

Hoshizaki America, Inc.

Modular Crescent Cuber Serenity Series

Model
KMS-I230MLH

Including
Condensing Unit Model SRK-I3H/3



“A Superior Degree
of Reliability”

www.hoshizaki.com

SERVICE MANUAL



Number: 73130
Issued: 2-21-2007

— **IMPORTANT** —

Only qualified service technicians should attempt to install, service or maintain this icemaker. No installation, service or maintenance should be undertaken until the technician has thoroughly read this Instruction Manual. Likewise, the owner/manager should not proceed to operate the icemaker until the installer has instructed them on its proper operation.

HOSHIZAKI provides this manual primarily to assist qualified service technicians in the installation, maintenance and service of the icemaker.

Should the reader have any questions or concerns which have not been satisfactorily addressed, please call, write or send an e-mail message to the HOSHIZAKI Technical Support Department for assistance.

HOSHIZAKI AMERICA, INC.
618 Highway 74 South
Peachtree City, GA 30269

Attn: HOSHIZAKI Technical Support Department

Phone: 1-800-233-1940 Technical Service
(770) 487-2331

Fax: 1-800-843-1056
(770) 487-3360

E-mail: techsupport@hoshizaki.com

Web Site: www.hoshizaki.com

NOTE: To expedite assistance, all correspondence/communication **MUST** include the following information:

- Model Number
- Serial Number
- Complete and detailed explanation of the problem

Please review this manual. It should be read carefully before the icemaker is serviced or maintenance operations are performed. Only qualified service technicians should service and maintain the icemaker. This manual should be made available to the technician prior to service or maintenance.

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I. Specifications

A. Ice maker

1. KMS-1230MLH – SRK-13H

AC SUPPLY VOLTAGE	208-230/60/1 (3 wire with neutral for 115V)				
AMPERAGE	15 A (5 Min. Freeze AT 104°F / WT 80°F)				
MINIMUM CIRCUIT AMPACITY	20 A				
MAXIMUM FUSE SIZE	20 A				
APPROXIMATE ICE PRODUCTION PER 24 HR.	Ambient Temp.(°F)	WATER TEMP. (°F)			
lbs./day (kg/day)		50	70	90	
Reference without *marks		70	* 1115 (506)	1118 (507)	1042 (473)
		80	1117 (507)	1122 (509)	1001 (454)
		90	1118 (507)	* 1126 (511)	1022 (464)
	100	1089 (494)	1102 (500)	927 (420)	
SHAPE OF ICE	Crescent Cube				
ICE PRODUCTION PER CYCLE	24 lbs. (10.9 kg) 1248 pcs.				
APPROXIMATE STORAGE CAPACITY	N/A				
ELECTRIC & WATER CONSUMPTION	90/70°F		70/50°F		
ELECTRIC W (kWH/100 lbs.)	2580 (5.5)		2648 (5.7)		
WATER gal./24HR (gal./100 lbs.)	303 (26.9)		570 (51.1)		
EXTERIOR DIMENSIONS (WxDxH)	KMS-1230MLH : 30" x 24" x 28" (762 x 610 x 711 mm) SRK-13H : 50" x 17" x 28" (1270 x 432 x 711 mm)				
EXTERIOR FINISH	KMS-1230MLH : Stainless steel; Galvanized steel (Rear) SRK-13H : Galvanized steel				
WEIGHT	KMS-1230MLH : Net 143 lbs. (65kg), Shipping 177 lbs. (80kg) SRK-13H : Net 230 lbs. (104kg), Shipping 273 lbs. (124kg)				
CONNECTIONS - ELECTRIC	Permanent Connection				
- WATER SUPPLY	Inlet	1/2" FPT			
- DRAIN	Outlet	3/4" FPT			
- CONDENSATE DRAIN		5/8" OD Pipe			
CUBE CONTROL SYSTEM	Float Switch				
HARVESTING CONTROL SYSTEM	Hot Gas and Water, Thermistor and Timer				
ICE MAKING WATER CONTROL	Timer Controlled, Overflow Pipe				
COOLING WATER CONTROL	N/A				
BIN CONTROL SYSTEM	Mechanical Level Switch and Timer				
COMPRESSOR	Hermetic, Model CS18K6E-PFV				
CONDENSER	Air cooled, Fin and Tube type				
EVAPORATOR	Vertical type, Stainless Steel and Copper				
REFRIGERANT CONTROL	Thermostatic Expansion Valve				
	Condensing Pressure Regulator				
REFRIGERANT CHARGE	R-404A, 16 lb. 5 oz. (7400 g) (Ice maker 7 oz.; Comp/Cond unit 15 lbs. 14 oz.)				
DESIGN PRESSURE	High 467 PSIG, Low 230 PSIG				
P.C. BOARD CIRCUIT PROTECTION	High Voltage Cut-out (Internal)				
COMPRESSOR PROTECTION	Auto-reset Overload Protector (Internal)				
REFRIGERANT CIRCUIT PROTECTION	Auto-reset High Pressure Control Switch				
LOW WATER PROTECTION	Float Switch				
ACCESSORIES -SUPPLIED	N/A				
-REQUIRED	Ice Storage Bin or Dispenser				
OPERATING CONDITIONS	VOLTAGE RANGE		187 - 253 V		
	AMBIENT TEMP.				
	KMS-1230MLH	45 - 100° F			
	SRK-13H (Outdoor use)	-20 - 122° F			
	WATER SUPPLY TEMP.		45 - 90° F		
	WATER SUPPLY PRESSURE		10 - 113 PSIG		

Note: We reserve the right to make changes in specifications and design without prior notice.

2. KMS-1230MLH – SRK-13H3

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Note: We reserve the right to make changes in specifications and design without prior notice.

B. Condensing Unit

1. SRK-13H

AC SUPPLY VOLTAGE	208-230/60/1 (3 wire with neutral for 115V) (Connection to icemaker)		
AMPERAGE	15 A (5 Min. Freeze AT 104°F / WT 80°F)		
MINIMUM CIRCUIT AMPACITY	20 A		
MAXIMUM FUSE SIZE	20 A		
EXTERIOR DIMENSIONS (WxDxH)	50" x 17" x 28" (1270 x 432 x 711 mm)		
DIMENSIONS INCLUDING LEGS (WxDxH)	52-3/8" x 19-1/2" x 43" (1330 x 495 x 1092 mm)		
EXTERIOR FINISH	Galvanized steel		
WEIGHT	Net 230 lbs. (104 kg)	Shipping 273 lbs. (124 kg)	
CONNECTIONS - ELECTRIC	Permanent - Connection		
- REFRIGERANT	Suction line	1-1/8-12 UNF Fitting (# 11 Parker)	
	Liquid line	1-1/16-12 UNF Fitting (# 10 Parker)	
COMPRESSOR	Hermetic, Model CS18K6E-PFV		
CONDENSER	Air cooled, Fin and Tube type		
COMPRESSOR PROTECTION	Auto-reset Overload Protector (Internal)		
FAN MOTOR PROTECTION	Thermal Protection		
REFRIGERANT CIRCUIT PROTECTION	Auto-reset High Pressure Control Switch		
REFRIGERANT CONTROL	Condensing Pressure Regulator		
REFRIGERANT CHARGE	15 lbs. 14 oz.	(7200 g)	
DESIGN PRESSURE	High 467 PSIG, Low 230 PSIG		
OPERATING CONDITIONS	VOLTAGE RANGE	187 - 253 V	
	AMBIENT TEMP. (Outdoor use)	-20 - 122° F	
ACCESSORIES -SUPPLIED	Leg		2 pcs
	Hex. Head Bolt w/Washer	M8 x 16	16 pcs
	Hex. Nut	M8	16 pcs

Note: We reserve the right to make changes in specifications and design without prior notice.

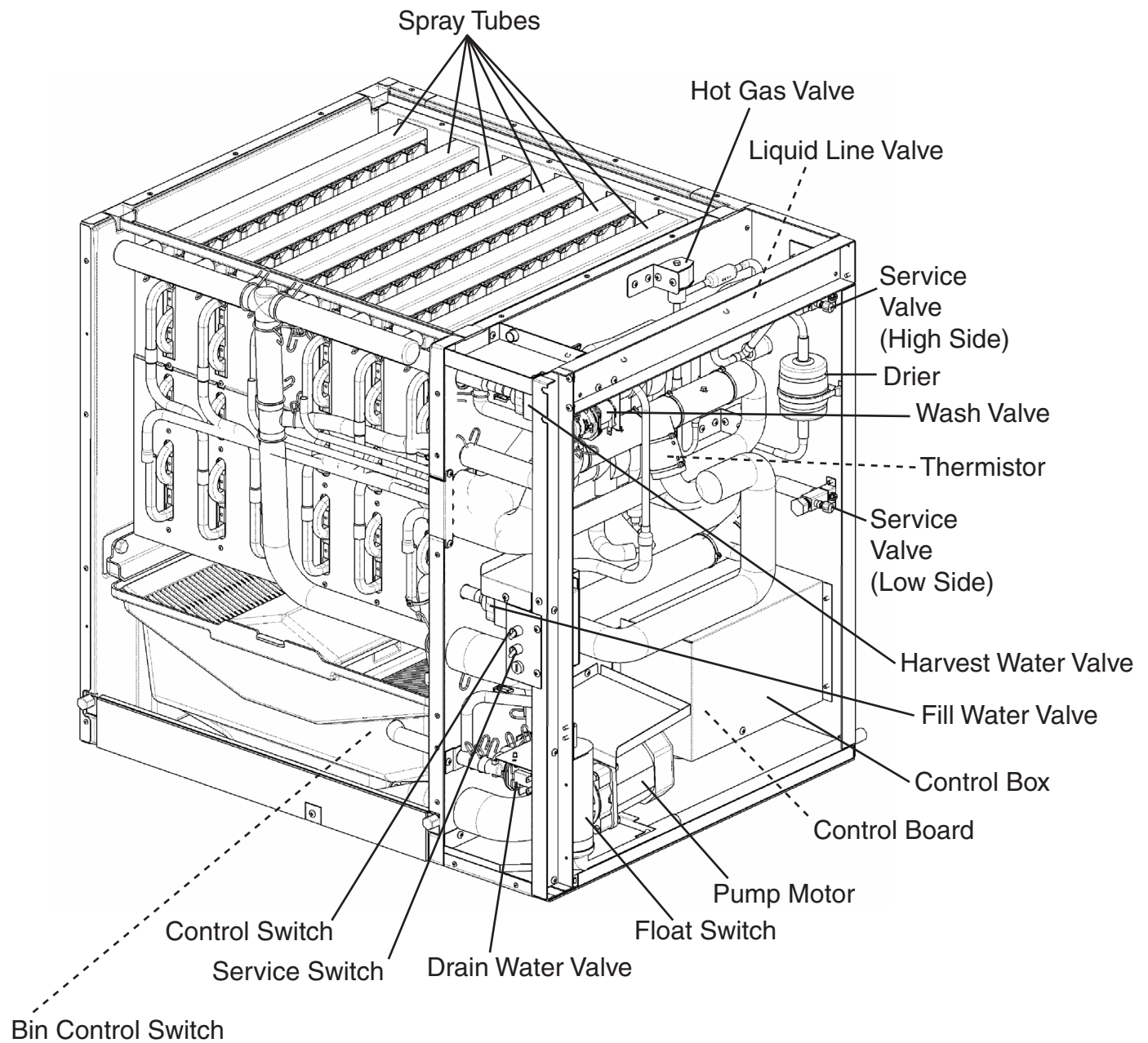
2. SRK-13H3

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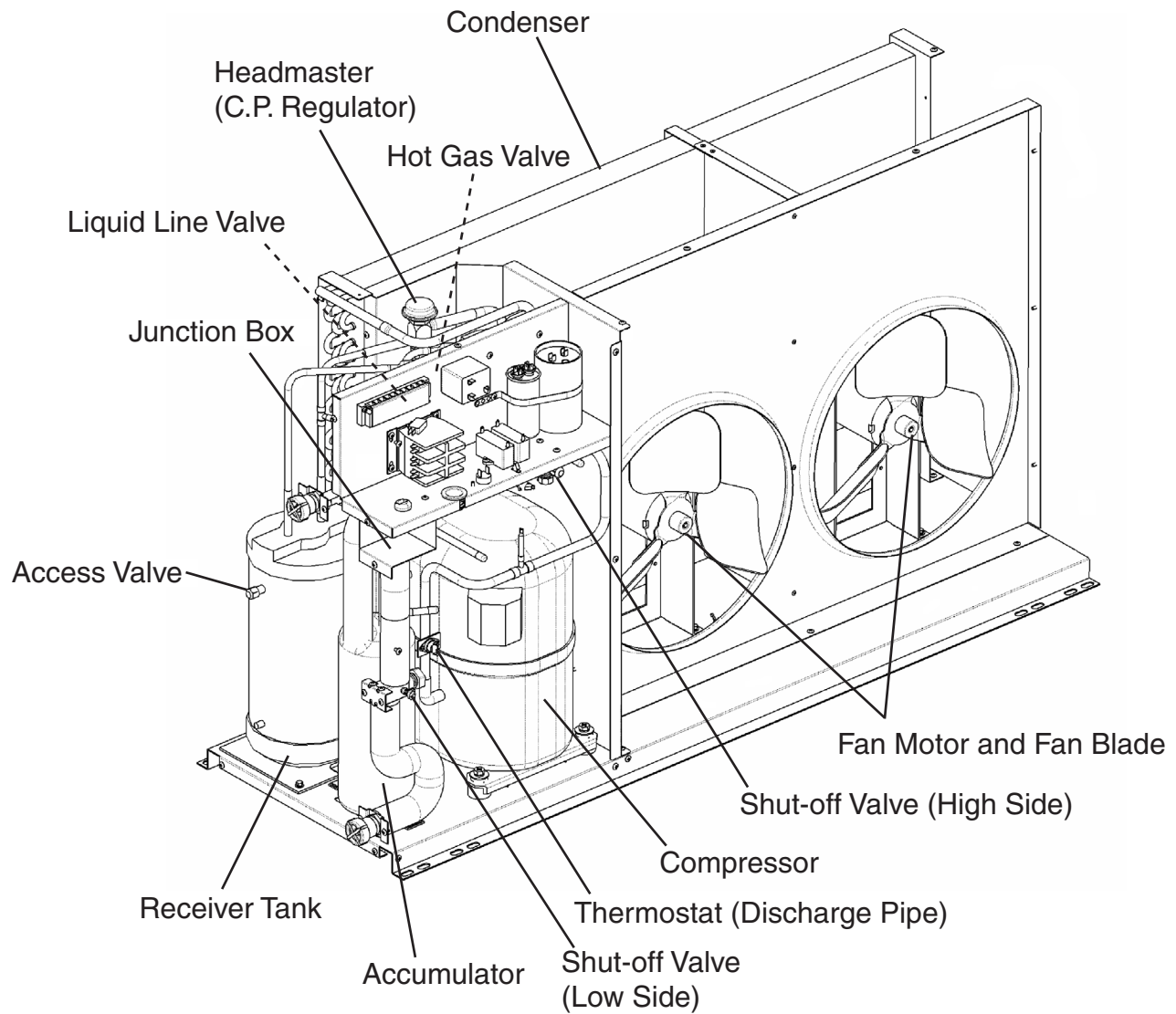
II. General Information

A. Construction

1. Icemaker



2. Condensing Unit



B. Sequence of Operation

The steps in the sequence are as outlined below. When power is supplied, the red POWER OK LED and the green BC CLOSED LED on the control board come on (If the yellow BC OPEN LED is on, the unit will not start. In this case clear ice away from the bin control actuator in the bin area). A 5-second delay occurs at startup. Note that the order of the green sequence LEDs from the outer edge of the board is 1, 4, 3, 2.

1. One Minute Fill Cycle

LED 4 is on. FWV opens and the fill period begins. After 1 minute, the board checks for a closed LF/S. If LF/S is closed, the harvest cycle begins. If not, FWV will remain energized through additional 1 minute cycles until water enters the sump and LF/S closes. This serves as a low water safety to protect the water pump.

2. Initial Harvest Cycle

LEDs 1, 4 and 2 are on. Comp, FMR, HGVs, HWV and X1 relay energize, FWV closes. The control board monitors the warming of the evaporator via the thermistor located on the suction line. When the thermistor reaches 48°F (9°C), the control board reads a 3.9 kΩ signal from the thermistor and turns harvest termination over to the adjustable harvest timer which is factory set for normal conditions. The timer has settings of 60, 90, 120, and 180 seconds (S4 dip switch 1 & 2). When the harvest timer completes its count down, the harvest cycle is complete and the freeze cycle starts. The minimum total time allowed by the board for a complete harvest cycle is 2 minutes. HWV is open during harvest for a maximum of 6 minutes or the length of harvest minus 50 seconds, whichever is shorter. LED 4 goes off when HWV closes. PM energizes and runs for the last 50 seconds of harvest. LED 3 comes on when PM energizes. At the end of harvest, the control board checks the position of LF/S and proceeds to the freeze cycle if it is closed or calls for a 1-minute fill if it is open.

3. Freeze Cycle

LED 1 is on. Comp, FMR and PM continue to run, LLVs open, HGVs close. For the first 5 minutes, the control board will not terminate the freeze cycle. As ice builds and LF/S opens, FWV opens (LED 4 is on when FWV is open). The refill will last until U/FS closes or for 60 seconds, whichever is shorter. After U/FS closes, FWV closes 3 seconds later. The KMS-1230MLH refills 1 time. After the refill, the freeze continues until LF/S opens again. The freeze cycle is then terminated, provided the 5 minute freeze timer has expired.

4. Pump-Out Cycle

The 1st pump out occurs after the 11th freeze cycle and every 10th cycle thereafter. LEDs 1, 3, and 2 are on. Comp and FMR continue to run, DWV opens, HGVs open, LLVs close. PM stops for 2 seconds. PM restarts, pumping water from the water tank through the DWV and down the drain. At the same time, water flows through the vent tube to power flush the F/S. After 10 seconds, the pump out is complete. The pump-out frequency control is factory-adjusted to drain the water tank every 10 cycles, and no adjustment is required. However, where water quality is bad and the icemaker needs a pump out more often, the pump-out frequency can be adjusted. See "II.C.3.d) Pump-Out Frequency Control."

5. Normal Harvest Cycle

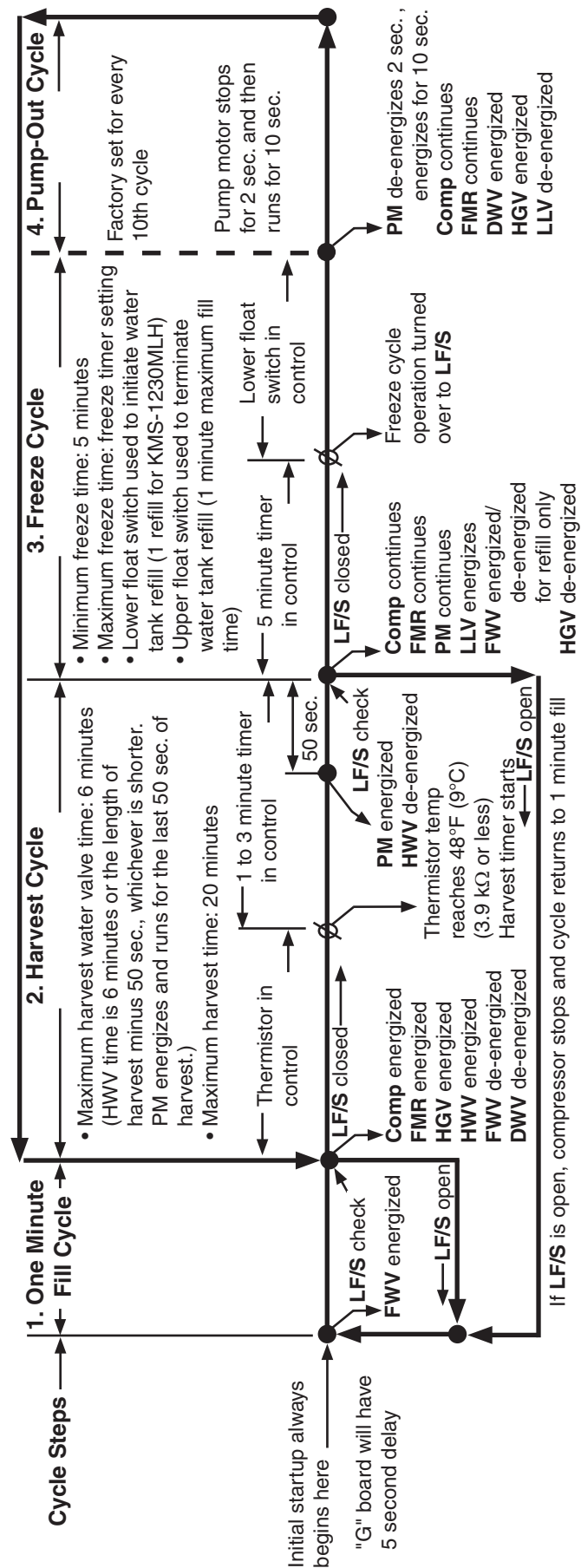
LEDs 1, 4 and 2 are on. Comp, FMR and HGVs remain energized. HWV and X1 relay energize, PM stops. As the evaporator warms, the thermistor reaches 48°F (9°C). The control board then receives the thermistor's 3.9 kΩ signal and starts the harvest timer. When the harvest timer completes its count down, the harvest cycle is complete. The minimum total time allowed by the board for a complete harvest cycle is 2 minutes. HWV is energized during harvest for a maximum of 6 minutes or the length of harvest minus 50 seconds, whichever is shorter. LED 4 goes off when HWV closes. PM energizes and runs for the last 50 seconds of harvest. LED 3 comes on when PM energizes. At the end of harvest, the control board checks the position of LF/S and proceeds to the freeze cycle if it is closed or calls for a 1-minute fill if it is open.

The unit continues to cycle through freeze and harvest cycles until the bin control activates (opens) and shuts the unit down.

Note: To prevent incomplete batches of ice from forming on the evaporator, the control board will only shut down the machine within the first 5 minutes of the freeze cycle. If ice pushes the bin control actuator in (open) after the first five minutes of the freeze cycle, the control board will allow the machine to complete the freeze cycle and the following harvest cycle before shutting down the machine.

Legend: **Comp**—compressor; **DWV**—drain water valve; **FMR**—remote fan motor; **F/S**—float switch; **FWV**—fill water valve; **HGV**—hot gas valve; **HWV**—harvest water valve; **LF/S**—lower float switch contacts; **LLV**—liquid line valve; **PM**—pump motor; **UF/S**—upper float switch contacts

KMS-1230MLH Sequence Flow Chart and Component Operation



Legend:

- Comp - compressor
- DWV - drain water valve
- FMR - remote fan motor
- FWV - fill water valve
- HGV - hot gas valve
- HWV - harvest water valve
- LF/S - lower float switch contacts
- LLV - liquid line valve
- PM - pump motor
- UF/S - upper float switch contacts

Components Energized when the Control Switch is in the SERVICE Position

When in the "SERVICE" position, the control switch supplies power to the service switch and the machine is in service mode. The service switch has three positions: "DRAIN," "CIRC." and "WASH." See the information below for details of each function.

DRAIN	Power is supplied to the pump and drain valve. This drains the water tank.
CIRC.	Power is supplied to the pump only. This operation can be used to circulate cleaner and sanitizer for extended periods of time over the outside surface of the evaporator.
WASH	Power is supplied to the pump and wash valve. This operation is used to circulate cleaner and sanitizer over both the inside and outside surfaces of the evaporator.

C. Control Board

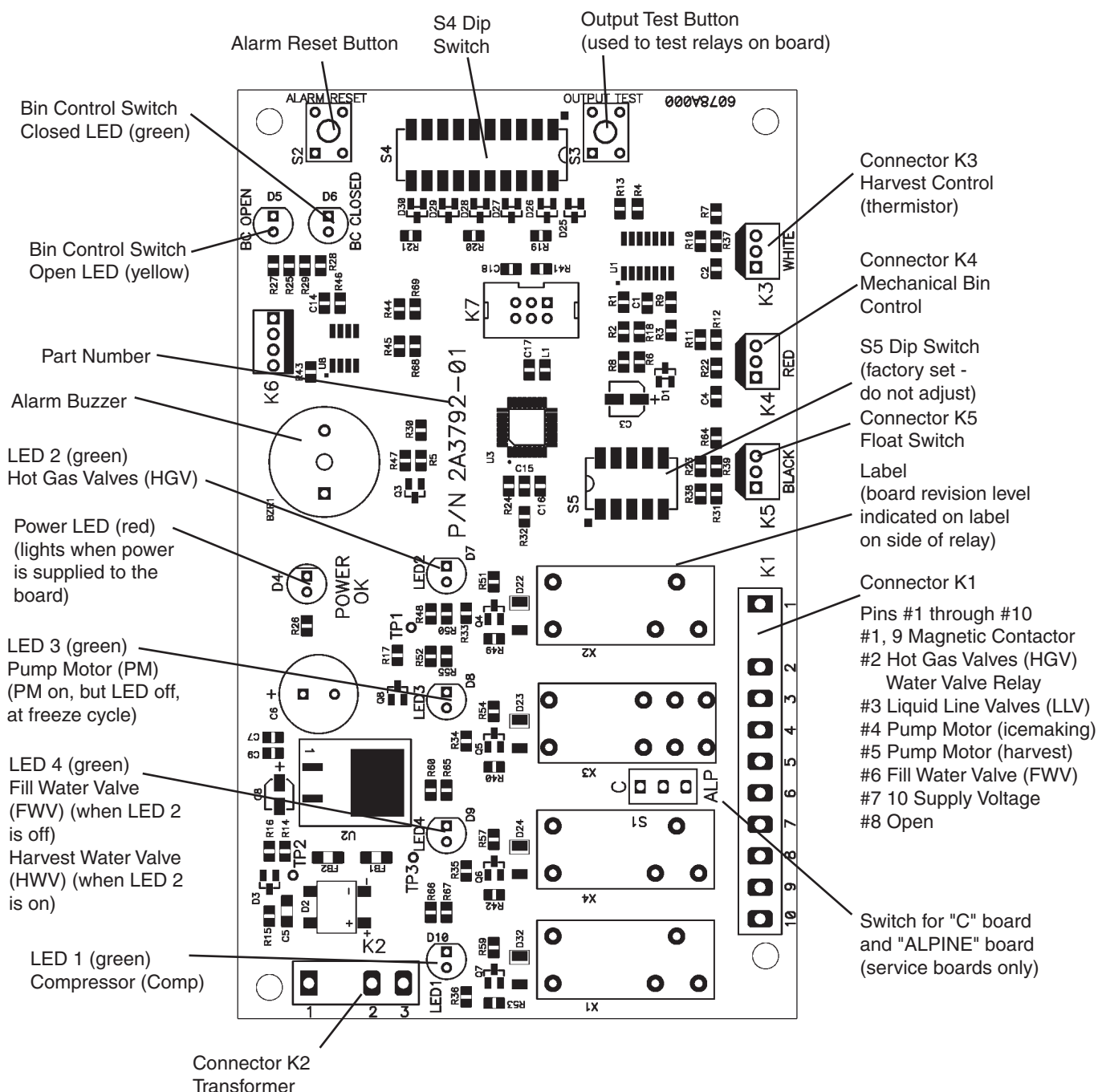
- A HOSHIZAKI exclusive solid-state control is employed in the KMS-1230MLH Modular Crescent Cuber.
- All models are pretested and factory-adjusted.

CAUTION

1. Fragile, handle very carefully.
2. A control board contains integrated circuits, which are susceptible to failure due to static discharge. It is especially important to touch the metal part of the unit when handling or replacing the board.
3. Do not touch the electronic devices on the board or the back of the board to prevent damage to the board.
4. Do not change wiring and connections. Do not misconnect K3, K4 and K5, because the same connector is used for the thermistor, mechanical bin control and float switch.
5. Always replace the whole board assembly if it goes bad.
6. Do not short out power supply to test for voltage.

1. Control Board Layout

Control Products "G" Control Board



Control Board	
Part Number	2A3792-01 (factory); 2A3792-02 (service)

2. Features

a) Maximum Water Supply Period – 6 minutes

The harvest water valve will be open during harvest for 6 minutes or the length of harvest minus 50 seconds, whichever is shorter.

b) Harvest Backup Timer and Freeze Timer

The harvest backup timer shuts down the icemaker if, for two cycles in a row, the harvest cycle takes more than 20 minutes to complete. The control board will signal this problem using 2 beeps every 3 seconds.

The freeze timer shuts down the icemaker if, for two cycles in a row, the freeze cycle takes longer than the time specified to complete. The control board will signal this problem using 3 beeps every 3 seconds. The time is factory set using S4 dip switch 9 & 10.

The alarm reset button on the control board must be pressed with power on to reset either of these safeties.

c) High Temperature Safety

The temperature of the suction line in the refrigeration circuit is limited by the high temperature safety. This protects the unit from excessively high temperatures. If the evaporator temperature rises above $127 \pm 7^{\circ}\text{F}$ ($53 \pm 4^{\circ}\text{C}$), the control board reads a .804 k Ω signal from the thermistor and operates the safety. This shuts down the circuit and the icemaker automatically stops.

The control board will signal this problem using 1 beep every 3 seconds. The alarm reset button on the control board must be pressed with power on to reset the safety.

d) Low Water Safety

The control board checks the position of the lower float switch at the end of the initial one minute water fill cycle and at the end of each harvest cycle. If the lower float switch is closed, the control board proceeds to the next cycle. If the lower float switch is open, the control board calls for a one minute water fill cycle. After one minute, the control board checks the position of the float and either proceeds to the next cycle if the lower float switch is closed or calls for an additional one minute fill if the switch is open. This serves as a low water safety to protect the water pump.

e) High Voltage and Low Voltage Cut-outs

High voltage and low voltage cut-outs help protect the icemaker from supply voltages outside of the accepted range.

If miswiring causes excessive voltage (147Vac $\pm 5\%$ or more for 3 seconds) on the control board, the high voltage cut-out shuts down the circuit and the icemaker automatically stops. The control board will signal this problem using 7 beeps every 3 seconds.

The icemaker also automatically stops in cases of insufficient voltage (92Vac $\pm 5\%$ or less). The control board will signal this problem using 6 beeps every 3 seconds.

When the proper supply voltage is resumed, the icemaker *automatically* starts running again.

f) LED Lights and Audible Alarm Safeties

The red LED indicates control voltage (10 to 12V at K2) and will remain on unless a control voltage problem occurs. At startup a 5 second delay occurs while the board conducts an internal timer check. A beep occurs when the control switch is moved to the "ICE" position.

The green LEDs 1 through 4 energize and sequence from initial startup as listed in the table below. Note that the order of the LEDs from the outer edge of the board is 1, 4, 3, 2. For more information, see "II.B. Sequence of Operation."

Sequence Step	LED	Energized Components	Time LEDs are On		
			Min.	Max.	Avg.
1 Minute Fill Cycle	4	FWV			60 seconds
Harvest Cycle	1, 4 and 2	HWV, HGV, Comp, FMR	2 minutes	20 minutes	3 to 5 minutes
Last 50 seconds of harvest, HWV de-energizes and PM energizes (LEDs 1, 3 and 2 are on)					
Freeze Cycle	1 (and 4 at refills)	Comp, PM, FMR, LLV (FWV at refill)	5 minutes	freeze timer setting	30 to 35 minutes
Pump-Out	1, 3 and 2	Comp, HGV, PM, DWV, FMR	10 seconds	20 seconds	factory setting

The built in safeties shut down the unit and have alarms as listed below.

No. of Beeps (every 3 sec.)	Type of Alarm	Notes
1	High Evaporator Temp. (temperature > 127°F) (53°C)	Check for harvest problem (stuck HGV or relay), hot water entering unit, stuck HM or shorted thermistor.
2	Harvest Backup Timer (harvest > 20 min. for two cycles in a row)	Check for open thermistor, HGV not opening, TXV leaking by, low charge or inefficient Comp.
3	Freeze Timer (freeze > specified setting for two cycles in a row) Timer is factory set using S4 dip switch 9 & 10	Check for a float switch stuck closed (up), HWV or FWV leaking by, HGV leaking by, TXV not feeding properly, low charge, HM not bypassing or inefficient compressor.
To reset the above safeties, press the alarm reset button with the power supply on.		
6	Low Voltage (92Vac ±5% or less)	Red LED will turn off if voltage protection operates.
7	High Voltage (147Vac ±5% or more)	The control voltage safeties automatically reset when voltage is corrected.

Legend: **Comp**—compressor; **DWV**—drain water valve; **FMR**—remote fan motor; **FWV**—fill water valve; **HGV**—hot gas valve; **HM**—headmaster; **HWV**—harvest water valve; **LLV**—liquid line valve; **PM**—pump motor; **TXV**—thermostatic expansion valve

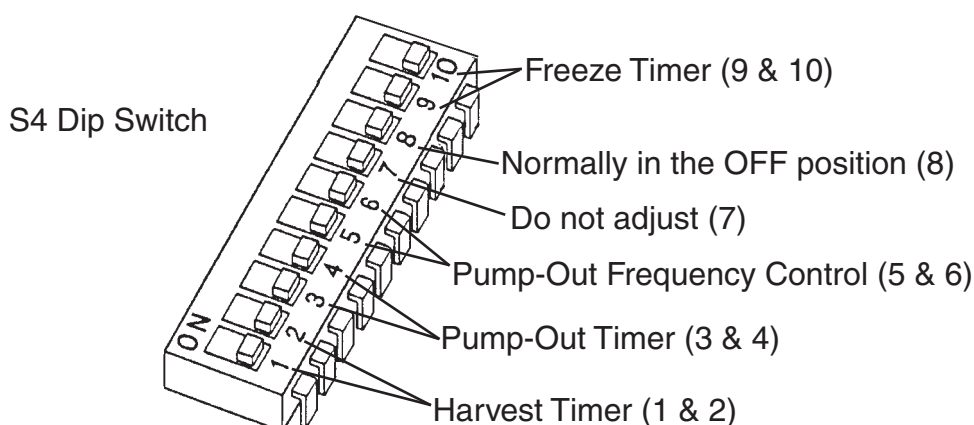
3. Controls and Adjustments

a) Default Dip Switch Settings

The dip switches are factory-adjusted to the following positions:

S4 Dip Switch										
Dip Switch No.	1	2	3	4	5	6	7	8	9	10
KMS-1230MLH	ON	OFF	OFF	ON	ON	ON	ON	OFF	OFF	ON

S5 Dip Switch (Do Not Adjust)					
Dip Switch No.	1	2	3	4	5
KMS-1230MLH	OFF	ON	OFF	OFF	OFF



b) Harvest Timer (S4 dip switch 1 & 2)

The harvest timer starts counting when the thermistor reads 48°F (9°C) at the evaporator outlet. No adjustment is required under normal use, as the harvest timer is adjusted to the suitable position. Before changing this setting, call the HOSHIZAKI Technical Support Department at 1-800-233-1940 for recommendations. Keep in mind that setting the harvest timer to a longer setting will decrease 24 hour production.

Dip Switch Setting		Time (seconds)
No. 1	No. 2	
OFF	OFF	60
ON	OFF	90
OFF	ON	120
ON	ON	180

c) Pump-Out Timer (S4 dip switch 3 & 4)

During cycles when a pump out is called for, the pump motor drains the water tank for the time determined by the pump-out timer. The pump-out timer also acts in place of the harvest timer during cycles with a pump out.

The pump-out timer is factory-adjusted, and no adjustment is required.

Dip Switch Setting		Time (seconds)	
No. 3	No. 4	T1	T2
OFF	OFF	10	150
ON	OFF	10	180
OFF	ON	10	120
ON	ON	20	180

T1: Time to drain the water tank

T2: Harvest timer at pump out

Depending on the pump-out frequency control setting (dip switch 5 & 6), pump out occurs every cycle, or every 2nd, 5th or 10th cycle.

d) Pump-Out Frequency Control (S4 dip switch 5 & 6)

The pump motor drains the water tank at the frequency set by the pump-out frequency control.

The pump-out frequency control is factory-adjusted to drain the water tank every 10 cycles, and no adjustment is required. However, where water quality is bad and the icemaker needs a pump out more often, the pump-out frequency can be adjusted as shown in the table below.

Dip Switch Setting		Frequency
No. 5	No. 6	
OFF	OFF	every cycle
ON	OFF	every 2 cycles
OFF	ON	every 5 cycles
ON	ON	every 10 cycles

e) S4 Dip Switch 7 & 8

Factory set for optimum performance. Do not adjust.

f) Freeze Timer (S4 dip switch 9 & 10)

CAUTION

Adjust to proper specification, or the unit may not operate correctly.

The freeze timer setting determines the maximum allowed freeze time to prevent possible freeze-up issues. Upon termination of freeze timer, the control board initiates the harvest cycle. After 2 consecutive timer terminations, the control board shuts the machine down. In this case, see "IV.B.3. Low Ice Production" for possible solutions. The freeze timer is factory adjusted and no adjustment is required.

Dip Switch Setting		Time (minutes)
No. 9	No. 10	
OFF	OFF	60
OFF	ON	50
ON	OFF	70
ON	ON	60

g) Float Switch Control and Refill Counter (S5 dip switch 1 through 5)

Do not adjust. These must be left in the factory default position or the unit will not operate properly. The KMS-1230MLH refills 1 time.

4. Control Board Check Procedure

Before replacing a control board that does not show a visible defect and that you suspect is bad, always conduct the following check procedure. This procedure will help you verify your diagnosis.

- 1) Check the S4 and S5 dip switch settings to assure that they are in the factory default positions.
- 2) Turn the control switch to "ICE" and check for proper control voltage. If the red LED is on, the control voltage is good. If the red LED is off, check the control transformer circuit.
- 3) Check the 115 volt input at the wire harness terminals and the 10-pin connector. Check the brown and white wire at pin #10 to a white neutral wire for 115 volts. (Always choose a white neutral wire to establish a good neutral connection when checking voltages.) On the 10 pin connector, a jumper also feeds 115 volts into pin #7. If no voltage is present, check the 115 volt supply circuit.
- 4) The output test button provides a relay sequence test. Make sure the control switch is in the "ICE" position, then press the output test button. The correct lighting sequence should be 1, 4, 3, 2. Some components (e.g., the compressor) will cycle during the test. Note that the order of the relays from the outer edge of the board is 1, 4, 3, 2. After checking the sequence, the unit automatically starts at the 1 minute fill cycle. If the LEDs light in a different sequence, the control board is bad and should be replaced.

5. Control Board Replacement

The application switch located between relay X3 & X4 must be set to match the original board application. Place this switch in the ALP position if there is no white wire supplied to the K1 connector. If there is a white wire, place the switch in the C position. If this switch is placed in the wrong position either the compressor contactor will remain energized with the control switch OFF or the unit will not start.

The dip switches should be adjusted to the factory default settings as outlined in this manual. S4 dip switch #8 must remain in the OFF position.

D. Harvest Control – Thermistor

A thermistor (semiconductor) is used for a harvest control sensor. The resistance varies depending on the suction line temperatures. The thermistor detects the temperature of the evaporator outlet to start the harvest timer. No adjustment is required. If necessary, check for resistance between thermistor leads, and visually check the thermistor mounting, located on the suction line next to the evaporator outlet.

Temperature (°F)	Temperature (°C)	Resistance (kΩ)
0	-18	14.401
10	-12	10.613
32	0	6.000
50	10	3.871
70	21	2.474
90	32	1.633

Check a thermistor for resistance by using the following procedure:

- 1) Disconnect the connector K3 on the board.
- 2) Remove the thermistor. See "V.C.6. Removal and Replacement of Thermistor."
- 3) Immerse the thermistor sensor portion in a glass containing ice and water for 2 or 3 minutes.
- 4) Check for a resistance between thermistor leads. Normal reading is within 3.5 to 7 kΩ. Replace the thermistor if it exceeds the normal reading.

E. Float Switch

1. Explanation of Operation

The float operates 2 switches within the float switch. The lower switch (black and blue wires) is used for low water safety protection, initiating the freeze cycle refill and terminating the freeze cycle. The upper switch (black and red wires) is used to terminate the freeze cycle refill only. Refill will last until the upper float switch closes or the 1 minute countdown timer ends, whichever comes first.

2. Cleaning

Depending on local water conditions, scale may build up on the float, float switch shaft and inside the housing. Scale on the float or shaft can cause the float to stick causing erratic operation. The float switch should be cleaned and checked before replacing. First, disconnect the black K5 float switch connector from the control board and remove the float switch and rubber boot from the icemaker. Remove the rubber boot from the float switch. Twist the mechanical lock at the top of the float housing and lower out the float and float shaft. Remove the retainer clip from the shaft and slide the float off the shaft. Soak the switch assembly in ice machine cleaner. Wipe down the shaft, float, housing, and rubber boot with cleaning solution. See "VI. Cleaning and Maintenance Instructions."

3. Float Switch Check Procedure

Before replacing a float switch that you suspect is bad, make sure the float switch has been cleaned. This procedure will help you verify your diagnosis. The float switch has three wires. The black wire is common. The blue wire is for the lower float switch contact and the red wire is for the upper float switch contact.

- 1) Disconnect the black K5 float switch connector from the control board.
- 2) Drain the reservoir water.
- 3) Turn the control switch to "ICE".
- 4) As water fills the reservoir, the float switch contacts should close. Check continuity of the lower float switch contacts using the black and blue wires and the upper float switch contacts using the black and red wires. With the float positioned all the way up, both float switch contacts should be closed. If either float switch contact fails, the assembly should be replaced.
- 5) Turn the control switch to "OFF".
- 6) Drain the reservoir water.
- 7) As water drains, the float switch contacts should open. Check continuity of the upper float switch contacts using the black and red wires and the lower float switch contacts using the black and blue wires. With the float positioned all the way down, both float switch contacts should be open. If either float switch contact fails, the assembly should be replaced.
- 8) Reconnect the black K5 connector to the control board when finished.

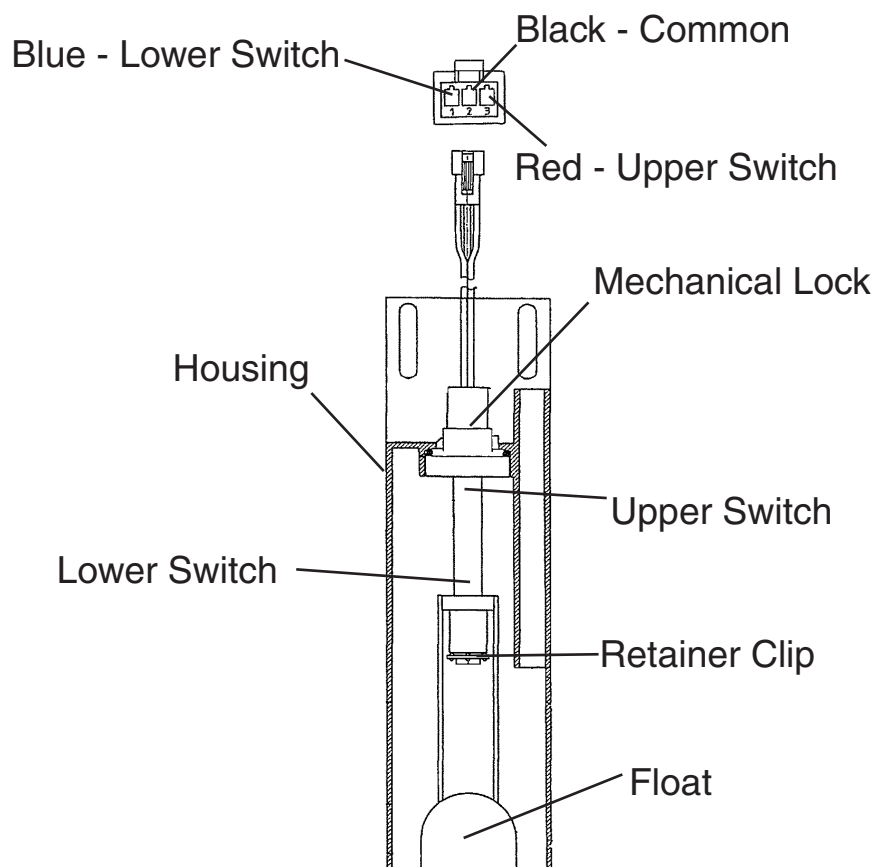


Fig. 1
Float Switch

F. Bin Control

This machine uses a lever-actuated proximity switch (mechanical bin control) to control the ice level in the storage bin. No adjustment is required.

1. Explanation of Operation

The bin control is connected to the red K4 connector on the control board. When the bin control is calling for ice (proximity switch closed; green LED, BC CLOSED, on), the control board continues icemaking operations. When the bin control is activated in the bin full position (proximity switch open; yellow LED, BC OPEN, on), the control board shuts down the unit. However, to prevent incomplete batches of ice from forming on the evaporator, the control board will only shut down the machine within the first 5 minutes of the freeze cycle. If ice pushes the lever in after the first five minutes of the freeze cycle, the control board will allow the machine to complete the freeze cycle and the following harvest cycle before shutting down the machine.

2. Bin Control Check Procedure

- 1) Clear any ice away from the bin control.
- 2) Turn the control switch to "ICE".
- 3) Check that the green "BC CLOSED" LED on the control board is on.
- 4) Activate the bin control actuator (press the actuator in). Check that the yellow "BC OPEN" LED on the control board is on.
- 5) Disconnect the red K4 bin control connector from the control board.
- 6) Check for continuity across the bin control leads. When calling for ice, the bin control proximity switch should be closed. If open, replace the bin control. Activate the bin control actuator (press the actuator in), check for continuity across the bin control leads. The bin control proximity switch should be open. If closed, replace the bin control.
- 7) Reconnect the red K4 connector. Allow the machine to cycle into the freeze cycle. In the first 5 minutes of the freeze cycle, activate the bin control actuator (press the actuator in). The yellow "BC OPEN" LED should come on and the machine should turn off. If not, replace the control board.

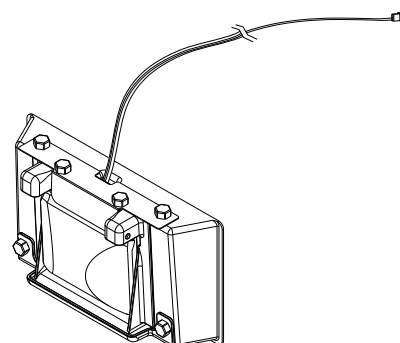
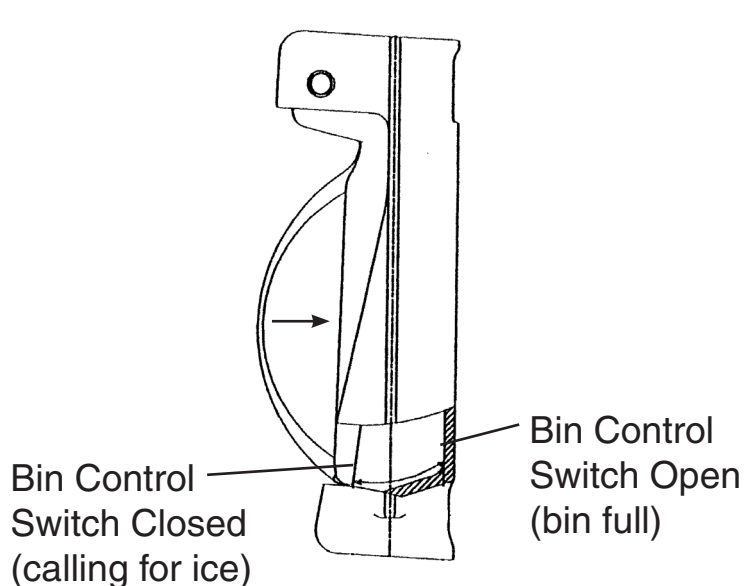


Fig. 2
Bin Control

G. Switches

Two control switches are used to control operation in KMS Series Modular Crescent Cubers. These switches are referred to as the "control switch" and the "service switch" and are located on the control box.

1. Control Switch

The control switch has three positions: "OFF" for power off; "ICE" for icemaking, and "SERVICE" to activate the service switch.

2. Service Switch

When the control switch is in the "SERVICE" position, the control switch supplies power to the service switch and the machine is in service mode. The service switch has three positions: "DRAIN," "CIRC." and "WASH." See the information below for details of each function.

Note:

1. When the service switch is activated, power is supplied to the water pump in all three positions.
2. When the control switch is in the "OFF" position or in the "ICE" position, the service switch has no power and can be left in any position.

a) DRAIN

The KMS series utilizes a pump-out drain system. When the service switch is active and placed in the "DRAIN" position, power is supplied to the pump and drain valve.

b) CIRC.

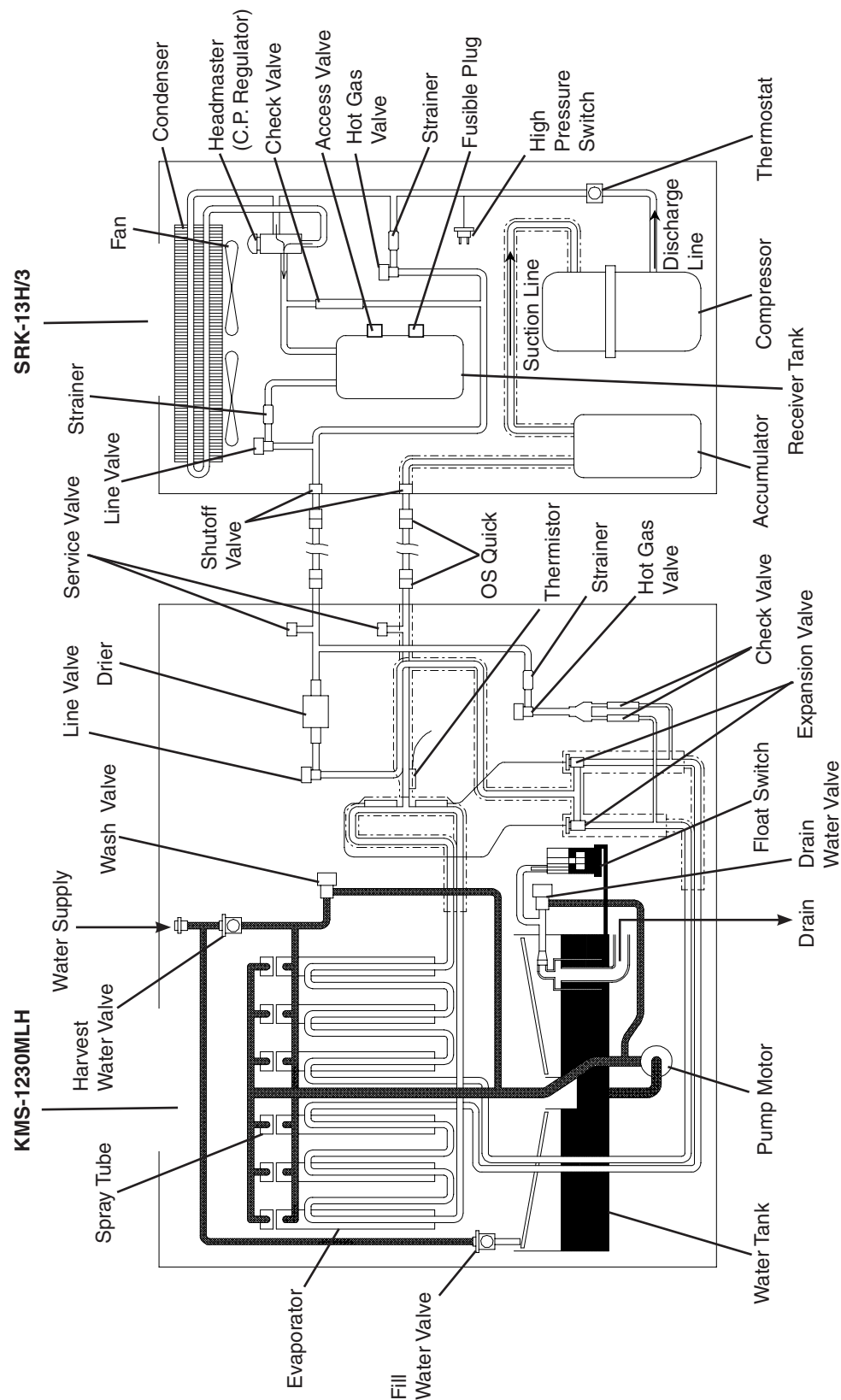
When the service switch is active and placed in the "CIRC." position, power is supplied to the pump only. This operation can be used to circulate cleaner for extended periods of time over the outside surface of the evaporator.

c) WASH

The KMS series utilizes a solenoid operated wash (bypass) valve. When the service switch is active and placed in the "WASH" position, power is supplied to the pump and wash valve. This operation is used to circulate cleaner and sanitizer over both the inside and outside of the evaporator.

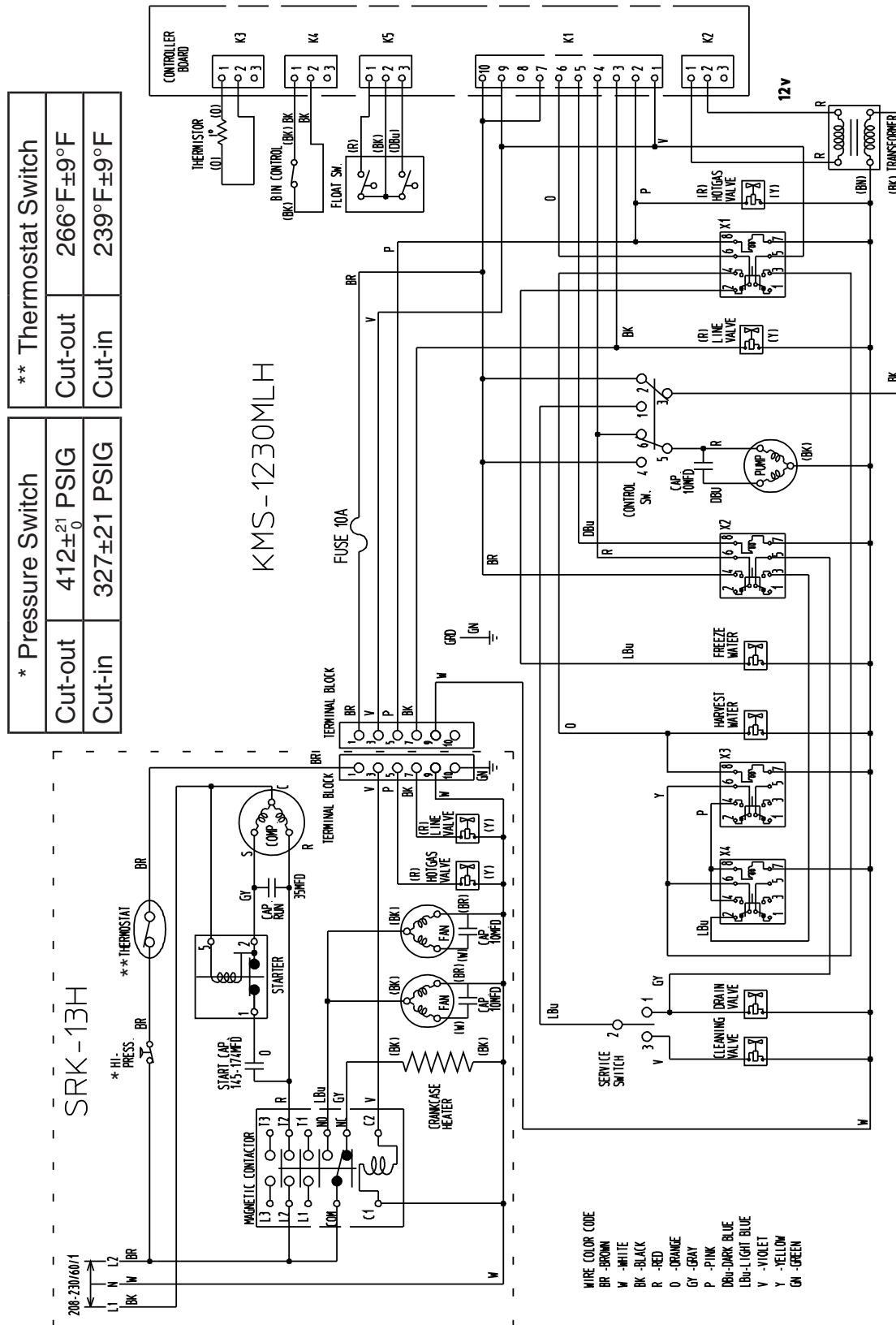
III. Technical Information

A. Water Circuit and Refrigeration Circuit



B. Wiring Diagrams

1. KMS-1230MLH – SRK-13H



2. KMS-1230MLH – SRK-13H3

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C. Performance Data

1. KMS-1230MLH – SRK-13H

APPROXIMATE ICE PRODUCTION PER 24 HR.	AMBIENT TEMP. (°F/°C)	WATER TEMP. (°F/°C)					
		50/10		70/21		90/32	
	70/21	1115	<u>506</u>	1118	<u>507</u>	1042	<u>473</u>
	80/27	1117	<u>507</u>	1122	<u>509</u>	1001	<u>454</u>
	90/32	1118	<u>507</u>	1126	<u>511</u>	1022	<u>464</u>
lbs./day <u>kg./day</u>	100/38	1089	<u>494</u>	1102	<u>500</u>	927	<u>420</u>
APPROXIMATE ELECTRIC CONSUMPTION	70/21	2648		2628		2655	
	80/27	2633		2602		2658	
	90/32	2628		2580		2625	
	100/38	2621		2591		2665	
watts							
APPROXIMATE WATER CONSUMPTION PER 24 HR.	70/21	570	<u>2.16</u>	492	<u>1.86</u>	433	<u>1.64</u>
	80/27	510	<u>1.93</u>	389	<u>1.47</u>	357	<u>1.35</u>
	90/32	492	<u>1.86</u>	303	<u>1.15</u>	258	<u>0.98</u>
	100/38	394	<u>1.49</u>	292	<u>1.11</u>	217	<u>0.82</u>
gal./day <u>m³/day</u>							
FREEZING CYCLE TIME	70/21	26		26		28	
	80/27	26		26		29	
	90/32	26		27		29	
	100/38	27		27		31	
min.							
HARVEST CYCLE TIME	70/21	6		5		5	
	80/27	5		4		4	
	90/32	5		3		3	
	100/38	4		3		3	
min.							
HEAD PRESSURE	70/21	230	<u>16.2</u>	231	<u>16.3</u>	249	<u>17.5</u>
	80/27	231	<u>16.2</u>	233	<u>16.4</u>	260	<u>18.3</u>
	90/32	231	<u>16.3</u>	235	<u>16.5</u>	258	<u>18.2</u>
	100/38	240	<u>16.9</u>	240	<u>16.9</u>	280	<u>19.7</u>
PSIG <u>kg/cm²G</u>							
SUCTION PRESSURE	70/21	39	<u>2.7</u>	40	<u>2.8</u>	41	<u>2.9</u>
	80/27	40	<u>2.8</u>	41	<u>2.9</u>	43	<u>3.0</u>
	90/32	40	<u>2.8</u>	42	<u>3.0</u>	44	<u>3.1</u>
	100/38	40	<u>2.8</u>	42	<u>3.0</u>	45	<u>3.2</u>
PSIG <u>kg/cm²G</u>							
TOTAL HEAT OF REJECTION (SRK-13H UNIT)				23700 BTU/h [AT 90°F (32°C) / WT 70°F (21°C)]			
CONDENSER VOLUME (SRK-13H UNIT)				226 CU. IN			

Note:

1. Pressure data is recorded at 5 minutes into freezing cycle. The data not in bold should be used for reference only.
2. We reserve the right to make changes in specifications and design without prior notice.

2. KMS-1230MLH – SRK-13H3

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IV. Service Diagnosis

A. 10-Minute Diagnostic Procedure

The 10-minute check out procedure is basically a sequence check which can be used at unit start-up or for system diagnosis. Using this check out procedure will allow you to diagnose electrical system and component failures in approximately 10 minutes under normal operating conditions of 70°F (21°C) or warmer air and 50°F (10°C) or warmer water temperatures. Before conducting a 10 minute checkout, check for correct installation, proper voltage per unit nameplate and adequate water supply. As you go through the procedure, check to assure the components energize and de-energize correctly. If not, those components and controls are suspect.

- 1) Turn power off and access the icemaker's control box. Clear any ice from the bin control actuator located in the bin.
- 2) Turn power on and place the control switch in the "ICE" position. A 5 second delay occurs. The red "POWER OK" LED and the green "BC CLOSED" LED on the control board come on.
- 3) **One Minute Fill Cycle** – LED 4 is on. The fill water valve is energized. After 1 minute, the control board checks for a closed lower float switch. If the lower float switch is closed, the harvest cycle begins. If closed, continue to step 4. If the lower float switch is open, the fill water valve will remain energized through additional 1 minute fill cycles until water enters the sump and the lower float switch closes (low water safety protection during initial start up and at the end of each harvest). **Diagnosis:** If the fill water valve does not open, check for no supply voltage at water valve terminals, bad coil, or plugged screen or external filter (no water flow). If the reservoir fills, but the unit fails to start harvest, check for open lower float switch (see "II.F.3. Float Switch Check Procedure") or bad 1 minute timer in control board. See "II.C.4. Control Board Check Procedure."
- 4) **Initial Harvest Cycle** – LEDs 1, 4 and 2 are on. The contactor coil energizes to start the compressor and fan motors, the hot gas valves energize (also energizing the X1 relay), the harvest water valve energizes and the fill water valve de-energizes. The harvest water valve is open during harvest for a maximum of 6 minutes or the length of harvest minus 50 seconds, whichever is shorter. The pump motor energizes and runs for the last 50 seconds of harvest.

The evaporator warms and the thermistor senses 48°F (9°C). The control board then receives the thermistor's 3.9 kΩ signal and turns operation of harvest over to the harvest countdown timer. The last 50 seconds of the harvest countdown timer, the harvest water valve de-energizes and the water pump energizes, (LED 4 goes off and LED 3 comes on). When the harvest countdown timer completes, the freeze cycle starts. **Diagnosis:** Check if evaporator is warming up, compressor and fan motors are on, hot gas valves are open, harvest water valve open. If these are okay, next check for at least 48°F (9°C) on the suction line. If the evaporator is cool, check for inlet water too cold or liquid line valves stuck open. If the suction line is at least 48°F (9°C), disconnect the thermistor at the white K3 connector on the control board and check for resistance of 3.9 kΩ or less. If different, see "II.D. Harvest Control – Thermistor," for check procedure. Replace if necessary. If resistance is 3.9 kΩ or less, reconnect the thermistor to the white K3 connector on the control board. If harvest does not terminate within 3 minutes, replace the control board.

- 5) **Freeze Cycle** – LED 1 is on. The compressor, fan motors and pump motor remain energized. The liquid line valves energize and the hot gas valves de-energize (also de-energizing the X1 relay). The lower float switch activates (open) 2 times during the course of a freeze cycle; the first is for refill, the second is for freeze termination. After the second lower float switch activation, the control board terminates freeze and initiates harvest. Every 10th cycle, the control board initiates a 10 second pump-out cycle between the freeze and harvest cycles. See "II.C.3.d) Pump-Out Frequency Control."
- a. **Lower Float Switch 1st Activation: Refill** – LEDs 1 and 4 are on. The refill can occur at any time during the freeze cycle (1 refill per cycle). As ice builds the water level drops in the reservoir and the lower float switch activates (opens). LED 4 comes on and the control board energizes the fill water valve. The fill water valve remains energized until the upper float switch closes or the 1 minute fill timer terminates, whichever comes first.
- b. **Lower Float Switch 2nd Activation:** LED 1 is on. The unit is held in freeze by a 5 minute short cycle protection timer. After the 1st lower float switch activation and refill, ice continues to form and the water level drops in the reservoir. When the lower float switch activates (opens) a second time, the freeze cycle terminates (freeze can only be terminated on the second activation of the lower float switch and after 5 minutes of freeze). **Diagnosis:** Minimum freeze time is 5 minutes. During the first 5 minutes of freeze, confirm that the evaporator temperature drops, compressor, fan motors, pump motor, and liquid line valves are energized and that the hot gas valves, harvest water valve and fill water valve (except during refill) are de-energized and not bypassing. Make sure the expansion valves are operating properly and, in cold conditions, make sure the headmaster (C.P. Regulator) is operating correctly. Make sure that the drain water valve is not leaking by (water flowing down the potable drain). Check for proper unit pressures (see "III.C. Performance Data"), or an inoperative compressor. Disconnect the black K5 float switch connector from the control board. 15 seconds after disconnecting the black K5 float switch connector, LED 4 comes on and refill begins. Connect the black K5 float switch connector back on the control board. When the refill is finished (LED 4 goes off), disconnect the black K5 float switch connector again. If 5 or more minutes have elapsed in the freeze cycle, the unit should switch out of the freeze cycle. After the unit switches out of freeze, reconnect the black K5 float switch connector to the control board. If the unit remains in freeze with the float switch disconnected, replace the board. To check the float switch, see "II.F.3. Float Switch Check Procedure."

Note: Normal freeze cycle will last 30 to 35 minutes depending on model and conditions. Cycle times and pressures should follow performance data provided in this manual.

- 6) **Pump-Out Cycle** – The 1st pump out occurs after the 11th freeze cycle and every 10th cycle thereafter. LEDs 1, 3, 2 are on. The compressor and fan motors remain energized. The drain water valve, hot gas valves and X1 relay energize, the liquid line valves de-energize. The pump motor stops for 2 seconds then restarts for 10 seconds (pump out frequency can be adjusted on S4 dip switches 5 and 6). This pump out removes contaminants from the water reservoir through the drain water valve and allows for a power flush of the float switch. **Diagnosis:** If the pump motor does not come on, check the circuit and capacitor. If water does not pump out, remove the drain water valve housing and check/clean the valve assembly, check for voltage on the drain valve coil with LED 3 on, make sure that the drain line is not clogged.
- 7) **Normal Harvest Cycle** – Same as the initial harvest cycle. Return to step 4.
- Note: Unit continues to cycle until bin control is satisfied or power is switched "OFF".
The unit always restarts at the 1 minute fill cycle.

B. Diagnostic Charts

1. No Ice Production

Problem	Possible Cause		Remedy
[1] The icemaker will not start.	a) Power Supply to Condensing Unit	1. OFF position.	1. Move to ON position.
		2. Breaker tripped or fuse blown.	2. Check for short circuit or ground, correct and reset or replace.
	b) High Pressure Control	1. Tripped or bad contacts.	1. Check for continuity, let reset or replace.
		2. Dirty condenser coil.	2. Clean.
		3. Refrigerant overcharged.	3. Recharge.
		4. Fan not operating.	4. See chart 1.[6]
		5. Refrigerant line or components plugged.	5. Clean and replace drier.
	c) Thermostat (Condensing Unit High Temperature Safety)	1. Tripped or bad contacts.	1. Let cool and reset. Check for continuity and replace if open.
	d) Wire Harness Terminal Block: Condensing Unit and Icemaker	1. Loose connection.	1. Tighten.
	e) Fuse (Icemaker fused disconnect, if any)	1. Blown.	1. Check for short circuit and correct. Reset or replace.
	f) Fuse (10A fuse in icemaker)	1. Blown.	1. Check for short circuit and replace.
	g) Control Switch	1. OFF position.	1. Move to ICE position.
		2. Bad contacts.	2. Check for continuity and replace.
		3. Loose connection.	3. Tighten.
	h) Transformer	1. Open windings.	1. Replace.
	i) Bin Control	1. Tripped with bin filled with ice.	1. Remove ice.
		2. Proximity switch stuck open.	2. Replace bin control.
	j) Wiring to Control Board	1. Loose connections or open.	1. Check for continuity and replace.
	k) Water Supply Line	1. Water supply off and water supply cycle does not finish.	1. Check and get recommended pressure.
	l) Fill Water Valve	1. Mesh filter or orifice clogged.	1. Clean.
		2. Coil winding opened.	2. Replace.
		3. Wiring to water valve.	3. Check for loose connection or open, and replace.

Problem	Possible Cause		Remedy
[1] The icemaker will not start. (continued)	m) Control Board	1. Defective.	1. See "II.C.4. Control Board Check Procedure".
	n) Control Board in Alarm	1. Audible alarm.	1. See "II.C.2.f) LED Lights and Audible Alarm Safeties".
[2] Water continues to be supplied, and the icemaker will not start.	a) Float Switch	1. Connector disconnected.	1. Reconnect.
		2. Leads opened or defective switch.	2. Check and replace.
		3. Float does not move freely.	3. Clean or replace.
	b) Control Board	1. Defective.	1. Replace. See "II.C.4. Control Board Check Procedure."
[3] Compressor will not start or stops operating.	a) Control Switch	1. SERVICE position.	1. Move to ICE position.
		2. Bad contacts.	2. Check and replace.
	b) Control Board	1. Defective.	1. See "II.C.4. Control Board Check Procedure."
	c) Wire Harness Terminal Block: Condensing Unit and Icemaker	1. Loose connection.	1. Tighten.
	d) Magnetic Contactor	1. Bad contacts.	1. Check for continuity and replace.
		2. Coil winding opened.	2. Replace.
	e) Starter	1. Bad contacts.	1. Check and replace.
		2. Coil winding opened.	2. Replace.
	f) Start Capacitor or Run Capacitor	1. Defective.	1. Replace.
	g) Overload Protector	1. Bad contacts.	1. Check for continuity and replace.
		2. Voltage too low.	2. Increase voltage.
		3. Refrigerant overcharged or undercharged.	3. Recharge.
		4. Line valve continues to close in freeze cycle and overload protector operates.	4. Check line valves operation in freeze cycle and replace.
	h) Compressor	1. Wiring to compressor.	1. Check for loose connection or open, and replace.
		2. Defective.	2. Replace.
[4] Water continues to be supplied in freeze cycle (outside of refill).	a) Fill or Harvest Water Valve	1. Diaphragm does not close.	1. Check for water leaks with icemaker off.
	b) Control Board	1. Defective.	1. See "II.C.4. Control Board Check Procedure".

Problem	Possible Cause		Remedy
[5] No water comes from spray tubes. Water pump will not start, or freeze cycle time is too short.	a) Water Supply Line	1. Water pressure too low and water level in water tank too low.	1. Check and get recommended pressure.
	b) Fill or Harvest Water Valve	1. Dirty mesh filter or orifice and water level in water tank too low.	1. Clean.
	c) Water System	1. Water leaks.	1. Check connections for water leaks, and replace.
		2. Clogged.	2. Clean.
		3. Drain valve leaking by.	3. Check assembly and clean.
	d) Pump Motor	1. Motor winding opened.	1. Replace.
		2. Bearing worn out.	2. Replace.
		3. Wiring to pump motor.	3. Check for loose connection or open, and replace.
		4. Defective capacitor.	4. Replace.
		5. Defective or bound impeller.	5. Replace or clean.
		6. Mechanical seal worn out.	6. Check and replace.
	e) Control Board	1. Defective.	1. See "II.C.4. Control Board Check Procedure".
[6] Fan motor will not start, or is not operating.	a) Fan Motor	1. Motor winding opened.	1. Replace.
		2. Bearing worn out.	2. Replace.
		3. Wiring to fan motor.	3. Check for loose connection or open, and replace.
		4. Defective capacitor.	4. Replace.
		5. Fan blade bound.	5. Check and replace.
	b) Magnetic Contactor	1. Bad contacts.	1. Check for continuity and replace.
[7] All components run, but no ice is produced.	a) Refrigerant	1. Undercharged.	1. Check for leaks and recharge.
		2. Air or moisture trapped.	2. Replace drier and recharge.
	b) Compressor	1. Defective valve.	1. Replace.
	c) Hot Gas Valve	1. Continues to open in freeze cycle.	1. Check and replace.
	d) Liquid Line Valve	1. Continues to close in freeze cycle.	1. Check and replace.
	e) Fill or Harvest Water Valve	1. Water valve is wide open during freeze (outside of refill).	1. Check for water leaks.

2. Evaporator is Frozen Up

Problem	Possible Cause		Remedy
[1] Freeze cycle time is too long.	a) Float Switch	1. Leads short-circuit or defective switch.	1. Check and replace.
		2. Float does not move freely.	2. Clean or replace.
	b) Fill or Harvest Water Valve	1. Diaphragm does not close.	1. Check for water leaks.
	c) Control Board	1. Defective.	1. See "II.C.4. Control Board Check Procedure".
[2] All ice formed on evaporator does not fall into bin in harvest cycle.	a) Evaporator	1. Scaled up.	1. Clean.
	b) Water Supply Line	1. Water pressure too low.	1. Check and get recommended pressure.
	c) Water Filter System	1. Dirty/restricted.	1. Replace filter.
	d) Harvest Water Valve	1. Dirty mesh filter or orifice.	1. Clean.
		2. Diaphragm does not close.	2. Check for water leaks.
	e) Ambient and/or Water Temperature	1. Too cool.	1. Increase temperature.
	f) Liquid Line Valve	1. Continues to open in harvest cycle.	1. Check operation in harvest cycle and replace.
	g) Thermistor	1. Out of position or loose attachment.	1. See "V.C.6. Removal and Replacement of Thermistor."
[3] Other	a) Spray Tubes	1. Clogged.	1. Clean.
		2. Out of position.	2. Place in position.
	b) Water System	1. Dirty.	1. Clean.
	c) Refrigerant	1. Undercharged.	1. Check for leaks and recharge.
	d) Expansion Valve	1. Bulb out of position or loose attachment.	1. Place in position.
		2. Defective.	2. Replace.
	e) Hot Gas Valve	1. Coil winding opened.	1. Replace.
		2. Plunger does not move.	2. Replace.
		3. Wiring to hot gas valve.	3. Check for loose connection or open, and replace.
	f) Water Supply Line	1. Too small; requires 1/2" OD line dedicated per machine.	1. Increase water line size.
	g) Water Filter	1. Flow rate too small.	1. Replace with filter that has larger flow rate.

3. Low Ice Production

Problem	Possible Cause	Remedy
[1] Freeze cycle time is long.	a) See chart 1.[3]. Also check dirty condenser coil, ambient temperature and refrigerant charge.	
	b) See chart 2.[1] and check float switch, water valves and control board.	
[2] Harvest cycle time is long.	a) See chart 2.[2] and check evaporator, water supply line, harvest water valve, ambient and/or water temperature, liquid line valve, thermistor, and control board.	

4. Abnormal Ice

Problem	Possible Cause		Remedy
[1] Small cubes.	a) Ice Cube Guide or Ice Separator	1. Out of position. Circulated water falls into bin.	1. Place in position.
	b) See chart 1.[5] and check water supply line, water valves, water system, pump motor, and control board.		
	c) Drain Water Valve	1. Leaking.	1. Check and replace.
[2] Cloudy or irregular cubes.	a) See chart 2.[1] and 2.[3], and check float switch, water valves, control board, spray tubes, water system, refrigerant charge, and expansion valve.		
	b) Spray Guide	1. Dirty.	1. Clean.
	c) Water Quality	1. High hardness or contains impurities.	1. Install a water softener or filter.

5. Other

Problem	Possible Cause		Remedy
[1] Icemaker will not stop when bin is filled with ice.	a) Bin Control	1. Defective.	1. Replace.
	b) Control Board	1. Defective.	1. See "II.C.4. Control Board Check Procedure".
[2] Abnormal noise.	a) Pump Motor	1. Bearings worn out.	1. Replace.
	b) Fan Motor	1. Bearings worn out.	1. Replace.
		2. Fan blade deformed.	2. Replace fan blade.
		3. Fan blade does not move freely.	3. Replace.
	c) Compressor	1. Bearings worn out or cylinder valve broken.	1. Replace.
		2. Mounting pad out of position.	2. Reinstall.
	d) Refrigerant Lines	1. Rub or touch other lines or surfaces.	1. Reposition.
[3] Ice in storage bin often melts.	a) Bin Drain	1. Plugged.	1. Clean.
	b) Icemaker and Bin	1. Drains not run separately.	1. Separate the drain lines.

V. Removal and Replacement of Components

IMPORTANT

1. Ensure all components, fasteners and thumbscrews are securely in place after the equipment is serviced.
2. The Polyol Ester (POE) oils used in R-404A units can absorb moisture quickly. Therefore it is important to prevent moisture from entering the system when replacing or servicing parts.
3. Always install a new drier every time the sealed refrigeration system is opened. Do not replace the drier until after all other repair or replacement has been made.
4. Do not leave the system open for longer than 15 minutes when replacing or servicing parts.

A. Service for Refrigerant Lines

IMPORTANT

The condensing unit is provided with two shutoff valves, one on the low-side, one on the high-side and also with an access valve on the receiver tank. The icemaker unit is provided with two service valves, one on the low-side and one on the high-side.

For refrigerant recovery, evacuation and recharge of the system, always use the access valve on the receiver tank for the high-side and either the shutoff valve of the condensing unit or the service valve of the icemaker unit for the low-side line.

1. Refrigerant Recovery

Using proper refrigerant practices recover the refrigerant and store it in an approved container. Do not discharge the refrigerant into the atmosphere.

2. Brazing.

WARNING

1. Refrigerant R-404A itself is not flammable at atmospheric pressure and temperatures up to 176°F (80°C).
2. Refrigerant R-404A itself is not explosive or poisonous. However, when exposed to high temperatures (open flames) R-404A can be decomposed to form hydrofluoric acid and carbonyl fluoride both of which are hazardous.
3. Always recover the refrigerant and store it in an approved container. Do not discharge the refrigerant into the atmosphere.
4. Do not use silver alloy or copper alloy containing arsenic.

- 1) Always install a new drier every time the sealed refrigeration system is opened. Do not replace the drier until after all other repair or replacement has been made. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.
- 2) Braze all fittings while purging with nitrogen gas flowing at a pressure of 3 to 4 PSIG.
- 3) Check for leaks using nitrogen gas (140 PSIG) and soap bubbles. Do not use R-404A as a mixture with pressurized air for leak testing.

Note: Because the pipes in the evaporator case are specially coated to resist corrosion, it is important to make connections outside the evaporator case when possible. If it is necessary to braze inside the evaporator case, use sandpaper to remove the coating from the brazing connections before unbrazing the components.

3. Evacuation and Recharge [R-404A]

- 1) Attach a vacuum pump to the system. Be sure the charging hoses are connected to both high and low-side lines.

IMPORTANT

The vacuum level and vacuum pump may be the same as those for current refrigerants. However, the rubber hose and gauge manifold to be used for evacuation and refrigerant charge should be exclusively for POE oils.

- 2) Turn on the vacuum pump. Never allow the oil in the vacuum pump to flow backwards.
- 3) Allow the vacuum pump to pull down to a 29.9" Hg vacuum. Evacuating period depends on pump capacity.
- 4) Close the low-side valve and high-side valve on the service manifold.
- 5) Disconnect the vacuum pump and attach a refrigerant service cylinder to the high-side line. Remember to loosen the connection and purge the air from the hose. For the required refrigerant charge, see the charge label inside the front panel on the icemaker or on the nameplate on the condensing unit. Hoshizaki recommends only virgin refrigerant or reclaimed refrigerant which meets ARI Standard No. 700-88 be used.
- 6) A liquid charge is recommended for charging an R-404A system. Invert the service cylinder and place it on scales. Open the high-side valve on the service manifold.
- 7) Allow the system to charge with liquid until the proper charge weight is met.
- 8) If necessary, add any remaining charge to the system through the low-side. Use a throttling valve or liquid dispensing device to add the remaining liquid charge through the low-side access port with the unit running.
- 9) Close the two refrigerant access valves and disconnect the service manifold hoses.
- 10) Cap the access valves to prevent a possible leak.

B. Condensing Unit

1. Removal and Replacement of Compressor

IMPORTANT

Always install a new drier every time the sealed refrigeration system is opened. Do not replace the drier until after all other repair or replacement has been made. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

Note: When replacing a compressor with a defective winding, be sure to install the new start capacitor and start relay supplied with the replacement compressor. Due to the ability of the POE oil in the compressor to absorb moisture quickly, the compressor must not be opened more than 15 minutes for replacement or service. Do not mix lubricants of different compressors even if both are charged with R-404A, except when they use the same lubricant.

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Recover the refrigerant and store it in an approved container.
- 4) Remove the terminal cover on the compressor and disconnect the compressor wiring.
- 5) Remove the hold-down bolts, washers and rubber grommets.
- 6) Remove the discharge and suction pipes.
- 7) Remove the compressor. Unpack the new compressor package.
- 8) Attach the rubber grommets of the prior compressor.
- 9) Place the compressor in position and secure it using the bolts and washers.
- 10) Remove the drier, then place the new drier in position (located in the icemaker). Install the new drier with the arrow on the drier in the direction of the refrigerant flow.
- 11) Remove the plugs from the suction, discharge and process pipes.
- 12) Braze all fittings while purging with nitrogen gas flowing at a pressure of 3 to 4 PSIG.
- 13) Check for leaks using nitrogen gas (140 PSIG) and soap bubbles.
- 14) Evacuate the system, and charge it with refrigerant. See the nameplate on the condensing unit for the required refrigerant charge.
- 15) Connect the terminals and replace the terminal cover in its correct position.
- 16) Replace the panels in their correct positions.
- 17) Turn on the power supply.

2. Removal and Replacement of Condenser

IMPORTANT

Always install a new drier every time the sealed refrigeration system is opened. Do not replace the drier until after all other repair or replacement has been made. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Recover the refrigerant and store it in an approved container.
- 4) Disconnect the condenser refrigerant tubing.
- 5) Remove the condenser.
- 6) Place the new condenser in position and secure with the mounting screws.
- 7) Remove the drier, then place the new drier in position (located in the icemaker). Install the new drier with the arrow on the drier in the direction of the refrigerant flow.
- 8) Braze all fittings while purging with nitrogen gas flowing at a pressure of 3 to 4 PSIG.
- 9) Check for leaks using nitrogen gas (140 PSIG) and soap bubbles.
- 10) Evacuate the system, and charge it with refrigerant. See the nameplate on the condensing unit for the required refrigerant charge.
- 11) Replace the panels in their correct positions.
- 12) Turn on the power supply.

3. Removal and Replacement of Hot Gas Valve and Liquid Line Valve

CAUTION

1. The condensing unit has 1 hot gas valve and 1 liquid line valve. Both valves have a strainer prior to the valve body. It is advisable to change the strainer when replacing the hot gas or liquid line valve.
2. Always use a copper tube of the same diameter and length when replacing the hot gas and liquid lines; otherwise performance may be reduced.
3. Always install a new drier every time the sealed refrigeration system is opened. Do not replace the drier until after all other repair or replacement has been made. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Recover the refrigerant and store it in an approved container.
- 4) Remove the screw and the solenoid.

- 5) Disconnect the valve body. Remove the strainer and check valve.
- 6) Place the new valve and strainer in position.
- 7) Remove the drier, then place the new drier in position (located in the icemaker). Install the new drier with the arrow on the drier in the direction of the refrigerant flow.
- 8) Braze all fittings while purging with nitrogen gas flowing at a pressure of 3 to 4 PSIG.

CAUTION

Always protect the valve body by using a damp cloth to prevent the valve from overheating. Do not braze with the valve body exceeding 250°F (121°C).

- 9) Check for leaks using nitrogen gas (140 PSIG) and soap bubbles.
- 10) Evacuate the system, and charge it with refrigerant. See the nameplate on the condensing unit for the required refrigerant charge.
- 11) Cut the leads of the solenoid allowing enough lead length to reconnect using closed end connectors.
- 12) Connect the new solenoid leads.
- 13) Attach the solenoid to the valve body and secure it with a screw.
- 14) Replace the panels in their correct positions.
- 15) Turn on the power supply.

4. Removal and Replacement of Headmaster (Condensing Pressure Regulator - C.P. Regulator)

IMPORTANT

Always install a new drier every time the sealed refrigeration system is opened. Do not replace the drier until after all other repair or replacement has been made. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Recover the refrigerant and store it in an approved container.
- 4) Before heating, break off the stub on the dome to release the dome charge.
- 5) Disconnect the headmaster.
- 6) Place the new headmaster in position.
- 7) Remove the drier, then place the new drier in position (located in the icemaker). Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

- 8) Braze all fittings with nitrogen gas flowing at a pressure of 3 to 4 PSIG.

CAUTION

Always protect the headmaster body by using a damp cloth to prevent it from overheating. Do not braze with the headmaster body exceeding 250°F (121°C).

- 9) Check for leaks using nitrogen gas (140 PSIG) and soap bubbles.
- 10) Evacuate the system and charge it with refrigerant. See the nameplate on the condensing unit for the required refrigerant charge.
- 11) Replace the panels in their correct positions.
- 12) Turn on the power supply.

5. Removal and Replacement of Fan Motor

Note: When replacing a fan motor with defective winding, it is recommended that a new capacitor be installed.

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Remove the closed end connectors from the fan motor leads.
- 4) Remove the fan motor bracket and fan motor.
- 5) Install the new fan motor and replace the removed parts in the reverse order of which they were removed.
- 6) Replace the panels in their correct positions.
- 7) Turn on the power supply.

C. Icemaker

IMPORTANT

Always install a new drier every time the sealed refrigeration system is opened. Do not replace the drier until after all other repair or replacement has been made. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

Note: Because the pipes in the evaporator case are specially coated to resist corrosion, it is important to make connections outside the evaporator case when possible. If it is necessary to braze inside the evaporator case, use sandpaper to remove the coating from the brazing connections before unbrazing the components.

1. Removal and Replacement of Evaporator

- 1) Turn off the power supply.
- 2) Remove the panels and insulation pieces.
- 3) Recover the refrigerant and store it in an approved container.

- 4) Remove the spray tubes and the insulation at the "U" shaped notch where the refrigeration tubing passes through the molded chassis.
- 5) Disconnect the evaporator tubing.
- 6) Remove the pop rivets securing the evaporator, then lift out the evaporator.
- 7) Install the new evaporator.
- 8) Remove the drier, then place the new drier in position. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.
- 9) Braze all fittings while purging with nitrogen gas flowing at a pressure of 3 to 4 PSIG.
- 10) Check for leaks using nitrogen gas (140 PSIG) and soap bubbles.
- 11) Evacuate the system, and charge it with refrigerant. See the nameplate on the condensing unit for the required refrigerant charge.
- 12) Replace the removed parts in the reverse order of which they were removed.
- 13) Replace the insulation pieces and the panels in their correct positions.
- 14) Turn on the power supply.

2. Removal and Replacement of Expansion Valve

IMPORTANT

1. Sometimes moisture in the refrigerant circuit exceeds the drier capacity and freezes up at the expansion valve. Always install a new drier every time the sealed refrigeration system is opened. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.
2. It is advisable to change out both expansion valves when replacing an expansion valve.
3. Connect the expansion valve bulb to the corresponding refrigeration circuit suction line.

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Recover the refrigerant and store it in an approved container.
- 4) Remove the insulation and the expansion valve bulb on the suction line.
- 5) Remove the expansion valve cover and disconnect the expansion valve. Place the new expansion valve in position.
- 6) Remove the drier, then place the new drier in position. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

- 7) Braze all fittings while purging with nitrogen gas flowing at a pressure of 3 to 4 PSIG.

WARNING

1. Do not heat the wall of the machine. Place a steel barrier for protection.
2. Always protect the valve body by using a damp cloth to prevent the valve from overheating. Do not braze with the valve body exceeding 250°F (121°C).

- 8) Check for leaks using nitrogen gas (140 PSIG) and soap bubbles.
- 9) Evacuate the system and charge it with refrigerant. See the nameplate on the condensing unit for the required refrigerant charge.
- 10) Attach the expansion valve bulb to the suction line in the same location as the previous bulb. The bulb should be at the 12 o'clock position on the tube. Be sure to secure the bulb with the clamp and holder and to insulate it.
- 11) Place the new expansion valve cover in position.
- 12) Replace the panels in their correct positions.
- 13) Turn on the power supply.

3. Removal and Replacement of Hot Gas Valve and Liquid Line Valve

CAUTION

1. The icemaker unit has 1 hot gas valve and 1 liquid line valve. The hot gas valve has a strainer prior to the valve body. It is advisable to change the strainer and check valves when replacing the hot gas valve.
2. Always use a copper tube of the same diameter and length when replacing the hot gas and liquid lines; otherwise performance may be reduced.
3. Always install a new drier every time the sealed refrigeration system is opened. Do not replace the drier until after all other repair or replacement has been made. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Recover the refrigerant and store it in an approved container.
- 4) Remove the screw and the solenoid.
- 5) Disconnect the valve body. Remove the strainer and check valve (if applicable).
- 6) Place the new valve, strainer and check valve in position.
- 7) Remove the drier, then place the new drier in position. Install the new drier with the arrow on the drier in the direction of the refrigerant flow.

- 8) Braze all fittings while purging with nitrogen gas flowing at a pressure of 3 to 4 PSIG.

CAUTION

Always protect the valve body by using a damp cloth to prevent the valve from overheating. Do not braze with the valve body exceeding 250°F (121°C).

- 9) Check for leaks using nitrogen gas (140 PSIG) and soap bubbles.
- 10) Evacuate the system, and charge it with refrigerant. See the nameplate on the condensing unit for the required refrigerant charge.
- 11) Cut the leads of the solenoid allowing enough lead length to reconnect using closed end connectors.
- 12) Connect the new solenoid leads.
- 13) Attach the solenoid to the valve body and secure it with a screw.
- 14) Replace the panels in their correct positions.
- 15) Turn on the power supply.

4. Removal and Replacement of Pump Motor

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Drain the water tank by removing the insulation panel, front frame and suction hose. (See Fig. 3.)
- 4) Disconnect the pump suction and discharge hoses.
- 5) Unplug the water pump connector.
- 6) Remove the screws and pump motor bracket.
- 7) Remove the pump housing and check the impeller.
- 8) If the impeller is defective, install a new impeller.
- 9) Install the new motor or new parts, and replace the removed parts in the reverse order of which they were removed.
- 10) Turn on the power supply and check for leaks.
- 11) Replace the panels in their correct positions.

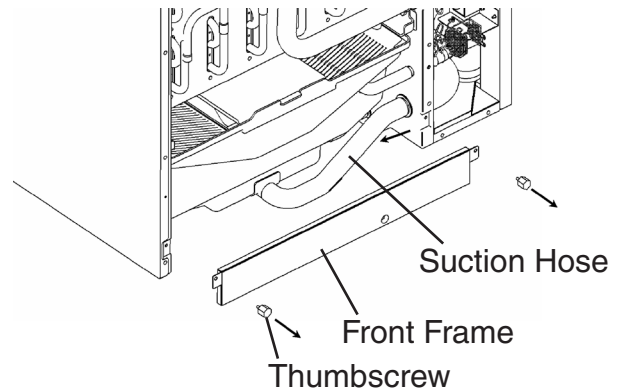


Fig. 3

5. Removal and Replacement of Fill and Harvest Water Valve

- 1) Turn off the power supply.
- 2) Close the water supply line shut-off valve.
- 3) Open the water supply line drain valve and let the water supply line drain.
- 4) Remove the panels.
- 5) Remove the valve outlet tubing and fitting nut.

- 6) Disconnect the terminals from the water valve.
- 7) Remove the bracket and water valve from the unit.
- 8) Install the new water valve and replace the removed parts in the reverse order of which they were removed.
- 9) Close the water supply line drain valve.
- 10) Open the water supply line shut-off valve.
- 11) Turn on the power supply and check for leaks.
- 12) Replace the panels in their correct positions.

6. Removal and Replacement of Thermistor

CAUTION

1. Fragile, handle very carefully.
2. Always use a recommended sealant (High Thermal Conductive Type), Model KE4560RTV manufactured by SHINETSU SILICONE, Part Code 60Y000-11, or Part Code 4A0683-01 equivalent.
3. Always use a recommended foam insulation (Non-absorbent Type) or equivalent.
4. Do not shorten or cut the thermistor leads when installing.

- 1) Turn off the power supply.
- 2) Remove the panels.
- 3) Remove the control box cover.
- 4) Disconnect the thermistor leads from the K3 connector on the control board.
- 5) Remove the plastic cable ties, foam insulation, thermistor holder and thermistor.
- 6) Scrape away the old sealant on the thermistor holder and the suction pipe.
- 7) Wipe off moisture or condensation on the suction pipe.
- 8) Smoothly apply recommended sealant (KE4560RTV, Part Code 60Y000-11 or 4A0683-01) to the thermistor holder concave.
- 9) Attach the new thermistor to the suction pipe in the same position as the previous thermistor. Be very careful to prevent damage to the leads. Secure it using the thermistor holder and recommended foam insulation.
- 10) Secure the insulation using plastic cable ties.
- 11) Connect the thermistor leads through the bushing of the control box to the K3 connector on the control board.
Note: Do not cut the leads of the thermistor while installing it.
- 12) Replace the control box cover and the panels in their correct positions.

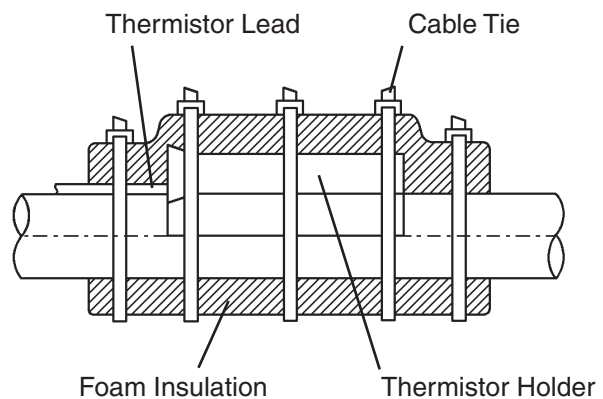


Fig. 4

VI. Cleaning and Maintenance Instructions

IMPORTANT

Ensure all components, fasteners and thumbscrews are securely in place after any maintenance or cleaning is done to the equipment.

A. Cleaning and Sanitizing

WARNING

1. HOSHIZAKI recommends cleaning this unit at least once a year. More frequent cleaning, however, may be required in some existing water conditions.
2. To prevent injury to individuals and damage to the icemaker, do not use ammonia type cleaners.
3. Always wear liquid-proof gloves to prevent the cleaning and sanitizing solutions from coming into contact with skin.

1. Cleaning Procedure

- 1) Dilute 22 fl. oz. (650 ml) of the recommended cleaner Hoshizaki "Scale Away" or "LIME-A-WAY" (Economics Laboratory, Inc.) with 4 gal. (15 l) of warm water.
- 2) Remove all ice from the evaporator and the storage bin/dispenser unit.
Note: To remove cubes on the evaporator, turn off the power supply and turn it on after 3 minutes. The defrost cycle starts and the cubes will be removed from the evaporator.
- 3) Turn off the power supply. Remove the front panel.
- 4) Place the control switch in the "SERVICE" position. Then place the service switch in the "DRAIN" position.
- 5) Replace the front panel and turn on the power supply for 2 minutes.
- 6) Turn off the power supply.
- 7) Remove the front panel.
- 8) In bad or severe water conditions, clean the float switch as described below. Otherwise, continue to step 9.
 - a. Remove the right-side panel.
 - b. Disconnect the vent tube from the top of the float switch, then remove the float switch and rubber boot.
 - c. Twist the wire stem on top of the float switch housing to release the float assembly, then lower it out of the housing.
 - d. Wipe down the float switch housing, shaft and float with cleaning solution. Clean the inside of the rubber boot and hose with cleaning solution.
 - e. Reassemble the float switch. Replace the rubber boot and the float switch in their correct positions. Reconnect the vent tube.
 - f. Replace the right-side panel in its correct position.

- 9) Remove the insulation panel by removing the thumbscrews, then pour the cleaning solution into the water tank.
 - 10) Move the service switch to the "WASH" position.
 - 11) Replace the insulation panel and the front panel in their correct positions.
 - 12) Turn on the power supply and start the washing process.
 - 13) Turn off the power supply after 30 minutes. Remove the front panel.
 - 14) Move the service switch to the "DRAIN" position.
 - 15) Replace the front panel and turn on the power supply for 2 minutes.
 - 16) Turn off the power supply and remove the front panel.
 - 17) Move the control switch to the "ICE" position.
 - 18) Replace the front panel in its correct position.
 - 19) Turn on the power supply to fill the water tank with water.
 - 20) Turn off the power supply after 3 minutes.
 - 21) Remove the front panel.
 - 22) Move the control switch to the "SERVICE" position, then move the service switch to the "WASH" position.
 - 23) Replace the front panel in its correct position.
 - 24) Turn on the power supply to rinse off the cleaning solution.
 - 25) Turn off the power supply after 5 minutes.
 - 26) Remove the front panel.
 - 27) Move the service switch to the "DRAIN" position.
 - 28) Replace the front panel and turn on the power supply for 2 minutes.
 - 29) Turn off the power supply. Remove the front panel.
 - 30) Repeat the above steps 17) through 29) three more times to rinse thoroughly.
- Note: If you do not sanitize the icemaker, go to step 13 in "2. Sanitizing Procedure."

2. Sanitizing Procedure - Following Cleaning Procedure

- 1) Dilute a 5.25% sodium hypochlorite solution (chlorine bleach) with water. (Add 2 fl. oz. (60 ml) of sanitizer to 4 gal. (15 l) of water).
- 2) Remove the insulation panel, if it is in its normal position.
- 3) Pour the sanitizing solution into the water tank.
- 4) Move the service switch to the "WASH" position.
- 5) Replace the insulation panel and the front panel in their correct positions.
- 6) Turn on the power supply, and start the sanitizing process.
- 7) Turn off the power supply after 15 minutes. Remove the front panel.
- 8) Move the service switch to the "DRAIN" position.
- 9) Replace the front panel and turn on the power supply for 2 minutes.

- 10) Turn off the power supply. Remove the front panel.
- 11) Repeat the above steps 17) through 29) in "1. Cleaning Procedure" two times to rinse thoroughly.
- 12) Repeat the above steps 1) through 11) one more time.
- 13) Move the control switch to the "ICE" position.
- 14) Replace the front panel in its correct position.
- 15) Clean the storage bin with water.
- 16) Turn on the power supply and start the automatic icemaking process.

B. Maintenance

IMPORTANT

This icemaker must be maintained individually, referring to the instruction manual and labels provided with the icemaker.

1. Stainless Steel Exterior

To prevent corrosion, wipe the exterior occasionally with a clean and soft cloth. Use a damp cloth containing a neutral cleaner to wipe off oil or dirt build up.

2. Storage Bin/Dispenser Unit and Scoop

- Wash your hands before removing ice. Use the plastic scoop provided (accessory).
- The storage bin is for ice use only. Do not store anything else in the bin.
- Keep the scoop clean. Clean it by using a neutral cleaner and rinse thoroughly.
- Clean the bin liner by using a neutral cleaner. Rinse thoroughly after cleaning.

3. Condenser

Check the condenser once a year, and clean the coil if required by using a brush or vacuum cleaner. More frequent cleaning may be required depending on the location of the condensing unit.

C. Preparing the Icemaker for Long Storage

CAUTION

When the icemaker is not used for two or three days under normal conditions, it is sufficient to only move the control switch to the "OFF" position. When storing the icemaker for extended time or in sub-freezing temperatures, turn the water off and drain out all water from the water lines and remove the ice from the dispenser or storage bin. The dispenser or storage bin should be cleaned and dried. Drain the icemaker water hoses using air or carbon dioxide to prevent damage at sub-freezing temperatures.

To drain all water from the icemaker, follow the steps below. See Fig. 5.

- 1) Remove the front panel.

- 2) Move the control switch to the "OFF" position. Confirm that the service switch is in the "CIRC." position.
- 3) Remove the front insulation, front frame, right side panel, and control box cover.
- 4) Disconnect the thermistor from the K3 connector on the control board, and unplug the water pump connector at the water pump.
- 5) Wait 3 minutes, then move the control switch to the "ICE" position. Confirm that the bin control switch is closed and calling for ice. The green BC CLOSED LED on the control board should be on.
- 6) Once LED 1 and 2 on the control board energize (the order of the LEDs from the outer edge of the control board is 1,4,3,2), close the potable water supply line shut-off valve and open the potable water supply line drain valve. Allow the line to drain by gravity.
- 7) Disconnect the harvest water valve hose in the evaporator section and blow out the water line to the harvest water valve using compressed air or carbon dioxide. This will clear water from the harvest water valve.
- 8) Move the control switch to the "OFF" position.
- 9) Move the service switch to the "WASH" position and the control switch to the "SERVICE" position.
- 10) Using the same hose as with the harvest water valve, blow out the wash valve using compressed air or carbon dioxide.
- 11) Move the service switch to the "CIRC." position and the control switch to the "OFF" position.
- 12) Remove the 4 hoses connected to the water tank. Allow the tank and hoses to completely drain.
- 13) Move the control switch to the "ICE" position.
- 14) Using the fill water valve hose, blow the water line out using compressed air or carbon dioxide. This will clear water from the fill water valve.
- 15) Move the control switch to the "OFF" position.
- 16) Disconnect the float switch vent hose from the drain hose tee. Move the service switch to the "DRAIN" position and the control switch to the "SERVICE" position.
- 17) From the tee on the drain hose, blow the drain water valve out using compressed air or carbon dioxide.
- 18) Move the service switch to the "OFF" position and the control switch to the "CIRC." position.
- 19) Reconnect the thermistor to the K3 connector on the control board. Reconnect the water pump connector.
- 20) Close the potable water supply line drain valve.
- 21) Remove all ice from the dispenser or storage bin and clean the bin.
- 22) Turn off the power supply.
- 23) Replace all removed parts and panels in their correct positions.

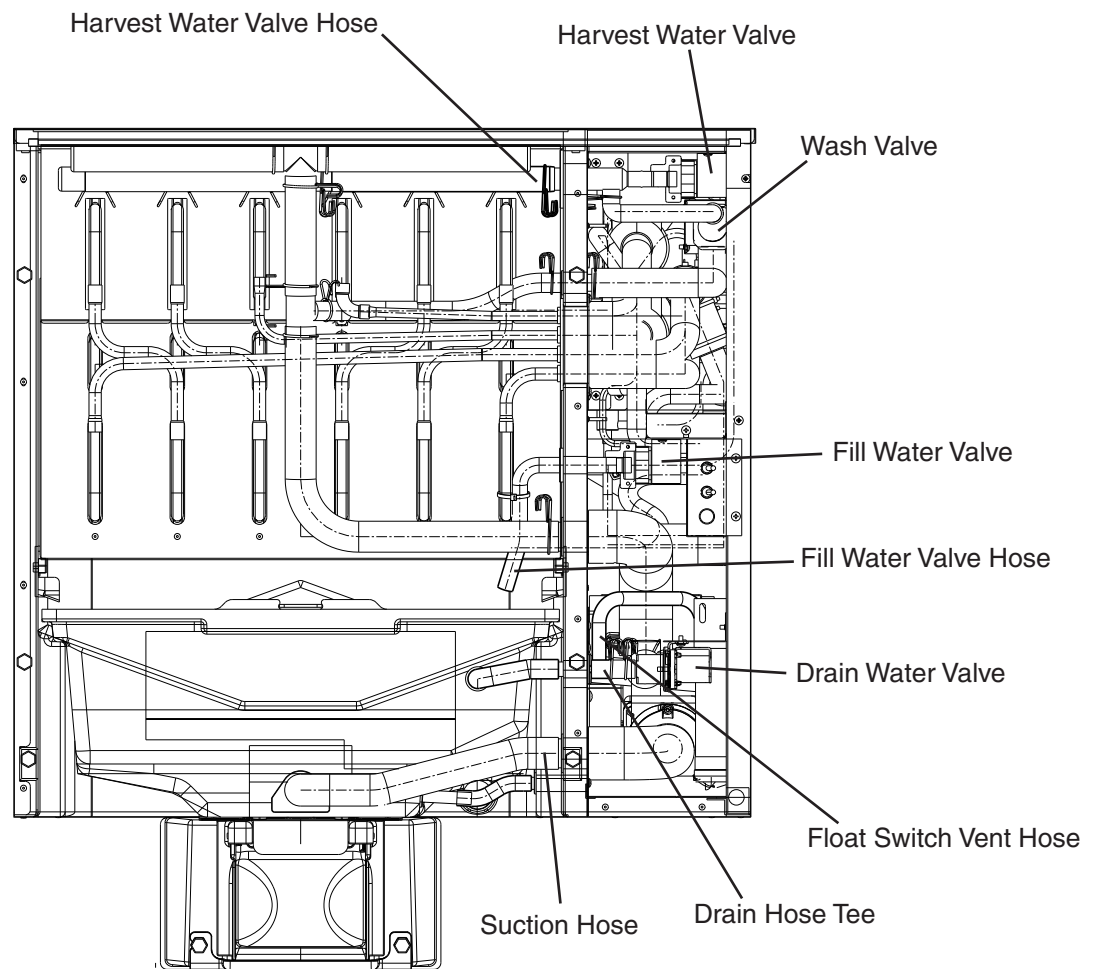


Fig. 5