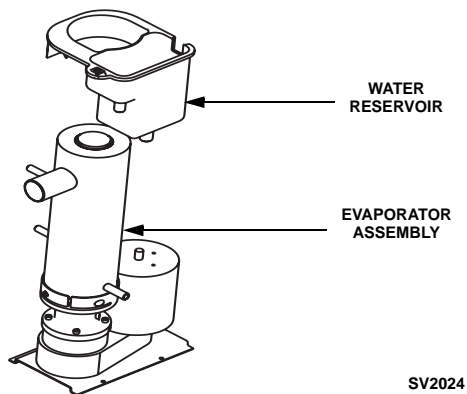
1. Place the toggle switch in the OFF position, turn off the water supply and disconnect electrical power to the ice machine.
2. Disconnect water supply line at float valve quick disconnect by depressing stainless steel lever.
3. Remove water float valve coil.
4. Depress coil and rotate 1/4 turn counterclockwise.
5. With coil wires attached, lift coil off enclosure tube.
6. QF0800/QC0700/QF2300 ONLY Rotate quarter turn fasteners counterclockwise.
7. QF0800/QC0700 ONLY Remove cotter key and pin from ice chute.
8. Remove top cover from float reservoir.
9. Lift float valve out of float reservoir.

**QC700/QF800 Shown**

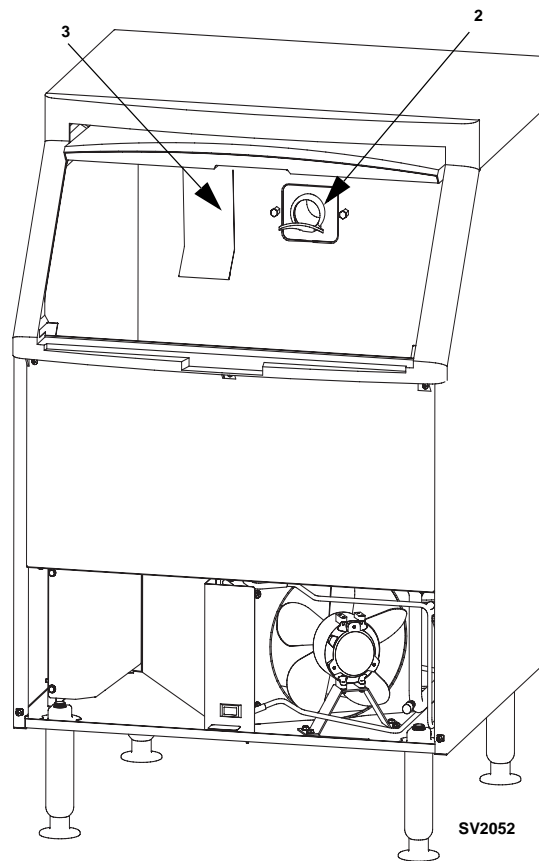
SV2015

Water Reservoir Removal

1. Place the toggle switch in the OFF position and turn off the water supply to the ice machine at the water service valve.
2. Disconnect water supply line at float valve quick disconnect by depressing stainless steel lever.
3. Place the toggle switch in the ICE position. The dump valve will open and the float reservoir will empty.
4. After the reservoir is empty, place the toggle switch in the OFF position and disconnect power to the ice machine at the service disconnect.
5. Remove water float valve coil.
 - A. Depress coil and rotate 1/4 turn counterclockwise.
 - B. With coil wires attached, lift coil off enclosure tube.
5. QF0800/QC0700 ONLY Rotate quarter turn fasteners counterclockwise.
6. QF0800/QC0700 ONLY Remove cotter key and pin from ice chute.
7. Remove top cover from float reservoir.
8. Lift float valve out of float reservoir.
9. Disconnect the drain lines from reservoir.
10. Lift reservoir off of evaporator assembly.

**QC700/QF800 Shown****Ice Diverter Removal****QF0400**

1. Place the toggle switch in the OFF position, turn off the water supply and disconnect electrical power to the ice machine.
2. Remove thumbscrews and lift panel forward.
3. Remove bin level sensor from white plastic panel.
4. Remove ice diverter from bin.

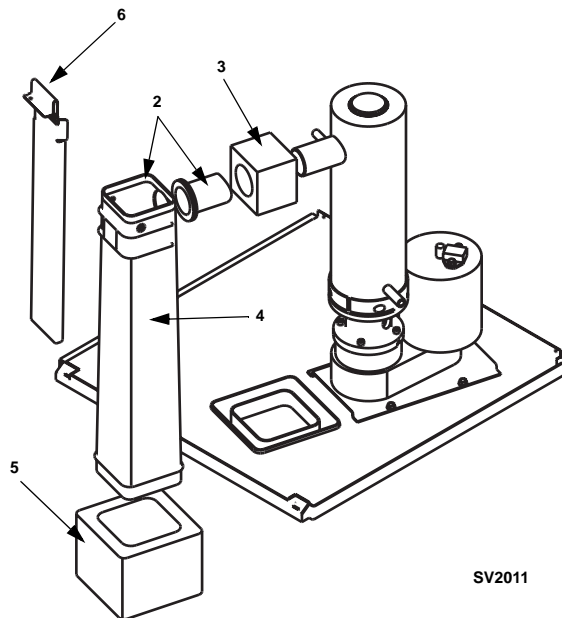


Ice Chute Removal

QC700/QF800

1. Follow steps to remove float reservoir.
2. The ice chute and ice chute grommet will be removed as a unit. Pull forward on the top of the ice chute, and slide the ice chute and grommet off the end of the evaporator spout.
3. Remove evaporator spout insulation.
4. Lift ice chute out of the base.
5. Remove insulation from the bottom of the ice chute.
6. Remove bin level sensor (stainless steel plate) from ice chute. (Bin level sensor can be disconnected from the control board for complete removal from the ice machine.)

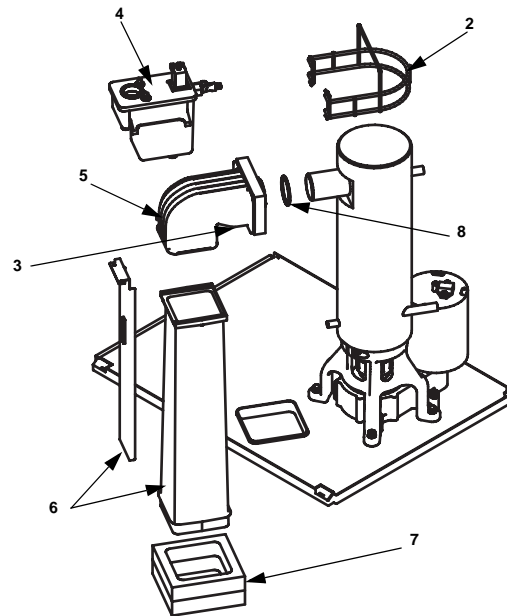
NOTE: Clean and sanitize the base and all ice chute components before reinstalling.



QF2300

1. Place the toggle switch in the OFF position, turn off the water supply and disconnect electrical power to the ice machine.
2. Remove ice chute retaining clamp from top of evaporator.
3. Remove vinyl hose from ice chute spout.
4. Follow steps to remove water reservoir.
5. The ice chute elbow and the ice chute will be removed separately. Support the ice chute and pull forward on the elbow to remove.
6. Lift ice chute out of the base, tip bottom forward and remove bin level sensor (stainless steel plate) from the top of the ice chute. (Bin level sensor can be disconnected from the control board for complete removal from the ice machine.)
7. Remove insulation from ice chute elbow and ice chute base.
8. Remove evaporator spout o-ring.

NOTE: Clean and sanitize the base, spout and all ice chute components before re-installing.



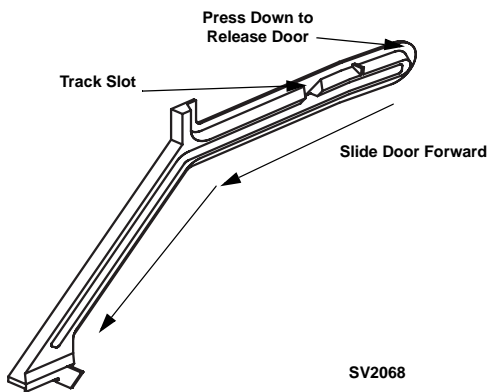
SV1787

Bin Door Removal

QF0400

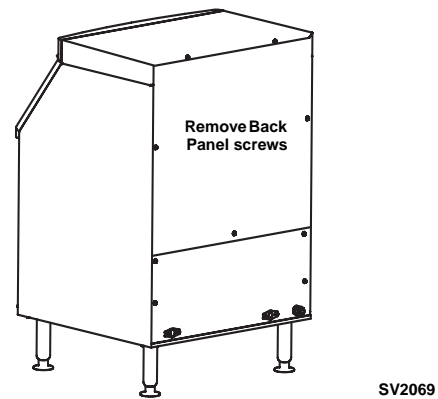
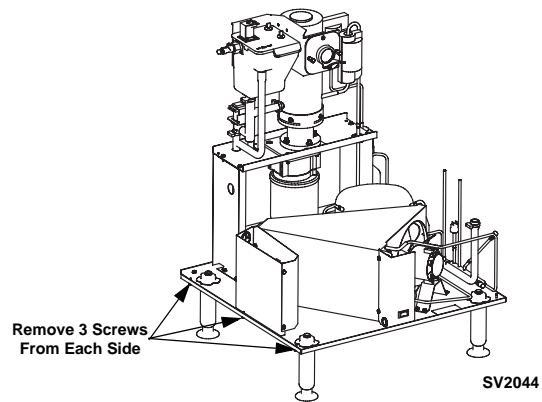
Door removal allows easier access for cleaning and sanitizing.

1. Disconnect the electrical power to the ice machine and remove ice from bin.
2. Grasp the rear of the bin door and pull bin door forward approximately 5".
3. Slide bin door to the rear while applying upward pressure (the rear door pins will ride up into the track slot).
4. Slide the rear door pins off the end and then below the door track. Slide bin door forward allowing the back of the door to lower into the bin. Continue forward with the bin door until the front pins bottom out in the track.
5. Lift the right side of the bin door until the front pin clears the track.
6. Remove door from bin.

**Cabinet Removal**

QF0400

1. Remove all ice from bin and disconnect power.
2. Remove thumbscrews and evaporator panel.
3. Remove three screws from the bottom of the left and right side of cabinet.
4. Remove nine screws from back panel.
5. Disconnect drain line clamp.
6. Slide cabinet forward and remove from base.



Water Dump Valve

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

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

Follow the procedure below to remove the dump valve.

Warning

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

1. If so equipped, remove the water dump valve shield from its mounting bracket.
2. Leaving the wires attached, twist coil and rotate it counter-clockwise 1/4 turn.
3. Lift the coil assembly off the valve body.
4. Remove the spring, plunger, and nylon gasket from the valve body.
- 5.

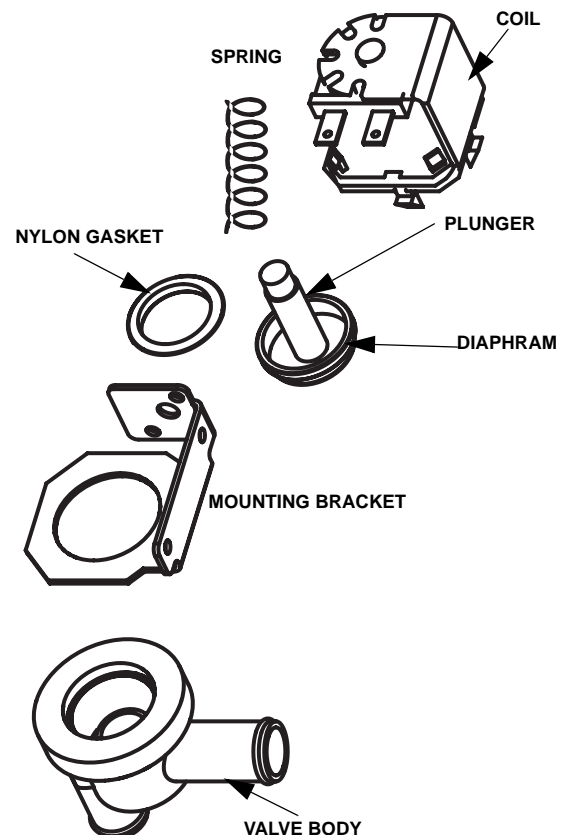
NOTE: At this point, the water dump valve can easily be cleaned. If complete removal is desired, continue with step 5.

Important

The plunger and the inside of the enclosing tube must be completely dry before assembly.

NOTE: During cleaning, do not stretch or damage the spring.

6. Remove the tubing from the dump valve by twisting the clamps off.
7. Remove the valve body, twist off.



Dump Valve Disassembly

Removal from Service/Winterization

GENERAL

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

⚠ Caution

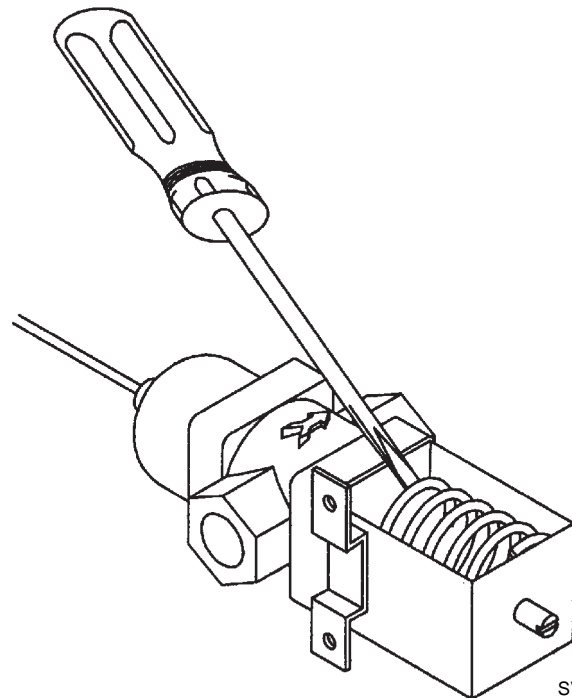
If water is allowed to remain in the ice machine in freezing temperatures, severe damage to some components could result. Damage of this nature is not covered by the warranty.

Follow the applicable procedure below.

1. Disconnect the electrical power at the circuit breaker or the electric service switch.
2. Turn off the water supply.
3. Disconnect and drain the incoming ice-making water line at the rear of the ice machine.
4. Disconnect drain tubing (from the inlet to dump valve) and drain water into container and discard.
5. Make sure water is not trapped in any of the water lines, drain lines, distribution tubes, etc.

WATER COOLED CONDENSING UNIT

1. Perform steps 1-6 in previous column.
2. Disconnect the incoming water and drain lines from the water-cooled condenser.
3. Insert a large screwdriver between the bottom spring coils of the water regulating valve. Pry upward to open the valve.



Pry Open the Water Regulating Valve

4. Hold the valve open and blow compressed air through the condenser until no water remains.

Section 4

Ice Machine Sequence of Operation

QF400/QC700/QF800

PRIOR TO START-UP

When the toggle switch is placed in the "ice" position the following must occur prior to starting an ice making cycle.

- A. The **bin level probe** must be **open** (bin level light off). If the probe is closed, (bin level light on) when the toggle switch is moved to ICE, the control system waits until the bin level probe opens, (bin level light off) before starting an ice making sequence. If the bin level probe is removed/disconnected the ice machine will not start.
- B. The **water level probe** must be **closed** (water level light on) to start the compressor. If the water level probe is open, (water level light off) the control system waits until the water level probe closes before starting the compressor.

INITIAL START-UP

1A. Flush

Immediately after placing the toggle switch into ICE, the dump valve solenoid, and gearbox are energized. After 45 seconds the dump valve de-energizes.

1B. Water Fill

After 45 seconds the water float valve solenoid is energized.

2. Freeze Cycle

When water contacts the water level probe the compressor and condenser fan motor energize (condenser fan motor is wired through a fan cycling control).

The gear motor, compressor, condenser fan motor and water float valve solenoid remain energized as the ice machine makes ice. The water float valve will open and close automatically to maintain the proper water level.

AUTOMATIC SHUT-OFF

3A. Ice Run Out

Ice will build up in the bin until it contacts the bin level probe. After ice contacts the bin level probe for 30 continuous seconds the compressor de-energizes. To allow excess ice to run out, the gear motor and the water float valve solenoid remain energized for an additional 45 seconds, then de-energize.

3B. Water Drain

To allow water to drain from the evaporator, the dump valve energizes for 45 seconds, then de-energizes.

An 8-minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the "8-minute lockout" has expired.

8 Minute Lockout

The bin level light will flash until the 8-minute lockout expires.

After the 8 minute lockout expires the bin level light will de-energize.

The 8 minute lockout time can be overridden by moving the ON/OFF/CLEAN toggle switch from ICE to OFF then back to ICE.

FLUSH SEQUENCE IN THE "ICE" POSITION

After the ice machine has run for 100 hours the ice machine will stop making ice and perform a flush sequence. The flush sequence will remove minerals that have settled in the bottom of the evaporator. The entire flush sequence lasts approximately 11 minutes, after which the ice machine automatically resumes ice making and the 100 hour counter in the control board resets to zero.

NOTE: Flake ice machines use an auger to remove ice from the evaporator. Occasional noises (creaks, groans, or pops) are a normal part of the ice making process.

QF2200**PRIOR TO START-UP**

When the toggle switch is placed in the "ice" position the following must occur prior to starting an ice making cycle.

- A. The **bin level probe** must be **open** (bin level light off). If the probe is closed, (bin level light on) when the toggle switch is moved to ICE, the control system waits until the bin level probe opens, (bin level light off) before starting an ice making sequence. If the bin level probe is removed/disconnected the ice machine will not start.
- B. The **water level probe** must be **closed** (water level light on) to start the compressor. If the water level probe is open, (water level light off) the control system waits until the water level probe closes before starting the compressor.

INITIAL START-UP**1A. Flush**

Immediately after placing the toggle switch into ICE, the dump valve solenoid, and gearbox are energized. After 45 seconds the dump valve de-energizes.

1B. Water Fill

After 45 seconds the water float valve solenoid is energized.

2. Freeze Cycle

When water contacts the water level probe the compressor and condenser fan motor energize (condenser fan motor is wired through a fan cycling control).

The gear motor, liquid line solenoid, condenser fan motor and water float valve solenoid remain energized as the ice machine makes ice. The water float valve will open and close automatically to maintain the proper water level.

Remote Condensing Unit**2. Freeze**

When the refrigerant pressure is high enough, the low-pressure control closes. Closing the low pressure control energizes the contactor coil and the compressor starts.

The compressor increases the refrigerant pressure, the fan cycling control closes and the condenser fan motor starts. The compressor and condenser fan motor remain energized during the entire Freeze Cycle.

AUTOMATIC SHUT-OFF**3A. Ice Run Out**

Ice will build up in the bin until it contacts the bin level probe. After ice contacts the bin level probe for 30 continuous seconds the compressor de-energizes. To allow excess ice to run out, the gear motor and the water float valve solenoid remain energized for an additional 4 minutes, then de-energize.

3B. Water Drain

To allow water to drain from the evaporator, the dump valve energizes for 90 seconds, then de-energizes.

An 8-minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the "8-minute lockout" has expired.

8 Minute Lockout

An 8 minute lockout starts when the compressor de-energizes. The bin level light will flash until the 8-minute lockout expires.

After the 8 minute lockout expires the bin level light will de-energize.

The 8 minute lockout time can be overridden by moving the ON/OFF/CLEAN toggle switch from ICE to OFF then back to ICE.

FLUSH SEQUENCE IN THE "ICE" POSITION

After the ice machine has run for 100 hours the ice machine will stop making ice and perform a flush sequence. The flush sequence will remove minerals that have settled in the bottom of the evaporator. The entire flush sequence lasts approximately 11 minutes, after which the ice machine automatically resumes ice making and the 100 hour counter in the control board resets to zero.

NOTE: Flake ice machines use an auger to remove ice from the evaporator. Occasional noises (creaks, groans, or pops) are a normal part of the ice making process.

Remote Condensing Unit**3. Automatic Shut-Off**

When the refrigerant pressure is low enough to open the low-pressure switch, the contactor coil is de-energized and the compressor and condenser fan motor stop.

QF2300**PRIOR TO START-UP**

When the toggle switch is placed in the "ice" position the following must occur prior to starting an ice making cycle.

- A. The **bin level probe** must be **open** (bin level light off). If the probe is closed, (bin level light on) when the toggle switch is moved to ICE, the control system waits until the bin level probe opens, (bin level light off) before starting an ice making sequence. If the bin level probe is removed/disconnected the ice machine will not start.
- B. The **water level probe** must be **closed** (water level light on) to start the compressor. If the water level probe is open, (water level light off) the control system waits until the water level probe closes before starting the compressor.

INITIAL START-UP**1A. Flush**

Immediately after placing the toggle switch into ICE, the dump valve solenoid, and gearbox are energized. After 45 seconds the dump valve de-energizes.

1B. Water Fill

After 45 seconds the water float valve solenoid is energized.

2. Freeze Cycle

When water contacts the water level probe the liquid line solenoid valve, equalization valve, compressor and condenser fan motor energize (condenser fan motor is wired through a fan cycling control).

The gear motor, compressor, condenser fan motor and water float valve solenoid remain energized as the ice machine makes ice. The water float valve will open and close automatically to maintain the proper water level.

AUTOMATIC SHUT-OFF**3A. Ice Run Out**

Ice will build up in the bin until it contacts the bin level probe. After ice contacts the bin level probe for 30 continuous seconds the liquid line solenoid valve, equalization valve and compressor de-energizes.

To allow excess ice to run out, the gear motor and the water float valve solenoid remain energized for an additional 4 minutes, then de-energize.

3B. Water Drain

To allow water to drain from the evaporator, the dump valve energizes for 90 seconds, then de-energizes.

An 8-minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the "8-minute lockout" has expired.

8 Minute Lockout

The bin level light will flash until the 8-minute lockout expires.

After the 8 minute lockout expires the bin level light will de-energize.

The 8 minute lockout time can be overridden by moving the ON/OFF/CLEAN toggle switch from ICE to OFF then back to ICE.

FLUSH SEQUENCE IN THE "ICE" POSITION

After the ice machine has run for 100 hours the ice machine will stop making ice and perform a flush sequence. The flush sequence will remove minerals that have settled in the bottom of the evaporator. The entire flush sequence lasts approximately 11 minutes, after which the ice machine automatically resumes ice making and the 100 hour counter in the control board resets to zero.

NOTE: Flake ice machines use an auger to remove ice from the evaporator. Occasional noises (creaks, groans, or pops) are a normal part of the ice making process.

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Section 5 Troubleshooting

Checklist

Problem	Possible Cause	To Correct
Ice machine does not operate.	No electrical power to the ice machine.	Replace the fuse/reset the breaker/turn on main power switch/plug cord into receptacle.
	Control Board fuse open	
	ICE/OFF/CLEAN toggle switch set improperly.	Move toggle switch to the ICE position.
	8 minute lockout has not expired.	Bin level light will flash to indicate 8 minute lockout has not expired. Refer to Sequence of Operation
	Bin level sensor is disconnected or is contacting the ice.	Connect bin level sensor or remove ice contacting probe.
Gear Motor runs but compressor will not start. Remotes Only	Water reservoir is empty. (Water must contact the water level probe to start the compressor).	Open water service valve or clean float valve screen. Check water level probe
	Water level probes out of position	Correct water level probe position.
	No electrical power to condensing unit	Replace the fuse/reset the breaker/turn on the main power switch.
Ice machine stops and can be restarted by moving the toggle switch to OFF and back to ICE.	The SafeGuard feature is stopping the ice machine.	Refer to "SafeGuard Feature" in this section
Ice quality is poor.	Poor incoming water quality.	Test the quality of the incoming water and check filter.
	Water filtration is poor.	Replace filter.
	Incoming water temperature is above 90°F (32.3°C)	Correct water temperature. (Verify check/mixing valves in other equipment are working properly). Connect the ice machine to a cold water supply.
	Water pressure is low.	Water pressure must remain between 20 and 80 psig.
	Water softener is working improperly (if applicable).	Repair the water softener.
Low ice capacity. Air-Cooled Models Only	Water float valve screen is dirty.	Remove and clean the filter screen.
	Incoming water supply is shut-off.	Open the water service valve.
	Water dump valve is leaking.	Clean the dump valve.
	Water Pressure is low.	Water pressure must remain between 20 and 80 psig.
	Incoming water temperature is above 90°F (32.2°C)	Correct water temperature. (verify check/mixing valves in other equipment is working properly)
	Water float valve stuck open or leaking.	Remove the float valve and clean it.
	Objects stacked around ice machine, blocking airflow to condenser.	Remove items blocking airflow.
	High air temperature around ice machine.	Air temperature must not exceed 110°F (43.3°C)
	Inadequate clearance around the ice machine.	Provide adequate clearance.
The condenser is dirty.	Clean the condenser.	

Safeguard Feature

In addition to standard safety controls, your Manitowoc ice machine features built-in SafeGuards. The ice machine will stop when conditions arise that would cause major component failure.

RESET PROCEDURE

1. Move the ICE/OFF/CLEAN toggle switch to OFF and then back to ICE.
 - A. If a safeguard feature has stopped the ice machine, it will restart after a short delay. Proceed to step 2.
 - B. If the ice machine does not restart, see “Ice Machine Does Not Operate” on previous page.
2. Allow the ice machine to run to determine if the condition is reoccurring.
 - A. If the ice machine continues to run, the condition has corrected itself. Allow the ice machine to continue running.
 - B. If the ice machine stops again, the condition has reoccurred.

SafeGuards

- No Water
- Gear Motor Speed is Incorrect
- QF400/QC700/QF800 Only - Discharge line temperature is too high or low during the freeze cycle.
- QF2200 Only - Liquid line temperature is too high or low during the freeze cycle.

STANDBY MODE

The first time a failure occurs, the ice machine de-energizes and initiates a Standby Mode. The ice machine will remain off for 60 minutes, then automatically restart to see if the problem reoccurs. During the Standby Mode the corresponding light flashes continuously (disch temp, water level or speed). If the same failure keeps occurring, the ice machine will initiate a SafeGuard Mode and remain off until manually restarted.

SAFEGUARD INDICATOR LIGHTS

During a SafeGuard Mode the corresponding light (disch temp, water level or speed) will flash continuously.

The SafeGuard will remain in memory for 48 hours of ice making time. After 48 hours of ice making time the SafeGuard will automatically be erased. If power is interrupted during the 48 hours, the timing will resume when power is applied to the ice machine.

Placing the toggle switch in the OFF position:

The corresponding light will flash continuously.

Placing the toggle switch in the ICE position:

The light will de-energize and a start-up sequence will initiate.

The corresponding light will flash anytime the toggle switch is placed in the OFF position provided 48 hours of ice making time has not been exceeded.

Analyzing Why SafeGuards May Stop the Ice Machine

According to the refrigeration industry, a high percentage of compressor failure are the result of external causes. These can include flooding or starving expansion valves, dirty condensers, water loss to the ice machine, etc. SafeGuards protect the ice machine (primarily the compressor) from external failures by stopping ice machine operation before major component damage occurs.

Refrigeration and electrical component failures may also trip a safeguard. Eliminate all electrical components and external causes first. If it appears that the refrigeration system is causing the problem, use the charts, checklists, and other references to determine the cause.

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

SAFEGUARD MODES

No Water

During the Freeze cycle if the water level probe opens or remains open for more than 90 continuous seconds, the ice machine will de-energize the compressor and gear motor, continuously flash the water level light and initiate a 60 minute Standby Mode.

During the Standby Mode the water level light will continually flash to indicate a Standby Mode.

After the 60 -minute Standby Mode, the ice machine will de-energize the water level light and initiate a start-up sequence.

WATER CONTACTS THE WATER LEVEL PROBE:

The ice machine continues to make ice.

WATER LEVEL PROBE OPENS OR REMAINS OPEN FOR MORE THAN 90 CONTINUOUS SECONDS:

The ice machine will start another 60-minute Standby Mode.

The ice machine repeats the above sequence until:

Water contacts the water level probe

or

The toggle switch is moved to the OFF position.

INDICATOR LIGHT

Before 48 hours have elapsed:

After a Standby Mode has been initiated the water level light will flash anytime the toggle switch is placed in the OFF position.

After 48 hours have elapsed:

The SafeGuard will be automatically erased from memory and the water level will not flash.

No Water Checklist

Possible Problem List	Corrective Action List
No water	Restore water supply.
Quick disconnect removed from water float valve	Restore water supply.
Water float valve screen blocked	Clean screen.
Water float valve solenoid coil defective	Replace coil (see Water float valve diagnostics).
Water float valve improperly adjusted	Adjust valve (see Water level check).
Dump valve leaking	Repair or replace dump valve.
Water level probes disconnected or removed	Connect and correctly position probes.

Gear Motor Speed

Anytime the motor speed sensor detects the motor speed (rpm) is below the minimum range for 3 continuous seconds, the ice machine will:

1. De-energize the compressor and/or gear motor.
2. Continuously flash the Gear Motor Speed light.
3. Initiate a 60-minute Standby Mode.

During the Standby Mode the Motor Speed Sensor light will flash to indicate a Standby Mode.

After the 60-minute Standby Mode, the ice machine will de-energize the Motor Speed light and initiate a start-up sequence.

Gear motor speed normal:

The ice machine continues to make ice.

Gear motor speed below minimum range for 3 continuous seconds:

The ice machine will start another 60-minute Standby Mode.

If the gear motor speed drops below the minimum range for 3 continuous seconds during 7 consecutive cycles, the ice machine will initiate a SafeGuard Mode.

During the SafeGuard Mode the Motor Speed Sensor light will continually flash to indicate a SafeGuard Mode.

The ice machine remains off until:

- The toggle switch is moved from OFF to ICE.
- Line voltage is interrupted and restored.

INDICATOR LIGHT

Before 48 hours have elapsed:

After a Standby Mode has been initiated the Gear Motor Speed light will flash anytime the toggle switch is placed in the OFF position.

After 48 hours have elapsed:

The SafeGuard will be automatically erased from memory and the Gear Motor Speed light will not flash.

Gear Motor Speed Checklist

Possible Problem List	Corrective Action List
Low water pressure	Verify water pressure is between 20 and 80 psig.
Defective motor speed sensor	Replace motor speed sensor.
Defective motor	Replace motor.
Defective coupler	Replace coupler.
Defective evaporator/auger assembly	Replace evaporator assembly.
Low voltage	Verify voltage is within $\pm 10\%$ of nameplate voltage.
Ice frozen to auger/evaporator	Allow evaporator to thaw.

Temperature is Too High or Low**QF400/QC700/QF800**

The temperature sensor (thermistor) is mounted on the compressor discharge line. The temperature sensor provides input to the control board. The control board monitors the temperature anytime the compressor is energized.

If the thermistor detects 245°F or higher for 15 continuous seconds:

1. The ice machine will de-energize the compressor and gear motor and initiate a SafeGuard Mode.
2. The control board "Disch Temp" light will continue to flash twice then pause, to indicate the ice machine has shut off on high temperature.
3. The ice machine will remain off until the toggle switch is moved from ICE to OFF, and back to ICE.

or

Line voltage is interrupted and restored.

If the thermistor detects 155°F or less for 3 continuous minutes:

1. The control board ignores the low temperature limit for the first 30 minutes of compressor run time.
2. The ice machine will de-energize the compressor and gear motor, continuously flash the control board "Disch Temp" light and initiate a 60-minute Standby Mode.
3. After the 60-minute Standby Mode, the ice machine will de-energize the "Disch Temp" light and initiate a start-up sequence.

4. After 30 minutes of compressor run time, the ice machine will check the discharge line temperature.

Discharge line temperature normal:

The ice machine continues to make ice.

Discharge line temperature below 155°F after 30 minutes of run time:

The ice machine will start another 60-minute Standby Mode.

If the discharge line temperature drops below 155°F for 3 continuous minutes during 7 consecutive cycles the ice machine will start a SafeGuard Mode.

During the SafeGuard Mode the "Disch Temp" light will continually flash to indicate a Safeguard Mode. The ice machine remains off until:

- The toggle switch is moved from ICE to OFF, then back to ICE.
- Line voltage is interrupted and restored.

INDICATOR LIGHTBefore 48 hours have elapsed:

After a Standby Mode has been initiated the Control Board "Disch Temp" light will flash anytime the toggle switch is placed in the OFF position.

After 48 hours have elapsed:

The SafeGuard will be automatically erased from memory and the "Disch Temp" light will not flash.

Temperature Sensor Checklist**QF400/QC700/QF800**

Possible Problem List	Corrective Action List
Thermistor is not properly insulated	Insulate thermistor.
Thermistor loose	Secure thermistor to discharge line.
Thermistor mounted in the wrong location	Position thermistor on discharge line 6 in. from compressor discharge port.
Thermistor defective	Refer to CHECK PROCEDURE under "Thermistor."
Flooding expansion valve	Replace expansion valve.
Refrigerant overcharge or undercharge	Recover and weigh in nameplate charge.
Low ambient temperature	Verify ambient temperature remains above 45°F (7.2°C).
Defective compressor	Replace compressor.
Insufficient or low water pressure	Verify water pressure is between 20 and 80 psig.

Temperature is Too High or Low

QF2200 Only

The temperature sensor (thermistor) is mounted on the liquid line. The temperature sensor provides input to the control board. The control board monitors the temperature anytime the liquid line solenoid valve is energized.

If the thermistor detects 123°F or higher for 15 continuous seconds:

1. The ice machine will de-energize the compressor and gear motor and initiate a SafeGuard Mode.
2. The control board “Disch Temp” light will continue to flash twice then pause, to indicate the ice machine has shut off on high temperature.
3. The ice machine will remain off until the toggle switch is moved from ICE to OFF, and back to ICE.

or

Line voltage is interrupted and restored.

If the thermistor detects 30°F or less for 3 continuous minutes:

1. The control board ignores the low temperature limit for the first 30 minutes of compressor run time.
2. The ice machine will de-energize the liquid line solenoid valve and gear motor, continuously flash the control board “Disch Temp” light and initiate a 60-minute Standby Mode.
3. After the 60-minute Standby Mode, the ice machine will de-energize the “Disch Temp” light and initiate a start-up sequence.

4. After 30 minutes of compressor run time, the ice machine will check the liquid line temperature.

Liquid line temperature normal:

The ice machine continues to make ice.

Liquid line temperature 30°F or less after 30 minutes of run time:

The ice machine will start another 60-minute Standby Mode.

If the liquid line temperature is 30°F or less for 3 continuous minutes during 7 consecutive cycles the ice machine will start a SafeGuard Mode.

During the SafeGuard Mode the “Disch Temp” light will continually flash to indicate a Safeguard Mode. The ice machine remains off until:

- The toggle switch is moved from ICE to OFF, then back to ICE.
- Line voltage is interrupted and restored.

INDICATOR LIGHT

Before 48 hours have elapsed:

After a Standby Mode has been initiated the Control Board “Disch Temp” light will flash anytime the toggle switch is placed in the OFF position.

After 48 hours have elapsed:

The SafeGuard will be automatically erased from memory and the “Disch Temp” light will not flash.

Temperature Sensor Checklist

QF2200

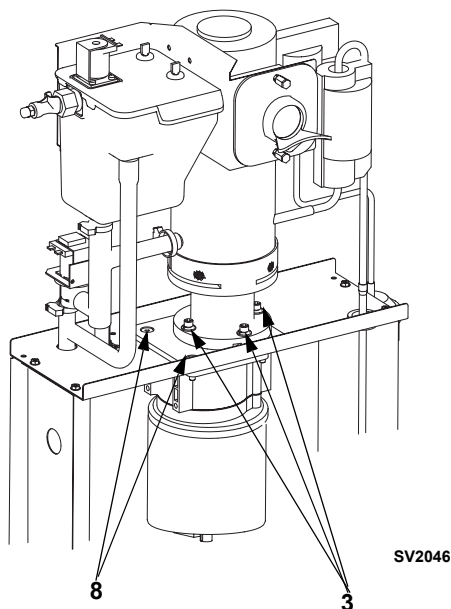
Possible Problem List	Corrective Action List
Thermistor is not properly insulated	Insulate thermistor.
Thermistor loose	Secure thermistor to liquid line.
Thermistor mounted in the wrong location	Position thermistor on liquid line between heat exchanger and line drier.
Thermistor defective	Refer to CHECK PROCEDURE under “Thermistor.”
Flooding expansion valve	Replace expansion valve.
Refrigerant overcharge or undercharge	Recover and weigh in nameplate charge.
Low ambient temperature	Verify ambient temperature remains above 45°F (7.2°C).
Headmaster will not bypass	Replace headmaster.
Insufficient or low water pressure	Verify water pressure is between 20 and 80 psig.

Gear Box Removal

QF400

The evaporator and motor / gearbox are separate assemblies. Warranty procedures require replacement of the entire evaporator or motor / gearbox assembly. Separate components are not available, and field rebuilding during the warranty period is not allowed.

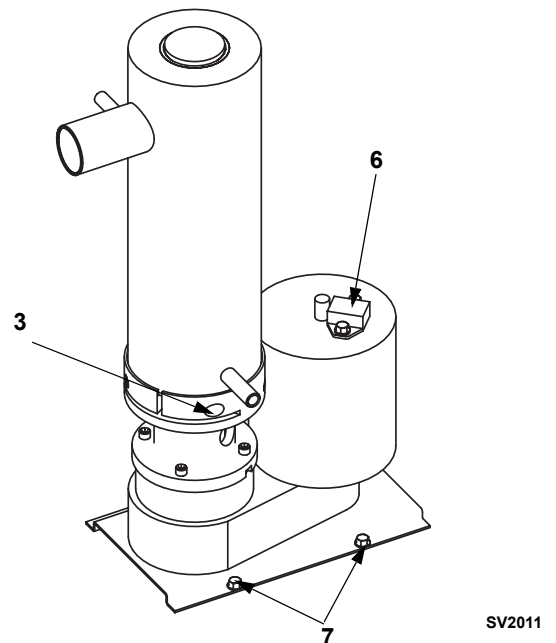
1. Disconnect power to the ice machine.
2. Remove water level probes, water reservoir cover, float valve, water reservoir, ice chute, and drain tubing (refer to Component Removal).
3. Remove bolts securing foundation coupling to gear motor assembly.
4. Lift evaporator and rest on top of foundation coupling.
5. Disconnect line voltage wiring at motor Molex connector.
6. Remove two screws holding motor speed sensor and remove sensor.
7. Remove coupling, spline hub and keyway from gear motor.
8. Support motor / gearbox assembly and remove 4 bolts securing gear motor assembly to base.
9. Remove gear motor assembly from ice machine.
10. Apply anti-seize compound to the shaft and all bolts to ease future disassembly.



QC700/QF800

The evaporator and motor / gearbox are separate assemblies. Warranty procedures require replacement of the entire evaporator or motor / gearbox assembly. Separate components are not available, and field rebuilding during the warranty period is not allowed.

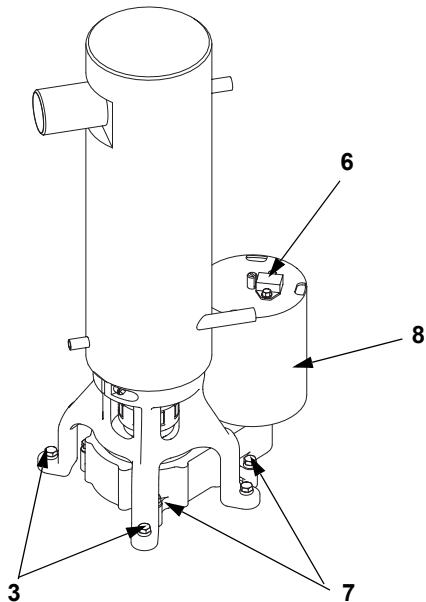
1. Disconnect power to the ice machine.
2. Remove water level probes, water reservoir cover, float valve, water reservoir, ice chute, and drain tubing (refer to Component Removal).
3. Remove bolts securing foundation coupling to gear motor assembly.
4. Lift evaporator and rest on top of foundation coupling.
5. Disconnect line voltage wiring at motor Molex connector.
6. Remove two screws holding motor speed sensor and remove sensor.
7. Remove bolts securing gear motor assembly mounting bracket to base.
8. Remove gear motor assembly from ice machine.
9. Remove coupling, spline hub, keyway, and mounting bracket from gear motor.
10. Apply anti-seize compound to the shaft and all bolts to ease future disassembly.



QF2200/QF2300

The evaporator and motor / gearbox are separate assemblies. Warranty procedures require replacement of the entire evaporator or motor /gearbox assembly. Separate components are not available, and field rebuilding during the warranty period is not allowed.

1. Disconnect power and water supply to the ice machine and drain all water from the reservoir and evaporator.
2. Remove reservoir retaining pin, water reservoir, ice chute, and drain tubing (refer to Component Removal).
3. Remove bolts securing foundation coupling to base.
4. Lift and support evaporator (evaporator weighs 80 lbs.).
5. Remove gear motor drip shield and disconnect line voltage wiring at motor Molex connector.
6. Remove two screws holding motor speed sensor and remove sensor.
7. Remove bolts securing gear motor assembly to base.
8. Remove gear motor assembly from ice machine.
9. Remove coupling (use a 8 mm hex wrench for coupling set screw), spline hub and keyway from gear motor.
10. Apply anti-seize compound to the shaft and all bolts to ease future disassembly.



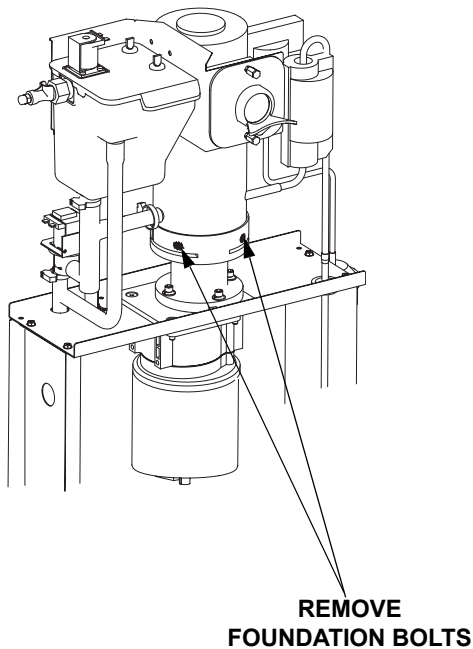
SV3017

Evaporator Removal

QF400

The evaporator and motor / gearbox are separate assemblies. Warranty procedures require replacement of the entire evaporator or motor /gearbox assembly. Separate components are not available, and field rebuilding during the warranty period is not allowed.

1. Disconnect power to the ice machine.
2. Remove water level probes, water reservoir cover, float valve, water reservoir, ice chute, and drain tubing (refer to Component Removal).
3. Recover refrigerant and disconnect refrigeration tubing from evaporator.
4. Remove foundation-coupling bolts.
5. Lift evaporator out of foundation coupling and remove from ice machine.
6. Remove spline hub and keyway from evaporator.
7. Apply anti-seize compound to the shaft and all bolts to ease future disassembly.
8. After reinstallation of evaporator, torque foundation bolts to 195-205 inch lbs.

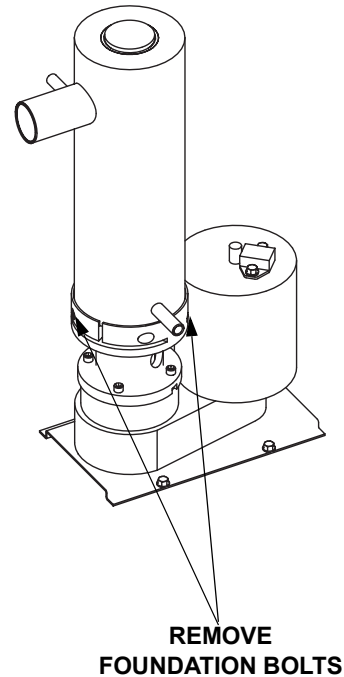


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QC700/QF800

The evaporator and motor / gearbox are separate assemblies. Warranty procedures require replacement of the entire evaporator or motor /gearbox assembly. Separate components are not available, and field rebuilding during the warranty period is not allowed.

1. Disconnect power to the ice machine.
2. Remove water level probes, water reservoir cover, float valve, water reservoir, ice chute, and drain tubing (refer to Component Removal).
3. Recover refrigerant and disconnect refrigeration tubing from evaporator.
4. Remove foundation-coupling bolts.
5. Lift evaporator out of foundation coupling and remove from ice machine.
6. Remove spline hub and keyway from evaporator.
7. Apply anti-seize compound to the shaft and all bolts to ease future disassembly.
8. After reinstallation of evaporator, torque foundation bolts to 195-205 inch lbs.

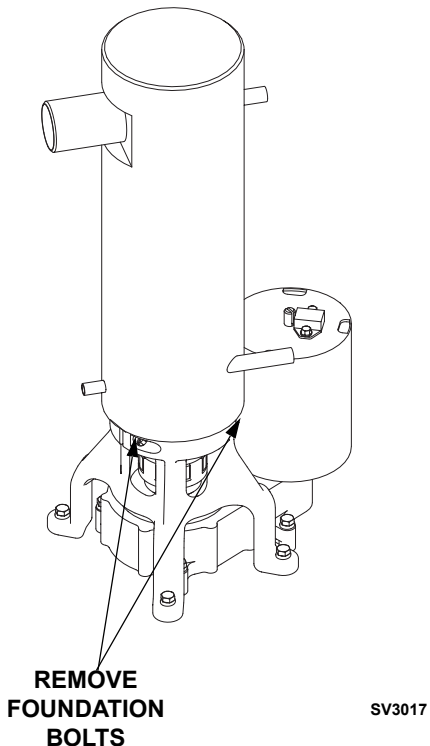


SV3057

QF2200/QF2300

The evaporator and motor / gearbox are separate assemblies. Warranty procedures require replacement of the entire evaporator or motor /gearbox assembly. Separate components are not available, and field rebuilding during the warranty period is not allowed.

1. Disconnect power and water supply to the ice machine and drain all water from the reservoir and evaporator.
2. Remove reservoir retaining pin, water reservoir, ice chute, and drain tubing (refer to Component Removal).
3. Recover refrigerant and disconnect refrigeration tubing from evaporator.
4. Remove foundation-coupling bolts.
5. Lift evaporator out of foundation coupling and remove from ice machine.
6. Remove spline hub and keyway from evaporator (8 mm hex wrench for coupling set screw).
7. Apply anti-seize compound to the shaft and all bolts to ease future disassembly.
8. After reinstallation of evaporator, torque foundation bolts to 195-205 inch lbs.



Section 6 Electrical System

Energized Parts Charts

QF400/QC700/QF800

Ice Making Sequence Of Operation	Control Relays				Sensors				Length Of Time
	1 Contactor Coil	2 Dump Valve	3 Gear Motor	4 Float Valve Coil	Water Level Probe	Bin Level Probe	Temperature Sensor	Gear Motor Speed	
START-UP 1A. Water Flush	Off	On	On	Off	Not Sensing for Water Level	Sensing No Ice Contact	Not Sensing for Temperature	Sensing for Gear Motor Speed	45 Seconds
1B. Water Fill	Off	Off	On	On	Sensing for Water Level	Sensing No Ice Contact	Not Sensing for Temperature	Sensing for Gear Motor Speed	Until Water Contacts Water Level Probe
FREEZE SEQUENCE 2. Freeze	On	Off	On	On	Sensing for Water Level	Sensing No Ice Contact	Sensing for 245°F Immediately. Sensing for 155°F after 30 min. of Ice Making	Sensing for Gear Motor Speed	Until Ice Contacts Bin Level Probe for 30 Continuous Seconds
AUTOMATIC SHUT-OFF 3A. Ice Run Out	Off	Off	On	On	Sensing for Water Level	Sensing Ice Contact	Not Sensing for Temperature	Sensing for Gear Motor Speed	45 Seconds
3B. Drain Evaporator	Off	On	Off	Off	Not Sensing for Water Level	Sensing Ice Contact	Not Sensing for Temperature	Not Sensing for Gear Motor Speed	45 Seconds
AUTOMATIC SHUT-OFF	Off	Off	Off	Off	Not Sensing for Water Level	Sensing Ice Contact	Not Sensing for Temperature	Not Sensing for Gear Motor Speed	Until Ice No Longer Contacts Bin Level Probe

When the toggle switch is placed in the ICE position, the following must occur prior to starting an ice making cycle.

A.) The **bin level probe** must be **open** (Bin Level light off). If the probe is closed (Bin Level light on) when the toggle switch is moved to ICE, the control system waits until the bin level probe opens (Bin Level light off) before starting an ice making sequence.

If the bin level probe is disconnected from the control board, the ice machine will not start and will continuously flash the Bin Level light.

The ice machine will remain off until:

1. The bin level probe is reconnected to the circuit board
2. The toggle switch is moved from ICE to OFF, then back to ICE.

B. The **water level probe** must be **closed** (Water Level light on) to start the compressor.

If the water level probe is open (Water Level light off), the control system waits until the water level probe closes before starting the compressor.

QC700/QF800

Condenser Fan Motor - The fan motor is wired through a fan cycle pressure control. The fan motor will cycle on/off depending on discharge pressure 8-Minute Lockout - The Bin Level light will flash until the 8-minute lockout expires.

After the 8-minute lockout expires, the Bin Level light will de-energize.

The 8-minute lockout time can be overridden by moving the ICE/OFF/CLEAN toggle switch from ICE to OFF, then back to ICE.

Energized Parts Charts

QF2200

Ice Making Sequence Of Operation	Control Relays				Sensors				Length Of Time
	1	2	3	4	Water Level Probe	Bin Level Probe	Temperature Sensor	Gear Motor Speed	
	Liquid Line Solenoid Valve	Dump Valve	Gear Motor	Float Valve Coil					
START-UP 1A. Water Flush	Off	On	On	Off	Not Sensing for Water Level	Sensing No Ice Contact	Not Sensing for Temperature	Sensing for Gear Motor Speed	45 Seconds
1B. Water Fill	Off	Off	On	On	Sensing for Water Level	Sensing No Ice Contact	Not Sensing for Temperature	Sensing for Gear Motor Speed	Until Water Contacts Water Level Probe
FREEZE SEQUENCE 2. Freeze	On	Off	On	On	Sensing for Water Level	Sensing No Ice Contact	Sensing for 123°F Immediately. Sensing for 30°F after 30 min. of Ice Making	Sensing for Gear Motor Speed	Until Ice Contacts Bin Level Probe for 30 Continuous Seconds
AUTOMATIC SHUT-OFF 3A. Ice Run Out	Off	Off	On	On	Sensing for Water Level	Sensing Ice Contact	Not Sensing for Temperature	Sensing for Gear Motor Speed	4 Minutes
3B. Drain Evaporator	Off	On	Off	Off	Not Sensing for Water Level	Sensing Ice Contact	Not Sensing for Temperature	Not Sensing for Gear Motor Speed	90 Seconds
AUTOMATIC SHUT-OFF	Off	Off	Off	Off	Not Sensing for Water Level	Sensing Ice Contact	Not Sensing for Temperature	Not Sensing for Gear Motor Speed	Until Ice No Longer Contacts Bin Level Probe

*After the liquid line solenoid valve energizes, the suction pressure will rise above the low-pressure switch cut-in (22 psig) and the compressor and condenser fan motor energize. The condenser fan motor remains energized during the entire freeze cycle, the head pressure control valve controls the discharge pressure.

When the toggle switch is placed in the ICE position, the following must occur prior to starting an ice making cycle.

A.)The **bin level probe** must be **open** (Bin Level light off). If the probe is closed (Bin Level light on) when the toggle switch is moved to ICE, the control system waits until the bin level probe opens (Bin Level light off) before starting an ice making sequence.

If the bin level probe is disconnected from the control board, the ice machine will not start and will continuously flash the Bin Level light.

The ice machine will remain off until:

- 1.The bin level probe is reconnected to the circuit board
- 2.The toggle switch is moved from ICE to OFF, then back to ICE.

B. The **water level probe** must be **closed** (Water Level light on) to start the compressor.

If the water level probe is open (Water Level light off), the control system waits until the water level probe closes before starting the compressor.

8-Minute Lockout - The Bin Level light will flash until the 8-minute lockout expires.

After the 8-minute lockout expires, the Bin Level light will de-energize.

The 8-minute lockout time can be overridden by moving the ICE/OFF/CLEAN toggle switch from ICE to OFF, then back to ICE.

Energized Parts Charts

QF2300

Ice Making Sequence Of Operation	Control Relays				Sensors			Length Of Time
	1	2	3	4	Water Level Probe	Bin Level Probe	Gear Motor Speed	
	Liquid Line Solenoid/ Equalization Valve/ Compressor	Dump Valve	Gear Motor	Float Valve Coil				
START-UP 1A. Water Flush	Off	On	On	Off	Not Sensing for Water Level	Sensing No Ice Contact	Sensing for Gear Motor Speed	45 Seconds
1B. Water Fill	Off	Off	On	On	Sensing for Water Level	Sensing No Ice Contact	Sensing for Gear Motor Speed	Until Water Contacts Water Level Probe
FREEZE SEQUENCE 2. Freeze	On	Off	On	On	Sensing for Water Level	Sensing No Ice Contact	Sensing for Gear Motor Speed	Until Ice Contacts Bin Level Probe for 3 Continuous Minutes
AUTOMATIC SHUT-OFF 3A. Ice Run Out	Off	Off	On	On	Not Sensing for Water Level	Sensing Ice Contact	Sensing for Gear Motor Speed	4 Minutes
3B. Drain Evaporator	Off	On (90 Seconds)	Off	Off	Not Sensing for Water Level	Sensing Ice Contact	Not Sensing for Gear Motor Speed	90 Seconds
AUTOMATIC SHUT-OFF	Off	Off	Off	Off	Not Sensing for Water Level	Sensing Ice Contact	Not Sensing for Gear Motor Speed	Until Ice No Longer Contacts Bin Level Probe

When the toggle switch is placed in the ICE position, the following must occur prior to starting an ice making cycle.

A.) The **bin level probe** must be **open** (Bin Level light off). If the probe is closed (Bin Level light on) when the toggle switch is moved to ICE, the control system waits until the bin level probe opens (Bin Level light off) before starting an ice making sequence.

If the bin level probe is disconnected from the control board, the ice machine will not start and will continuously flash the Bin Level light.

The ice machine will remain off until:

1. The bin level probe is reconnected to the circuit board
2. The toggle switch is moved from ICE to OFF, then back to ICE.

B. The **water level probe** must be **closed** (Water Level light on) to start the compressor.

If the water level probe is open (Water Level light off), the control system waits until the water level probe closes before starting the compressor.

8-Minute Lockout - The Bin Level light will flash until the 8-minute lockout expires.

After the 8-minute lockout expires, the Bin Level light will de-energize.

The 8-minute lockout time can be overridden by moving the ICE/OFF/CLEAN toggle switch from ICE to OFF, then back to ICE.

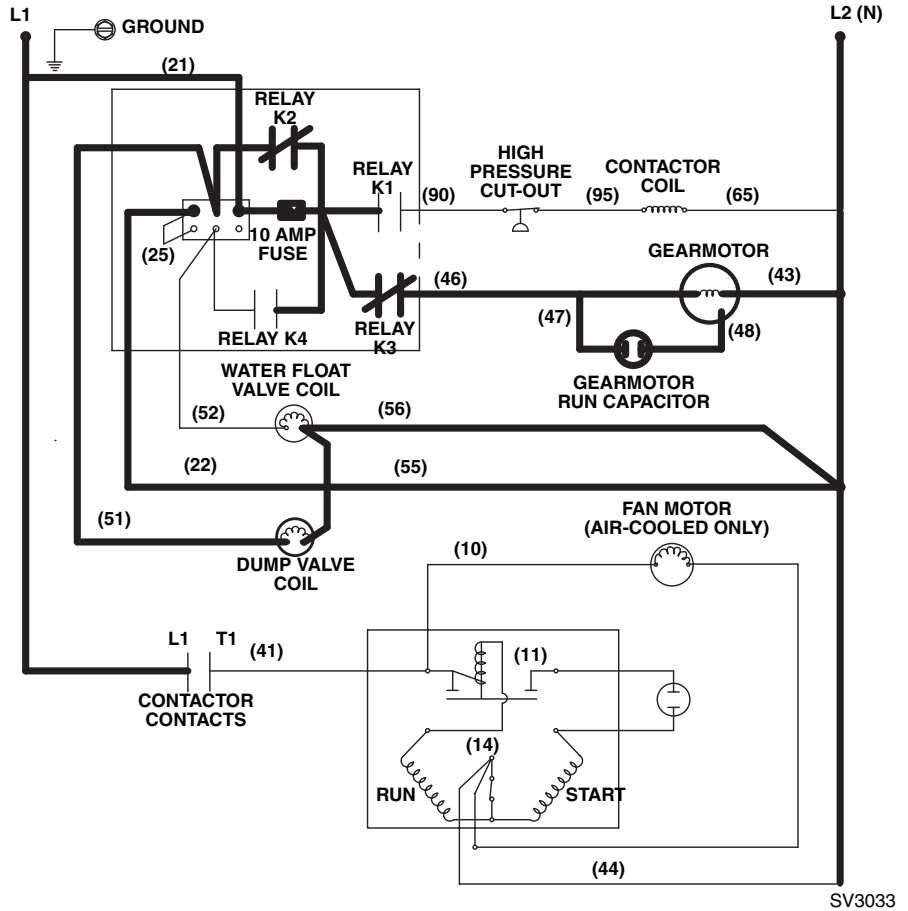
Wiring Diagram Sequence of Operation

QF400

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

1A. WATER FLUSH

Immediately after placing the toggle switch in "ICE", the dump valve solenoid, and gearbox are energized. After 45 seconds the dump valve de-energizes.



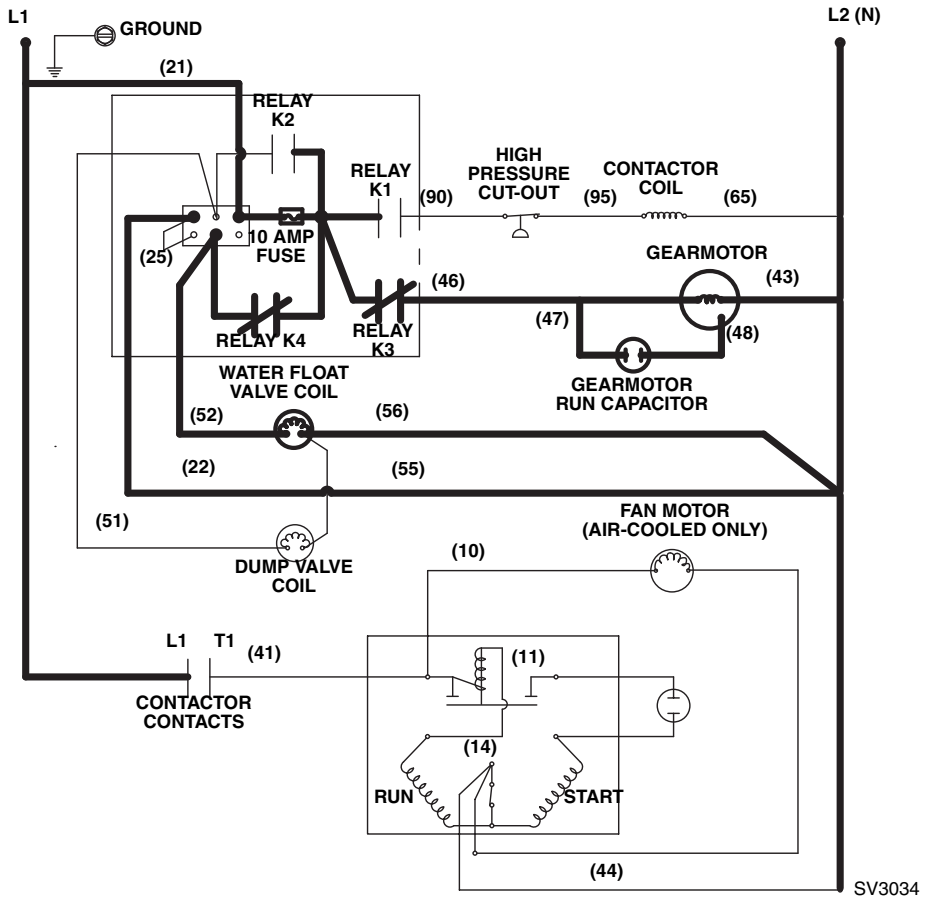
SV3033

1A. Water Flush (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Contactors Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	ON
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	OFF

Initial Start-Up or Start-Up After Automatic Shut-Off (cont.)

1B. WATER FILL

After 45 seconds the float valve solenoid is energized.



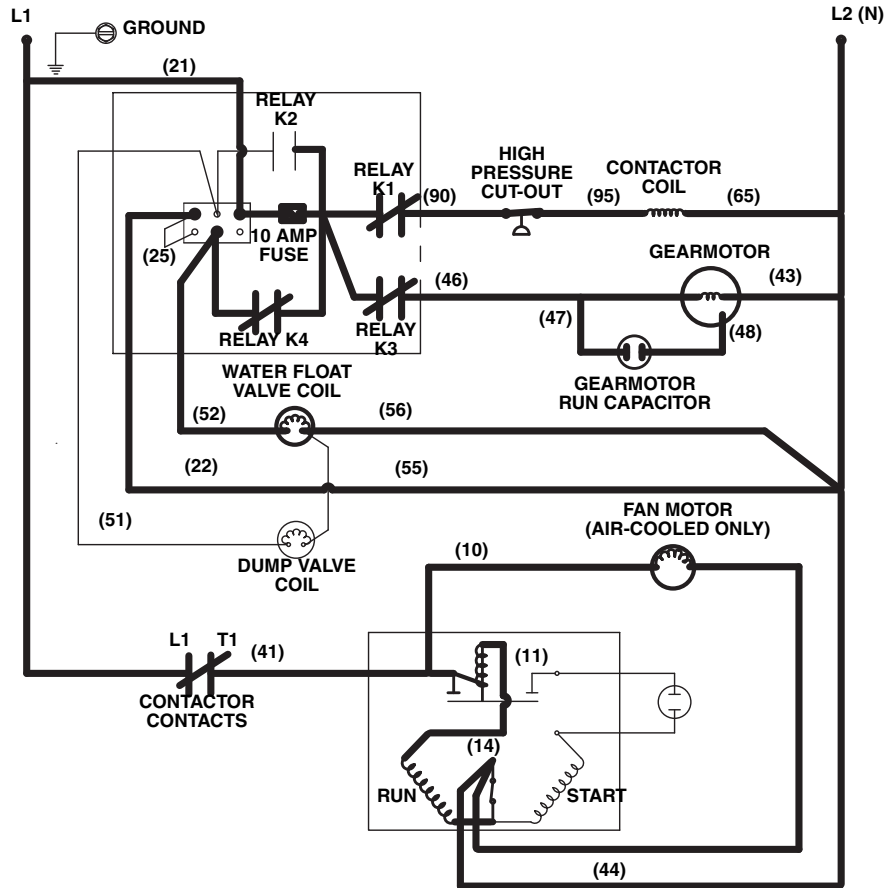
SV3034

1B. Water Fill (Until Water Contacts Water Level Probe)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Contactor Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

Freeze Cycle

2. FREEZE

The gear motor, compressor, condenser fan motor and water float valve solenoid remain energized as the ice machine makes ice. The water float valve will open and close automatically to maintain the proper water level.



SV3036

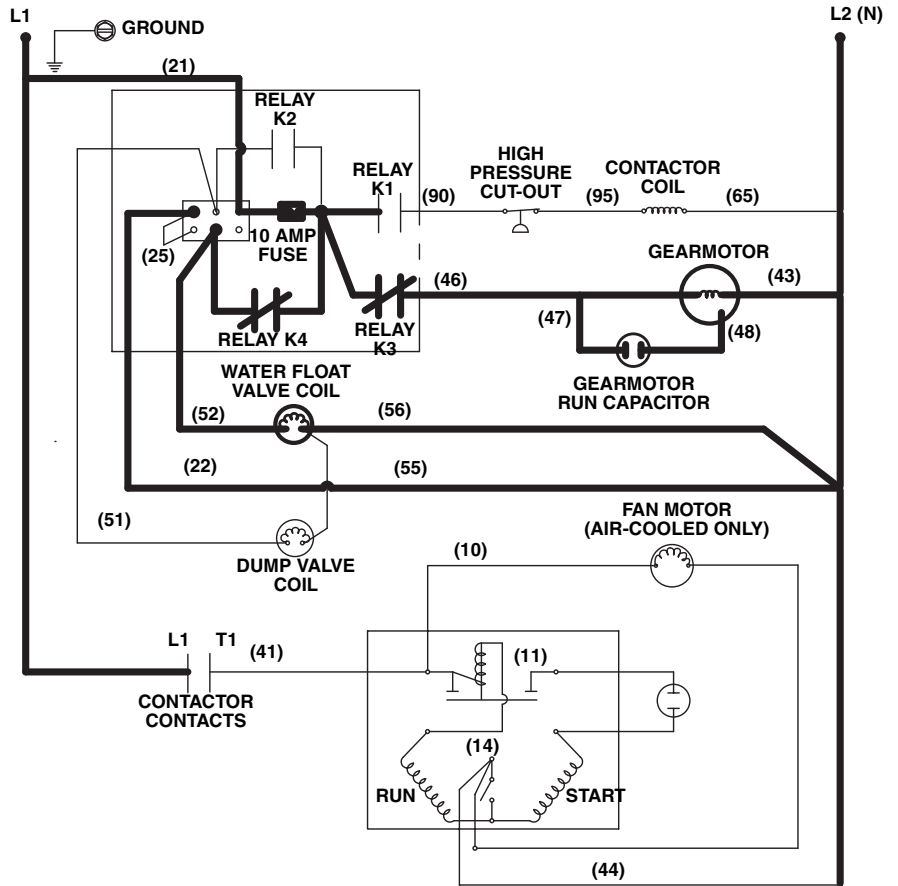
2. Freeze (Until Ice Contacts Bin Level Probe for 30 Continuous Seconds)

Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Contactors Coil	Closed / ON
	Compressor	ON
	Condenser Fan Motor	ON
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

Automatic Shut-Off

3A. ICE RUN OUT

Ice will build up in the bin until it contacts the bin level probe. After ice contacts the bin level probe for 30 continuous seconds the compressor de-energizes. To allow excess ice to run out, the gear motor and the water float valve solenoid remain energized for an additional 45 seconds, then de-energize.



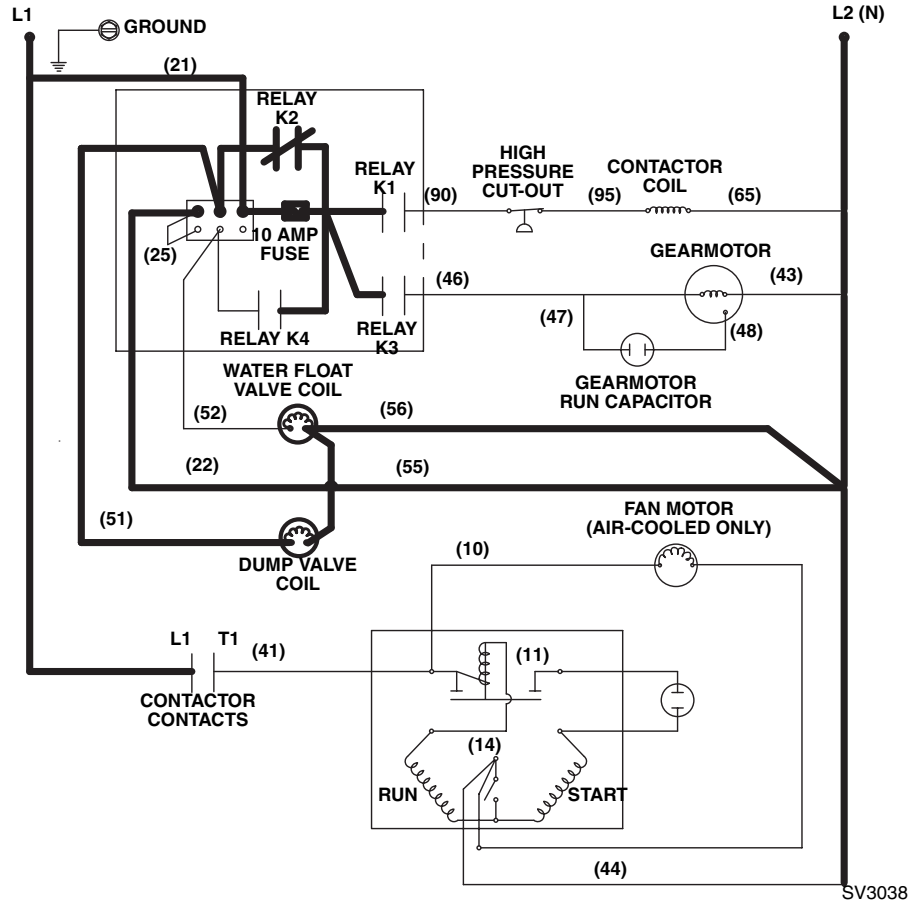
SV3037

3A. Ice Run Out (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		Closed (Ice Contacting Probe)
Control Board Relays		
#1	Contactors Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

Automatic Shut-Off

3B. DRAIN EVAPORATOR

To allow water to drain from the evaporator, the dump valve energizes for 45 seconds, then de-energizes.



SV3038

3B. Drain Evaporator (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		Closed (Ice Contacting Probe)
Control Board Relays		
#1	Contactors Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	OFF

Automatic Shut-Off

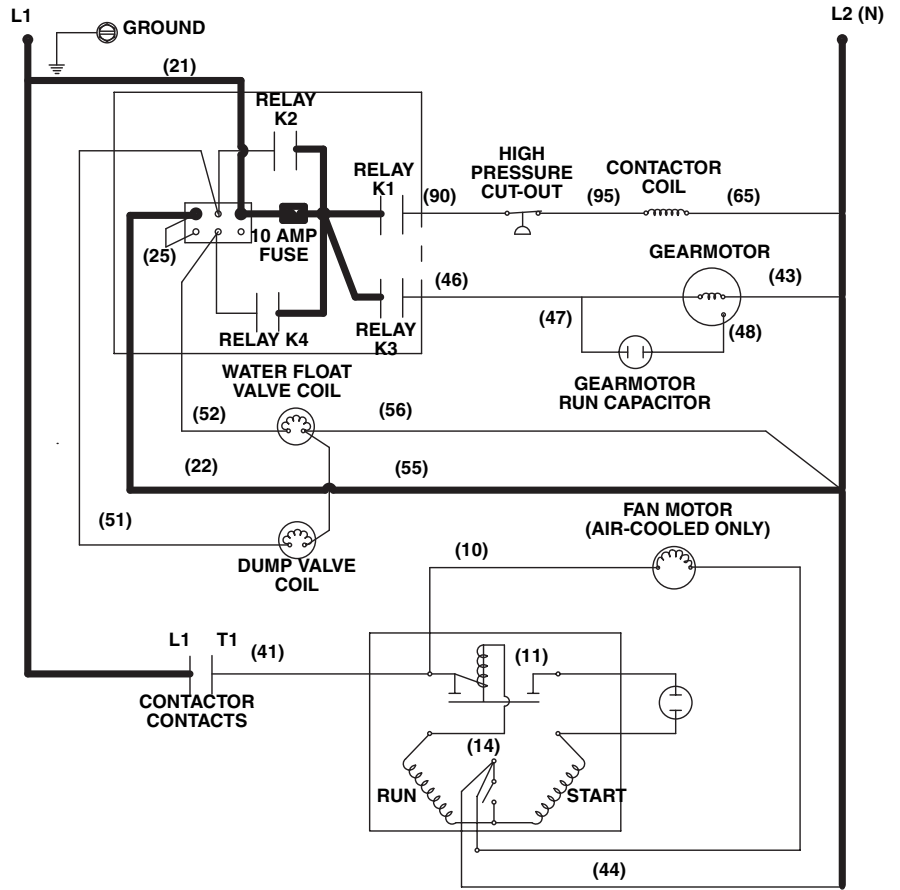
An 8 minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the “8 minute lock-out” has expired.

8 Minute Lock-out

The bin level light will flash until the 8 minute lock-out expires.

After the 8 minute lock-out expires the bin level light will de-energize.

The 8 minute lock-out time can be overridden by moving the ON/OFF/ICE toggle switch from ICE to OFF then back to ICE.



SV3039

Automatic Shut-Off (Until Ice No Longer Contacts Bin Level Probe)		
Toggle Switch		ICE
Bin Level Probe		Closed (Ice Contacting Probe)
Control Board Relays		
#1	Contactors Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	OFF
#3	Gear Motor	OFF
#4	Water Float Valve Solenoid Coil	OFF

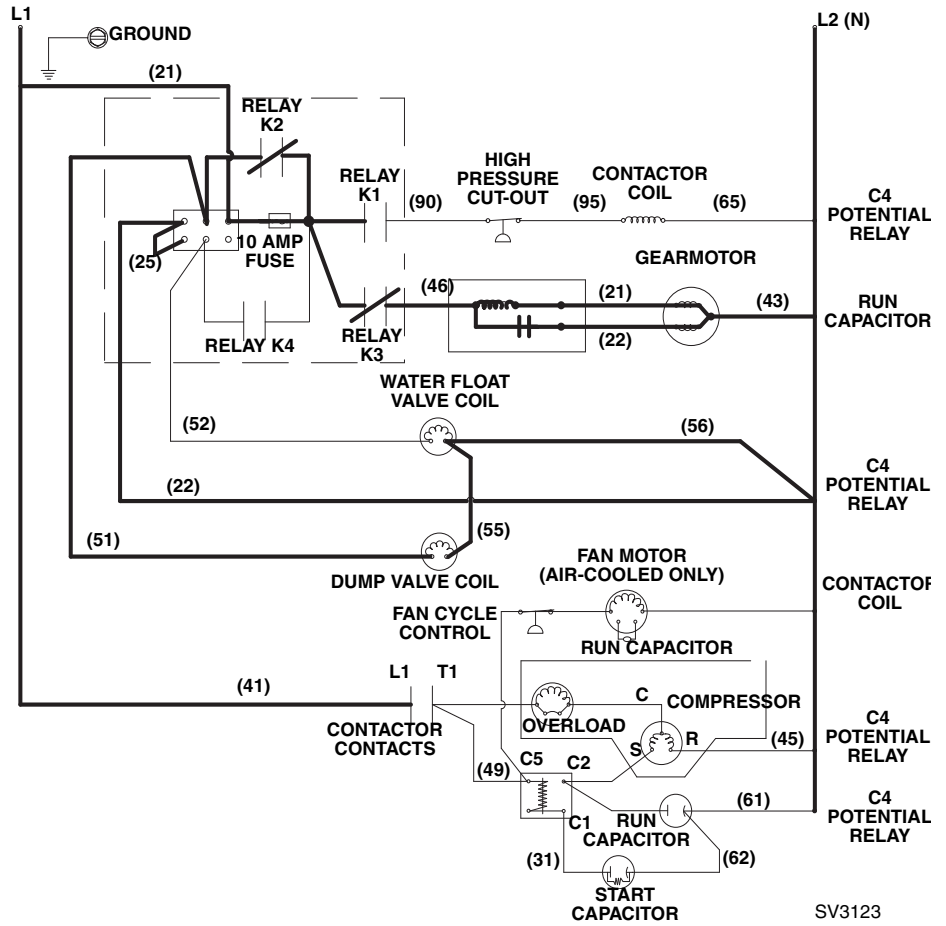
Wiring Diagram Sequence of Operation

QC700/QF800

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

1A. WATER FLUSH

Immediately after placing the toggle switch in "ICE", the dump valve solenoid, and gearbox are energized. After 45 seconds the dump valve de-energizes.

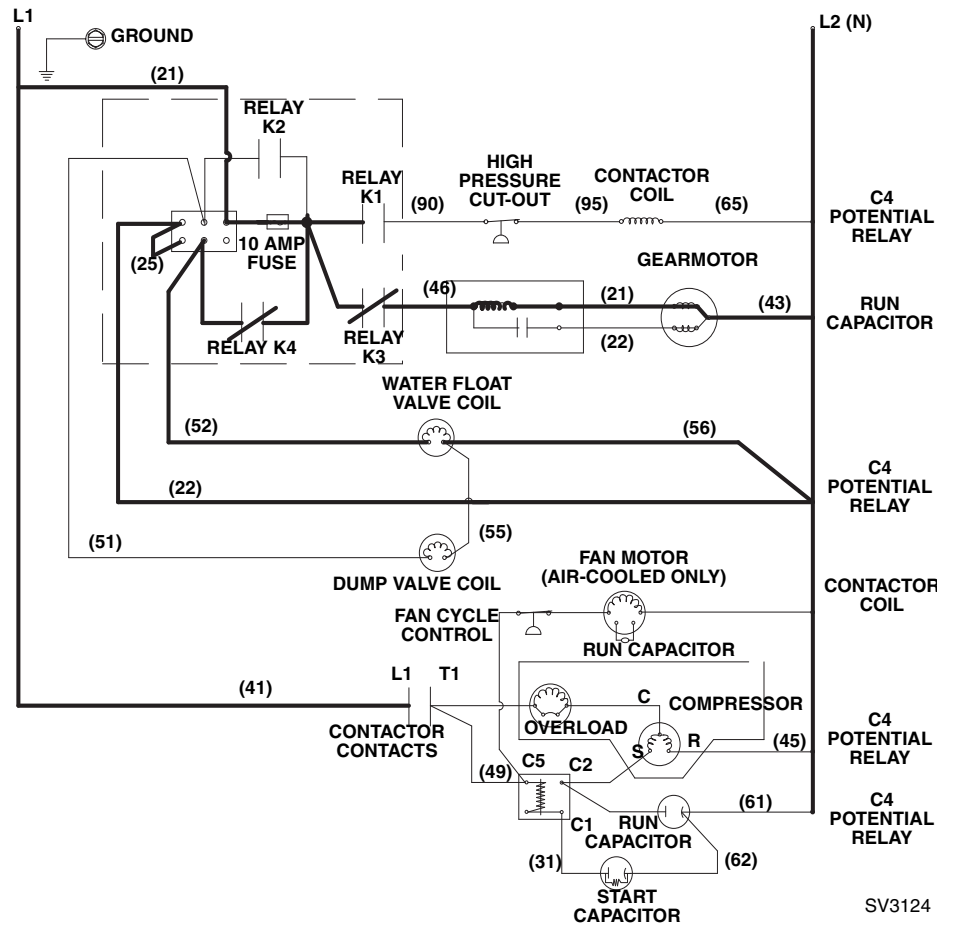


1A. Water Flush (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Contactor Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	ON
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	OFF

Initial Start-Up or Start-Up After Automatic Shut-Off (cont.)

1B. WATER FILL

After 45 seconds the float valve solenoid is energized.



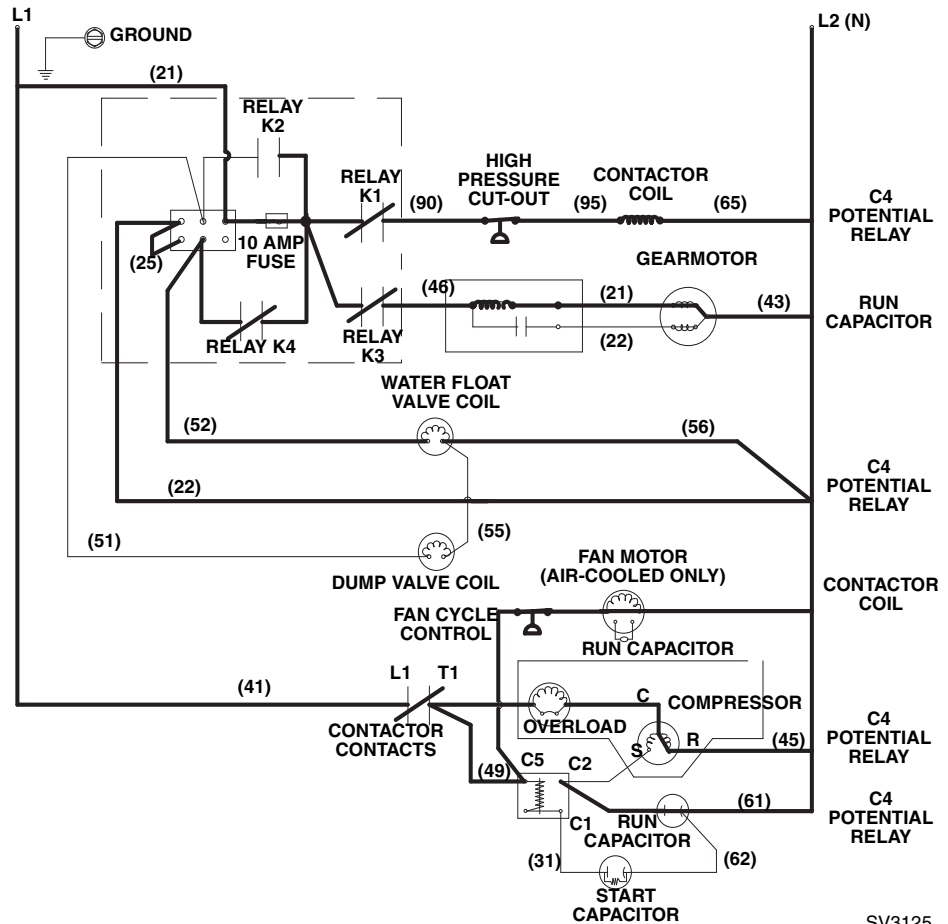
SV3124

1B. Water Fill (Until Water Contacts Water Level Probe)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Contactors Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

Freeze Cycle

2. FREEZE

The gear motor, compressor, condenser fan motor and water float valve solenoid remain energized as the ice machine makes ice. The water float valve will open and close automatically to maintain the proper water level.



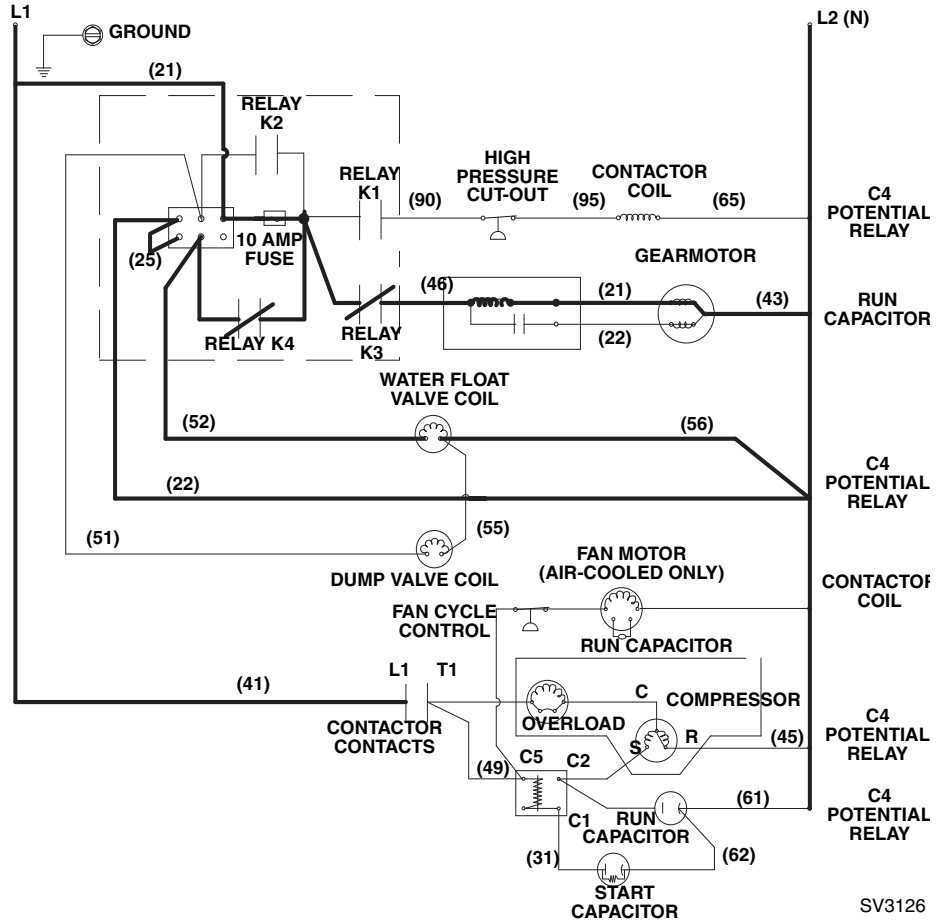
SV3125

2. Freeze (Until Ice Contacts Bin Level Probe for 30 Continuous Seconds)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Contactor Coil	Closed / ON
	Compressor	ON
	Condenser Fan Motor	ON
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

Automatic Shut-Off

3A. ICE RUN OUT

Ice will build up in the bin until it contacts the bin level probe. After ice contacts the bin level probe for 30 continuous seconds the compressor de-energizes. To allow excess ice to run out, the gear motor and the water float valve solenoid remain energized for an additional 45 seconds, then de-energize.

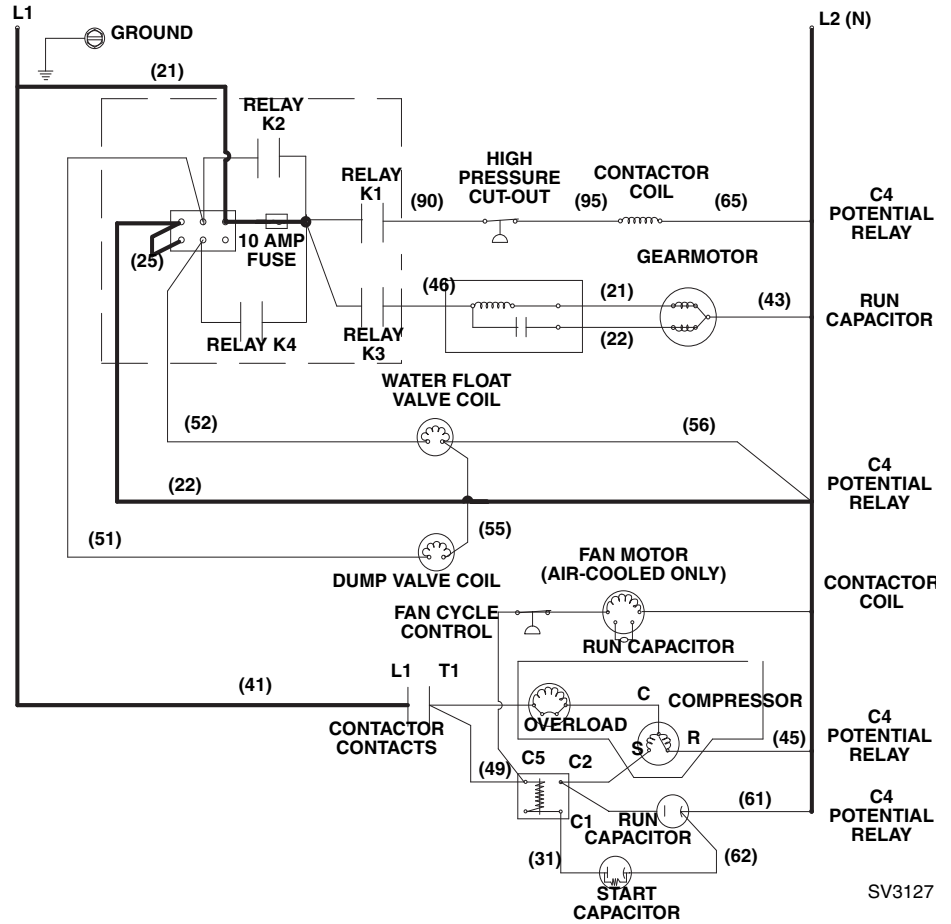


3A. Ice Run Out (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		Closed (Ice Contacting Probe)
Control Board Relays		
#1	Contactors Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

Automatic Shut-Off

3B. DRAIN EVAPORATOR

To allow water to drain from the evaporator, the dump valve energizes for 45 seconds, then de-energizes.



3B. Drain Evaporator (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		Closed (Ice Contacting Probe)
Control Board Relays		
#1	Contactors Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	OFF

Automatic Shut-Off

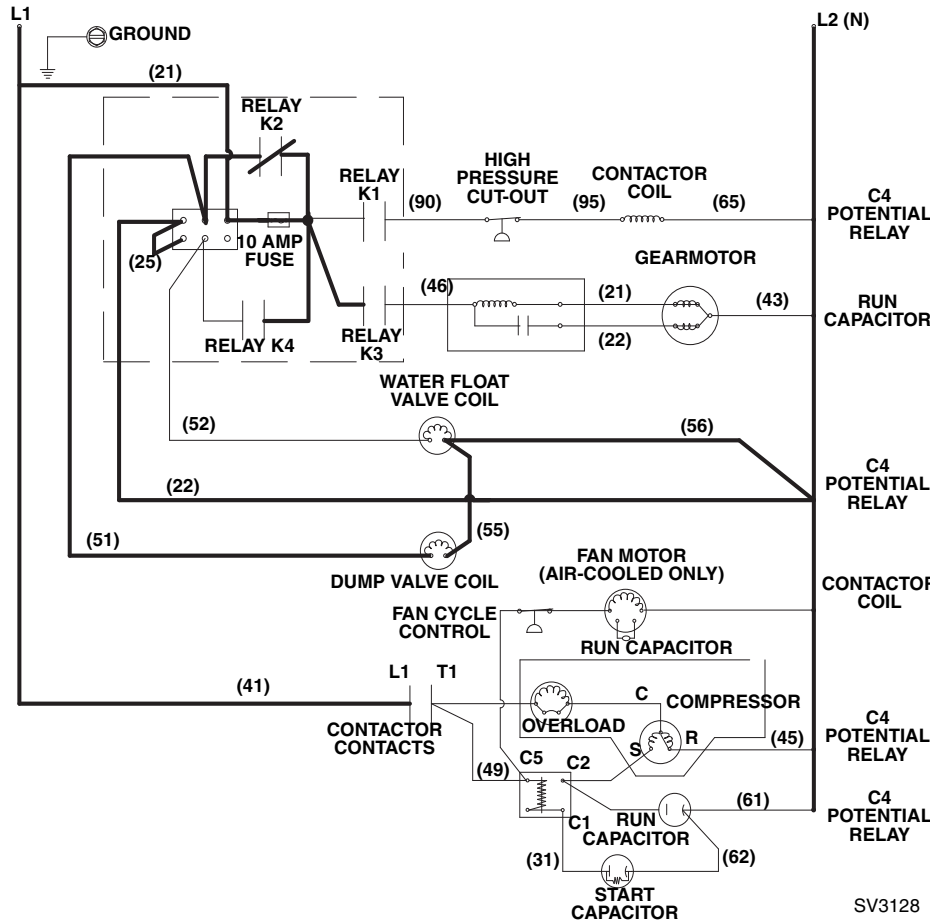
An 8 minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the “8 minute lock-out” has expired.

8 Minute Lock-out

The bin level light will flash until the 8 minute lock-out expires.

After the 8 minute lock-out expires the bin level light will de-energize.

The 8 minute lock-out time can be overridden by moving the ON/OFF/ICE toggle switch from ICE to OFF then back to ICE.



Automatic Shut-Off (Until Ice No Longer Contacts Bin Level Probe)		
Toggle Switch		ICE
Bin Level Probe		Closed (Ice Contacting Probe)
Control Board Relays		
#1	Contactors Coil	Open / OFF
	Compressor	OFF
	Condenser Fan Motor	OFF
#2	Dump Valve	OFF
#3	Gear Motor	OFF
#4	Water Float Valve Solenoid Coil	OFF

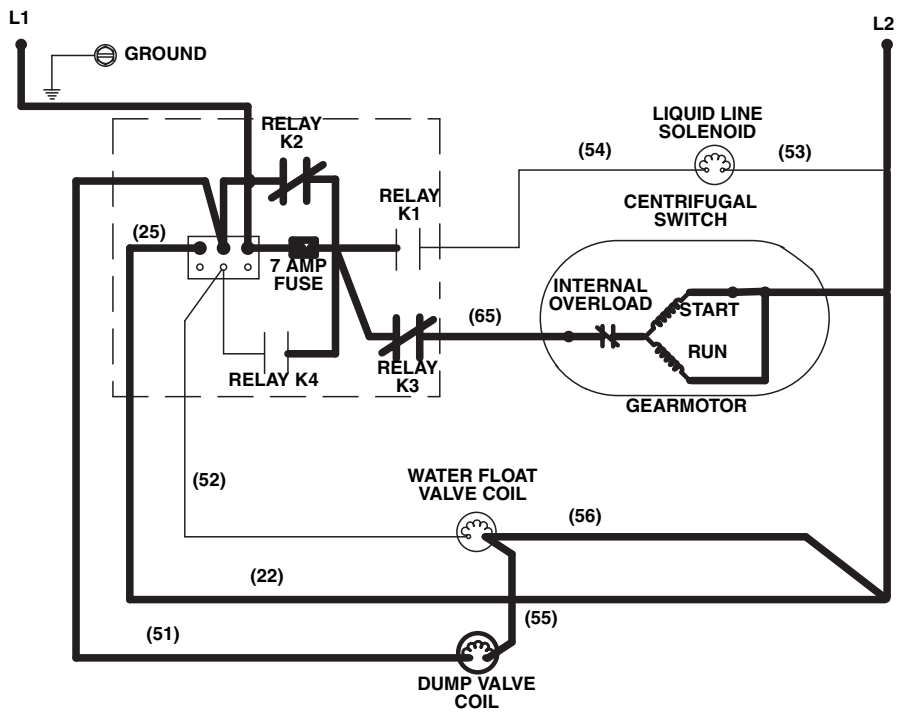
Wiring Diagram Sequence of Operation

QF2200

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

1A. WATER FLUSH

Immediately after placing the toggle switch in "ICE", the dump valve solenoid, and gearbox are energized. After 45 seconds the dump valve de-energizes.



SV3043

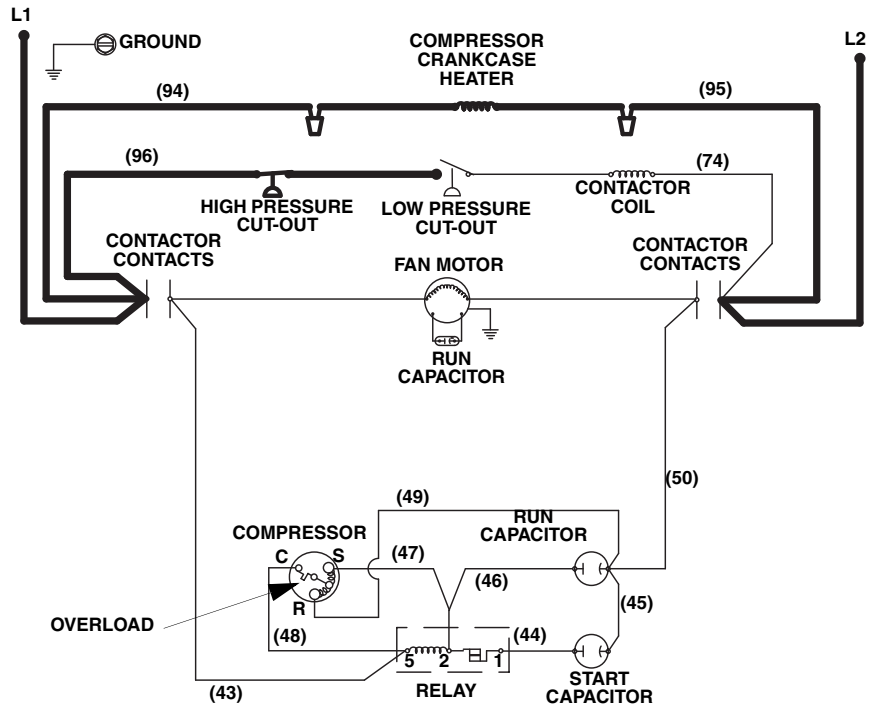
1A. Water Flush (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	ON
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	OFF

RFC2085

Initial Start-Up
Remote Condensing Unit

1A. WATER FLUSH

The condensing unit is off.



SV3040

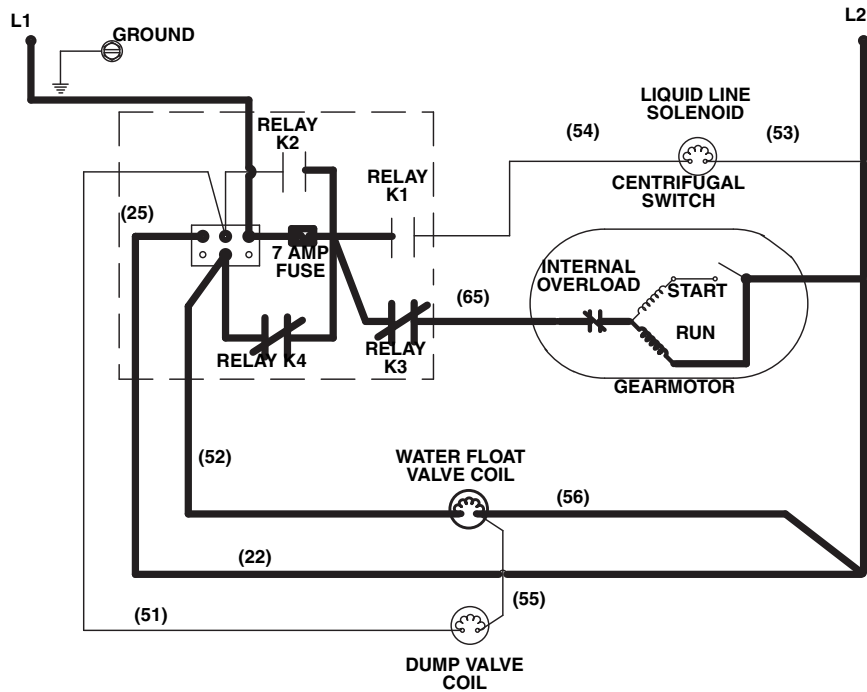
1A. Water Flush (45 Seconds)	
High Pressure Control	CLOSED
Low Pressure Control	OPEN
Contactors Coil	OPEN / OFF
Compressor	OFF
Condenser Fan Motor	OFF

QF2200

Initial Start-Up

1B. WATER FILL

After 45 seconds the water float valve solenoid is energized. When water contacts the water level probe the liquid line solenoid valve energizes and remains on throughout the Freeze Cycle.



SV3044

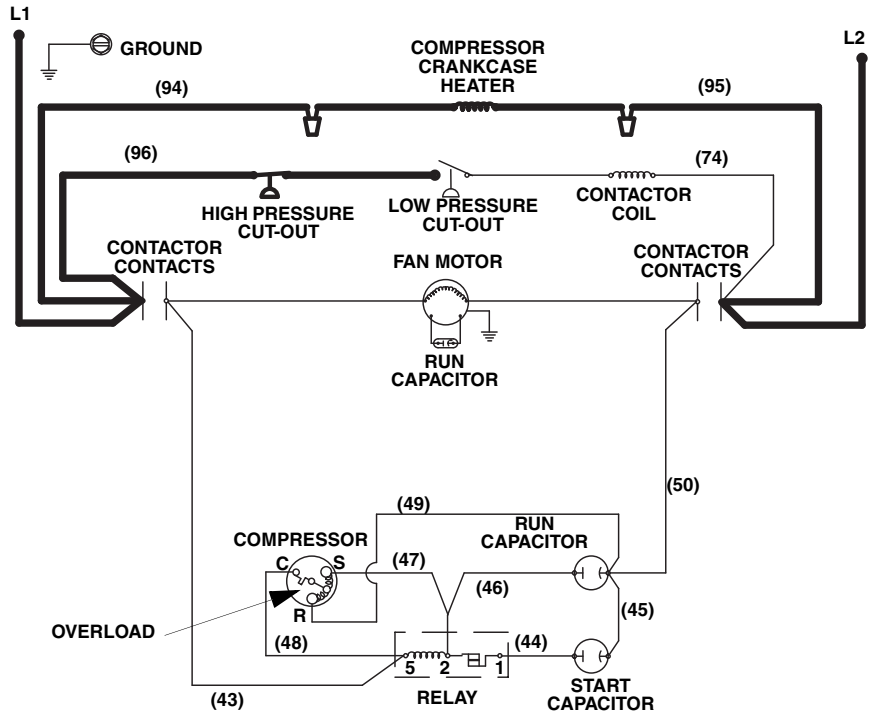
1B. Water Fill (Until Water Contacts Water Level Probe)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

RFC2085

Initial Start-Up

1B. WATER FILL

The condensing unit is off.



SV3040

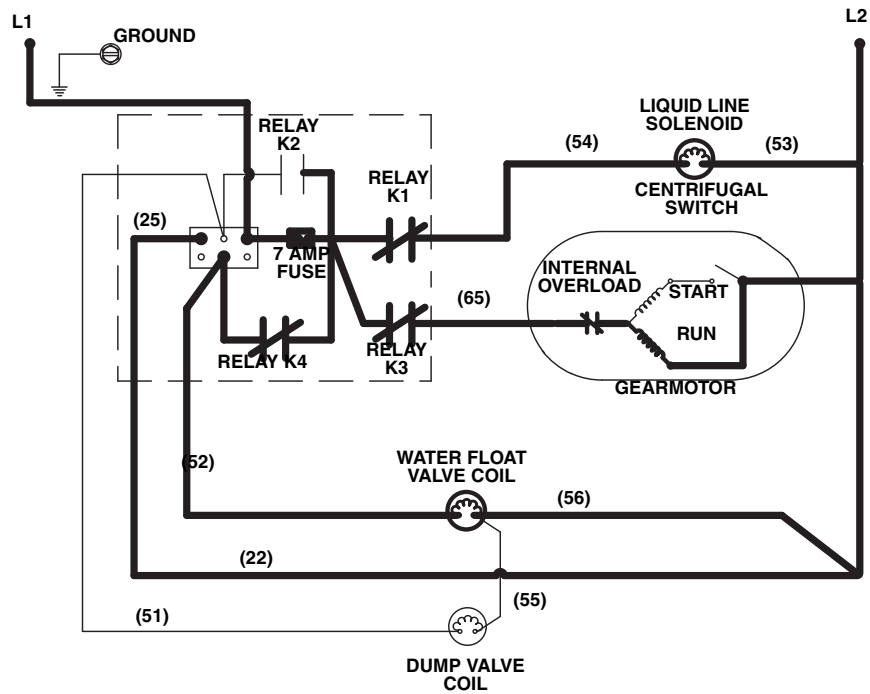
1B. Water Flush (Until Water Contacts Water Level Probe)	
High Pressure Control	CLOSED
Low Pressure Control	OPEN
Contactor Coil	OPEN / OFF
Compressor	OFF
Condenser Fan Motor	OFF

QF2200

Freeze Cycle

2. FREEZE

The gear motor, liquid line solenoid valve and water float valve solenoid remain energized as the ice machine makes ice. The water float valve will open and close automatically to maintain the proper water level.



SV3046

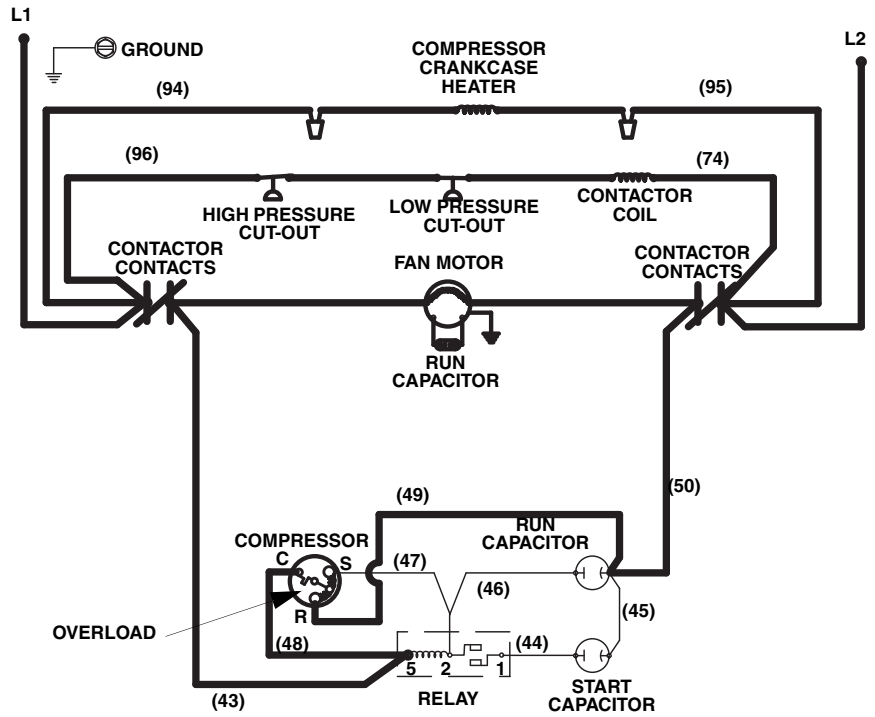
2. Freeze (Until Ice Contacts Bin Level Probe for 30 Continuous Seconds)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Liquid Line Solenoid Valve	ON
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

RFC2085

Freeze Cycle

2. FREEZE

Refrigerant pressure exceeds the low pressure control setpoint. The contactor coil energizes and the contacts close. The compressor and condenser fan motor energize and remain on throughout the entire freeze cycle.



SV3042

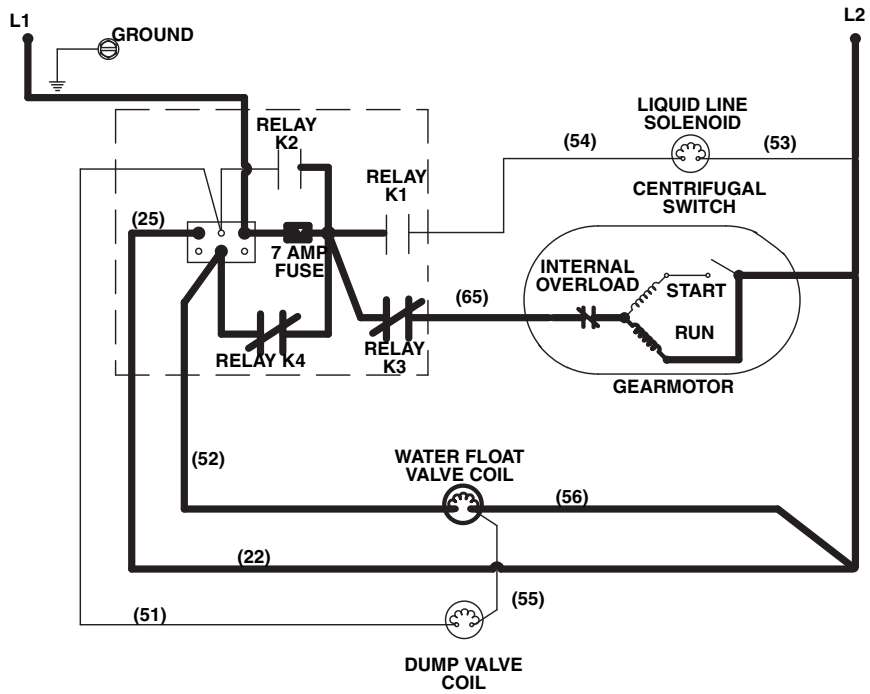
2. Freeze (Until Ice Contacts Bin Level Probe for 30 Continuous Seconds)	
High Pressure Control	CLOSED
Low Pressure Control	CLOSED
Contactor Coil	CLOSED / ON
Compressor	ON
Condenser Fan Motor	ON

QF2200

Automatic Shut-Off

3A. ICE RUN OUT

Ice will build up in the bin until it contacts the bin level probe. After ice contacts the bin level probe for 30 continuous seconds the liquid line solenoid valve de-energizes. To allow excess ice to run out, the gear motor and the water float valve solenoid remain energized for an additional 4 minutes, then de-energize.



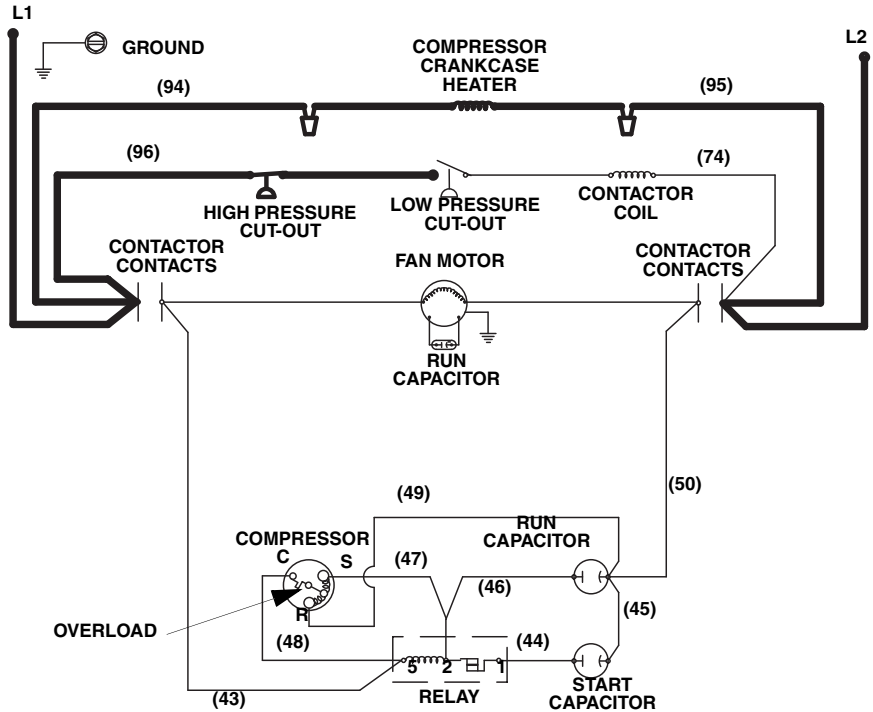
SV3047

3A. ICE RUN OUT (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		CLOSED (Ice Contacting probe)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#\$	Water Float Valve Solenoid Coil	ON

RFC2085

Automatic Shut-Off

When the refrigerant pressure is low enough to open the low-pressure switch, the contactor coil is de-energized and the compressor and condenser fan motor stop.



SV3040

3. Automatic Shut-Off (45 Seconds)	
High Pressure Control	CLOSED
Low Pressure Control	OPEN
Contactor Coil	OPEN / OFF
Compressor	OFF
Condenser Fan Motor	OFF

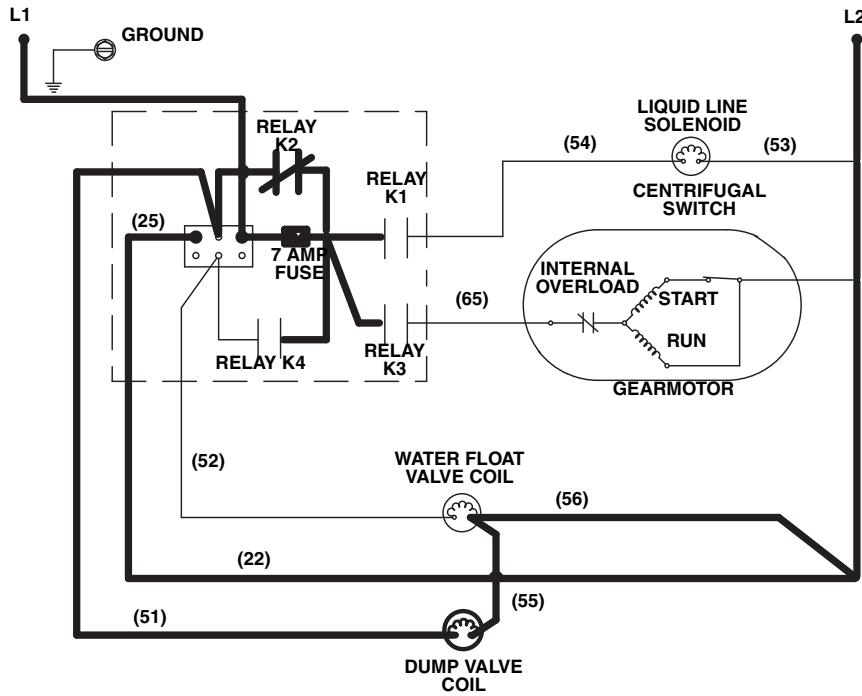
QF2200

Automatic Shut-Off

3B. WATER DRAIN

To allow water to drain from the evaporator, the dump valve energizes for 90 seconds, then de-energizes.

An 8 minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the "8 minute lockout" has expired.



SV3048

3B. Water Drain (90 Seconds)		
Toggle Switch		ICE
Bin Level Probe		CLOSED (Ice Contacting probe)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	ON
#3	Gear Motor	OFF
#\$	Water Float Valve Solenoid Coil	OFF

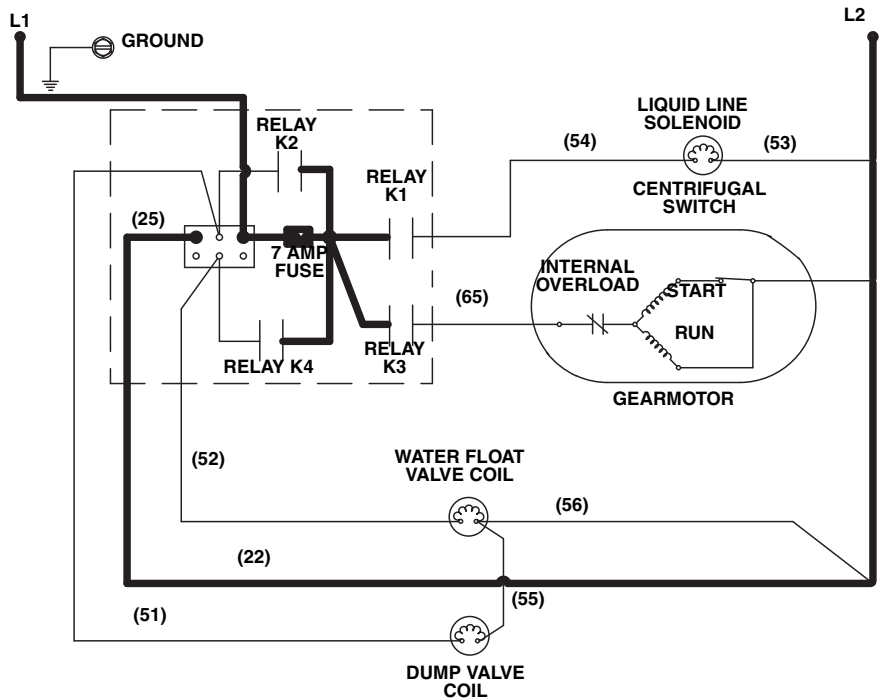
QF2200

Automatic Shut-Off

An 8 minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the "8 minute lockout" has expired.

8 Minute Lockout

The bin level light will flash until the 8 minute lockout expires. After the 8 minute lockout time can be overridden by moving the ON/OFF/CLEAN toggle switch for ICE to OFF and back to ICE.



SV3048

Automatic Shut-Off (Until Ice No Longer Contacts Bin Level Probe)		
Toggle Switch		ICE
Bin Level Probe		CLOSED (Ice Contacting probe)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	OFF
#3	Gear Motor	OFF
#\$	Water Float Valve Solenoid Coil	OFF

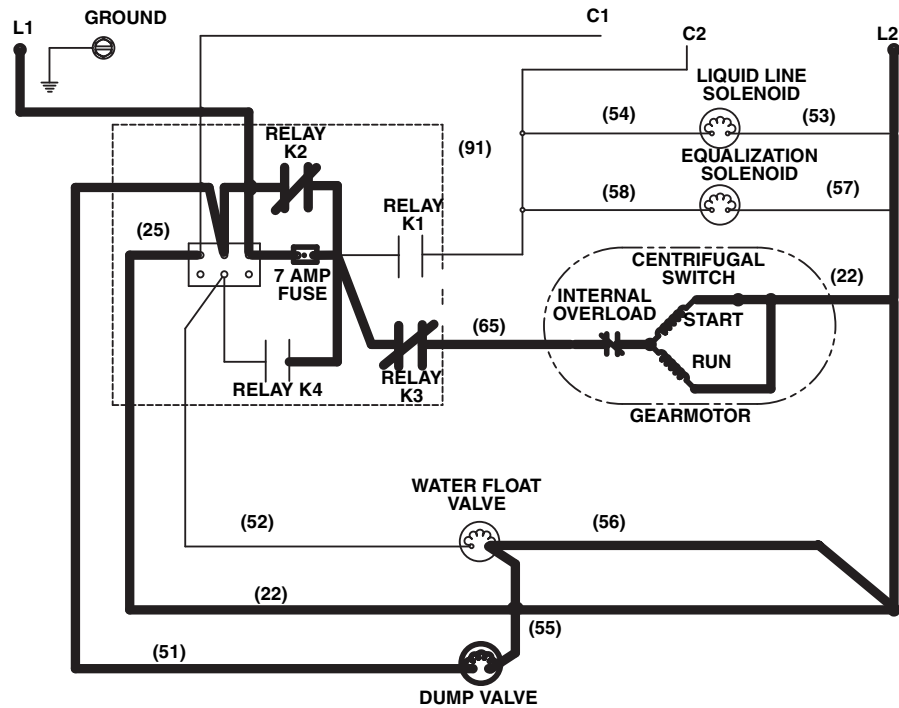
Wiring Diagram Sequence of Operation

QF2300

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

1A. WATER FLUSH

Immediately after placing the toggle switch in "ICE", the dump valve solenoid, and gearbox are energized. After 45 seconds the dump valve de-energizes.



SV2109

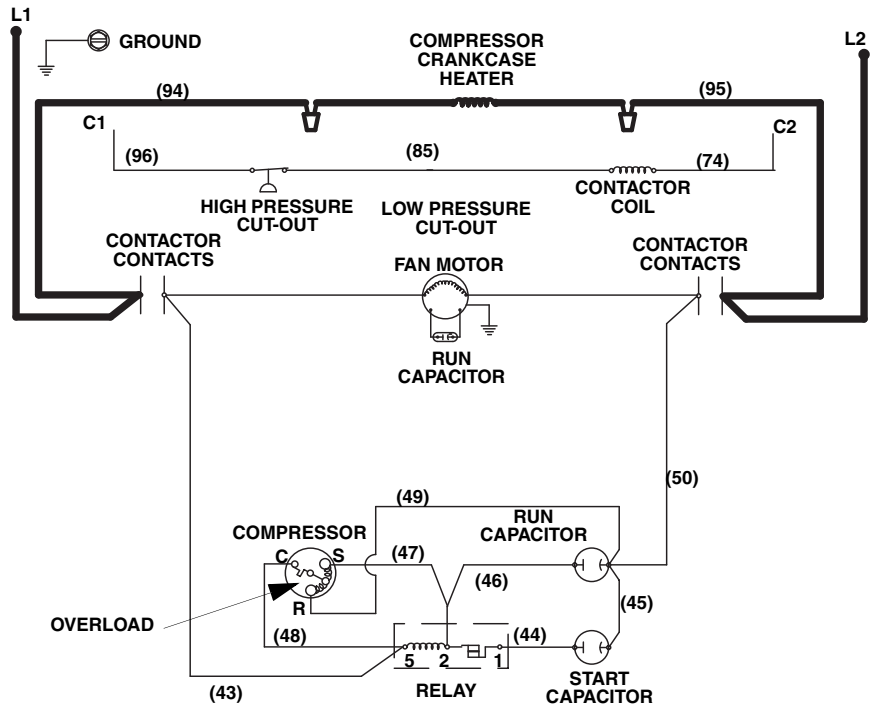
1A. Water Flush (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	ON
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	OFF

RFC2385

Initial Start-Up
Remote Condensing Unit

1A. WATER FLUSH

Immediately after placing the toggle switch in "ICE", the dump valve solenoid, and gearbox are energized. After 45 seconds the dump valve de-energizes.



SV2121

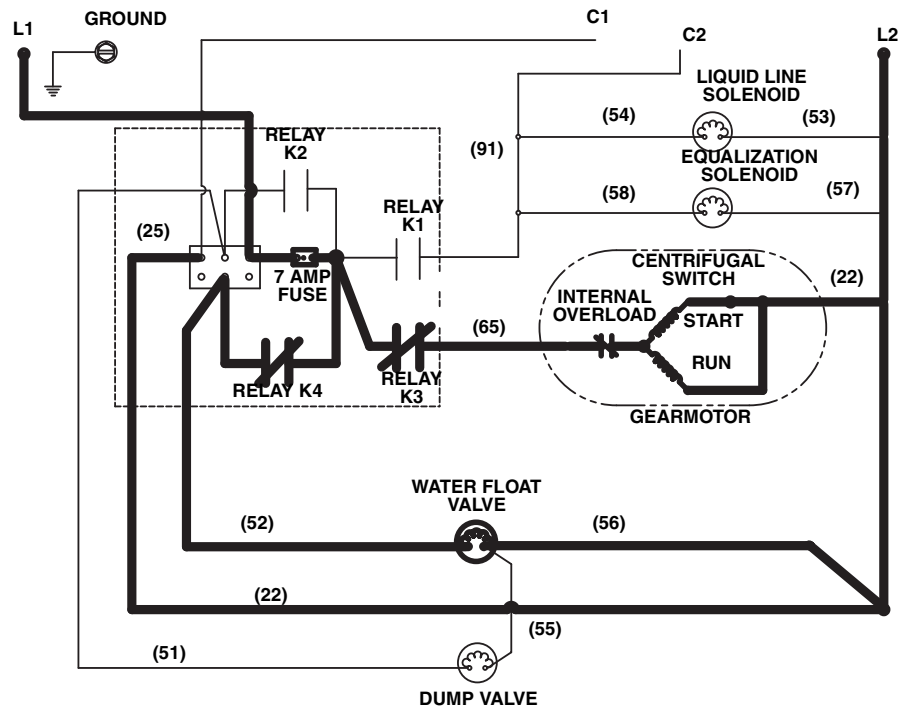
1A. Water Flush (45 Seconds)	
High Pressure Control	CLOSED
Low Pressure Control	OPEN
Contactors Coil	OPEN / OFF
Compressor	OFF
Condenser Fan Motor	OFF

QF2300

Initial Start-Up

1B. WATER FILL

After 45 seconds the water float valve solenoid is energized.



SV2110

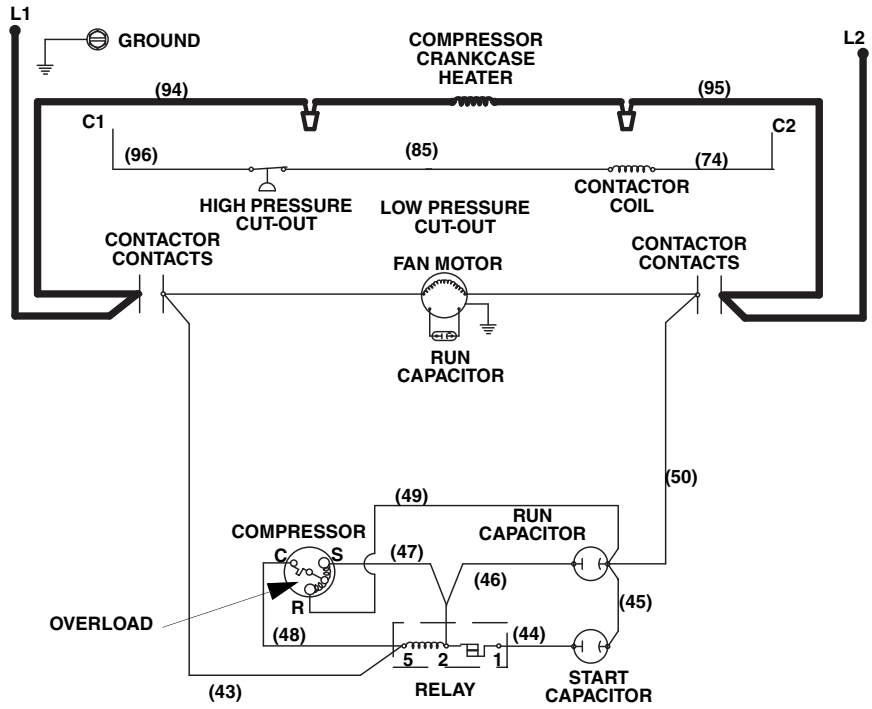
1B. Water Fill (Until Water Contacts Water Level Probe)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

RFC2385

Initial Start-Up

1B. WATER FILL

After 45 seconds the water float valve solenoid is energized.



SV2121

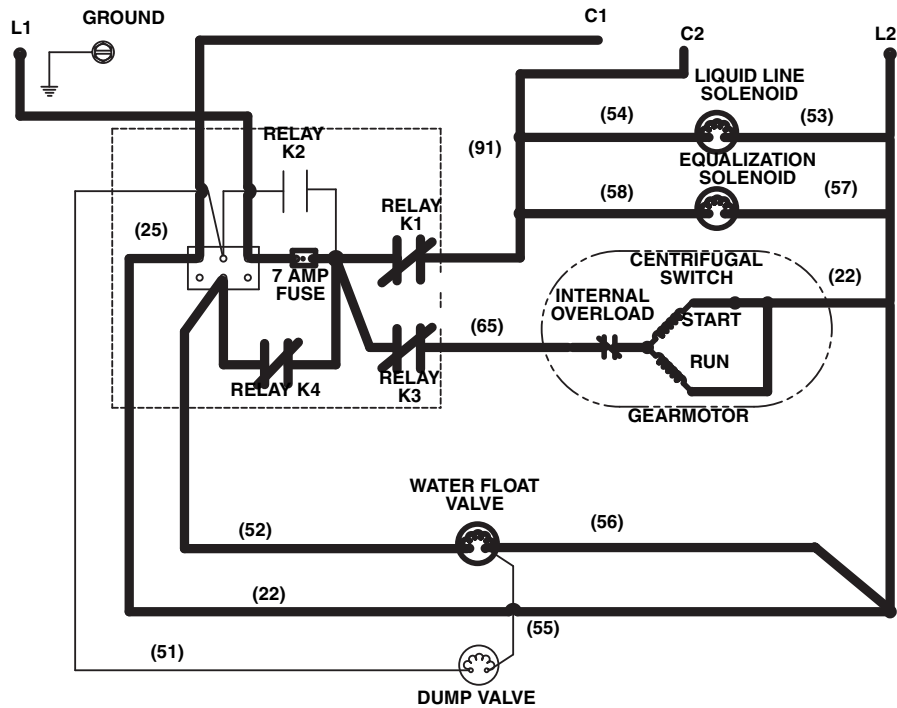
1B. Water Flush (Until Water Contacts Water Level Probe)	
High Pressure Control	CLOSED
Low Pressure Control	OPEN
Contactor Coil	OPEN / OFF
Compressor	OFF
Condenser Fan Motor	OFF

QF2300 Ice Machine Head Section

Freeze Cycle

2. FREEZE

When water contacts the water level probe the liquid line solenoid valve, equalization valve, compressor and condenser fan motor energize. The gear motor, compressor, condenser fan motor and water float valve solenoid remain energized as the ice machine makes ice. The water float valve will open and close automatically to maintain the proper water level.



SV2111

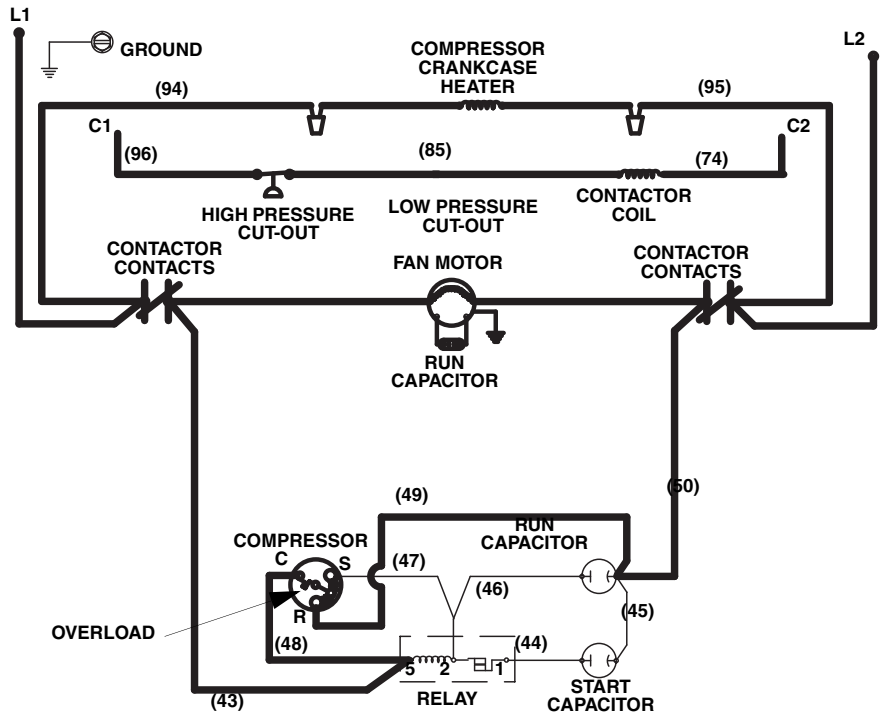
2. Freeze (Until Ice Contacts Bin Level Probe for 30 Continuous Seconds)		
Toggle Switch		ICE
Bin Level Probe		Open (No Ice Contact)
Control Board Relays		
#1	Liquid Line Solenoid Valve	ON
#2	Dump Valve	OFF
#3	Gear Motor	ON
#4	Water Float Valve Solenoid Coil	ON

RFC2385

Freeze Cycle

2. FREEZE

The compressor and condenser fan motor remain energized during the entire Freeze Cycle.



SV2122

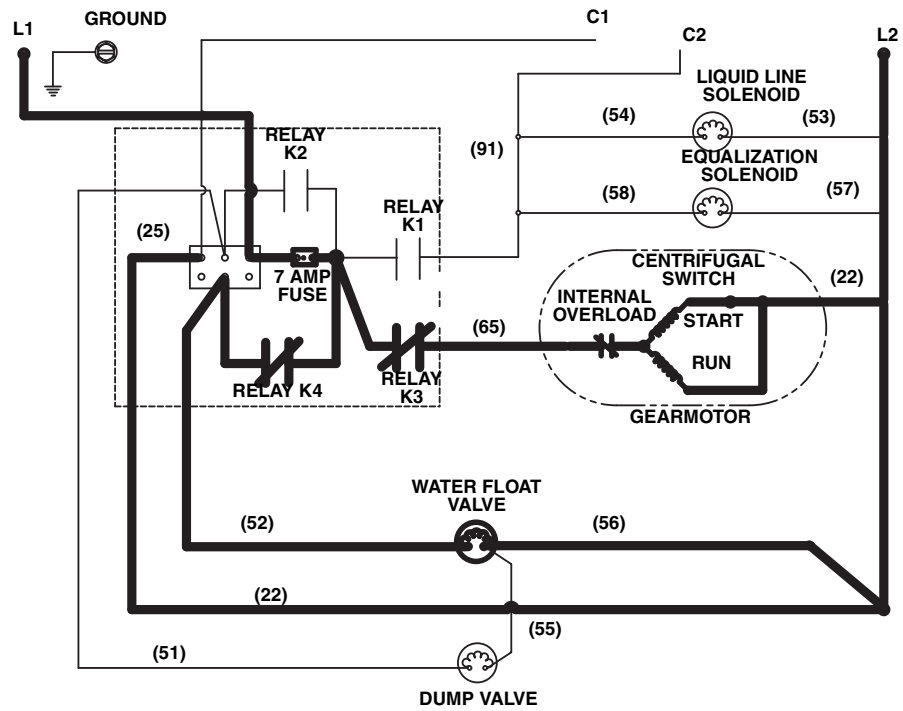
2. Freeze (Until Ice Contacts Bin Level Probe for 30 Continuous Seconds)	
High Pressure Control	CLOSED
Low Pressure Control	CLOSED
Contactor Coil	CLOSED / ON
Compressor	ON
Condenser Fan Motor	ON

QF2300

Automatic Shut-Off

3A. ICE RUN OUT

Ice will build up in the bin until it contacts the bin level probe. After ice contacts the bin level probe for 30 continuous seconds the liquid line solenoid valve, equalization valve and compressor de-energize. To allow excess ice to run out, the gear motor and the water float valve solenoid remain energized for an additional 4 minutes, then de-energize.



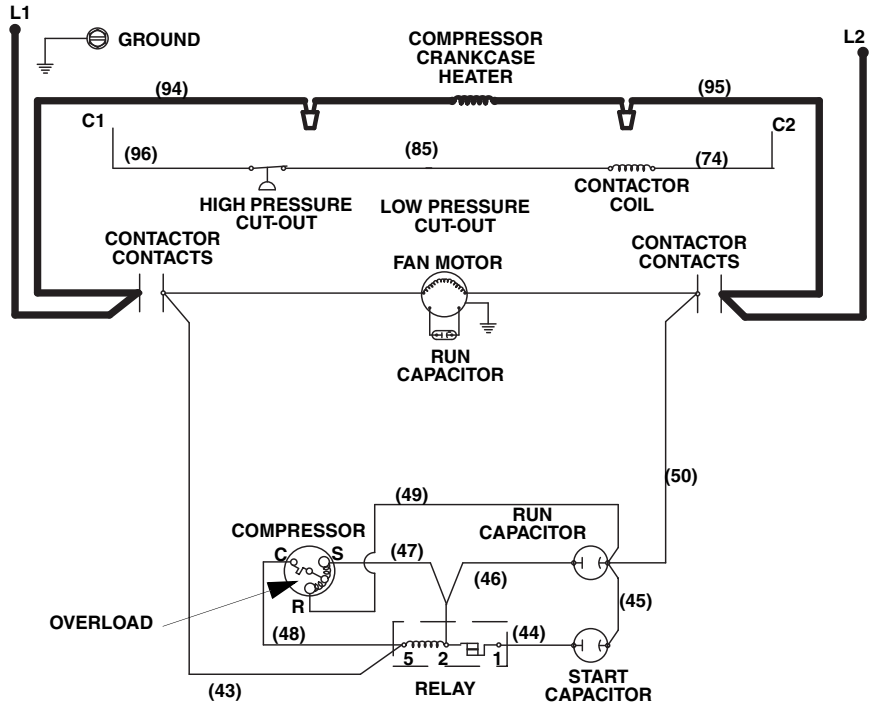
SV2110

3A. ICE RUN OUT (45 Seconds)		
Toggle Switch		ICE
Bin Level Probe		CLOSED (Ice Contacting probe)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	OFF
#3	Gear Motor	ON
#\$	Water Float Valve Solenoid Coil	ON

RFC2385

Automatic Shut-Off

When the refrigerant pressure is low enough to open the low-pressure switch, the contactor coil is de-energized and the compressor and condenser fan motor stop.



SV2121

3. Automatic Shut-Off (45 Seconds)	
High Pressure Control	CLOSED
Low Pressure Control	OPEN
Contactor Coil	OPEN / OFF
Compressor	OFF
Condenser Fan Motor	OFF

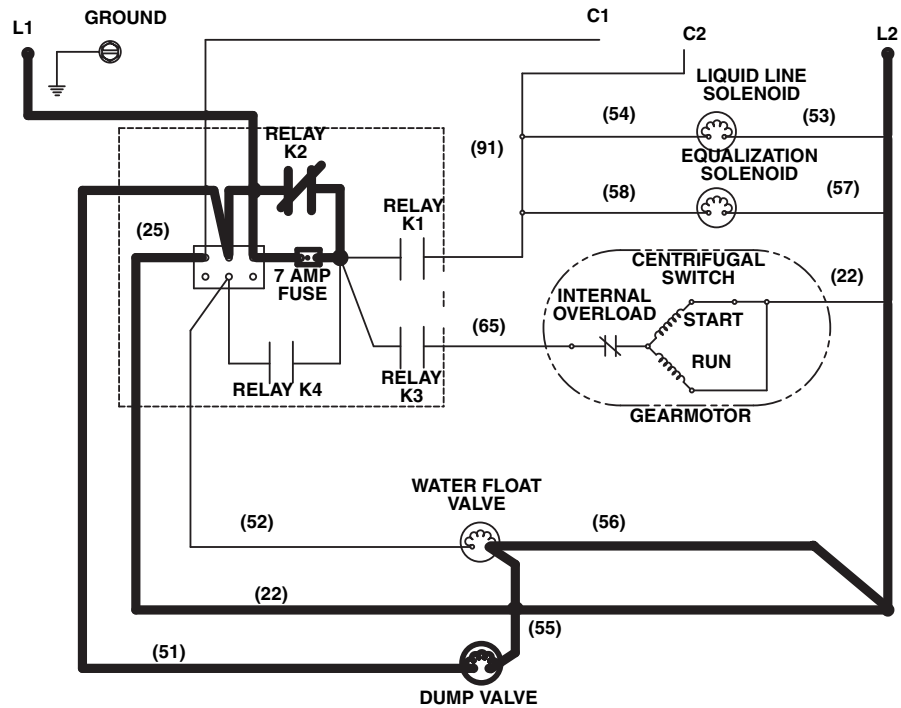
QF2300

Automatic Shut-Off

3B. WATER DRAIN

To allow water to drain from the evaporator, the dump valve energizes for 90 seconds, then de-energizes.

An 8 minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the "8 minute lockout" has expired.



SV2112

3B. Water Drain (90 Seconds)		
Toggle Switch		ICE
Bin Level Probe		CLOSED (Ice Contacting probe)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	ON
#3	Gear Motor	OFF
#\$	Water Float Valve Solenoid Coil	OFF

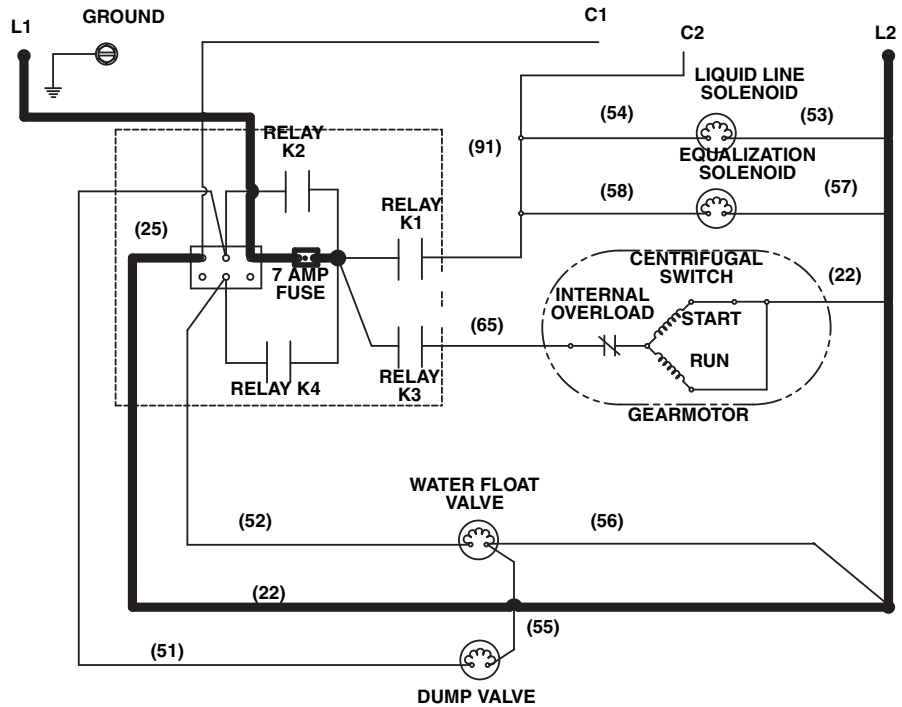
QF2300

Automatic Shut-Off

An 8 minute lockout starts when the compressor de-energizes. When the ice drops away from the bin level probe the ice machine will begin an initial start-up cycle, provided the "8 minute lockout" has expired.

8 Minute Lockout

The bin level light will flash until the 8 minute lockout expires. After the 8 minute lockout time can be overridden by moving the ON/OFF/CLEAN toggle switch for ICE to OFF and back to ICE.



SV2113

Automatic Shut-Off (Until Ice No Longer Contacts Bin Level Probe)		
Toggle Switch		ICE
Bin Level Probe		CLOSED (Ice Contacting probe)
Control Board Relays		
#1	Liquid Line Solenoid Valve	OFF
#2	Dump Valve	OFF
#3	Gear Motor	OFF
#\$	Water Float Valve Solenoid Coil	OFF

Wiring Diagrams

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

 **Warning**

Always disconnect power before working on electrical circuitry.

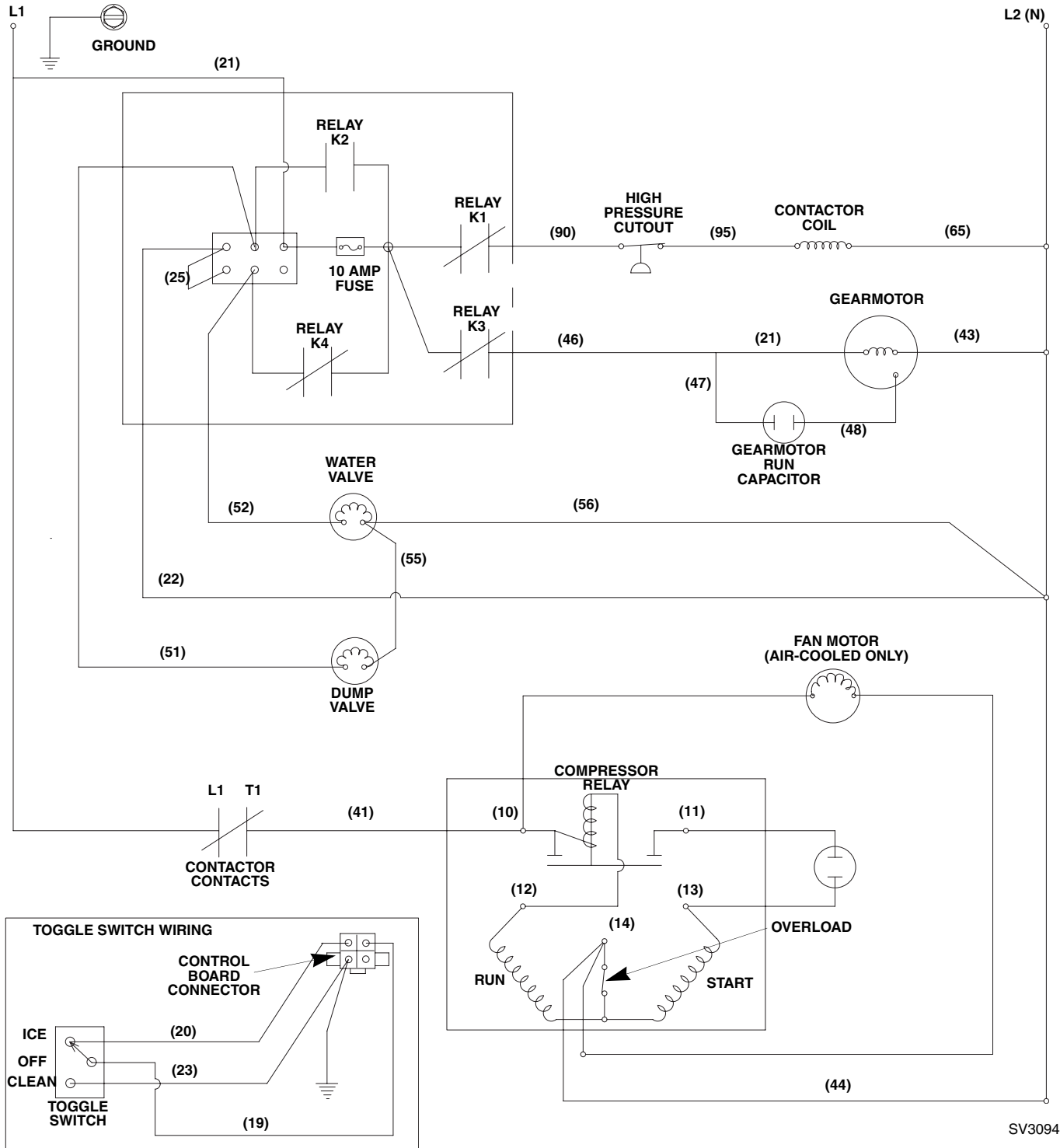
WIRING DIAGRAM LEGEND

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

- * Internal Compressor Overload
(Some models have external compressor overloads)
- () Wire Number Designation
(The number is marked at each end of the wire)
- >>— Multi-Pin Connection
(Electrical Box Side) —>>— (Compressor Compartment Side)

ICE MACHINE HEAD SECTION
QF400
115V/60Hz/1Ph - 230V/50Hz/1Ph
 (Diagram Shown During Freeze Cycle)

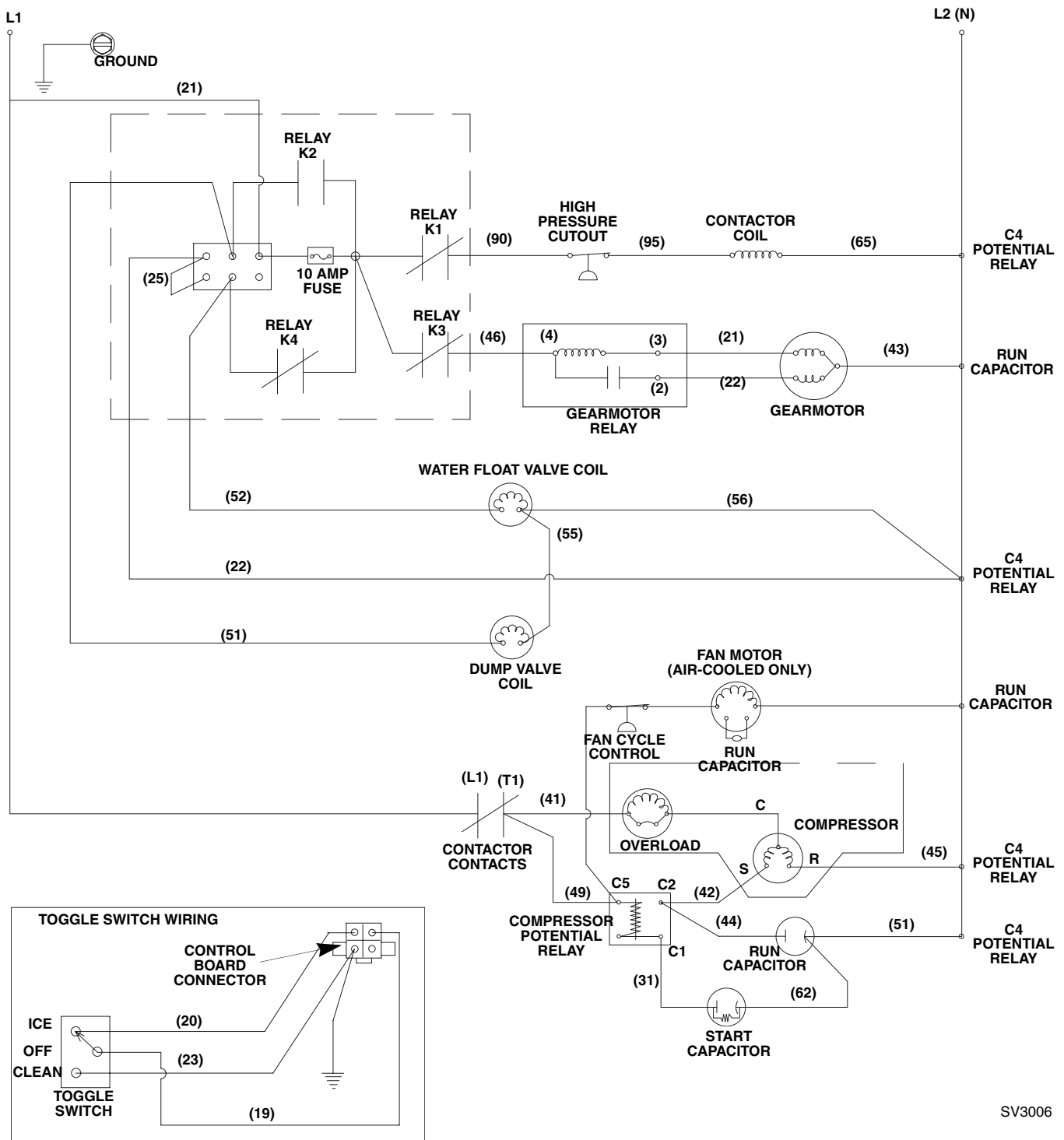
SEE SERIAL PLATE FOR VOLTAGE



SV3094

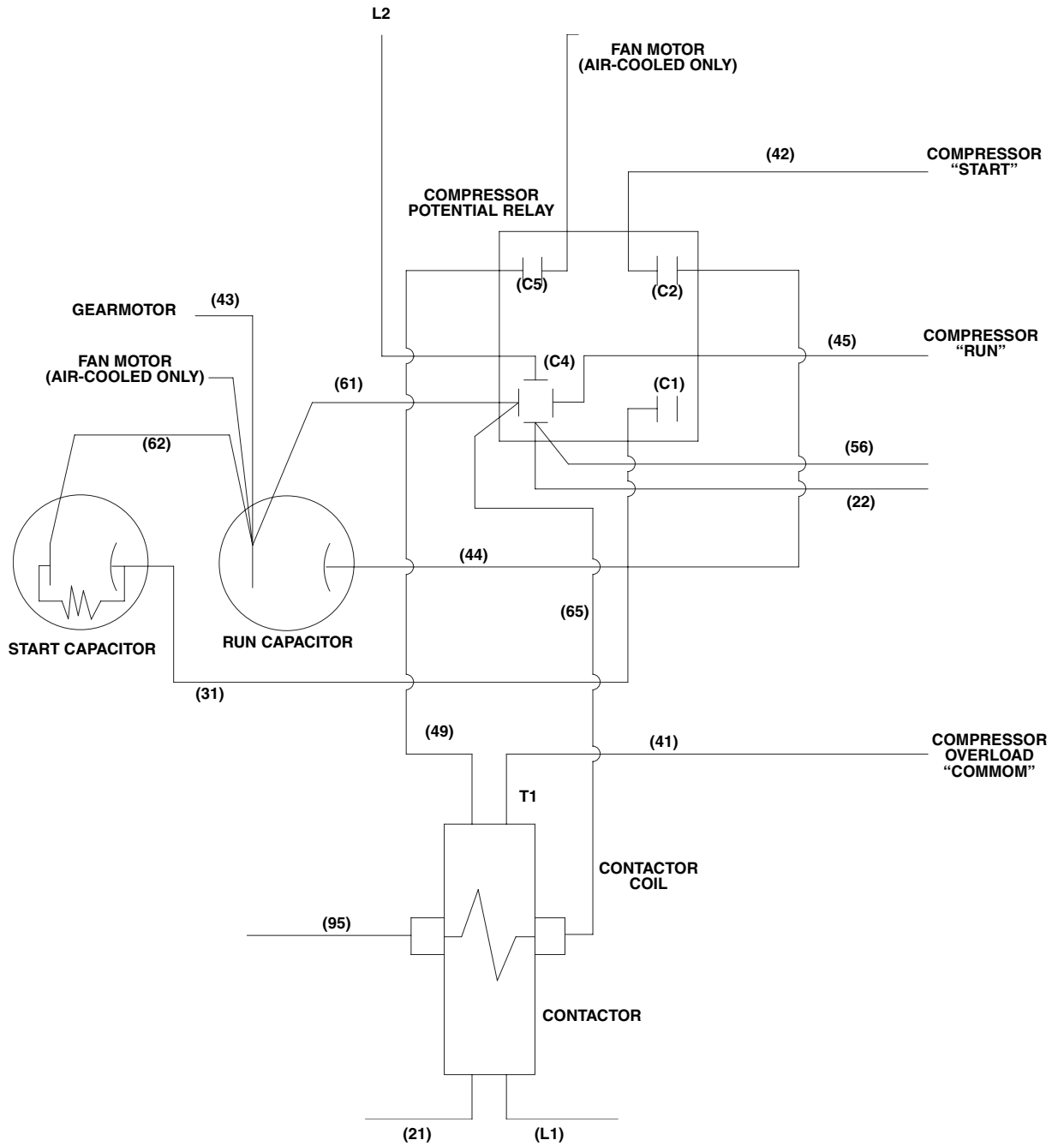
QC700/QF800
115V/60Hz/1Ph - 230V/50Hz/1Ph
 (Diagram Shown During Freeze Cycle)

SEE SERIAL PLATE FOR VOLTAGE



SV3006

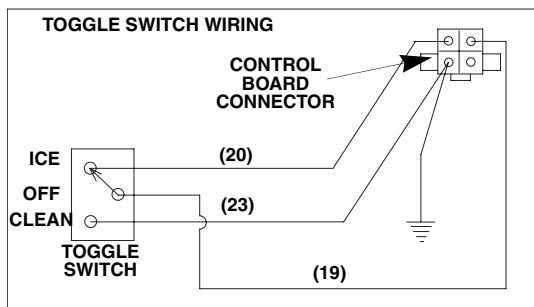
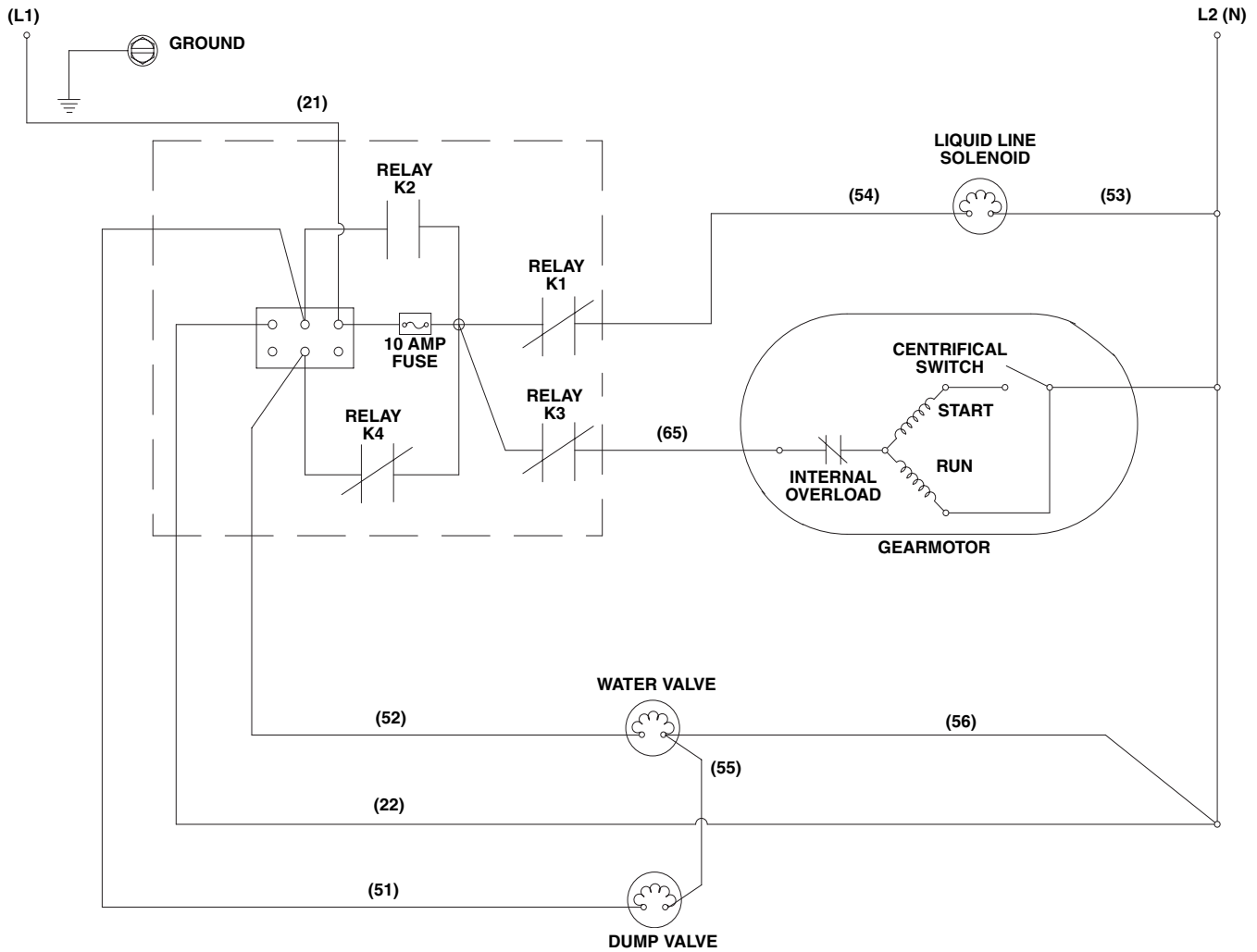
COMPRESSOR SECTION
QC700/QF800
115/60/1 - 230/50/1
(Diagram Shown During Freeze Cycle)



SV2005

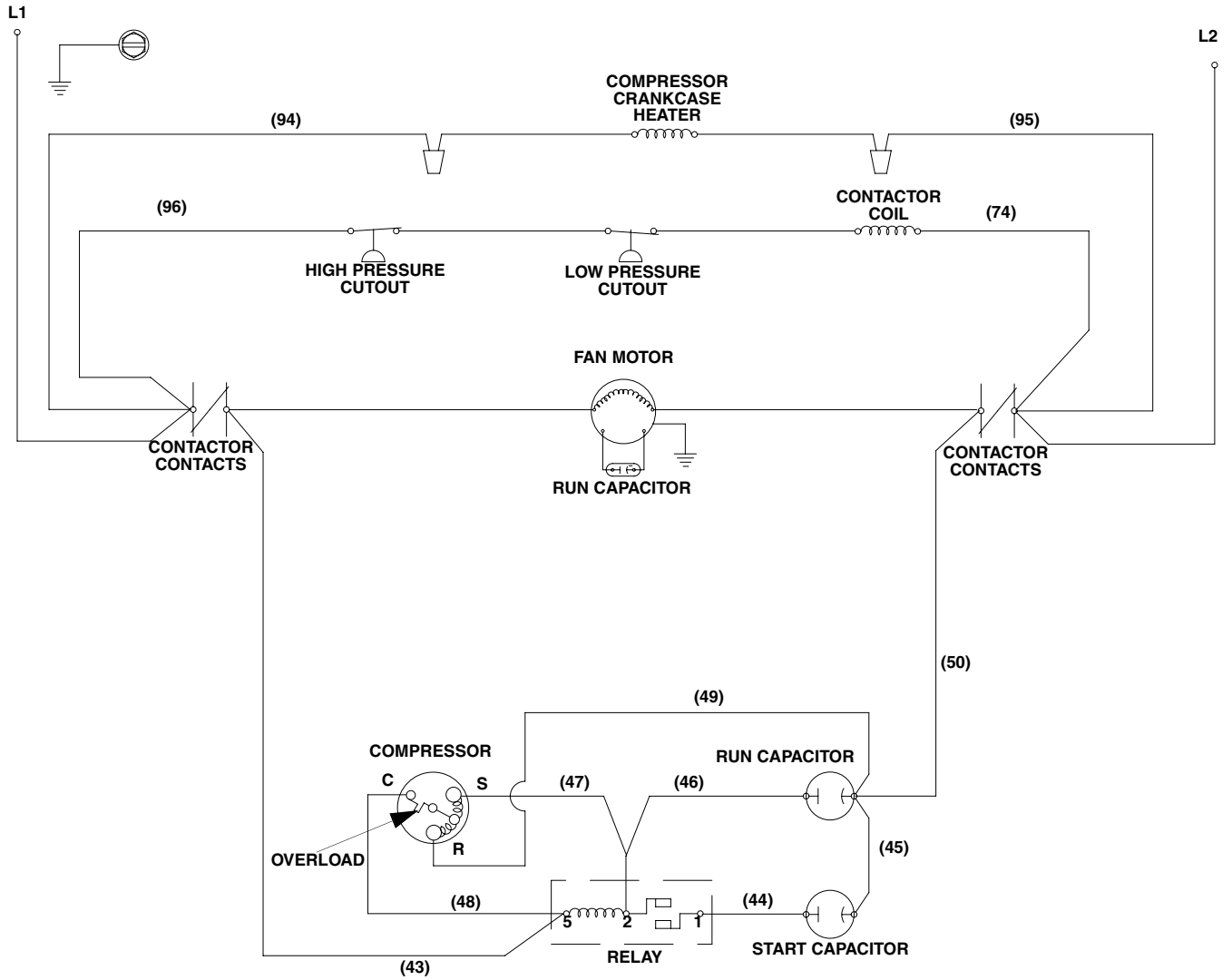
ICE MACHINE HEAD SECTION
QF2200
115/60/1 - 230/50/1
 (Diagram Shown During Freeze Cycle)

SEE SERIAL PLATE FOR VOLTAGE



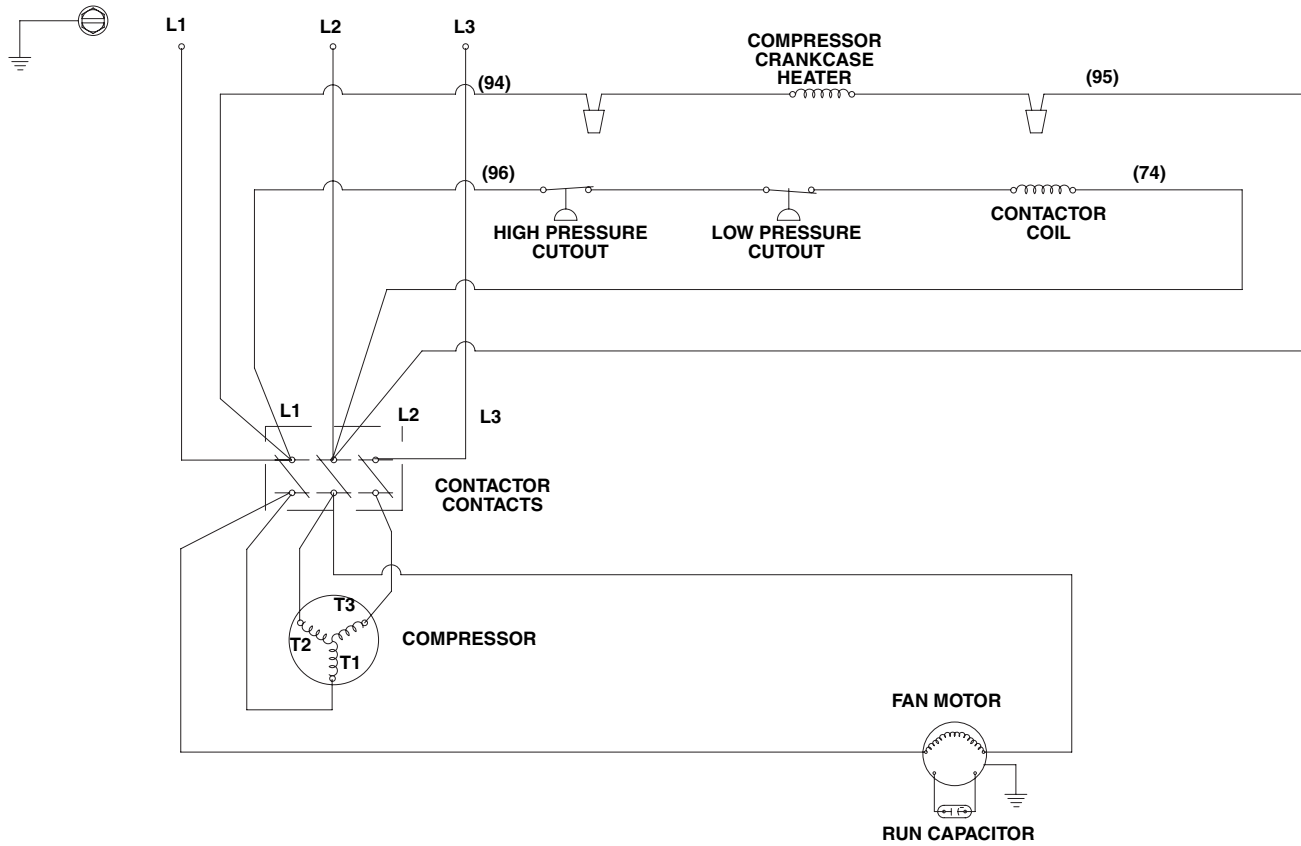
SV3012

RFC2085
230V/60HZ/1PH - 230/50/1
 (Diagram Shown During Freeze Cycle)



SV3014

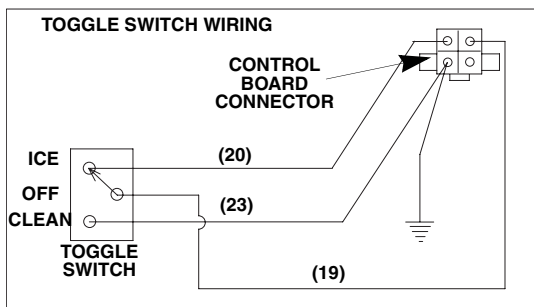
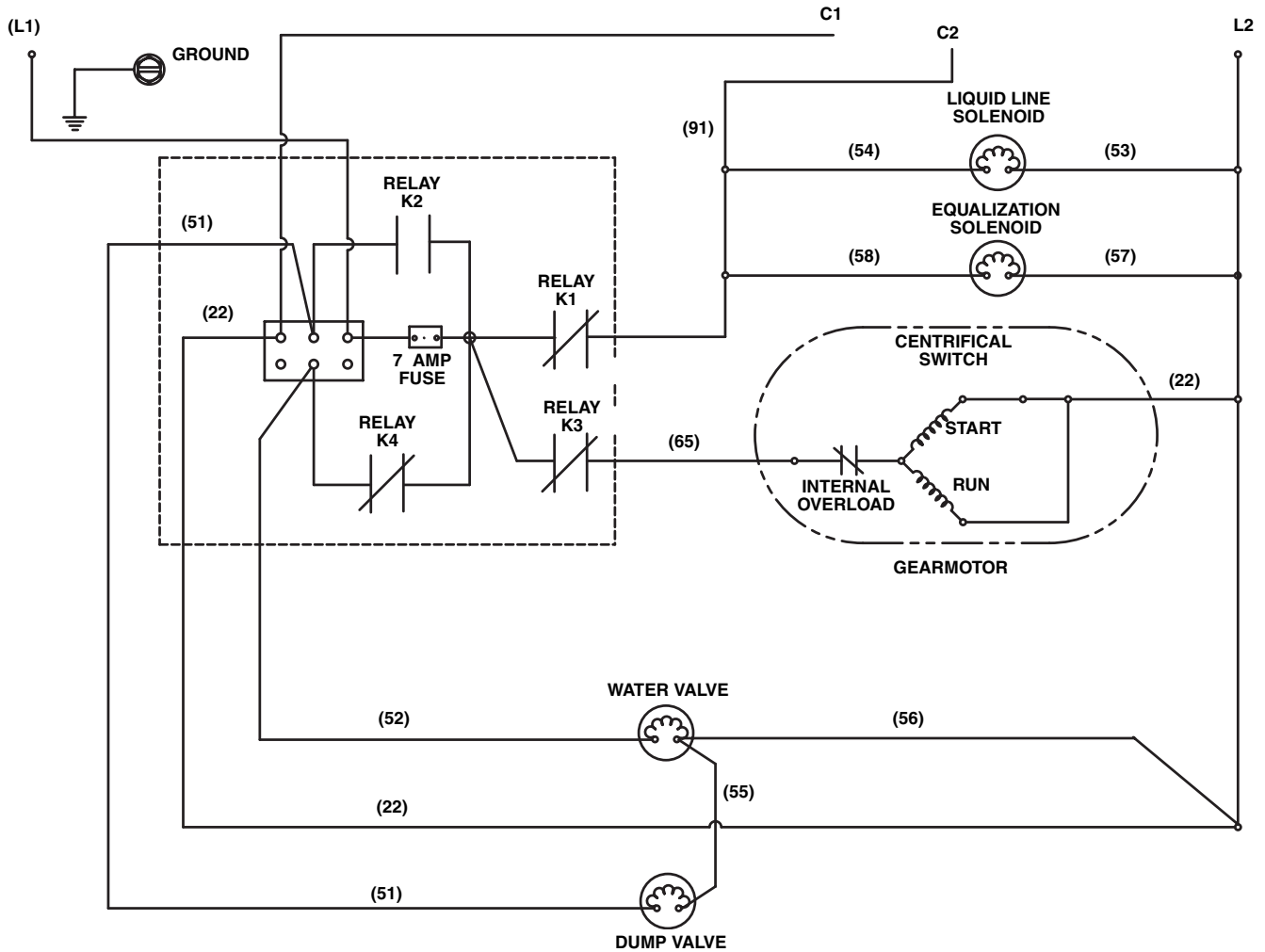
RFC2085
208-230V/60HZ/3PH
 (Diagram Shown During Freeze Cycle)



SV3013

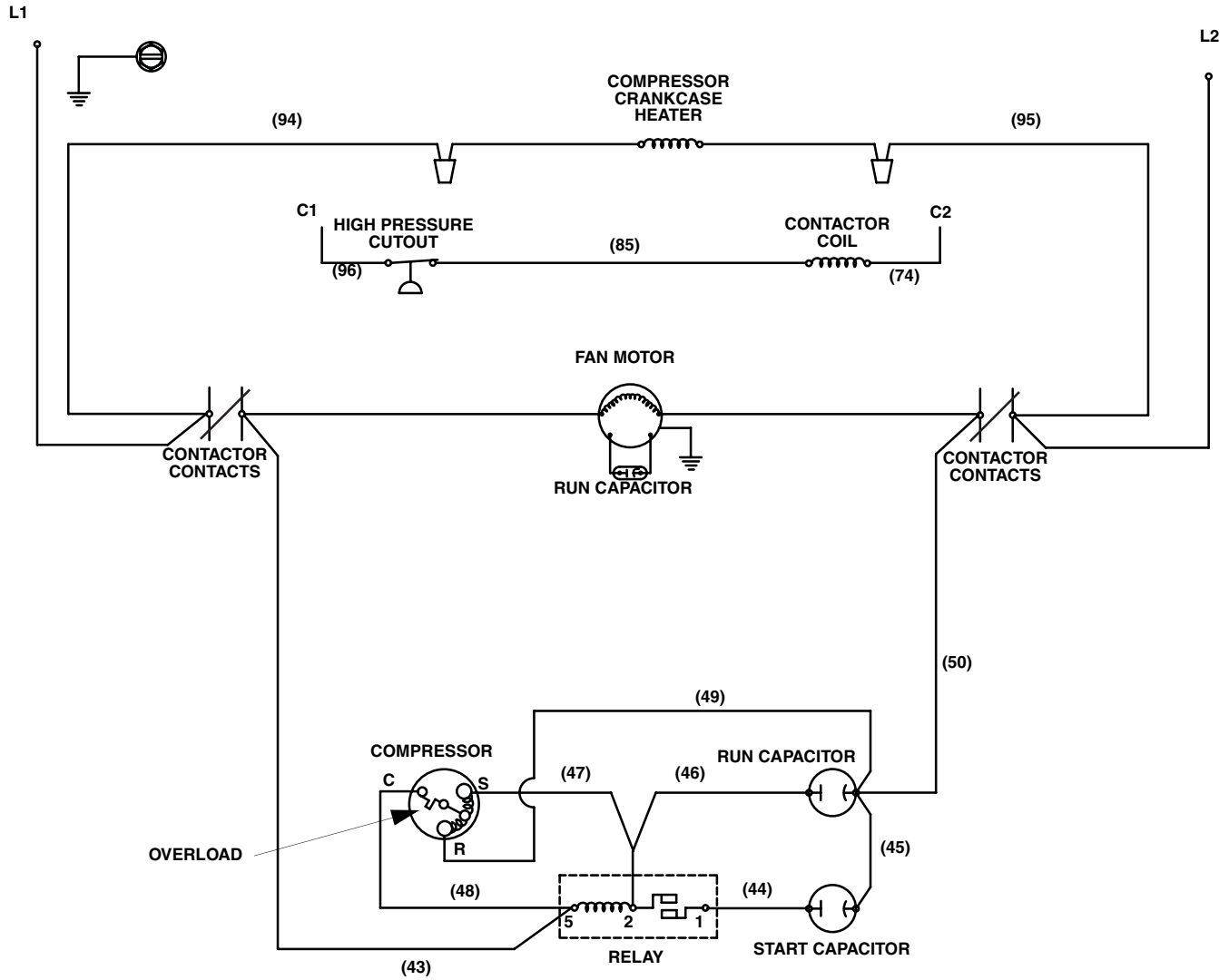
ICE MACHINE HEAD SECTION
QF2300
115/60/1 - 230/50/1
 (Diagram Shown During Freeze Cycle)

SEE SERIAL PLATE FOR VOLTAGE



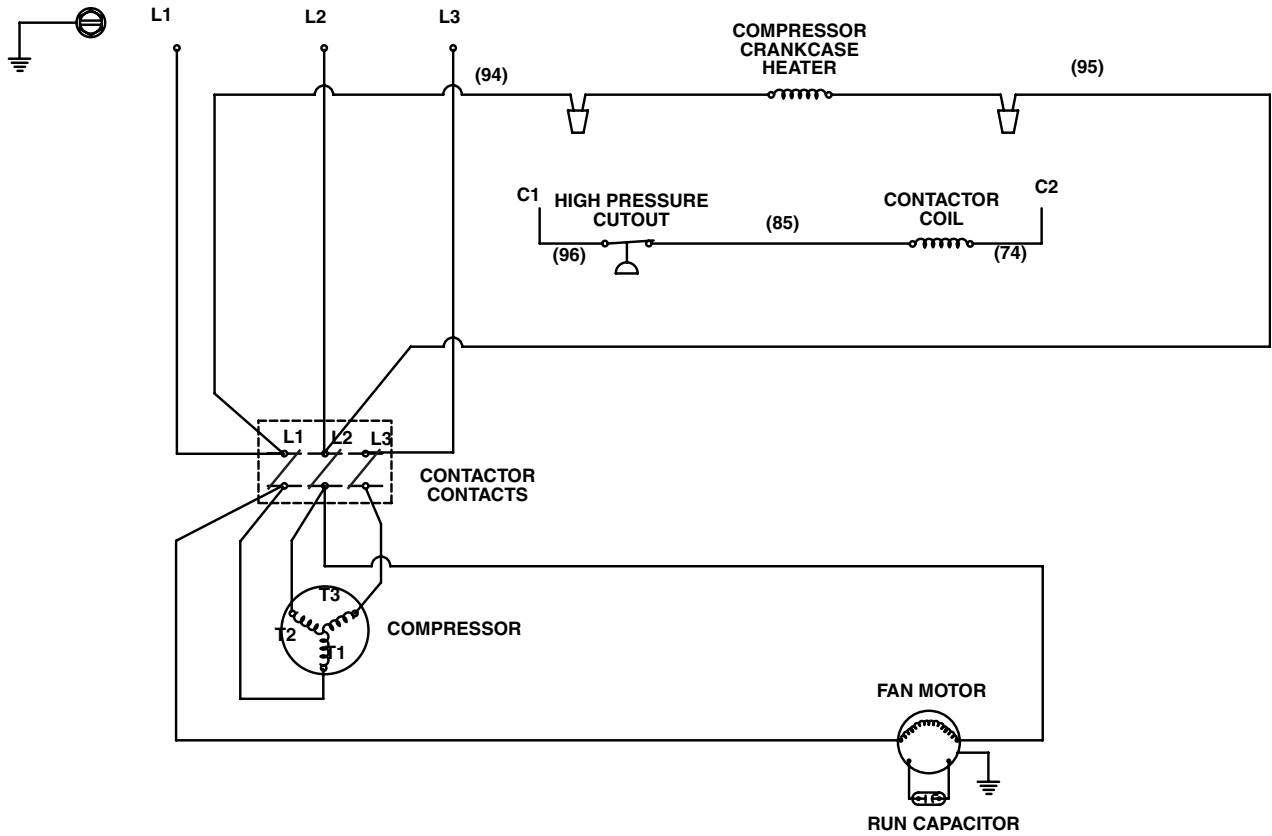
SV3012

RFC2385
230V/60HZ/1PH - 230/50/1
 (Diagram Shown During Freeze Cycle)



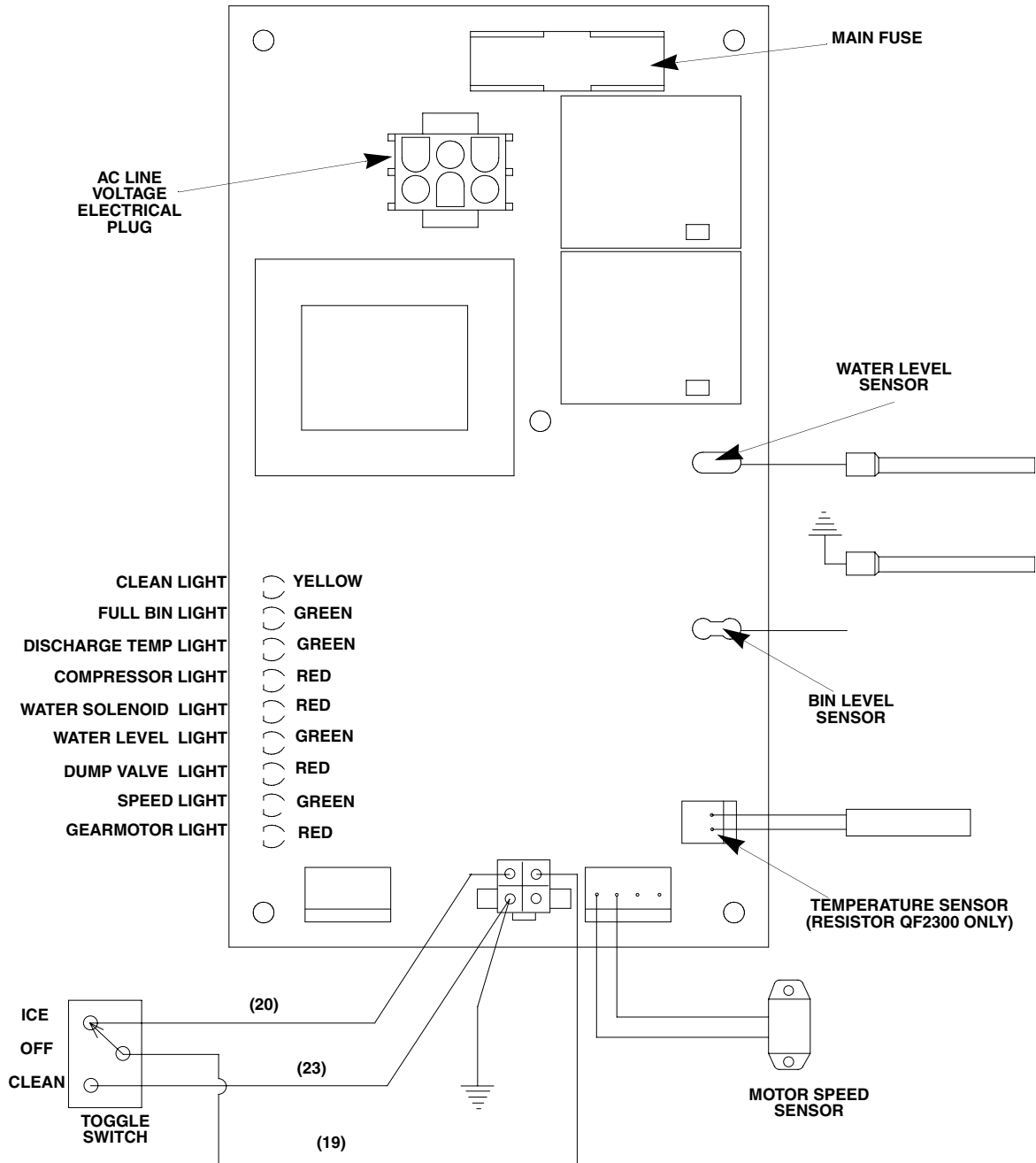
SV2107a

RFC2385
208-230V/60HZ/3PH
(Diagram Shown During Freeze Cycle)



SV2108a

Control Board



Component Specifications and Diagnostics

ICE/OFF/CLEAN TOGGLE SWITCH

Function

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

Specifications

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

Check Procedure

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

1. Inspect the toggle switch for correct wiring.
2. Isolate the toggle switch by disconnecting all wires from the switch, or by disconnecting the Molex connector from the control board.
3. Check across the toggle switch terminals using a calibrated ohm meter. Note where the wire numbers are connected to the switch terminals, or refer to the wiring diagram to take proper readings.

Switch Setting	Terminals	Ohm Reading
ICE	19-20	Closed
	19-23	Open
	20-23	Open
CLEAN	19-20	Open
	19-23	Closed
	20-23	Open
OFF	19-20	Open
	19-23	Open
	20-23	Open

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

BIN LEVEL PROBE

Function

The bin level probe shuts off the ice machine after the bin fills with ice.

To start ice making, the bin level probe must be open (Bin Level light off). If the probe is closed (Bin Level light on) when the toggle switch is moved to ICE, the control system waits until the bin level probe opens (Bin Level light off) before starting an ice making sequence. If the bin level probe is disconnected from the circuit board, the ice machine will not start. This prevents overfilling the bin with ice.

FAILURE MODES

Bin Level Probe Open or Disconnected

The ice machine will not start and continuously flashes the Bin Level light. Opening the bin level probe for 15 continuous seconds in the Freeze cycle will initiate an Automatic Shut-Off sequence.

Bin Level Probe Closed or Shorted

The ice machine will not start and the Bin Level light is energized.

Shorting the probe for 30 continuous seconds in the Freeze cycle will initiate an Automatic Shut-Off sequence.

CHECK PROCEDURE

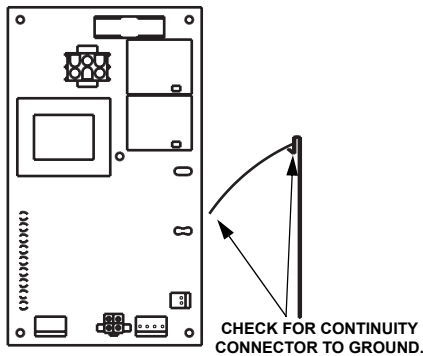
Bin Level Probe Open or Disconnected

The ice machine will not start and continuously flashes the Bin Level light.

1. Move toggle switch from OFF to ICE to OFF to ICE to verify ice machine is not in an 8-minute lockout.

Control Board Bin Level Light	Cause
Off	Ice machine was in an Automatic Shut-Off mode (8-minute lockout).
Flashes	Go to step 2.

- Disconnect bin level probe from control board and check continuity (ohms) from the female connector to the bin level probe.



Continuity	Cause
No	Replace bin level probe.
Yes	Go to step 3.

- Remove bin level probe from ice chute and clean with Manitowoc Ice Machine Cleaner and Sanitizer. Rinse well with fresh water, reinstall and monitor the Bin light.

Control Board Bin Level Light	Cause
Off	Bin level probe needed cleaning.
Flashes	Go to step 4.

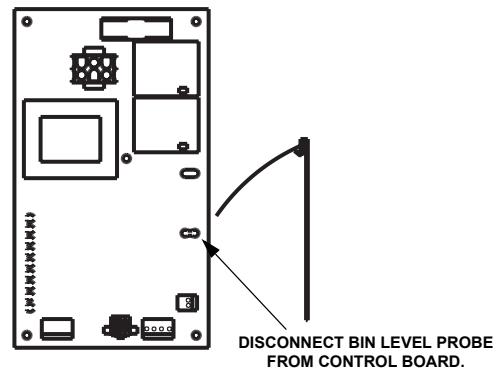
- Disconnect bin level probe wire from the control board and place a jumper from the bin level terminal to ground.

Control Board Bin Level Light	Cause
On	Replace bin level probe.
Flashes	Reconfirm control board is not in an 8-minute lockout. Repeat steps 1 – 4, then replace control board.

Bin Level Probe Closed or Shorted

The ice machine will not start and the Bin Level light is energized continuously.

- Verify ice is not in contact with bin level probe.
- Disconnect bin level probe wire from the control board.



Control Board Bin Level Light	Cause
Off	Clean bin level probe.
On	Replace control board.

MOTOR SPEED SENSOR

Function

The motor speed sensor verifies that the gearbox motor is rotating at the correct speed.

Failure Modes

MOTOR SPEED SENSOR OPEN OR DISCONNECTED (ICE MACHINE WILL NOT START.)

Performs initial start-up procedure. Ten to 15 seconds after the ice machine enters Water Flush (1), the ice machine will initiate an Automatic Shut-Off cycle, flash the Speed light and remain off for 60 minutes. (Refer to "Gear Motor Speed" for additional information.)

MOTOR SPEED SENSOR CLOSED OR SHORTED (ICE MACHINE WILL NOT START.)

Performs initial start-up procedure. Ten to 15 seconds after the ice machine enters Water Flush (1), the ice machine will initiate an Automatic Shut-Off cycle, flash the Speed light and remain off for 60 minutes. (Refer to "Gear Motor Speed" for additional information.)

Check Procedure

1. Allow time for the evaporator to warm. Disconnecting power in the Freeze cycle will result in ice build-up between the evaporator and auger.
2. Verify the motor speed sensor is in place and securely attached to the motor.
3. Verify the gearmotor run capacitor is functional.
4. Place toggle switch in the OFF position and place an identifying mark on the evaporator/gearbox coupling. This will provide a reference point to verify the coupler is rotating.

Move the toggle switch to the ICE position and verify the motor shaft and coupling are turning, then observe the Speed light.

(If the gear motor and coupling will not rotate, the switch is operating correctly.)

Speed light is:	Cause
On after 3 to 5 seconds	This is normal operation.
Off	Replace motor speed sensor.
On after 3 to 5 seconds and control board terminates Freeze cycle	Replace control board.

To verify coupling/auger RPM (revolutions per minute):

1. Verify line voltage is within 10% of ice machine nameplate rating when low RPM is suspected.
2. Verify the gear motor run capacitor is functional.
3. Place identifying mark on coupling.
4. Count coupling revolutions for 2 minutes.
5. Divide coupling revolutions by 2 (example: 31 coupling revolutions ÷ 2 = 15-1/2 RPM).

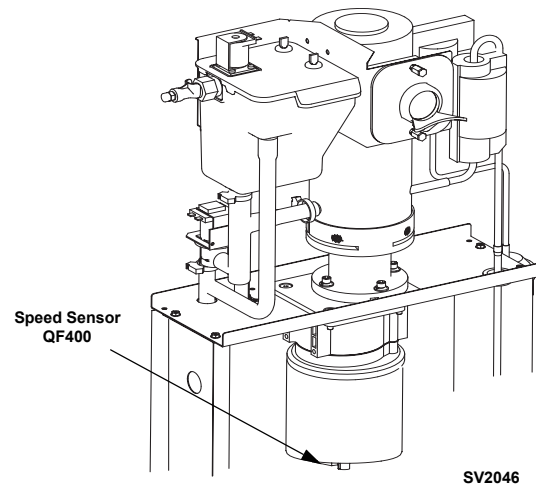
Minimum revolutions per minute:

QF400 = 9 RPM

QC700 = 15 RPM

QF800 = 15 RPM

QF2200/QF2300 = 11.6 RPM



WATER LEVEL PROBES

Function

The water level probe protects the compressor if water is not detected.

Water contacting the probes will complete the circuit and energize the Water Level Probe light.

There are two water level probes; one probe is connected to the circuit board and one probe is connected to the ice machine ground.

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

During the Water Fill and Freeze cycle, the water level probe monitors the water level. The water float valve maintains the correct water level. If the water level is incorrect, refer to "Water Float Valve."

Failure Modes

WATER LEVEL PROBE OPEN OR DISCONNECTED (ICE MACHINE WILL NOT START COMPRESSOR.)

Performs initial start-up procedure. Ninety seconds after ice machine enters Water Fill (1B), the ice machine will initiate an Automatic Shut-Off cycle, flash the Water Level Probe light and remain off for 60 minutes. (Refer to "No Water" SafeGuard for additional information.)

WATER LEVEL PROBE CLOSED OR SHORTED (ICE MACHINE WILL CONTINUE TO RUN.)

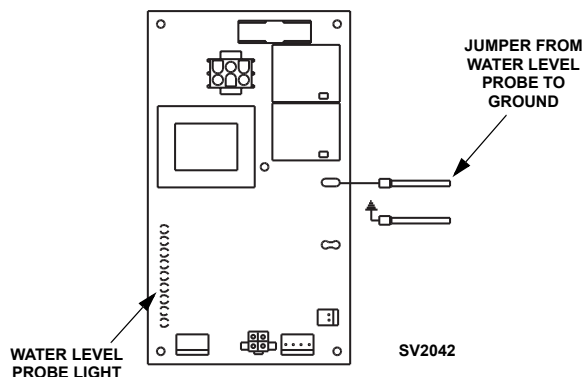
If the ice machine runs out of water with the water level probe shorted, the ice machine will initiate an Automatic Shut-Off cycle and flash the Temperature light. (Refer to "Temperature is Too High or Too Low SafeGuard" for additional information.)

CHECK PROCEDURE

WATER LEVEL PROBE OPEN OR DISCONNECTED

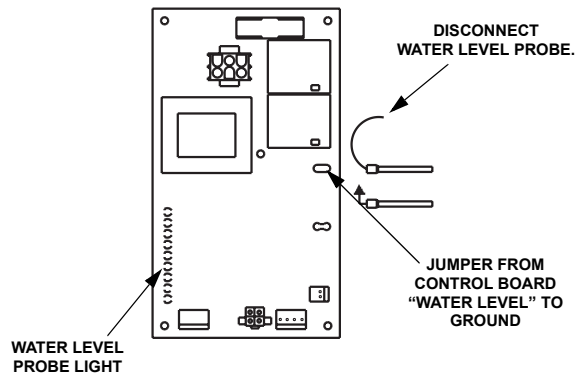
1. Determine which water level probe is connected to "water level" on the control board.
2. Remove water level probe from reservoir and place jumper wire from the water level probe to ground.
3. Move the toggle switch to the ICE position, wait 45 seconds, and then monitor the Water Level Probe light.

Step 3 Jumper water level probe to ground		
Water Level light is:	Compressor	Cause
On	Energizes	Control system is operating normally Verify water level is correct.
Off	Remains de-energized	Proceed to step 4.



4. Disconnect water level probe from control board. Install jumper from control board "water level" terminal to ground.
5. Move the toggle switch from ICE to OFF to ICE position. Wait 45 seconds, then monitor the Water Level Probe light.

Step 5 Jumper "water level" terminal to ground		
Water Level light is:	Compressor	Cause
On	Energizes	Replace water level probe wiring. (Verify defective component – ohm wire from connector to connector.)
Off	Remains de-energized	Replace control board.

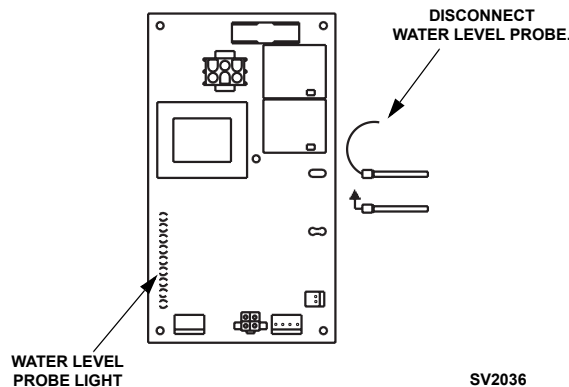


SV2035

WATER LEVEL PROBE CLOSED OR SHORTED

1. Disconnect the water level probe from the control board.
2. Move the toggle switch to the ICE position, wait 45 seconds and then monitor the Water Level Probe light.

Step 2 Disconnect water level probe from control board "water level" terminal		
Water Level light is:	Compressor	Cause
Off	Remains de-energized	Clean water level probe.
On	Energizes	Replace control board.



SV2036

TEMPERATURE SENSOR

Function

The temperature sensor provides input to the control board. The control board monitors the temperature anytime the liquid line solenoid valve or compressor is energized. When a temperature is sensed that is above or below the correct temperature range, the ice machine de-energizes.


Temperature Ranges:

QF400/QC700/QF800 155°F to 255°F (68°C to 124°C)

QF2200 30°F to 123°F

Specifications

10,000 Ohms at 77°F (25°C)

 **Caution**
Use only Manitowoc thermistors.

Check Procedure

The thermistor must be securely attached and insulated to operate properly.

Verify that the thermistor resistance is accurate and corresponding to the high and low temperature ranges.

1. Disconnect the thermistor at the control board. Connect the ohmmeter to the isolated thermistor wire leads.
2. Using a temperature meter capable of taking readings on curved copper lines, attach the temperature meter-sensing device to the refrigeration line next to the thermistor.

Important

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

3. With the ice machine running, verify that the temperature of the refrigeration line (step 2) corresponds to the thermistor resistance reading (step 1) as stated in the temperature/resistance chart.

TEMPERATURE/RESISTANCE CHART

As the temperature rises at the thermistor block, the resistance drops.

Important

If the ohmmeter reads "OL," check the scale setting on the meter before assuming the thermistor is bad.

Temperature of Thermistor		Resistance K Ohms (x 1000)
°C	°F	
-17.77° – -12.22°	0° – 10°	85.35 – 62.46
-12.22° – -6.66°	10° – 20°	62.46 – 46.22
-6.66° – -1.11°	20° – 30°	46.22 – 34.56
-1.11° – 4.44°	30° – 40°	34.56 – 26.10
4.44° – 10.0°	40° – 50°	26.10 – 19.90
10.0° – 15.55°	50° – 60°	19.90 – 15.31
15.6° – 21.1°	60° – 70°	15.31 – 11.88
21.1° – 26.7°	70° – 80°	11.88 – 9.29
26.7° – 32.2°	80° – 90°	9.29 – 7.33
32.2° – 37.8°	90° – 100°	7.33 – 5.82
37.8° – 43.3°	100° – 110°	5.82 – 4.66
43.3° – 48.9°	110° – 120°	4.66 – 3.75
48.9° – 54.4°	120° – 130°	3.75 – 3.05
54.4° – 60.0°	130° – 140°	3.05 – 2.49
60.0° – 65.6°	140° – 150°	2.49 – 2.04
65.6° – 71.1°	150° – 160°	2.04 – 1.68
71.1° – 76.7°	160° – 170°	1.68 – 1.40
76.7° – 82.2°	170° – 180°	1.40 – 1.17
82.2° – 87.8°	180° – 190°	1.17 – 0.98
87.8° – 93.3°	190° – 200°	0.98 – 0.82
93.3° – 98.9°	200° – 210°	0.82 – 0.70
104.4° – 110.0°	220° – 230°	0.59 – 0.51
110.0° – 115.6°	230° – 240°	0.51 – 0.43
115.6° – 121.1°	240° – 250°	0.43 – 0.37
121.1° – 126.7°	250° – 260°	0.37 – 0.33

CONTROL BOARD RELAYS

Function

The control board relays energize and de-energize system components.

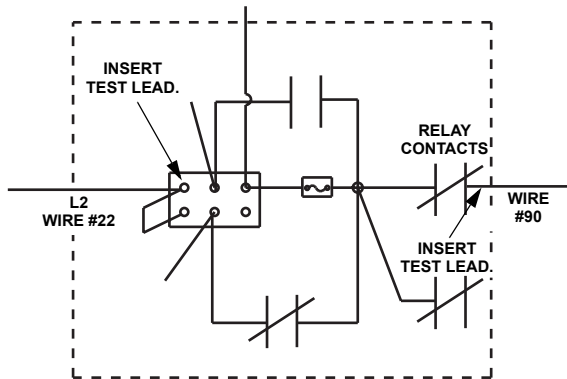
Specifications

Relays are not field replaceable. There are four relays on the control board:

Relay	Controls
#1	Contactor Coil
#2	Water Dump Valve
#3	Gear Motor
#4	Float Valve Coil

Check Procedure

1. Leave all wiring connected and refer to the Energized Parts Chart. Then verify:
 - A. The relay should be energized.
 - B. The red control board LED is energized for the relay contacts being tested.
2. Check for line voltage at the control board.
 - A. Insert one electrical test lead to test L2 (wire #22).
 - B. Insert one electrical test lead to test for voltage through the contacts.



Voltage Reading	Result
Line Voltage*	Relay is good.
No Voltage	Relay is defective. Replace control board.
*Refer to model/serial label for correct voltage.	

MAIN FUSE

Function

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

Specifications

The main fuse is 250 Volt, 10 amp.

Check Procedure

⚠ Warning

High (line) voltage is applied to the control board (terminals #21 and #22) at all times. Removing the control board fuse or moving the toggle switch to OFF will not remove the power supplied to the control board.

1. If any control board lights are energized, the fuse is good.

⚠ Warning

Disconnect electrical power to the entire ice machine before proceeding.

2. Remove the fuse. Check the resistance across the fuse with an ohm meter.

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

WATER FLOAT VALVE

Function

The float valve maintains correct water level during the Freeze cycle.

It allows the evaporator to drain completely during the Automatic Shut-Off cycle.

Check Procedure

1. Verify water is supplied to the float valve, the water inlet screen is clean, and the float and float arm are free moving.
2. Refer to the Energized Parts Chart and verify the following:
 - The float valve coil should be energized.
 - The red water valve LED on the control board is energized.
3. Check for line voltage at float valve coil. This test must be performed within 90 seconds of the water float valve energizing. If no water contacts the water level probes within 90 seconds, the valve will de-energize.

Step 3 Check for Line Voltage	
Voltage Reading	Result
Line Voltage	Replace Solenoid Coil or Replace Valve
No Voltage	See "Control Board Relays" for further diagnostics.

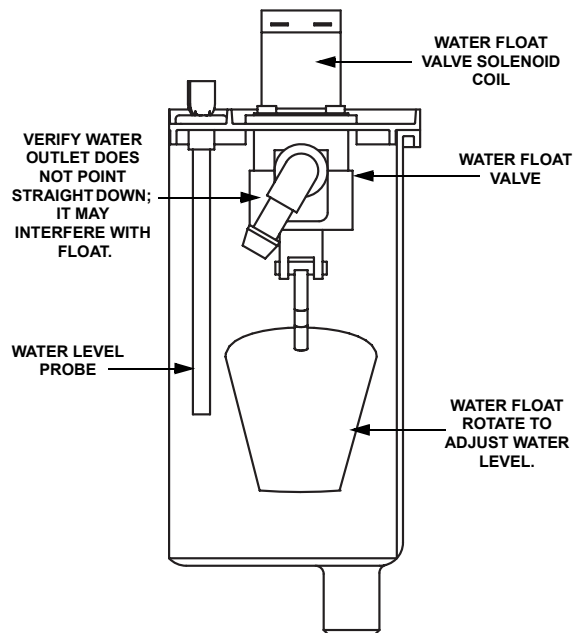
WATER LEVEL CHECK

The float valve maintains the correct water level. The water level must allow the water level probes to maintain water contact throughout the Freeze cycle. The water level is factory set and normally will not require adjustment. Check the water level during the Freeze cycle. The water level is correct if the Water Level indicator light is energized and no water is entering the overflow tube. (Check for overflow water exiting the ice machine drain line at the floor drain.)

If adjustments are necessary:

- A. Rotate float clockwise to increase water level.
- B. Rotate float counterclockwise to decrease water level.

Verify the outlet for the water float valve is at a 20° to 30° angle to prevent contact with the float.



HIGH PRESSURE CONTROL (HPCO)**Function**

The high pressure control stops the ice machine if subjected to excessive high-side pressure.

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

Specifications

Cut-out:450 psig \pm 10

Cut-in:Automatic reset

(must be below 300 psig to reset).

Check Procedure

1. Set ICE/OFF/CLEAN switch to OFF.
2. Disconnect main power supply to the ice machine.
3. Connect manifold gauges to access valves.
4. Hook voltmeter in parallel across the HPCO, leaving wires attached.
5. Reconnect main power supply to the ice machine.
6. Set ICE/OFF/CLEAN switch to ICE and block condenser with cardboard or similar material.
7. No air flowing through the condenser will cause the HPCO control to open because of excessive pressure. Watch the pressure gauge and record the cut-out pressure.

 **Warning**

If discharge pressure exceeds 460 psig and the HPCO control does not cut out, set ICE/OFF/CLEAN switch to OFF to stop ice machine operation.

Replace the HPCO control if it:

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

**LOW PRESSURE CUT-OUT CONTROL (LPCO)
RFC2085/RFC2385 (QF2200/QF2300) ONLY****Function**

Energizes and de-energizes the contactor coil when suction pressure rises above or falls below setpoint.

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

Specifications

Model	Cut-In (Close)	Cut-Out (Open)
RFC2085 RFC2385	22 psig \pm 3	7 psig \pm 3

Check Procedure

1. Connect manifold gauges at suction and discharge access valves at the condensing unit.
2. Set ICE/OFF/CLEAN switch to OFF.
3. The liquid line solenoid valve will de-energize and the suction pressure will begin to decrease. The low-pressure control will open at the listed specification.
4. Use the manifold gauge set to increase suction pressure. Feed refrigerant from the high side access valve to the low side access valve. Add refrigerant in small increments to allow the low side pressure to be monitored. The low pressure control will close at the listed specification.

Replace the LPCO control if it:

- Will not close at the specified set point.
- Does not open at the specified set point.

FAN CYCLE CONTROL

Function

Cycles the condenser fan motor on and off to maintain proper operating discharge pressure.

The fan cycling control closes on an increase in discharge pressure and opens on a decrease in discharge pressure.

Model	Cut-In (Close)	Cut-Out (Open)
QF0800 QC0700	250 psig +/- 5	200 psig +/- 5

Check Procedure

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

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

COMPRESSOR ELECTRICAL DIAGNOSTICS

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

Check Resistance (Ohm) Values

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

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

SINGLE PHASE COMPRESSORS

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

THREE PHASE COMPRESSORS

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

Check Motor Windings to Ground

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

Determine if the Compressor is Seized

Check the amp draw while the compressor is trying to start.

COMPRESSOR DRAWING LOCKED ROTOR

The two likely causes of this are:

- Defective starting component
- Mechanically seized compressor

To determine which you have:

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

COMPRESSOR DRAWING HIGH AMPS

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

The voltage when the compressor is trying to start must be within $\pm 10\%$ of the nameplate voltage.

Diagnosing Capacitors

- If the compressor attempts to start, or hums and trips the overload protector, check the starting components before replacing the compressor.
- Visual evidence of capacitor failure can include a bulged terminal end or a ruptured membrane. Do not assume a capacitor is good if no visual evidence is present.
- A good test is to install known good substitute capacitor.
- Use a capacitor tester when checking a suspect capacitor. Clip the bleed resistor off the capacitor terminals before testing.

Diagnosing Start Components


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

CAPACITOR

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

RELAY

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

 Warning Disconnect electrical power to the condensing unit before proceeding.

Relay Operation Check

1. Disconnect wires from relay terminals.
2. Verify the contacts are closed by checking for continuity between terminals:

QF400	QC700/QF800	RFC2085/ RFC2385 (QF2200/QF2300)
10 & 11	1 & 2	1 & 2


No continuity indicates open contacts. Replace the relay.

3. Check the relay coil. Measure the resistance between terminals:

QF400	QC700/QF800	RFC2085/ RFC2385 (QF2200/QF2300)
10 & 11	1 & 2	1 & 2

No resistance indicates an open coil. Replace the relay.

4. Replace control box cover and restore electrical power to the ice machine.

 Warning Replace control box cover before proceeding.
--

5. Move toggle switch to the ICE position.
6. The compressor start winding should energize for less than 1 second. Continued high amperage draw could indicate:
 - Low incoming power supply (Check voltage at compressor start-up when load is greatest)
 - Defective relay
 - Defective capacitor
 - Defective compressor
 - Verify voltage and replace all start components.
7. If all of the previous tests are satisfactory and the compressor will not operate or continue to operate, replace the compressor.

Diagnosing An Ice Machine That Will Not Run

QF400/QC700/QF800/QF2200/QF2300

 **Warning**

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

QF2200/QF2300 - If the gearmotor is energized but no ice is produced, refer to "Diagnosing a Condensing Unit That Will Not Run".

1. Verify primary voltage is supplied to ice machine and the fuse/circuit breaker is closed.
2. Verify control board fuse is okay. If any control board lights functions, the fuse is okay.
3. Verify the bin level control is connected to the control board and the bin level light is off.
4. Verify ICE/OFF/CLEAN toggle switch functions properly. Place the toggles switch in the ICE and CLEAN positions and check for energized components.
5. Verify low DC voltage is properly grounded. Loose DC wire connections may intermittently stop the ice machine.
6. Verify water is contacting the water level probes. The compressor (QF2300 liquid line solenoid valve) will not energize until water contacts the water level probes.

Be sure Steps 1-5 were followed thoroughly. Intermittent problems are not usually related to the control board.

Diagnosing A Condensing Unit That Will Not Run

RFC2085/RFC2385

If the ice machine water pump is not energized refer to "Ice Machine Head Section Will Not Run".

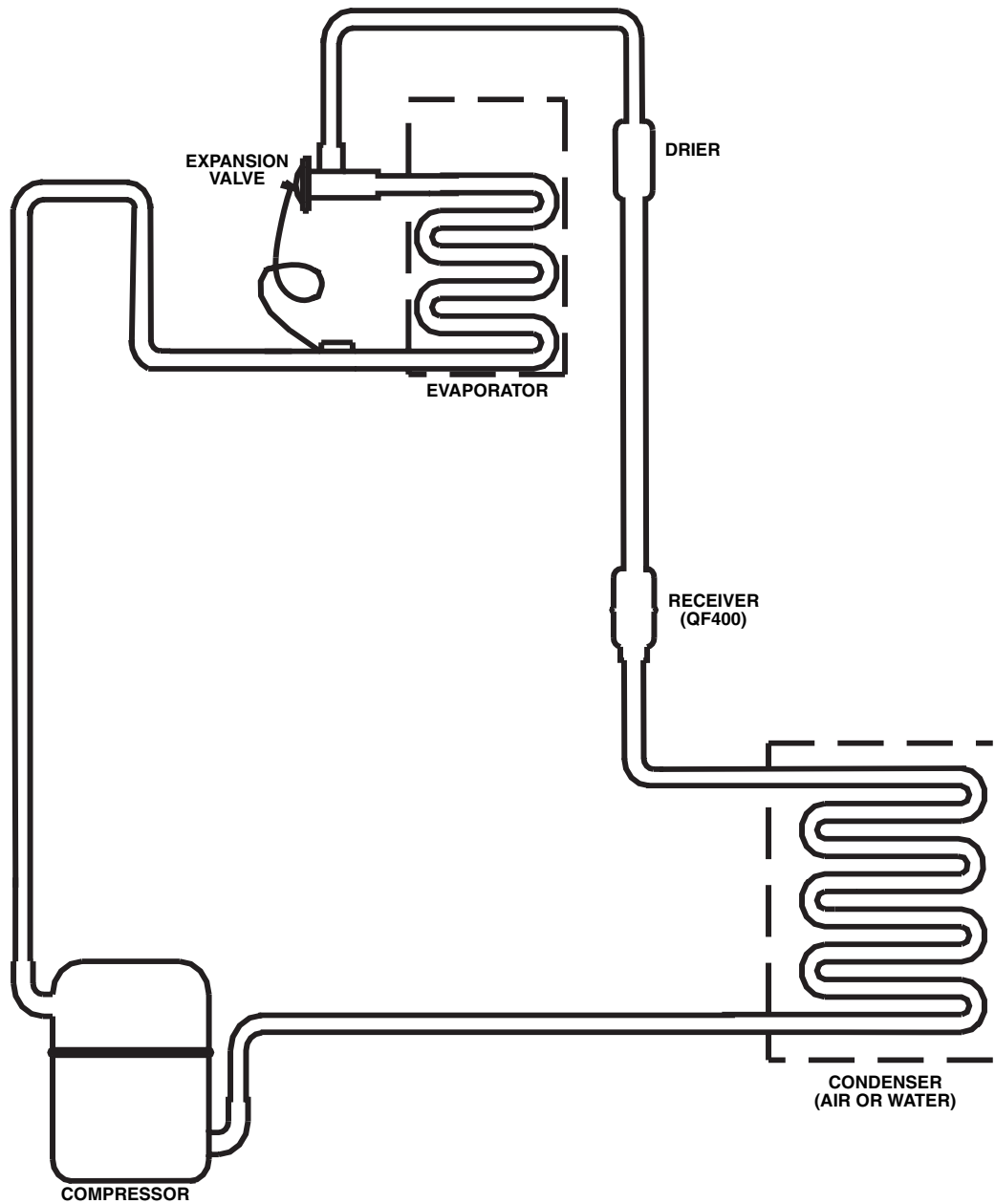
1. Verify primary voltage is supplied to ice machine condensing unit and the fuse/circuit breaker is closed.
2. Verify the high-pressure cutout and low-pressure (RFC2085 only) controls are closed. The HPCO and LPCO are closed if primary line voltage is present at the contactor coil terminals.
3. Verify line voltage is present at the contactor coil.
4. Verify the contactor contacts are closed and line voltage is present across all lines.
5. Refer to compressor diagnostics.

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Section 7 Refrigeration System

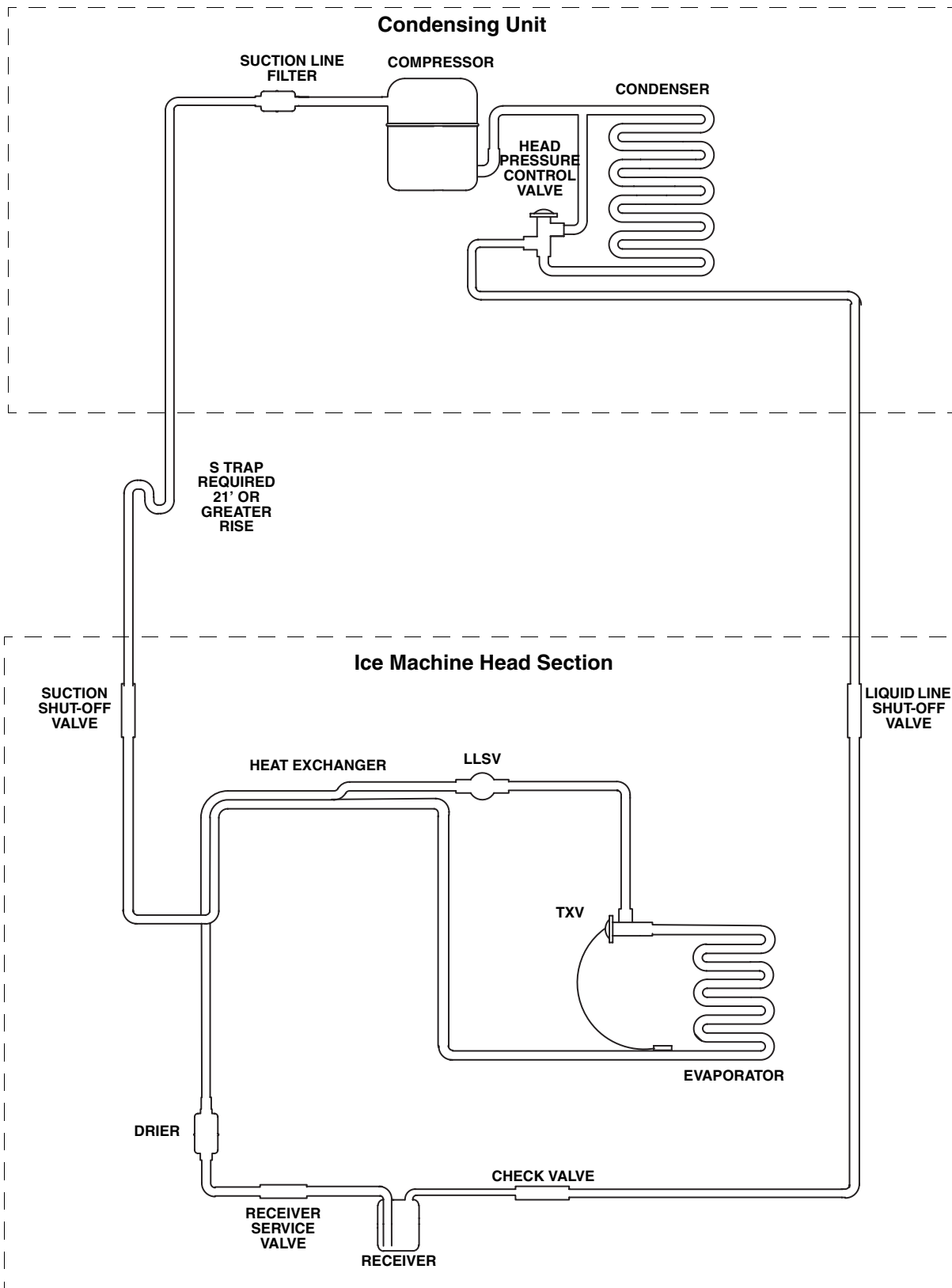
Tubing Schematic

QF400/QC700/QF800



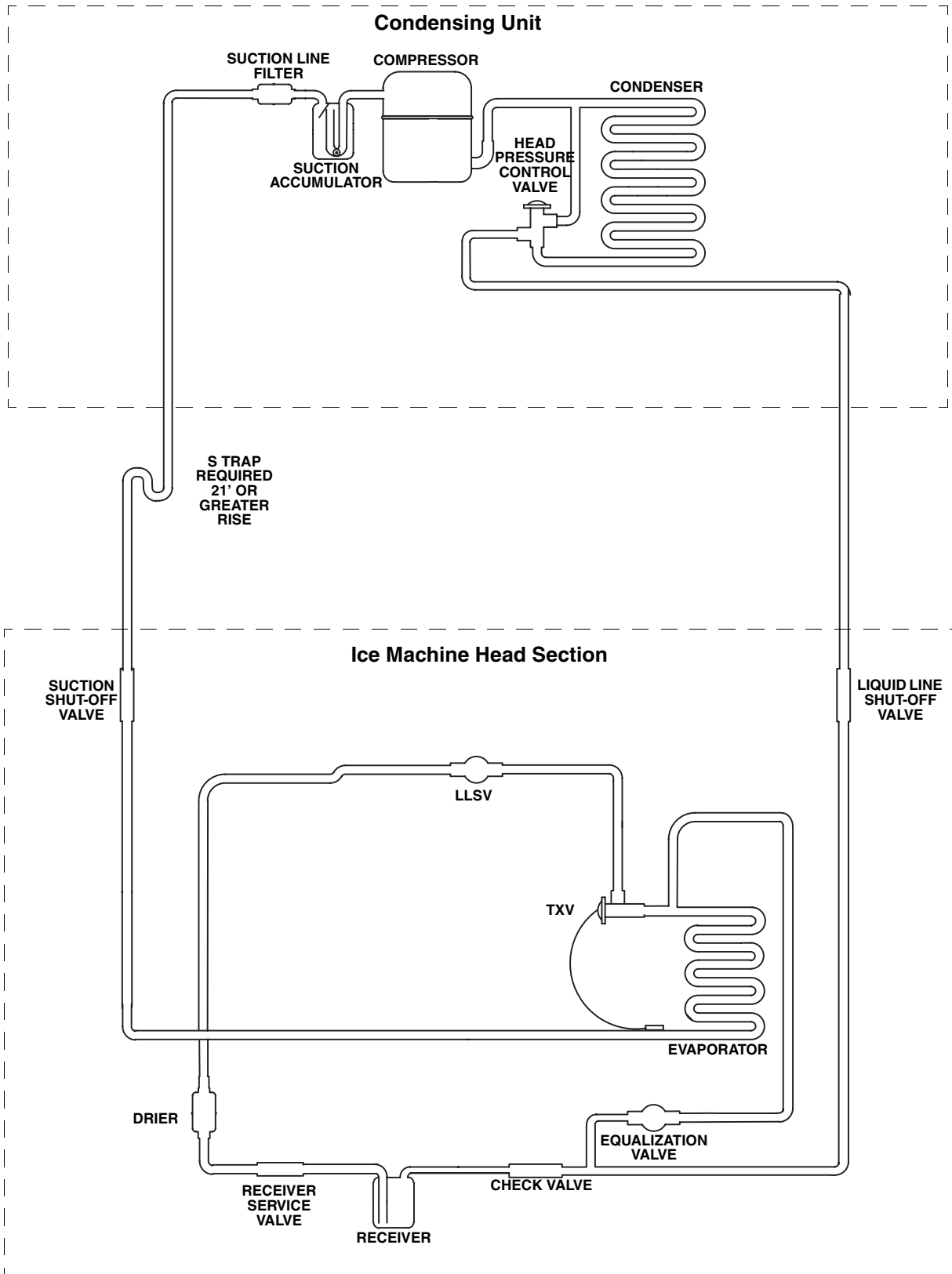
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QF2200/RFC2085



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QF2300/RFC2385



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Refrigeration System Diagnostics

General

When analyzing the refrigeration system, it is important to understand that different refrigeration component malfunctions may cause very similar symptoms.

Many external factors can make good refrigeration components appear bad. These factors can include improper installation, or water system malfunctions such as hot incoming water supply or water loss.

The following two examples illustrate how similar symptoms can result in a misdiagnosis.

1. An expansion valve bulb that is not securely fastened to the suction line and/or not insulated will cause a good expansion valve to flood. If a service technician fails to check for proper expansion valve bulb mounting, he may replace the expansion valve in error.

The ice machine now functions normally. The technician erroneously thinks that the problem was properly diagnosed and corrected by replacing the expansion valve. Actually, the problem (loose bulb) was corrected when the technician properly mounted the bulb of the replacement expansion valve.

The service technician's failure to check the expansion valve bulb for proper mounting (an external check) resulted in a misdiagnosis and the needless replacement of a good expansion valve.

2. An ice machine that is low on refrigerant may cause a good expansion valve to starve. If a service technician fails to verify the system charge, he may replace the expansion valve in error.

During the replacement procedure, recovery, evacuation and recharging are performed correctly. The ice machine now functions normally. The technician erroneously thinks that the problem was properly diagnosed and corrected by replacing the expansion valve.

The service technician's failure to check the ice machine for a low refrigerant condition resulted in a misdiagnosis and the needless replacement of a good expansion valve.

BEFORE BEGINNING SERVICE

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

Ask these questions before beginning service:

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

ICE PRODUCTION/QUALITY CHECK**Quality Check**

Ice quality will vary with ambient and water temperatures, and is measured by the amount of excess water in the ice. An easy test is to squeeze a handful of ice. High quality ice releases only a small amount of water. As ice quality drops, more water can be removed.

Generally speaking, higher incoming water temperature results in lower ice quality.

Lower water temperature results in higher ice quality.

Ice Production Check

1. Run the ice machine a minimum of 10 minutes to allow the system to stabilize.
2. Catch the ice in a non-perforated container for 7 minutes and 12 seconds or for more accuracy 14 minutes and 24 seconds.
3. Weigh the container and ice, then deduct the weight of the container.
4. Convert ounces to pounds.

Example: 3 lbs. 12 oz. converts to 3.75 lbs.

(12 oz. ÷ 16 oz. = .75 lb.)

5. Determine the 24-hour ice production capacity.

7 minutes 12 seconds

Multiply the total ice weight by 200.

14 minutes 24 seconds

Multiply the total ice weight by 100.

Example:

Collected ice for 7 minutes 12 seconds

Total weight (minus container) = 3.75 lbs.

3.75 lbs. x 200 = 750 lbs. of ice every 24 hours

6. Compare the capacity to the 24-hour ice production chart for the model being tested.

Ice production checks that are within 10% of the charted capacity are considered normal due to variances in air and water temperatures. Actual temperatures will seldom match the chart exactly.

INSTALLATION/VISUAL INSPECTION CHECKLIST

Possible Problem List	Corrective Action List
Filter and/or condenser is dirty.	Clean the filter and condenser.
Water filtration is plugged (if used).	Install a new water filter.
Water drains are not run separately and/or are not vented.	Run and vent drains according to the installation manual.

WATER SYSTEM CHECKLIST

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

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

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

Possible Problem List	Corrective Action List
Water area (evaporator) is dirty.	Clean as needed.
Water inlet pressure not between 20 and 80 psig.	Install a water regulator valve or increase the water pressure.
Incoming water temperature is not between 45°F (1.7°C) and 90°F (32.2°C).	If too hot, check the hot water line check valves in other store equipment.
Water filtration is plugged (if used).	Install a new water filter.
Vent tube is not installed on water outlet drain.	See installation instructions.
Hoses, fittings, etc., are leaking water.	Repair/replace as needed.
Water float valve is stuck open or closed.	Clean/replace as needed.
Dump valve is leaking.	Clean dump valve. Ice machine will shut off on Low Water SafeGuard.
Quick disconnect fitting is disconnected from the float valve.	Attach fitting to float valve.
Float valve outlet contacts float.	Adjust float valve outlet (see "Water Level Check").

SAFEGUARDS

In addition to standard safety controls, your Manitowoc ice machine features built-in SafeGuards. The ice machine will stop when conditions arise that would cause major component failure. Refer to Section 5 to determine if a SafeGuard has stopped the ice machine.

ANALYZING DISCHARGE PRESSURE DURING FREEZE OR HARVEST CYCLE

Procedure

1. Determine the ice machine operating conditions:

Air temp. entering condenser _____
 Air temp. around ice machine _____
 Water temp. entering water reservoir _____

2. Refer to Cycle Times/24 Hour Ice Production/ Refrigeration Pressure Chart for ice machine being checked.

Use the operating conditions determined in step 1 to find the published normal discharge pressures.
 Compare to actual discharge pressure readings.

3. Measure the actual discharge pressure.

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

The discharge pressure is normal when the actual pressure falls within the published pressure range for the ice machine's operating conditions.

Discharge Pressure High Checklist

Possible Cause	Check/Correct
Improper installation	See "Installation/Visual Inspection Checklist"
Restricted condenser air flow	High inlet air temperature Condenser discharge air recirculation Dirty condenser fins Defective fan motor Defective fan cycle control (QC700/QF800 only)
Improper refrigerant charge	Overcharged Non-condensables in system Wrong type of refrigerant
Other	Non-Manitowoc components in system High side refrigerant lines/component restricted (before mid-condenser) Defective head pressure control valve (RFC2085/RFC2385 only)

Discharge Pressure Low Checklist

Possible Cause	Check/Correct
Improper installation	See "Installation/Visual Inspection Checklist"
Improper refrigerant charge	Undercharged Wrong type of refrigerant
Other	Non-Manitowoc components in system Defective head pressure control valve (RFC2085/RFC2385 only) Defective fan cycle control (QC700/QF800 only) Suction pressure is too low and affecting discharge pressure. Refer to suction pressure low checklist. No water or insufficient pressure Starving expansion valve Defective compressor Moisture in refrigeration system

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

ANALYZING SUCTION PRESSURE

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

Suction Pressure High Checklist

Possible Cause	Check/Correct
Improper installation	See "Installation/Visual Inspection Checklist"
Discharge pressure	Discharge pressure is too high, and is affecting suction pressure (See "Freeze Cycle Discharge Pressure High Checklist")
Improper refrigerant charge	Overcharged Wrong type of refrigerant Non condensables in system
Other	Non-Manitowoc components in system TXV flooding (check bulb mounting) Defective compressor

Suction Pressure Low Checklist

Possible Cause	Check/Correct
Improper installation	See "Installation/Visual Inspection Checklist"
Discharge pressure	Discharge pressure is too low, and is affecting suction pressure (See "Freeze Cycle Discharge Pressure Low Checklist")
Improper refrigerant charge	Undercharged Wrong type of refrigerant
Other	Non-Manitowoc components in system Restricted/plugged liquid line drier Restricted/plugged tubing in suction side of refrigeration system Expansion valve starving No water or insufficient pressure Defective compressor Moisture in refrigeration system Dirty Evaporator Defective Fan Cycle Control RFC2085/RFC2385 Only - Defective Head Pressure Control

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

EQUALIZATION VALVE (QF2300)**General**

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

Normal Operation

The valve is energized (closed) during the freeze cycle and de-energized (open) during the off cycle. The valve equalizes low and high side pressure during the off cycle.

Analysis

The valve can fail in two positions:

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

VALVE WILL NOT OPEN IN THE OFF CYCLE

Discharge and suction pressure will not equalize.

VALVE REMAINS OPEN IN THE FREEZE CYCLE:

Symptoms of a equalization valve remaining partially open during the freeze cycle can be similar to symptoms of an expansion valve or compressor problem.

Symptoms are dependent on the amount of leakage in the freeze cycle.

A small amount of leakage will result in poor quality ice. As the size of the leak increases ice quantity will decrease until ice production stops completely.

A small amount of leakage will cause an audible indication as the vapor passes through the valve. As the size of the leak increases the audible indication becomes more apparent.

Refer to the Parts Manual for proper valve application. When replacement is necessary, use only "original" Manitowoc replacement parts.

**WATER REGULATING VALVE
(WATER-COOLED MODELS ONLY)****General**

The water regulating valve maintains the freeze cycle discharge pressure.

Check Procedure

1. Determine if the head pressure is high or low (refer to "Operational Pressure Charts").
2. Verify the condenser water meets specifications (refer to Section 2 for specifications).
3. Adjust valve to increase or decrease discharge pressure.
4. If the valve will not maintain the correct discharge pressure clean or replace as needed.

HEADMASTER CONTROL VALVE**Function**

The headmaster control valve maintains the correct discharge pressure and liquid line temperature.

Manitowoc Ice Machine systems require headmaster control valves with special settings. Replace defective headmaster control valves only with "original" Manitowoc replacement parts.

FREEZE CYCLE OPERATION**Air-Cooled Ice Machines**

During low ambient conditions, it is normal for the head pressure control valve to hunt (head pressure may fluctuate up and down) and generally settles out within the first 6 minutes of the freeze cycle.

At ambient temperatures of approximately 70°F (21.1°C) or above, refrigerant flows through the condenser to the receiver inlet. At temperatures below this (or at higher temperatures if it is raining), the head pressure controls nitrogen dome charge starts to modulate (closes the condenser port and opens the bypass port from the compressor discharge line).

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

Air-Cooled Condensing Units**FREEZE CYCLE**

1. Determine the air temperature entering the condenser.
2. Determine if the head pressure is high or low in relationship to the outside temperature. (Refer to the proper "Operational Pressure Chart") If the air temperature is below 70°F (21.1°C), the head pressure control will modulate to maintain the correct liquid line temperature and head pressure.
3. Determine the temperature of the liquid line entering the receiver by feeling it. This line is normally warm; "body temperature."
4. Using the information gathered, refer to the chart below.

NOTE: A headmaster that will not bypass, will function properly with condenser air temperatures of approximately 70°F (21.1°C) or above. When the temperature drops below 70°F (21.1°C), the headmaster fails to bypass and the ice machine malfunctions. Rinsing the condenser with cool water during the freeze cycle will simulate lower ambient conditions.

Freeze Cycle Headmaster Control Valve Failure List

Symptom	Probable Cause	Corrective Measure
Valve not maintaining pressures	Non-approved valve	Install a Manitowoc Headmaster control valve with proper setting
Discharge pressure extremely high; Liquid line entering receiver feels hot	Valve stuck in bypass	Replace valve
Discharge pressure low; Liquid line entering receiver feels extremely cold	Valve not bypassing	Replace valve
Discharge pressure low; Liquid line entering receiver feels hot	Ice machine low on charge	Locate and repair refrigerant leak

Cycle Time/24 Hour Ice Production/Refrigerant Pressure Charts

These charts are used as guidelines to verify correct ice machine operation. Accurate collection of data is essential to obtain the correct diagnosis.

- Refer to "Refrigeration System Diagnostics" for the data that must be collected. This list includes: before beginning service, ice production check, installation/visual inspection, water system checklist, ice formation pattern, safety limits, safeguards and suction pressure analysis.
- Ice production checks that are within 10% of the chart are considered normal. This is due to variances in water and air temperature. Actual temperatures will seldom match the chart exactly.
- Zero out manifold gauge set before obtaining pressure readings to avoid misdiagnosis.
- Discharge and suction pressure are highest at the beginning of the cycle. Suction pressure will drop throughout the cycle. Verify the pressures are within the range indicated.
- All pressure readings must be obtained at the ice machine head section. Lineset length will affect pressures at the condensing unit.

QF400 SELF-CONTAINED AIR COOLED

NOTE: These characteristics may vary depending on operating conditions.

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/ 21.1	395	360	335
80/26.7	375	320	300
90/32.2	335	300	270
100/37.8	295	250	240
110/43.3	255	230	225

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG
50/10.0	160-180	27-29
70/21.1	210-235	32-35
80/26.7	250-295	34-39
90/32.2	285-315	37-41
100/37.8	320-360	40-46
110/43.3	370-405	44-49

QC700 SELF-CONTAINED AIR COOLED

NOTE: These characteristics may vary depending on operating conditions.

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	710	710	710
80/26.7	710	710	710
90/32.2	710	710	700
100/37.8	710	710	670
110/43.3	710	670	630

QC700 SELF-CONTAINED WATER COOLED

NOTE: These characteristics may vary depending on operating conditions.

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	710	695	655
80/26.7	710	695	655
90/32.2	700	685	630
100/37.8	690	675	615
110/43.3	670	660	600

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG
70/21.1	200-235	18-22
80/26.7	250-320	20-26
90/32.2	270-340	23-29
100/37.8	320-350	26-34
110/43.3	360-400	29-41

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG
70/21.1	225-235	18-22
80/26.7	225-235	20-26
90/32.2	225-240	23-29
100/37.8	230-245	26-34
110/43.3	230-250	29-41

QF800 SELF-CONTAINED AIR COOLED

NOTE: These characteristics may vary depending on operating conditions.

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	760	750	740
80/26.7	760	750	710
90/32.2	760	740	680
100/37.8	760	700	660
110/43.3	730	670	610

QF800 SELF-CONTAINED WATER COOLED

NOTE: These characteristics may vary depending on operating conditions.

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	780	760	725
80/26.7	780	760	725
90/32.2	770	750	700
100/37.8	760	740	670
110/43.3	740	730	660

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG
70/21.1	220-235	18-22
80/26.7	250-320	20-26
90/32.2	270-340	23-29
100/37.8	320-350	26-34
110/43.3	360-400	29-41

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG
70/21.1	225-235	18-22
80/26.7	225-235	20-26
90/32.2	225-240	23-29
100/37.8	230-245	26-34
110/43.3	230-250	29-41

QF2200/RFC2085 REMOTE AIR COOLED

NOTE: These characteristics may vary depending on 24 Hour Ice Production

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	2150	1980	1840
80/26.7	2050	1870	1750
90/32.2	1870	1750	1635
100/37.8	1650	1530	1410
110/43.3	1400	1300	1250

QF2300/RFC2385 REMOTE AIR COOLED

NOTE: These characteristics may vary depending on 24 Hour Ice Production

24 Hour Ice Production

Air Temp. Entering Condenser °F/°C	Water Temperature °F/°C		
	50/10.0	70/21.1	90/32.2
70/21.1	2150	1980	1840
80/26.7	2050	1870	1750
90/32.2	1870	1750	1635
100/37.8	1650	1530	1410
110/43.3	1400	1300	1250

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG
-20 to 50/ -29 to 10.0	220-245 175-185*	14-18
70/21.1	220-250 210-225*	17-21
80/26.7	245-270	18-22
90/32.2	250-275	19-23
100/37.8	315-330	23-26
110/43.3	355-375	25-28

*Headmaster part number 82-5116-3 Only

Operating Pressures

Air Temp. Entering Condenser °F/°C	Freeze Cycle	
	Discharge Pressure PSIG	Suction Pressure PSIG
-20 to 50/ -29 to 10.0	175-185	14-18
70/21.1	210-220	19-21
80/26.7	225-265	20-22
90/32.2	250-275	19-23
100/37.8	275-305	21-26
110/43.3	300-340	22-28

Refrigerant Recovery/Evacuation and Recharging

REFRIGERANT RECOVERY/EVACUATION

Normal Self-Contained Model Procedures

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

Important

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

Important

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

CONNECTIONS

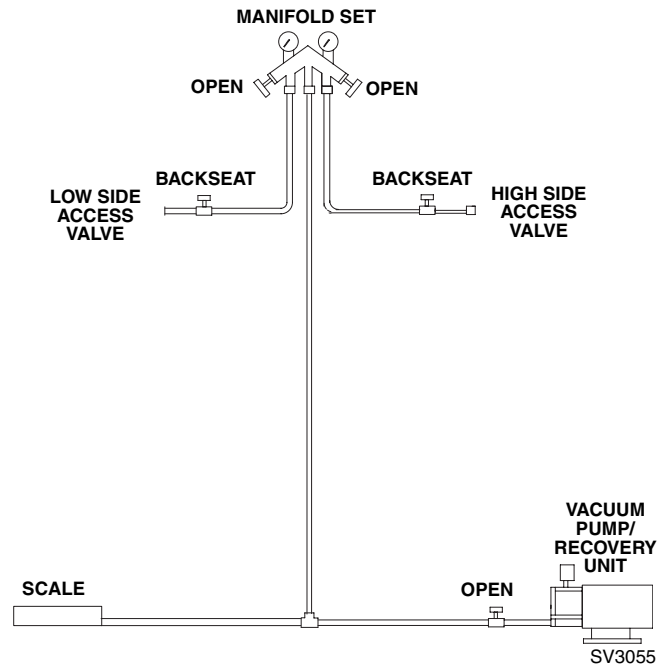
Quick disconnect fittings are recommended to prevent accidental release of refrigerant.

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

Do not purge refrigerant to the atmosphere. Capture refrigerant using recovery equipment. Follow the

SELF-CONTAINED RECOVERY/EVACUATION

1. Place the toggle switch in the OFF position and disconnect all power.
2. Install manifold gauges, charging cylinder/scale, and recovery unit or two-stage vacuum pump.



Recovery/Evacuation Connections

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

NOTE: Check for leaks using a halide or electronic leak detector after charging the ice machine.

4. Refer to Charging Procedures.

Remote Air-Cooled Models

manufacturer's recommendations.

Important

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

Important

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

Connections

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

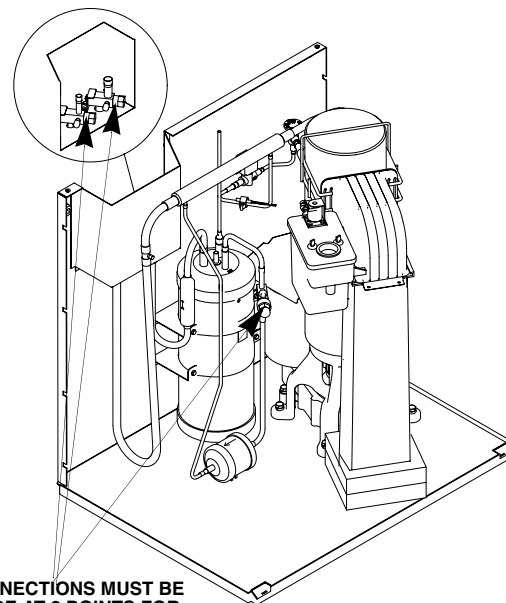
- Suction side of the compressor through the suction shut-off valve.
- Discharge side of the compressor through the liquid line shut-off valve.
- Receiver service valve, which evacuates the area between the check valve in the liquid line and the liquid line solenoid valve.

Warning

Recovery/Evacuation requires connections at three points for complete system recovery/evacuation. A check valve is located in the ice machine head section between the liquid line shut-off valve and the receiver. The check valve prevents refrigerant migration from the receiver to the condensing unit in the off cycle. Connections must be made at three points (receiver service valve, suction line and liquid line) to allow recovery and evacuation of the entire system.

Recovery/Evacuation (QF2200/QF2300)

1. Place the toggle switch in the OFF position and disconnect all power to the ice machine and condensing unit.
2. Install the manifold gauges, charging scale and recovery unit or two-stage vacuum pump.
3. Open the receiver service valve halfway.
4. Open high and low side on the manifold gauge set.
5. Perform recovery or evacuation:
 - A. Recovery: Operate the recovery unit as directed by the manufacturer's instructions.
 - B. Evacuation prior to recharging: Evacuate to 500 microns. Then allow the pump to run for an additional hour. Turn off the pump and perform a standing vacuum leak check.
6. Refer to Charging Procedures.



CONNECTIONS MUST BE
MADE AT 3 POINTS FOR
COMPLETE REFRIGERANT
RECOVERY OR EVACUATION

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Warning

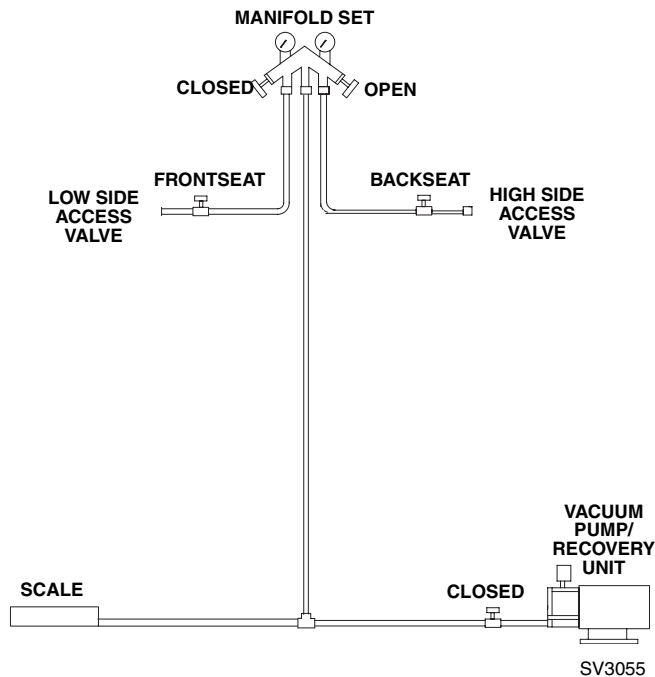
The receiver service valve (located in the ice machine head section) must be accessed during refrigerant recovery to allow complete removal of the refrigerant charge.

Self-Contained Model Charging Procedures

Important

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

1. Be sure the toggle switch is in the OFF position.



Charging Connections

2. Close the vacuum pump valve, the low side service valve, and the low side manifold gauge valve.
3. Open the high side manifold gauge valve, and backseat the high side access valve.
4. Open the charging cylinder and add the proper refrigerant charge (shown on nameplate) through the discharge access valve.
5. Let the system "settle" for 2 to 3 minutes.
6. Place the toggle switch in the ICE position.
7. Close the high side on the manifold gauge set. Add any remaining vapor charge through the suction access valve (if necessary).

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

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

Remote Charging Procedures (QF2200/QF2300)

1. Be sure the toggle switch is in the OFF position.
2. Close the vacuum pump valve and the low side manifold gauge valve.
3. Open the refrigerant cylinder and add the proper refrigerant charge (shown on nameplate) into the system high side (receiver service valve and discharge line quick-connect fitting).
4. If the high side does not take the entire charge, close the high side on the manifold gauge set. Start the ice machine and add the remaining charge through the suction filter low side service port. Compressor damage can result.
5. Ensure all vapor in charging hoses is drawn into the low side of the system, then disconnect the manifold gauges.
6. Run the ice machine in freeze cycle.
7. Close the receiver service valve in the ice machine head section.
8. Disconnect the manifold gauge set from the liquid line shut-off valve.
9. Open the high and low side valves on the manifold gauge set. Any refrigerant in the lines will be pulled into the low side of the system.
10. Allow the pressures to equalize while the ice machine is in the freeze cycle.
11. Disconnect the manifold gauge set from the suction line shut-off valve.
12. Remove the hoses from the ice machine and install the caps.

NOTE: Check for refrigerant leaks after all valve caps have been installed.

SYSTEM CONTAMINATION CLEAN-UP

General

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

Important

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

Determining Severity Of Contamination

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

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

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

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

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

Check the chart below to determine the type of cleanup required.

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

Mild System Contamination Cleanup Procedure

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

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

Important

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

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

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

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

Severe System Contamination Cleanup Procedure

1. Remove the refrigerant charge.
2. Remove the compressor.
3. If burnout deposits are found inside the suction or discharge lines at the compressor.
4. Wipe away any burnout deposits from suction and discharge lines at compressor.
5. Sweep through the open system with dry nitrogen.

Important

Refrigerant sweeps are not recommended, as they release CFC's into the atmosphere.

6. Install a new compressor and new start components.
7. Install a suction line filter-drier in front of compressor. (Remote Models replace suction filter with an acid removal suction filter/drier). Install access valves to allow pressure drop readings to be taken across the suction filter, when needed.
8. Install a new liquid line drier.

Continued on next page ...

9. Follow the normal evacuation procedure, except replace the evacuation step with the following:

Important

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

- A. Pull vacuum to 1000 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psi.
 - B. Change the vacuum pump oil.
 - C. Pull vacuum to 500 microns. Break the vacuum with dry nitrogen and sweep the system. Pressurize to a minimum of 5 psi.
 - D. Change the vacuum pump oil.
 - E. Pull vacuum to 500 microns. Run the vacuum pump for 1/2 hour.
10. Charge the system with the proper refrigerant to the nameplate charge.
11. Operate the ice machine for one hour. Then, check the pressure drop across the suction line filter/drier.
- A. If the pressure drop is less than 2 psi, the filter-drier should be adequate for complete cleanup.
 - B. If the pressure drop exceeds 2 psi, change the suction line filter-drier and the liquid line drier. Repeat until the pressure drop is acceptable.
12. Operate the ice machine for 48-72 hours. Then, remove the suction line filter/drier and change the liquid line drier. QF2300- Replace with a new suction filter.
13. Follow normal evacuation procedures.

REPLACING PRESSURE CONTROLS WITHOUT REMOVING REFRIGERANT CHARGE

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

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

Important

This is a required in-warranty repair procedure.

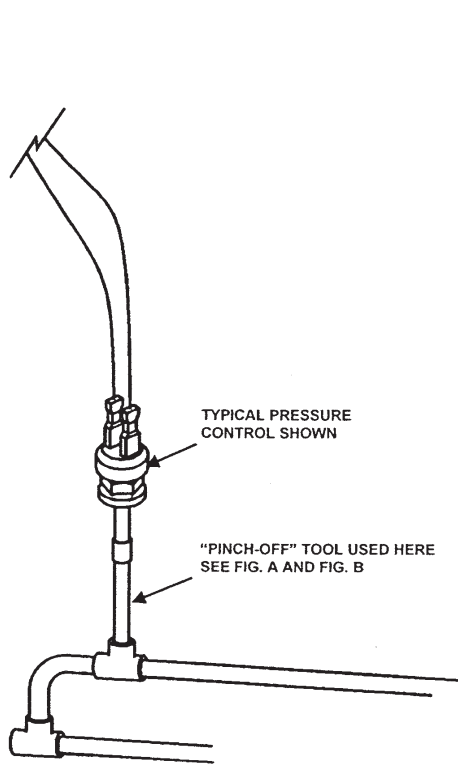
1. Disconnect power to the ice machine.
2. Follow all manufacturer's instructions supplied with the pinch-off tool. Position the pinch-off tool around the tubing as far from the pressure control as feasible. (See the figure on next page.) Clamp down on the tubing until the pinch-off is complete.

 **Warning**

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

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

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



Using Pinch-Off Tool

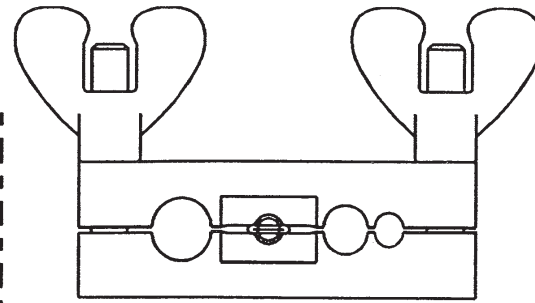


FIG. A - "PINCHING OFF" TUBING

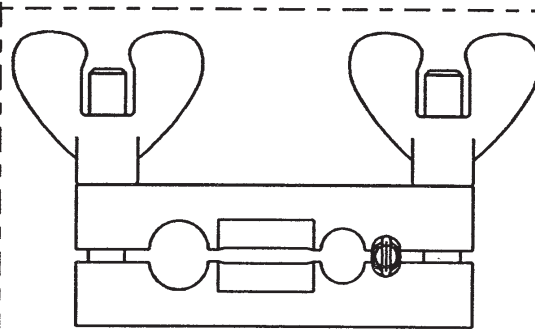


FIG. B - RE-ROUNDING TUBING

SV1406

FILTER-DRIERS

Liquid Line Filter Drier

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

The difference between Manitowoc driers and off-the-shelf driers is in filtration. Manitowoc driers have dirt-retaining filtration, with fiberglass filters on both the inlet and outlet ends.

These filter-driers have a very high moisture removal capability and a good acid removal capability.

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

Listed below are the recommended O.E.M. field replacement driers:

Model	Drier Size	End Connection Size	Part Number
QF400 QC700 QF800	UK-032S	1/4"	89-3025-3
QF2200/ QF2300	UK-083S	3/8"	89-3021-3

Important

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

Suction Line Filter

Remote condensing units have a suction line filter to trap particles introduced during field installation. The suction filter does not have acid or moisture removal capabilities.

Model	Drier Size	End Connection Size	Part Number
RFC2085/ RFC2385	ASF-45S6	3/4"	82-5026-3

SUCTION CLEAN-UP FILTER/DRIER

QF400/QC700/QF800

Contaminated systems must have a suction line filter/drier installed to remove contamination (See System Contamination Clean-Up Procedures). An access valve must be installed on the inlet side of the suction filter to allow pressure drop readings to be obtained.

Model	Drier Size	End Connection Size	Part Number
QF400 QC700 QF800	UK-165S	5/8"	89-3028-3

Remote Models

Contact your local Manitowoc Distributor for suction filter capable of cleaning the system. The clean-up filter drier must have a minimum nominal capacity of 3 hp. After clean-up is complete (see System Contamination Clean-Up Procedures), remove clean-up filter drier and replace with new suction filter.

TOTAL SYSTEM REFRIGERANT CHARGES

Important

This information is for reference only. Refer to the ice machine serial number tag to verify the system charge. Serial plate information overrides information listed on this page.

Series	Charge
QF400	13 oz. (369 g)
QC700	Air-Cooled - 20 oz (567 g)
QF800	Water-Cooled - 16 oz (454 g)
QF2200/QF2300	0' to 50' linesets 12.5 lbs (5.7 kg)
RFC2085/ RFC2385	50' to 100' linesets 14.0 lbs (6.4 kg)

NOTE: All ice machines on this list are charged using R-404A refrigerant.

REFRIGERANT DEFINITIONS**Recover**

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

Recycle

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

Reclaim

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

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

New Product Specifications

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

Revised 8/2003

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REFRIGERANT RE-USE POLICY

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

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

Important

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

Manitowoc approves the use of:

1. New Refrigerant

- Must be of original nameplate type.

2. Reclaimed Refrigerant

- Must be of original nameplate type.
- Must meet ARI Standard 700 (latest edition) specifications.

3. Recovered or Recycled Refrigerant

- Must be recovered or recycled in accordance with current local, state and federal laws.
- Must be recovered from and re-used in the same Manitowoc product. Re-use of recovered or recycled refrigerant from other products is not approved.
- Recycling equipment must be certified to ARI Standard 740 (latest edition) and be maintained to consistently meet this standard.
- Recovered refrigerant must come from a "contaminant-free" system. To decide whether the system is contaminant free, consider:
 - Type(s) of previous failure(s)
 - Whether the system was cleaned, evacuated and recharged properly following failure(s)
 - Whether the system has been contaminated by this failure
 - Compressor motor burnouts and improper past service prevent refrigerant re-use.
 - Refer to "System Contamination Cleanup" to test for contamination.

4. "Substitute" or "Alternative" Refrigerant

- Manitowoc Flake/Chiptlet ice machines use R404A refrigerant. Substitute refrigerants are not approved for use in Flake/Chiptlet ice machines.

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