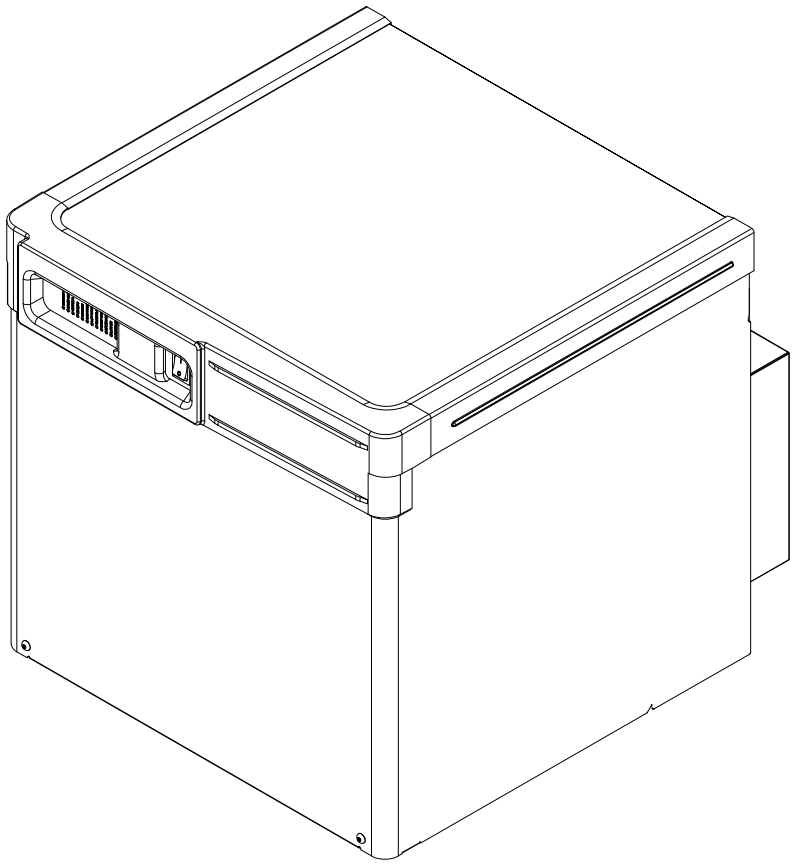
D1012R, D1412R
Horizon Elite™ Ice Machines (Remote Condensing)

Order parts online
www.follettice.com

Operation and Service Manual
After Serial Number R03746



Following installation, please forward this manual to the appropriate operations person.

FOLLETT®
801 Church Lane • Easton, PA 18040, USA
Toll free (877) 612-5086 • +1 (610) 252-7301
www.follettice.com

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Welcome to Follett

Follett equipment enjoys a well-deserved reputation for excellent performance, long-term reliability and outstanding after-the-sale support. To ensure that this equipment delivers the same degree of service, we ask that you review the installation manual (provided as a separate document) before beginning to install the unit. Our instructions are designed to help you achieve a trouble-free installation. Should you have any questions or require technical help at any time, please call our technical service group at (877) 612-5086 or +1 (610) 252-7301.

Before you begin

After uncrating and removing all packing material, inspect the equipment for concealed shipping damage. If damage is found, notify the shipper immediately and contact Follett Products, LLC so that we can help in the filing of a claim, if necessary.

Check your paperwork to determine which model you have. Follett model numbers are designed to provide information about the type and capacity of Follett equipment. Following is an explanation of the different model numbers in the series.

⚠ CAUTION

- Installation and service must be performed in accordance with all federal, state and local laws. It is the responsibility of the technician to ensure that these requirements are met.
- Risk of electric shock. Placing switch in OFF position does not de-energize all loads.
- Warranty does not cover exterior or outside installations.
- Moving parts. Do not operate with front cover removed.
- Hot parts. Do not operate with cover removed.
- To reduce risk of shock, disconnect power before servicing.
- Drain line must not be vented.
- Water supply must have particle filtration.
- Most ice machine cleaners contain citric or phosphoric acid, which can cause skin irritation. Read caution label on product and follow instructions carefully.
- Ice is slippery. Maintain counters and floors around dispenser in a clean and ice-free condition.
- Ice is food. Follow recommended cleaning instructions to maintain cleanliness of delivered ice.
- Follett recommends a Follett water filter system be installed in the ice machine inlet water line.

Specifications

Electrical

Separate circuit and equipment ground required.

Evaporator unit

Standard electrical: 115/60/1
Maximum fuse: 15A
Amperage: 3.5A

Condensing unit

	C1012CU Single-Phase	F1012CU 3-Phase	C1412CU Single-Phase	F1412CU 3-Phase
Electrical	208-230 V, 60 Hz			
Max Circuit HVACR breaker size	15 A	15 A	20 A	15 A
Min Circuit Ampacity	11A	10 A	13 A	11 A

Plumbing

⚠ WARNING

This equipment to be installed with adequate backflow protection to comply with applicable federal, state, and local codes.

Notes:

- Follett does not recommend the use of water softeners or bowl scale inhibitors.
- The potable water total dissolved solids (TDS) content must be greater than 10 ppm for the water control system to function properly. If using reverse osmosis water filtration system, ensure TDS level is greater than 10 ppm.

Evaporator plumbing

- 3/8" OD push-in water inlet - 3/8" OD tubing required.
- Water shut-off recommended within 10 feet (3 m).

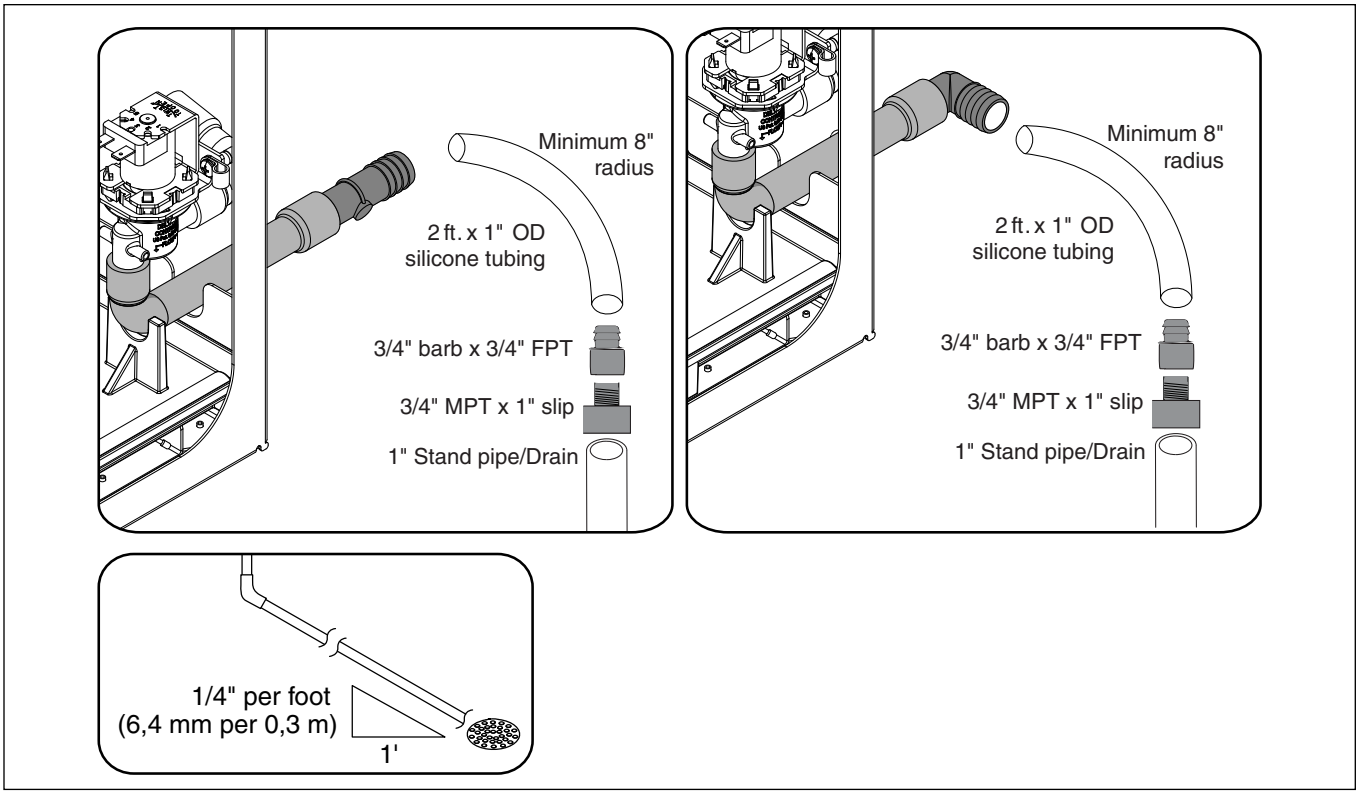
Flush drain plumbing

- Attach either the provided straight 3/4" barb adapter or a 90 degree adaptor. Connect the supplied 2' (0.61 m) silicone hose to the 3/4" drain barb.
- It is recommended that the silicone hose be routed down into a 1.5" or 2" standpipe/drain. The minimum drain size for the ice machine is 1".

  Note: 3/4" to 1" PVC adapter fittings are provided if a larger drain size is not possible.

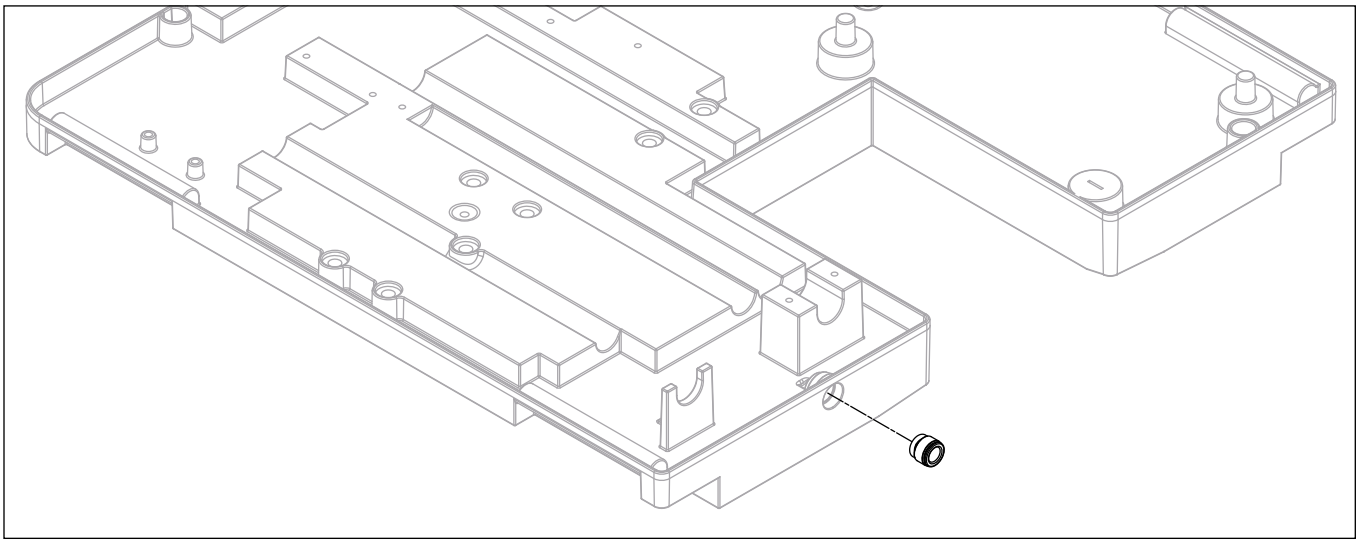
  Note: Minimum 8" radius on silicone drain line. Drain line from the ice machine must have at least 1/4" per foot pitch (6.4 mm/0.3 m).

  Note: Standpipe/drain provided by others. All other components provided with ice machine.



Chassis drain plumbing

- Route 3/8" OD drain tubing (preferably copper) through rear of docking station and fully insert into chassis base push-in fitting. Route into drain standpipe.
- Gravity drain. Drain must slope 1/4" inch per foot (6 mm per 30,4 cm). Ensure 3/8" OD tubing slopes down into drain standpipe without forming a trap.



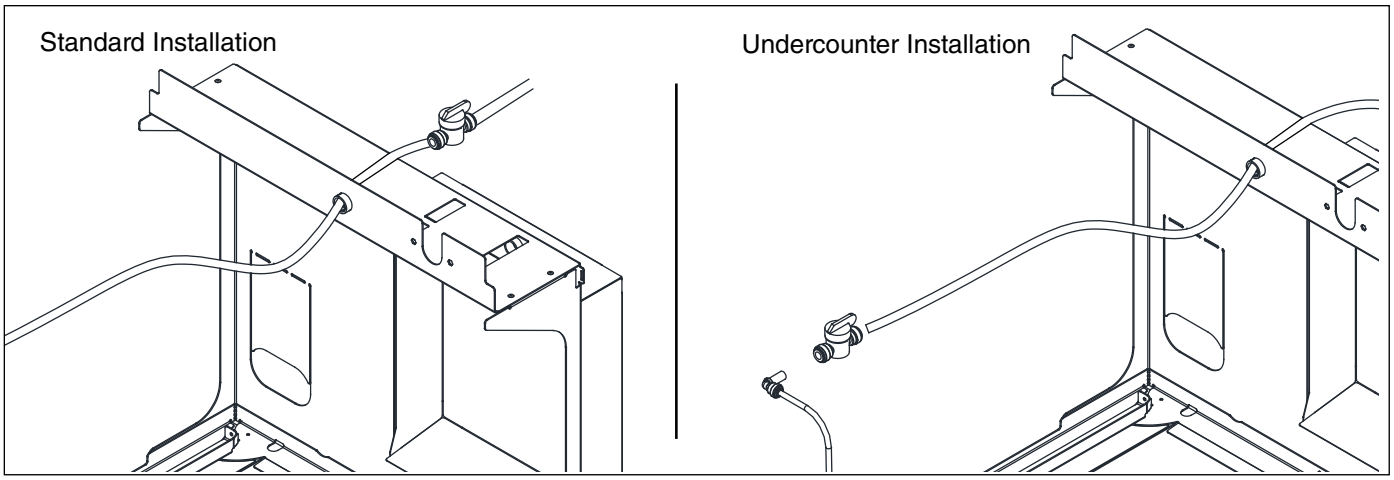
Shut-off Valve

Standard Installations

Locate the shut-of valve outside and at the back of the ice machine.

Undercounter Installations

Locate the shut-of valve *inside* the ice machine. This method of installation provides access to the water shut-off valve for service or in case of an emergency.



Ambient

Evaporator unit

Air temperature	100 F/38 C max.	50 F/10 C min.
Water temperature	90 F/32 C max.	45 F/7 C min.
Water pressure	70 psi max. (483 kPa)	10 psi min. (69 kPa)

Condenser unit

Air temperature 120 F/49 C max. –20F/–29C min.

Refrigeration

- R449A
- 3/8" liquid line
- 7/8" suction line

Note: Not compatible with rack system. Consult Technical Service at (877) 612-5086 or (610) 252-7301.

Refrigeration Pressure

Air-cooled condensers (air)	50 F	60 F	70 F	80 F	90 F	100 F	110 F	120 F
Discharge Pressure (psig)	182	186	189	211	233	270	307	344
Suction Pressure (psig)	22	23	23	25	27	28	28	29

- Superheat - EEV Controller: 18 F (–7.8 C)

Weight

Evaporator unit: D1012R - 130 lbs (59 kg), D1412R - 134 lbs (61 kg)

Condensing unit:

	D1012CU single phase	F1012CU 3-phase	D1412CU single phase	F1412CU 3-phase
Approximate ship weight	268 lbs (122 kg)	268 lbs (122 kg)	271 lbs (123 kg)	271 lbs (123 kg)
Approximate net weight	205 lbs (93 kg)	205 lbs (93 kg)	208 lbs (94 kg)	208 lbs (94 kg)

Ice production

D1012R ice machine capacity/24 hrs.

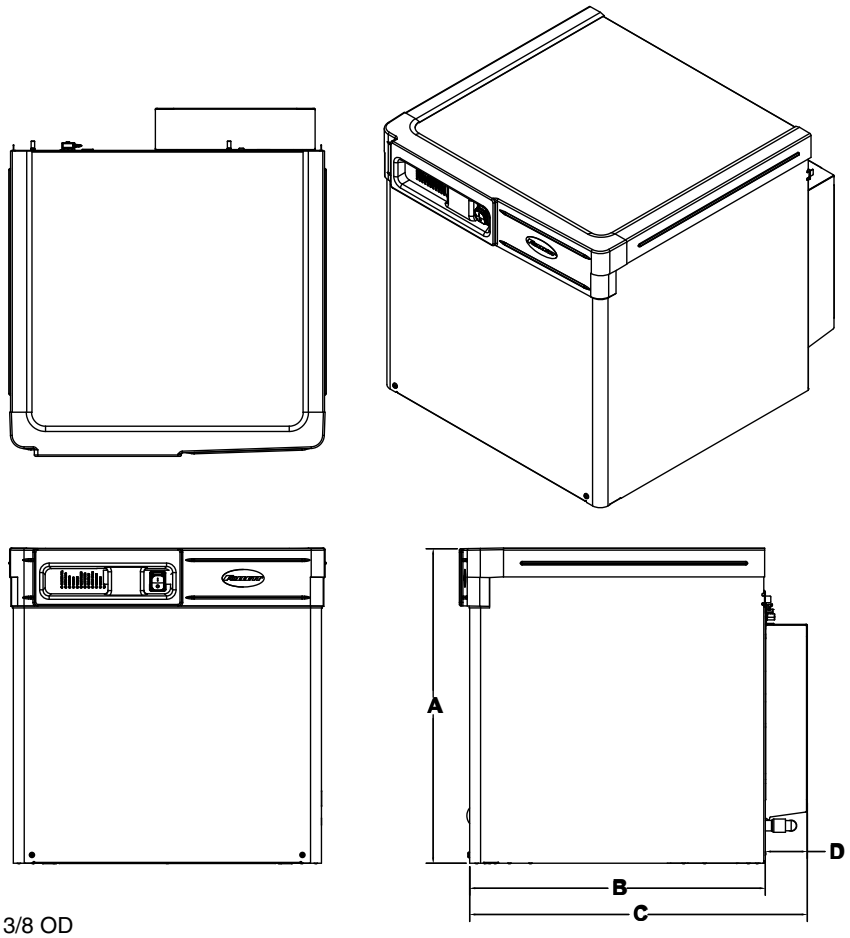
Ambient Air Temperature F							
Evap Potable Water Temperature F	F	50	60	70	80	90	
	50	1128	1089	1051	1021	991	lbs
	60	1040	1012	984	962	940	lbs
	70	953	935	917	903	889	lbs
	80	896	883	869	851	832	lbs
	90	839	830	821	798	775	lbs

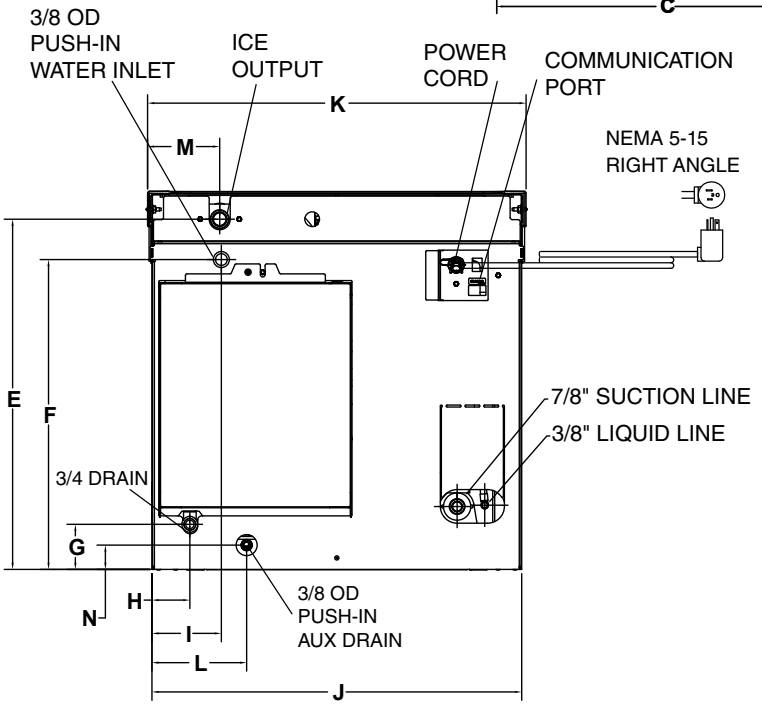
D1412R ice machine capacity/24 hrs.

Ambient Air Temperature F							
Evap Potable Water Temperature F	F	50	60	70	80	90	
	50	1304	1297	1291	1253	1216	lbs
	60	1231	1220	1209	1173	1137	lbs
	70	1158	1143	1127	1093	1059	lbs
	80	1097	1068	1039	1020	1000	lbs
	90	1036	994	952	947	942	lbs

Dimensions and clearances

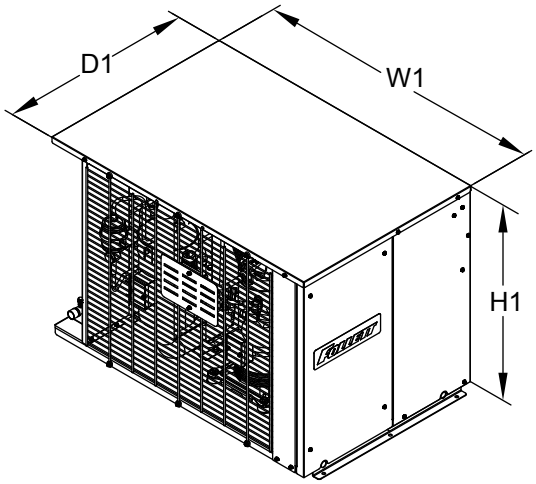
- Entire front of ice machine must be clear of obstructions/connections to allow removal.
- 1" (26 mm) clearance above ice machine for service.
- 1" (26 mm) minimum clearance on sides.
- 3" (78 mm) minimum clearance at rear.





A - 22.46" (57.05 cm)
B - 21.11" (53.62 cm)
C - 24.11" (61.24 cm)
D - 3.00" (7.62 cm)
E - 20.84" (52.92 cm)
F - 18.43" (46.83 cm)
G - 2.71" (6.88 cm)
H - 2.26" (5.74 mm)
I - 4.13" (10.49 cm)
J - 22.00" (55.88 cm)
K - 22.44" (56.98 cm)
L - 5.63" (14.31 cm)
M - 4.25" (10.79 cm)
N - 1.45" (3.67 cm)

Condensing unit



	C1012CU	F1012CU	C1412CU	F1412CU
W1 Width	39.60"	39.60"	39.60"	39.60"
Width (between mounting holes at base)	38.75"	38.75"	38.75"	38.75"
D1 Depth	34.30"	34.30"	34.30"	34.30"
Depth (at base, without hail guard)	25.80"	25.80"	25.80"	25.80"
H1 Height	26.05"	26.05"	26.05"	26.05"
Electrical	208-230/60/1	208-230/60/3	208-230/60/1	208-230/60/3
Minimum circuit ampacity	11A	10 A	13 A	11 A
Maximum overcurrent protection	15 A	15 A	20 A	15 A
Outdoor condensing unit operating limits (air temperature)	-20°F – 120°F	-20°F – 120°F	-20°F – 120°F	-20°F – 120°F
Maximum refrigerant line run length	100'	100'	100'	100'
Maximum line rise above evaporator	35'	35'	35'	35'
Evaporator mounting above condenser	15'	15'	15'	15'
Maximum refrigeration line drop without oil trap	15'	15'	15'	15'
Charge (R449A)	8 lbs	8 lbs	8 lbs	8 lbs
Ship Weight	268 lbs (122 kg)	268 lbs (122 kg)	271 lbs (123 kg)	271 lbs (123 kg)
Net Weight	205 lbs (93 kg)	205 lbs (93 kg)	208 lbs (94 kg)	208 lbs (94 kg)

Operation

Cleaning/sanitizing and preventive maintenance (all models)

Note: Do not use bleach to sanitize or clean the icemaker.

Preventive maintenance

Periodic cleaning of Follett's icemaker system is required to ensure peak performance and delivery of clean, sanitary ice. The recommended cleaning procedures that follow should be performed at least as frequently as recommended, and more often if environmental conditions dictate.

Cleaning of the condenser can usually be performed by facility personnel. Cleaning of the icemaker system, in most cases, should be performed by your facility's maintenance staff or a Follett authorized service agent. Regardless of who performs the cleaning, it is the operator's responsibility to see that this cleaning is performed according to the schedule below. Service problems resulting from lack of preventive maintenance will not be covered under the Follett warranty.

Weekly exterior care

The exterior may be cleaned with a stainless cleaner such as 3M Stainless Steel Cleaner & Polish or equivalent.

Monthly condenser cleaning (air-cooled icemaker only)

1. Use a vacuum cleaner or stiff brush to carefully clean condenser coils of air-cooled icemakers to ensure optimal performance.
2. When reinstalling counter panels in front of remote icemakers, be sure that ventilation louvers line up with condenser air duct.

Semi-annual evaporator cleaning (every 6 months)

⚠ WARNING

- Wear rubber gloves and safety goggles (and/or face shield) when handling ice machine cleaner or sanitizer.

⚠ CAUTION

- Use only Follett approved SafeCLEAN Plus™ cleaning solution.
- DO NOT USE BLEACH.
- 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 packaging before use.

Note: Complete procedure for cleaning and sanitizing MUST be followed. Ice must be collected for 10 minutes before putting ice machine back into service.

1. Note position of TDS switch. Set to HIGH for duration of cleaning. Press the CLEAN button. The machine will fill and drain three times (**approximately 5 minutes**). The auger will run for a short time and then stop. Wait for the LOW WATER light to come on.

Fig. 1

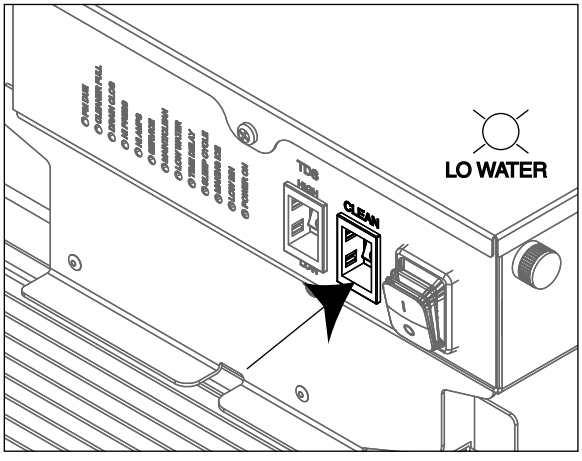


Fig. 2

2. Follow the directions on the SafeCLEAN Plus packaging to mix 1 gal. (3.8 L) of Follett SafeCLEAN Plus solution. Use 120 F (49 C) water.
3. Using a 1 quart (1 L) container, slowly fill cleaning cup until CLEANER FULL light comes on and cleaner just begins to flow from the vent tube.
4. Place plastic plug and four SaniSponge™ cleaning sponges in remaining sanitizing and cleaning solution and retain for Step 8.

Note: Do not use bleach to sanitize or clean the icemaker.

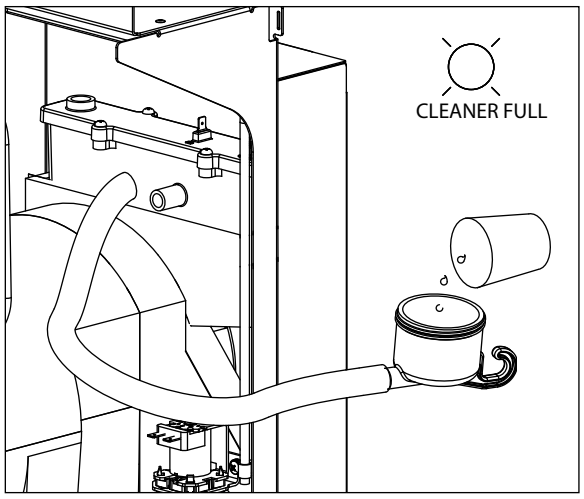


Fig. 3

5. Replace cover on cleaner cup. Machine will clean, then flush 3 times in approximately 15 minutes. Wait until machine restarts.

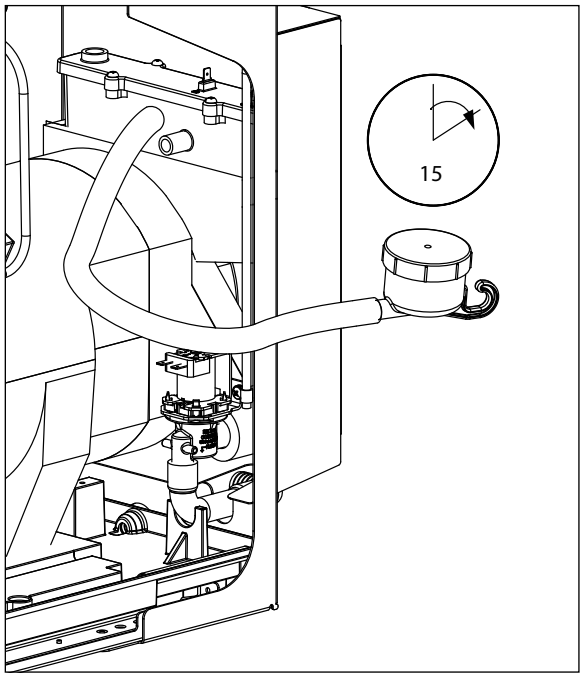
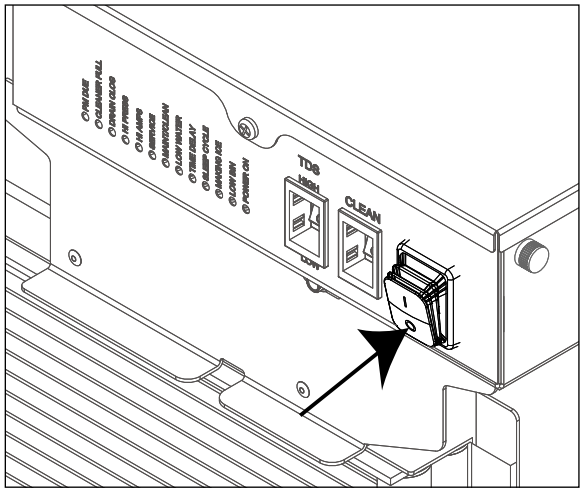


Fig. 4

6. To clean/sanitize ice transport tube – Press power switch OFF



7. Disconnect coupling as shown.

Fig. 5

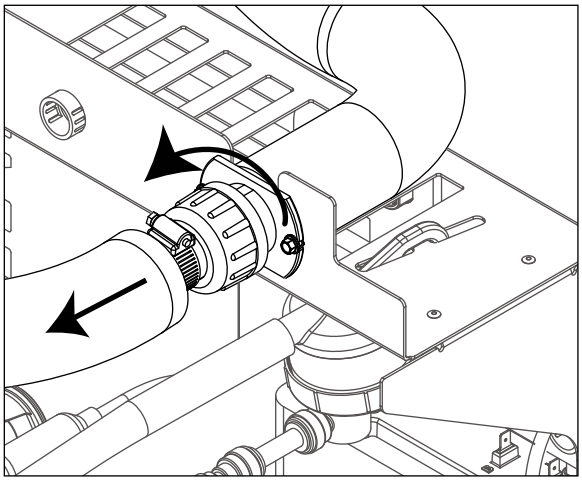


Fig. 6

8. Using disposable foodservice grade gloves, insert plastic plug (**Fig. 6.1**) followed by four SaniSponges (**Fig. 6.2**) saturated in cleaning solution (from Step 4).

9. Push plug and four SaniSponge cleaning sponges down ice transport tube with supplied pusher tube.

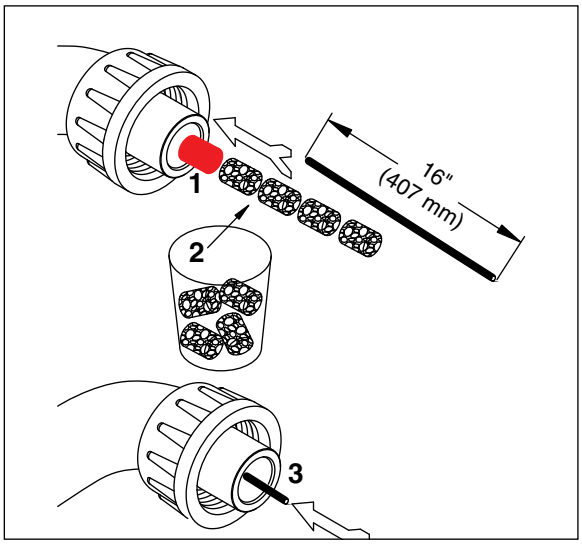
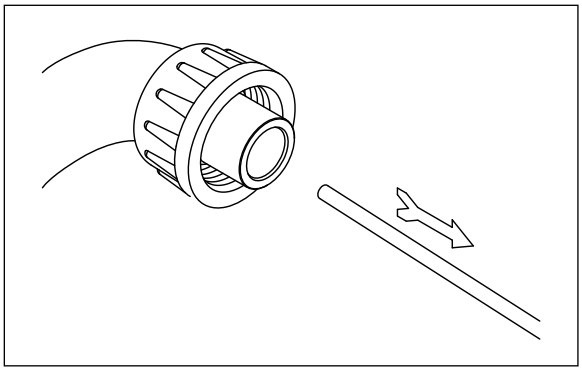


Fig. 7

10. Remove and discard 16 inch (407 mm) pusher tube.



11. Fill internal ice transport tube with remaining cleaning solution.

Fig. 8

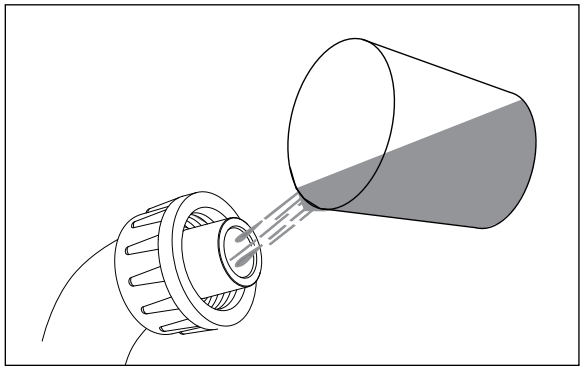


Fig. 9

12. Reconnect coupling. Press power switch ON. Ice pushes SaniSponge cleaning sponges through ice transport tube.

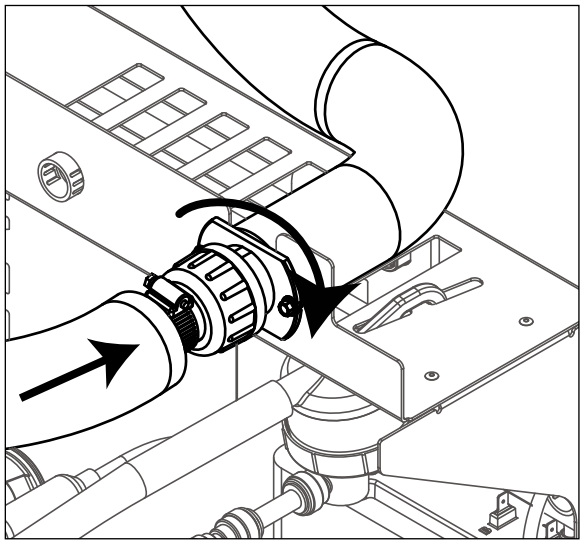
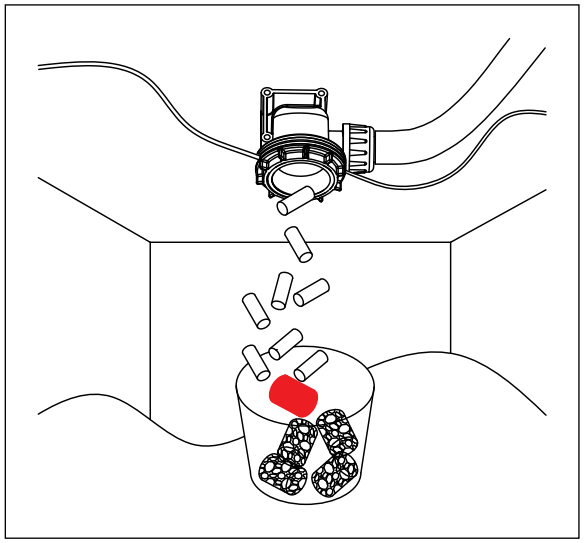


Fig. 10

13. Place a sanitary (2 gal. or larger) container in bin or dispenser to collect the plug, SaniSponge cleaning sponges and ice for 15 minutes* *after the Sani-Sponges come out*.

* If cleaning a 700 series ice maker with an ice transport tube run that exceeds 20 feet, the ice must be collected for 30 minutes to ensure proper sanitization of the ice transport tube.

14. Discard ice, Sani-Sponges and plug. Return TDS switch to the original position.



Service

Ice machine operation (all models)

Follett's ice machine consists of five distinct functional systems covered in detail as follows:

- Water system
- Electrical control system
- Mechanical assembly
- Refrigeration system
- Bin full

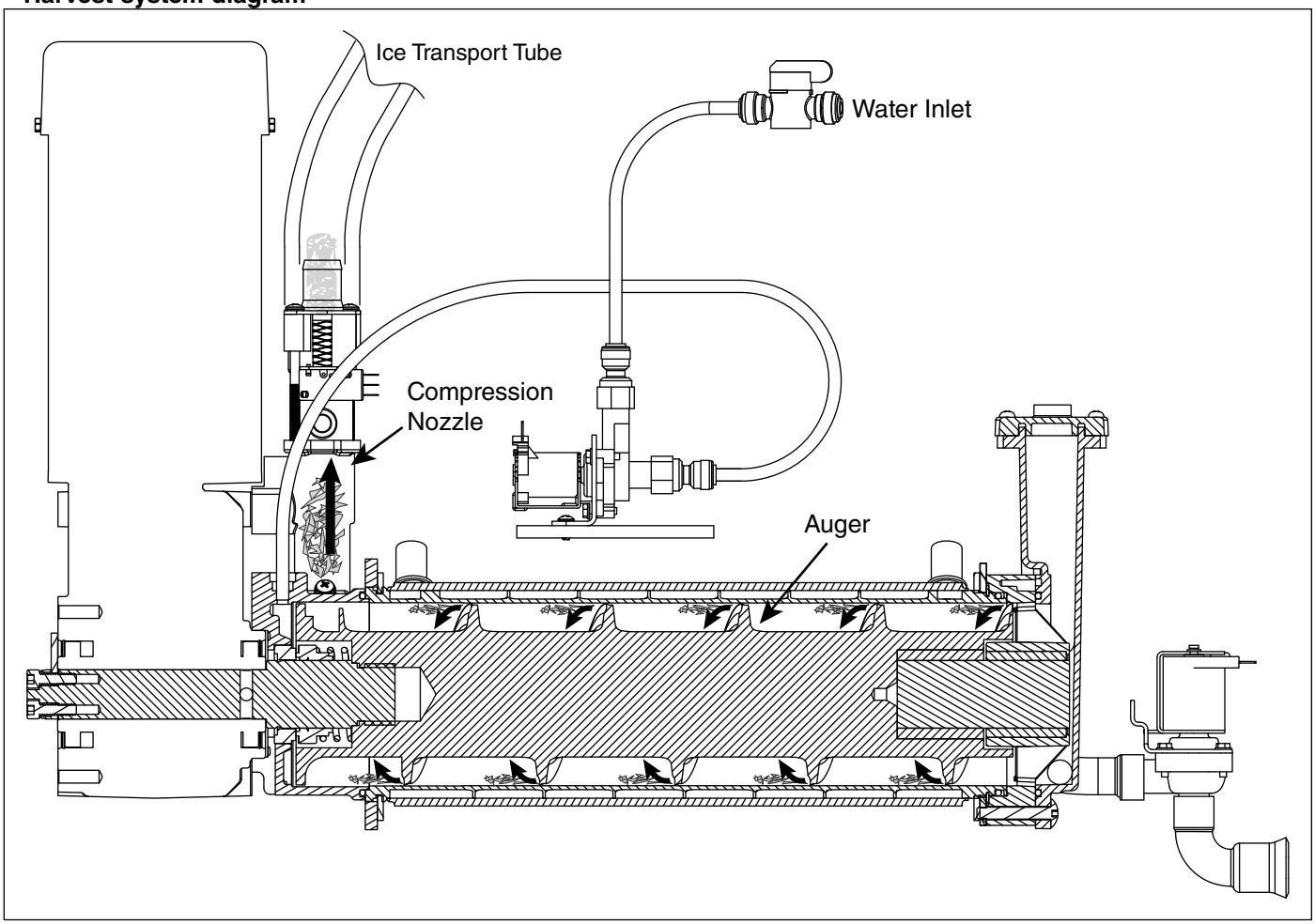
The Horizon ice machine overview

The Follett Horizon ice machine uses a horizontal, cylindrical evaporator to freeze water on its inner surface. The refrigeration cycle is continuous; there is no batch cycle. The evaporator is flooded with water and the level is controlled by sensors in a reservoir. A rotating auger (17 RPM) continuously scrapes ice from the inner wall of the evaporator. The auger moves harvested ice through the evaporator into an ice extrusion canal. The ice is forced through a restrictive nozzle that squeezes out the water and creates the Chewblet. The continuous extrusion process pushes the Chewblets through a transport tube into a dispenser or bin.

A solid state PC board controls and monitors the functionality of the ice machine. In addition to sequencing electrical components, the board monitors various operational parameters. A full complement of indicator lights allows visual status of the machine's operation. Additionally, the PC board controls the self-flushing feature of the ice machine. The evaporator water is periodically drained and replenished to remove minerals and sediment.

A unique "bin full" detection system is incorporated in the Horizon Elite ice machine. A switch located at the ice discharge port of the machine detects the position of the transport tube. When the bin fills up with ice, the transport tube moves out of the normal running position, and the switch turns the ice maker off. A domed housing at the end of the transport tube contains the ice extrusion loads during shut down.

Harvest system diagram



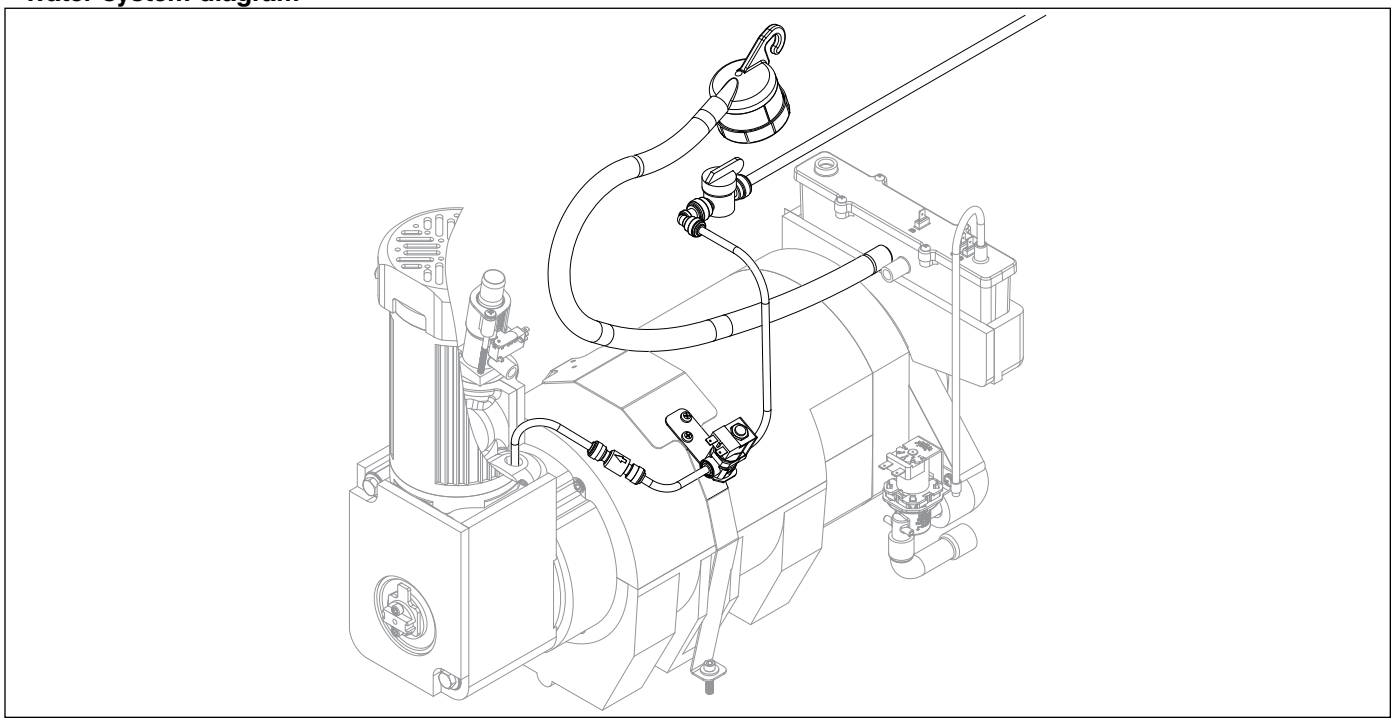
Water system

The water level in the evaporator is controlled by a feed solenoid and level detecting sensors. Referencing the diagram below, water sensing probes extend down into the reservoir at the end of the evaporator assembly. The system works via electrical conductivity as follows:

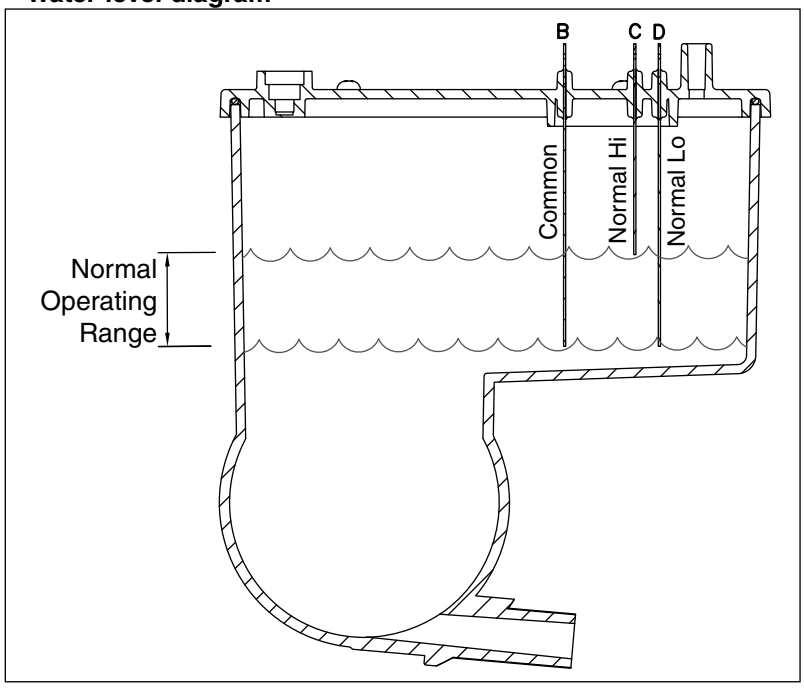
The probe labeled B is the common. When water is between any of the other probes and the common, the PC board will sense the activation. During normal operation, the water level rises and falls between the Normal High and Normal Low probes. As water is consumed to make ice, the level will fall until the Normal Low probe is exposed, triggering the water feed solenoid on. Water will fill until the Normal High sensor is activated.

Note: The potable water total dissolved solids (TDS) content must be greater than 10 ppm for the water control system to function properly. If using reverse osmosis water filtration system, ensure TDS level is greater than 10 ppm.

Water system diagram



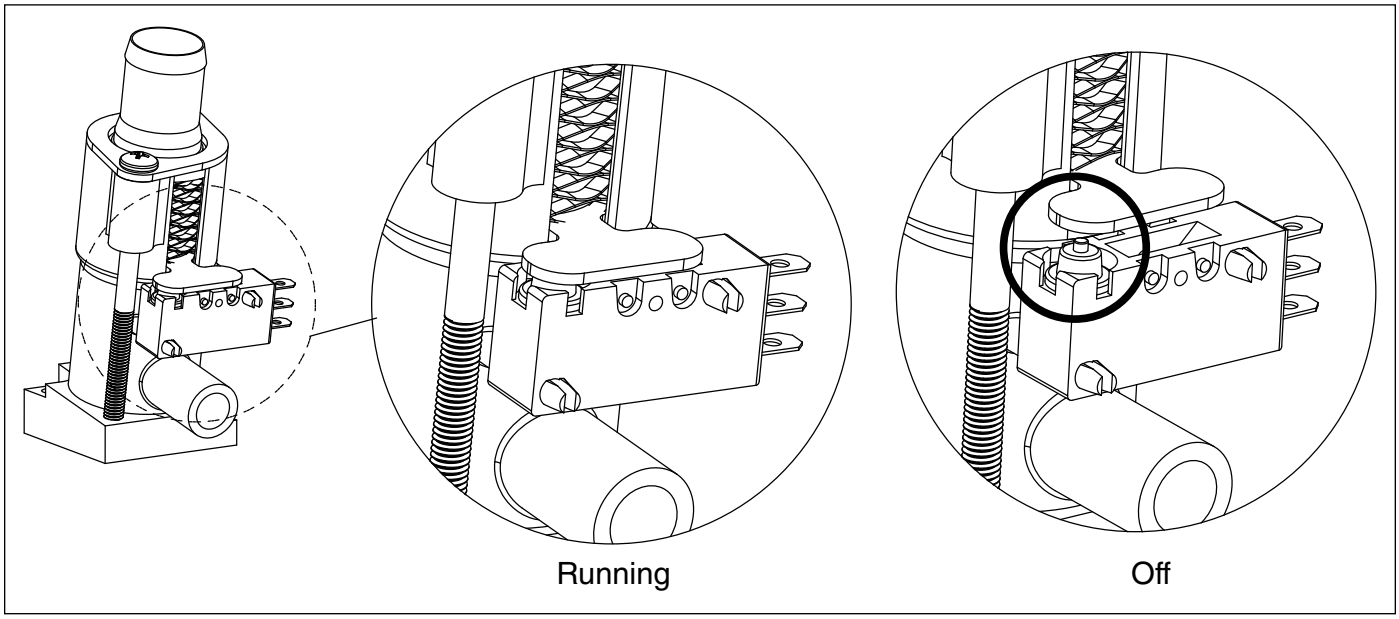
Water level diagram



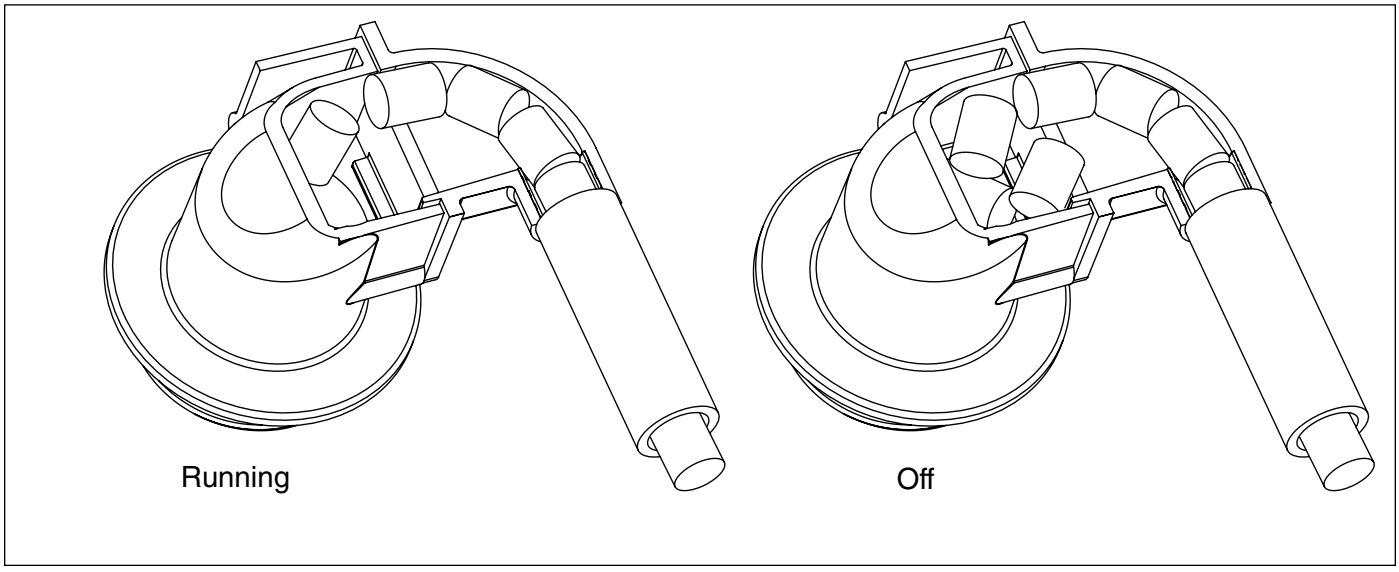
“Bin full” detection system

The Follett Horizon ice machine incorporates a unique “bin full” detection system that consists of the shuttle and actuator. The shuttle incorporates a flag and switch. Referencing the figure below, the normal running position of the flag is down, and the switch is closed. When the bin fills to the top and ice can no longer move through the tube, the machine will force the shuttle flag up, opening the switch and shutting the machine off. The shuttle actuator, located above the ice bin allows the ice to curl up within it when the bin is full. In this way, there are no loads generated that would tend to lift off the lid of the bin. Do not apply voltage, this system works on contact closure only.

Shuttle flag and sensor



Shuttle actuator



Electrical system

ATTENTION!

To prevent circuit breaker/Hi-amp overload, wait 5 minutes before restarting this unit. This allows the compressor to equalize and the evaporator to thaw.

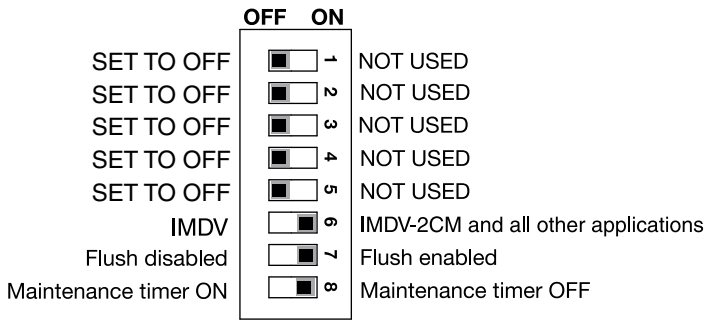
Normal control board operation

The PC board indicator lights provide all the information necessary to determine the machine's status. Green indicator lights generally represent “go” or normal operation; Yellow indicators represent normal off conditions; Red indicators generally represent alarm conditions, some of which will lock the machine off.

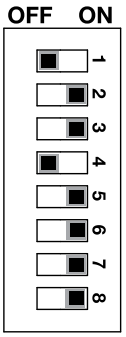
A flashing green light labeled POWER indicates power to the machine. All other normal operation status indicators are covered as follows:

Ice machine disposition	Operating conditions
Legend: ● ON ○ OFF ◐ ON or OFF ⊗ FLASHING	
1. Ice machine is making ice. CLEANER FULL ○ DRAIN CLOG ○ HI PRESS ○ HI AMPS ○ SERVICE ○ MAINT/CLEAN ○ LOW WATER ○ TIME DELAY ○ NOT USED ○ MAKING ICE ● LOW BIN ● POWER ON ⊗	1. **Normal running.**
2. Ice machine is not making ice. CLEANER FULL ○ DRAIN CLOG ○ HI PRESS ○ HI AMPS ○ SERVICE ○ MAINT/CLEAN ○ LOW WATER ○ TIME DELAY ● NOT USED ○ MAKING ICE ○ LOW BIN ◐ POWER ON ⊗	2. **Normal time delay.** When the bin fills with ice, the LOW BIN light goes out momentarily and the refrigeration and auger drive systems immediately shut down. (**Note:** The fan motor will continue to run for 10 minutes to cool condenser) The TIME DELAY light comes on, initiating the time delay period. When the time delay expires, the machine will restart provided that the LOW BIN light is on.

DIP Switch Settings



Bin Top Sleep Cycle DIP Switch Setting



Evaporator flushing sequence

During operation, the purge valve opens periodically to drain water and reduce TDS concentration while making ice. Two flush intervals are available: Low TDS and High TDS (selected by the rocker switch behind the front cover). As ice is produced, dissolved minerals concentrate in the evaporator water. Without periodic purging, mineral concentration can increase and promote scale formation and reduced performance. Typically, High TDS might be considered levels above 200 PPM, but local experience and varying water chemistry may compel a High TDS setting for best performance in even lower TDS levels.

- Low TDS: flush interval 60 minutes.
- High TDS: flush interval 10 minutes.

Flush sequence (3 cycles)

1. Purge opens until the water level drops below the low probe.

2. Fill opens until the water reaches the high probe.
3. Repeat for a total of three purge/fill cycles.

Off-cycle flush

At the end of the full bin time delay or upon entering a time delay accompanying an error, the control board checks cumulative ice-making time since the last off-cycle flush. If cumulative run time exceeds 10 minutes, it opens the purge valve for 60 seconds, refills, and resumes making ice. If less than 30 minutes, it starts without draining.

Relay output indication

Each relay on the board has an indicator LED associated with its output. For example, when the water feed solenoid relay is energized, the adjacent LED illuminates green.

Error faults

The Horizon Elite PC board monitors various operating parameters including refrigeration head pressure, auger gearmotor amperage, reservoir water level, and for the presence of excessive water in the chassis. If an error condition occurs there are two possible types of errors:

- Soft errors shut the machine down and start a 1-hour time delay. Soft errors clear automatically after the time delay expires or may be manually cleared by cycling power.
- Run errors indicate a condition that may require attention but do not prevent the machine from normal operation. Run errors only clear after a power cycle of the unit.

Soft errors

HI AMPS: The board monitors auger motor current through the P4 terminal. If current draw exceeds the maximum limit or drops below 0.2A, normal ice making operation ends and the machine shuts down on a TIME DELAY / HI AMPS soft error. After the 1-hour time delay expires, the indicators clear and the machine restarts.

During normal operation while the PC board monitors conductivity between the three water reservoir sensors/ probes (common, high, and low) a disruption in water supply or lack of water usage may result in either a solid or flashing LOW WATER soft error.

Solid LOW WATER: If water flow to the machine is disrupted during normal operation, the sequence is as follows: when the reservoir water level drops below the normal low probe, the PC board energizes the water feed solenoid. If water is not detected at the normal low sensor/probe within 30 seconds, the machine shuts down on a TIME DELAY / solid LOW WATER soft error. After the 1-hour time delay expires and if water flow returns allowing the reservoir to refill to the normal low probe, the indicators clear and the machine restarts.

Flashing LOW WATER: If water consumption ceases or significantly slows during normal operation, the sequence is as follows: When the reservoir water level fails to drop below the normal low probe within 3 minutes of the previous water fill, the machine shuts down on a TIME DELAY / flashing LOW WATER soft error. After the 1-hour time delay expires the indicators clear, the machine restarts and attempts to make ice. Important note: Upon initial startup, the timing threshold is 7 minutes.

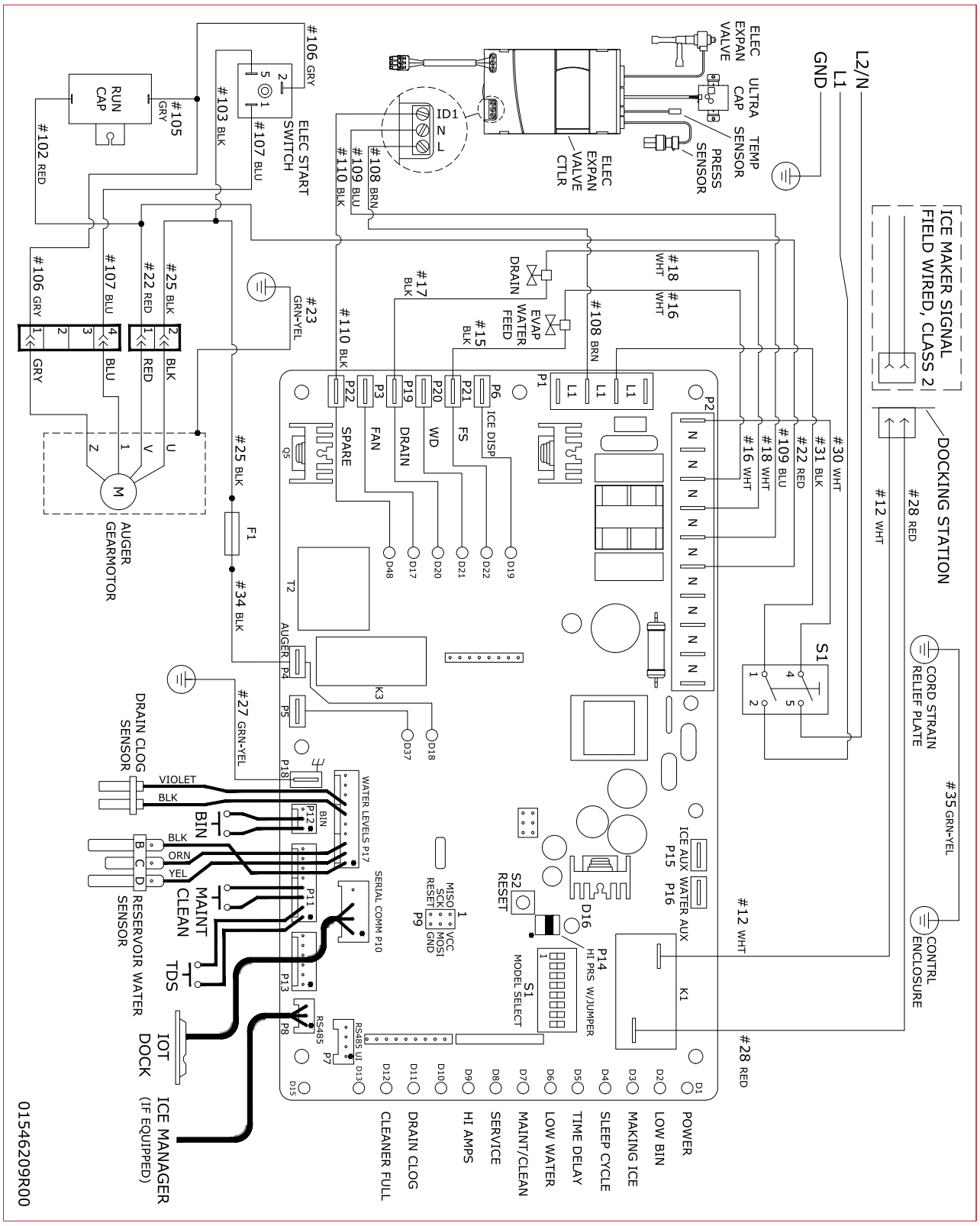
HI PRESSURE: A normally closed hi-pressure cutout is present in the refrigeration system. If head pressure rises above 425 psi, the hi-pressure cutout opens, the PC board senses the loss of conductivity through the circuit and the machine shuts down on a TIME DELAY / HI PRESSURE soft error. After the 1-hour time delay expires, if head pressure has dropped below the hi-pressure cutout's reset point of 295 psi, the machine restarts, and the indicators clear.

SERVICE: There are drain/overflow sensors located in the chassis positioned just below the top edge of the chassis. If the water level within the chassis rises enough to alert the PC board of conductivity between the sensors the machine shuts down on a TIME DELAY / SERVICE soft error. After the 1-hour time delay expires, if conductivity between the sensors is lost, the machine restarts and the indicators clear.

Run Errors:

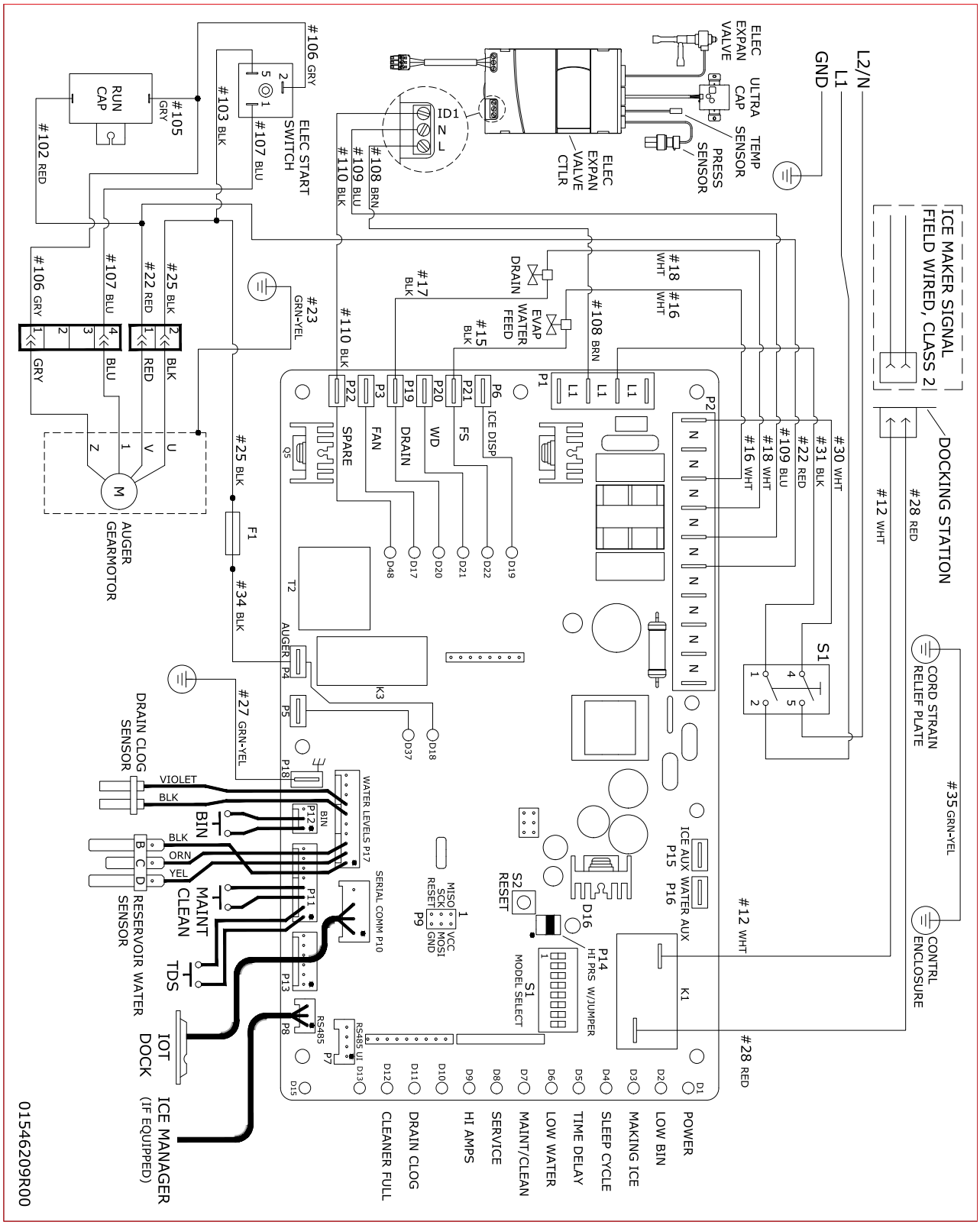
DRAIN CLOG: When the machine shuts down on a full bin TIME DELAY or upon entering an error state and accompanying 1-hour TIME DELAY and there has been at least 10 minutes of cumulative compressor run time, the machine purges before starting. During this purge, if the PC board does not sense conductivity lost between the common and low sensors/probes in the water reservoir within 20 seconds of energizing the purge solenoid, the DRAIN CLOG LED illuminates as a run error. After the time delay expires, the machine will continue to run but the DRAIN CLOG LED will remain illuminated until a power cycle has been performed. This is an indication of a poorly draining machine and must be addressed.

Electrical schematic, EEV Controller with Screen, 120 VAC

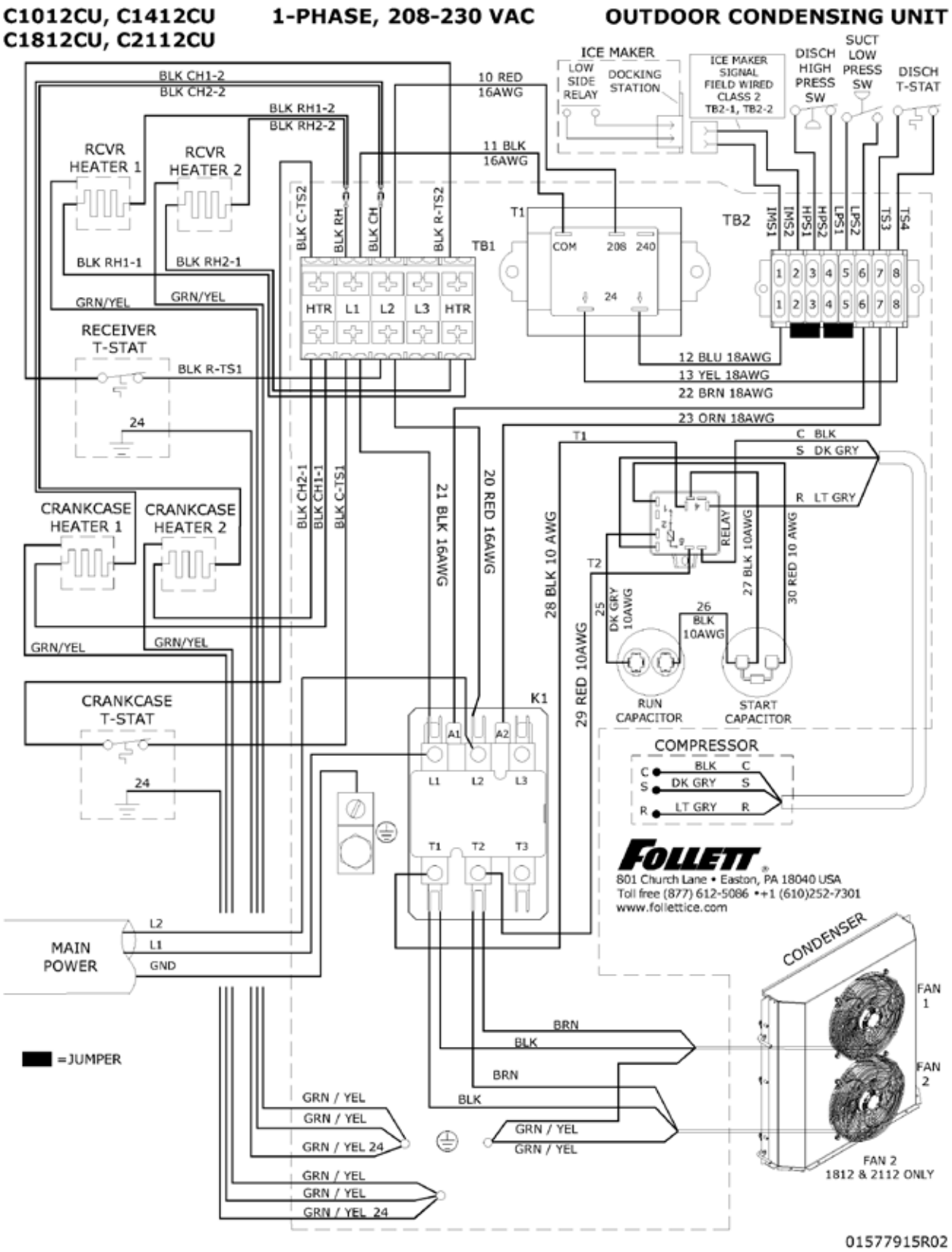


Gearmotor data		**Resistance of windings**
Gearmotor current	Power Electric: 2.6A @ 115 V Brother: 2.6A @ 115 V	**115 vac gearmotor (Brother):** White to Black: 3Ω White to Red: 3Ω Red to Black: 6Ω
Gearmotor torque-out (high amp) trip point:	7A	

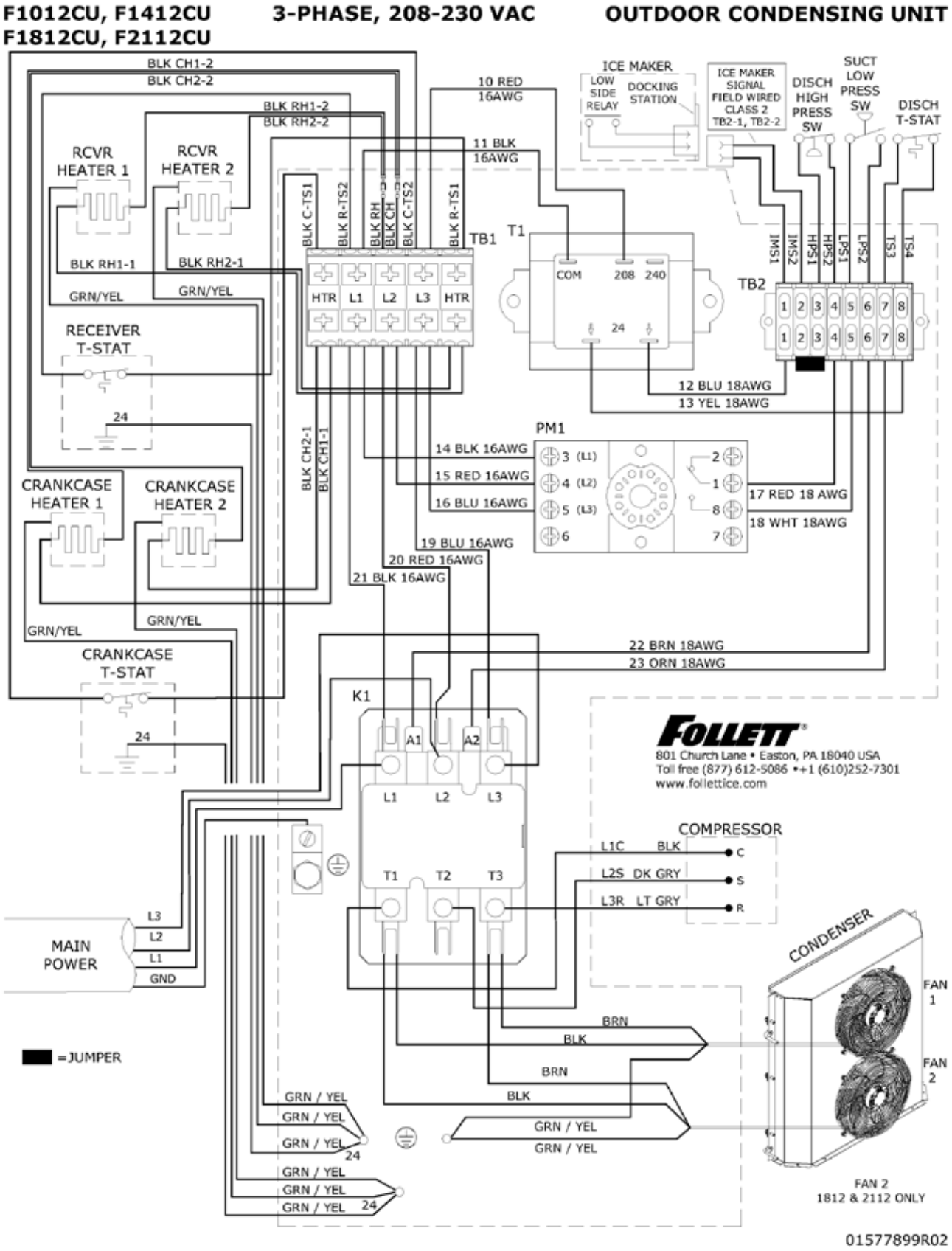
Electrical schematic, EEV Controller without Screen, 24 VAC



Single-phase condensing unit wiring diagram



3-phase condensing unit wiring diagram



Mechanical System

Evaporator disassembly

1. Press CLEAN button to purge evaporator. Turn power OFF when LO WATER lights.
2. Unscrew and disconnect transport tube from louvered docking assembly.

Fig. 11

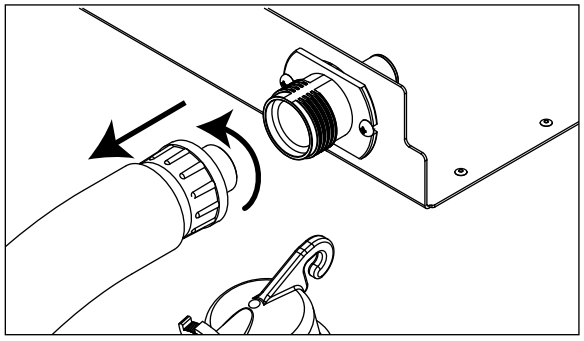


Fig. 12

3. Disconnect gear motor wires.

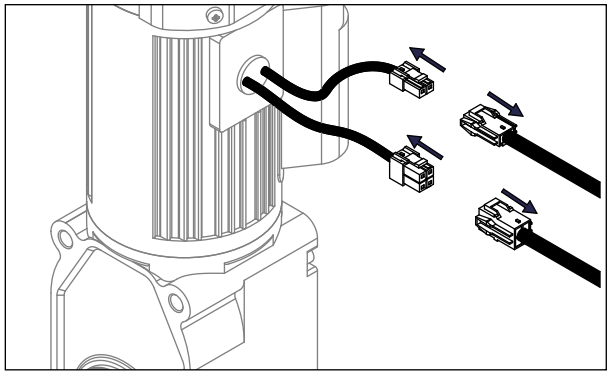


Fig. 13

4. Remove screws (with 3/16" allen wrench) and auger retaining fork:

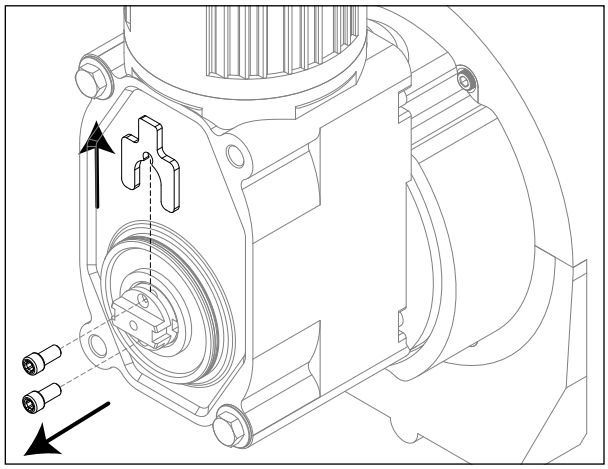
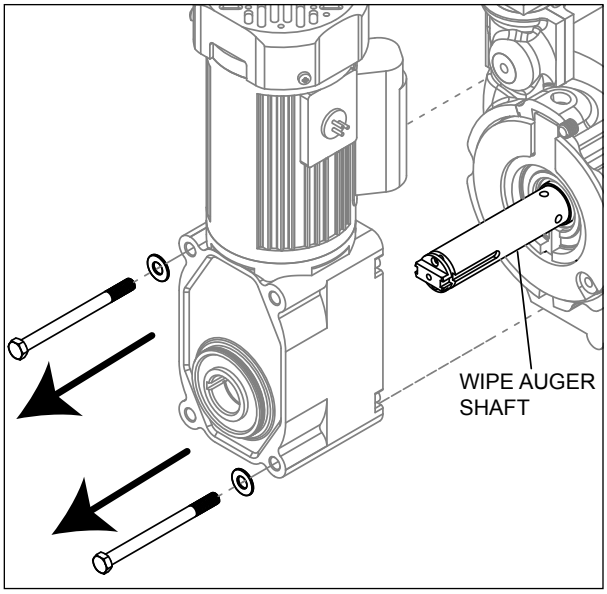
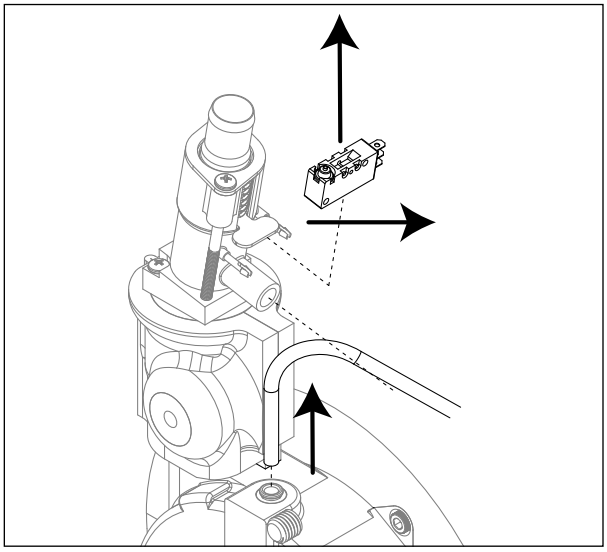


Fig. 14



5. Remove gear motor bolts (9/16" wrench).
6. Remove gear motor and wipe auger shaft clean.

Fig. 15



7. Remove front feed water tube from push-in fitting, shuttle drain tube, and shuttle switch.

Fig. 16

8. Remove 3 screws (with 3/16" allen wrench) then remove auger and main housing together.

Note: Auger is sharp - wear protective gloves.

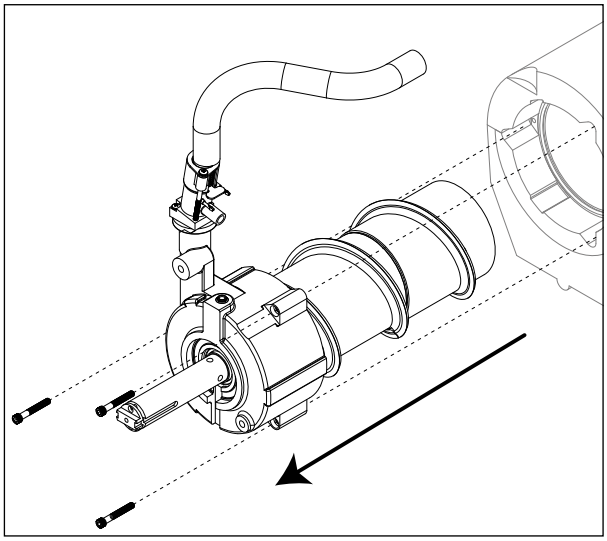


Fig. 17

9. Rotate auger to align opening in auger flange with stream divider.

Note: To prevent damage to internal components, pull outward on the auger shaft to rotate.

10. Pull out auger.

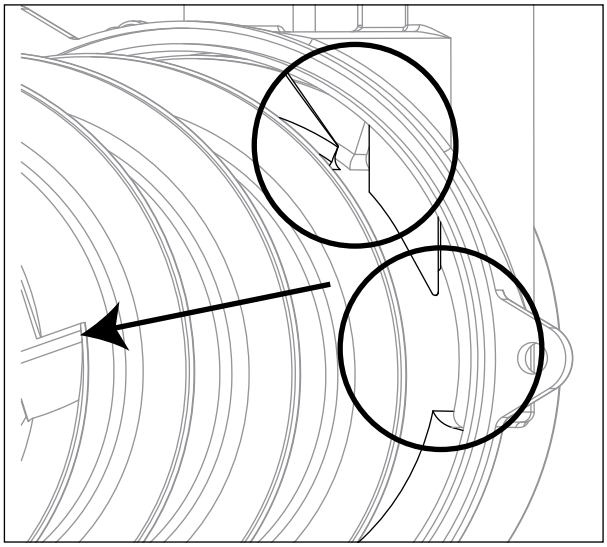
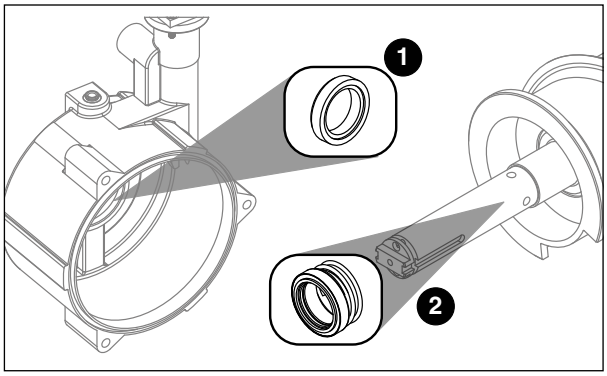


Fig. 18

11. Inspect ceramic mating ring and shaft seal, please note, **seal replacement is only necessary if seal is damaged.**

- Inspect ceramic seal face on interior of main housing. Ceramic ring **(Fig. 18.1)** should be free of cracks and chips. Discoloration on the face of the seal is normal. The ceramic ring can be cleaned with an alcohol pad.

12. Inspect the spring-loaded carbon seal **(Fig. 18.2)** on the auger shaft. The carbon seal face should be free of cracks and chips. The spring should move freely on the auger shaft. If the spring is stuck in place, it can be carefully removed, cleaned and re-installed. Gently pry the seal off the auger shaft. DO NOT place any force on the carbon portion of the seal. Once removed, clean seal with warm water and soap. The auger shaft can be cleaned with scotch-brite.



Evaporator reassembly

Caution: Do not touch the sealed surface of either part. Oil from bare skin will cause premature seal failure.

13. Use a small amount of liquid hand soap on the rubber part of the ceramic seal when installing in main housing. Use supplied cardboard disc to press into recess.

14. Apply a small amount of soap to the raised portion of the auger shaft and the interior rubber clad portion of the spring seal to ease assembly. DO NOT USE PETROLEUM GEL ON ANY PORTION OF THE SEAL.

15. Re-install the spring seal on the auger shaft. Before final assembly, clean the carbon face of the seal with an alcohol pad. Wipe away any residual soap.

16. Clean O ring groove. Lubricate O ring with petrol-gel and reinstall.

17. Carefully install auger.

18. Rotate auger to position shown to clear main housing stream divider.

19. Slide main housing **(Fig. 21.1)** onto auger.

20. When installing new water seal, use screwdriver to compress the spring **(Fig. 21.2)**, which allows for easier installation of the three screws.

Fig. 19

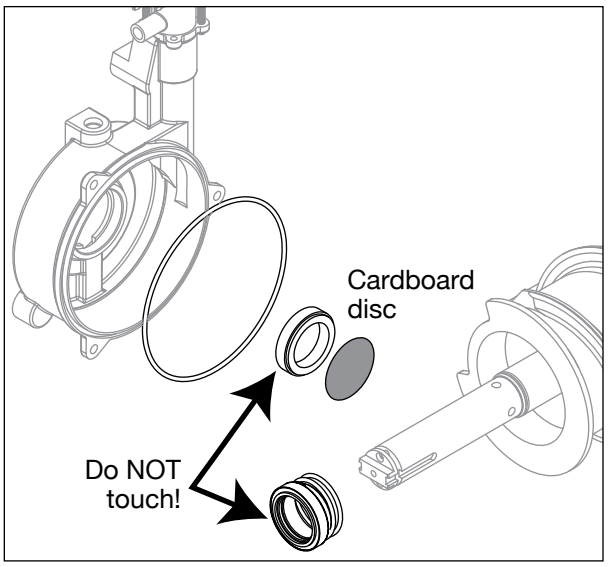


Fig. 20

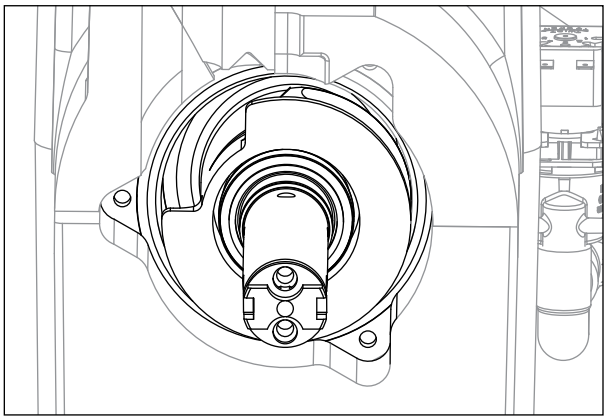
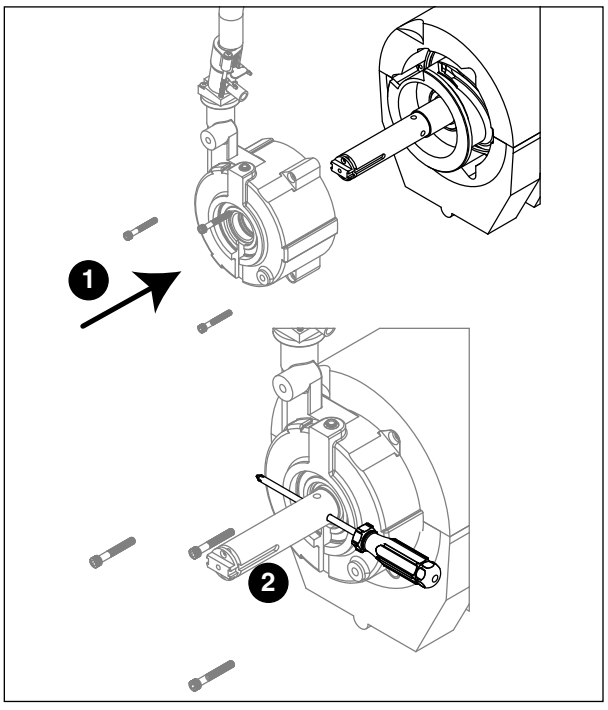


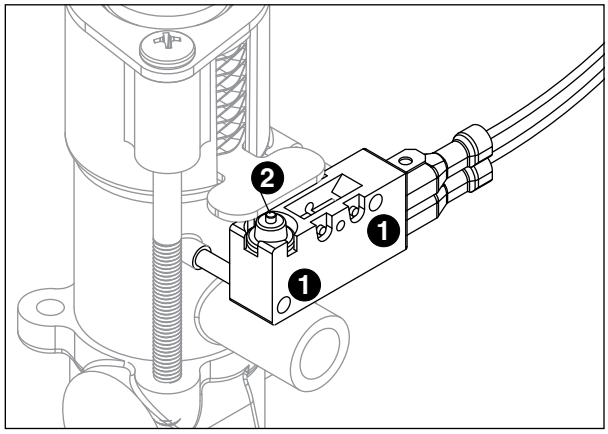
Fig. 21



21. Install shuttle switch.

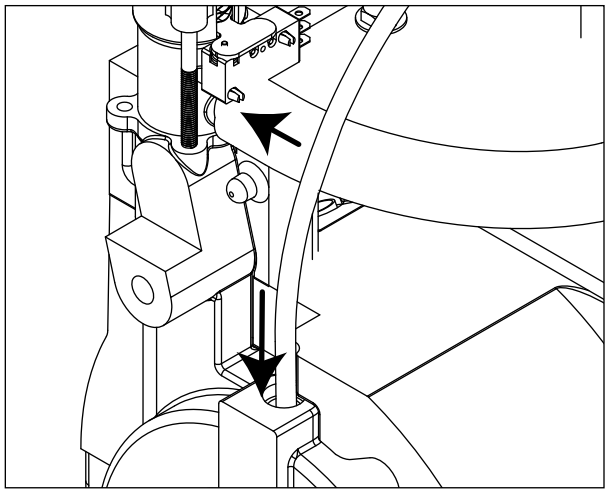
- Align holes with pins (Fig. 23.1) and depress switch button (Fig. 23.2) to clear shuttle tab.

Fig. 22



22. Install shuttle drain tube and front feed water tube **(Fig. 23)**.

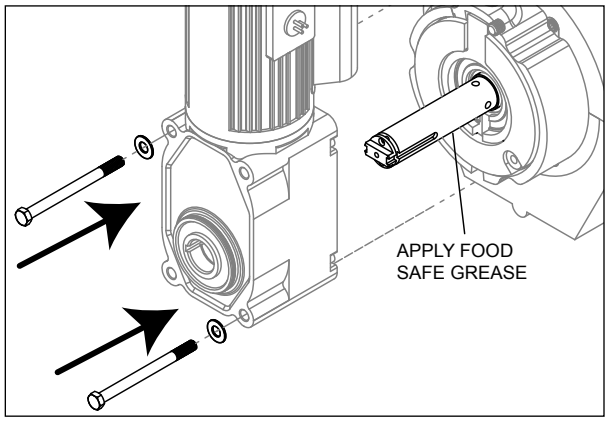
Fig. 23



23. Apply a coat of food safe grease to auger shaft.Slide gear motor onto auger and install gear motor bolts (9/16" wrench).

Note: DO NOT USE PETROL GEL.

Fig. 24



24. Connect gear motor wires.

Fig. 25

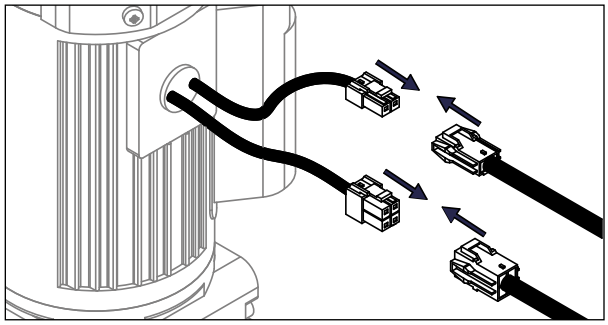


Fig. 26

25. Pry auger forward and rotate auger using 1/2" wrench to align keyways.

26. Insert key fully.

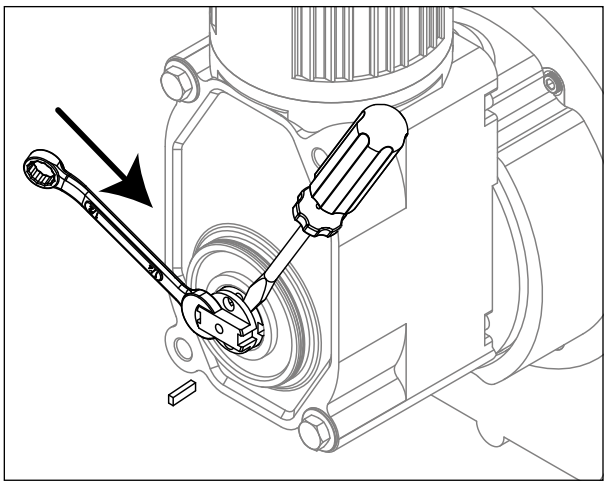


Fig. 27

27. Pry shaft forward to install retainer fork.

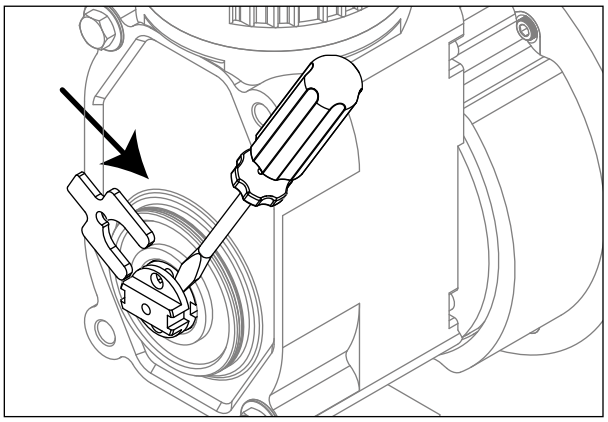


Fig. 28

28. Rotate retainer fork to align screw holes.

29. Install screws to secure retainer fork.

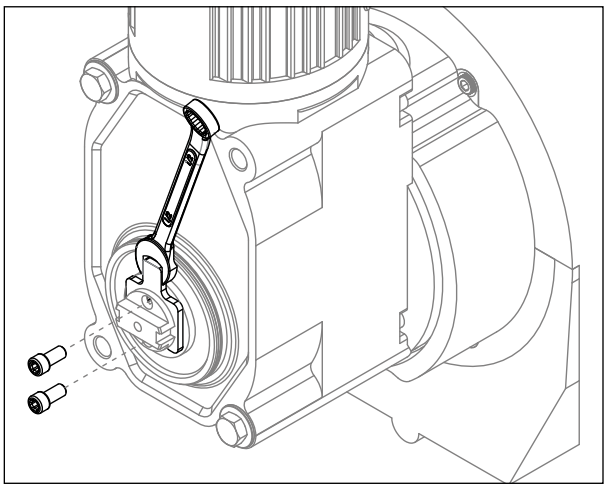
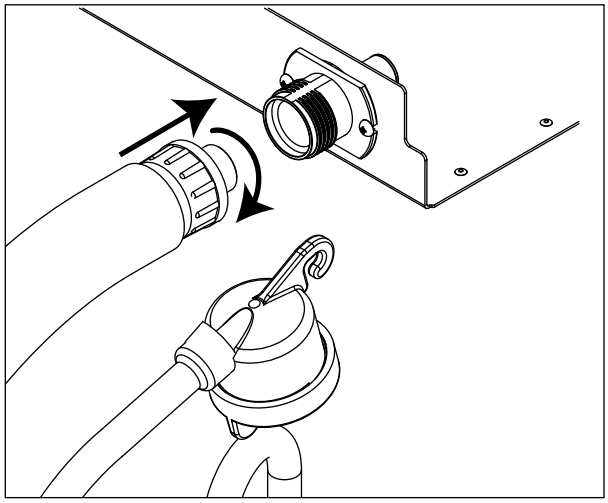


Fig. 29

30. Connect transport tube to louvered docking assembly.



Reservoir/rear bushing disassembly

Fig. 30

1. Press CLEAN button to purge evaporator. Turn power OFF when LO WATER lights.

Note: In many applications, removing the gearmotor, main housing, and auger will allow for the ice machine to be pulled out further for better access to rear components.

2. Slide ice machine forward to gain access.

3. Use Fig. 29 as disassembly guide.

Note: Use petrogel when installing/reinstalling o-rings.

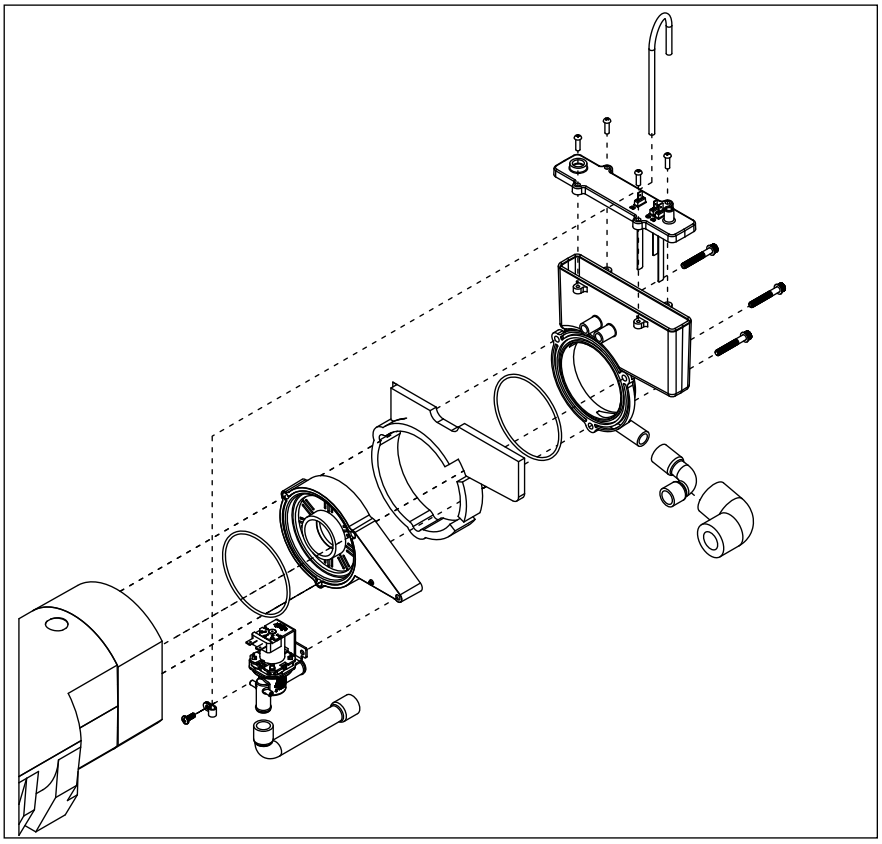
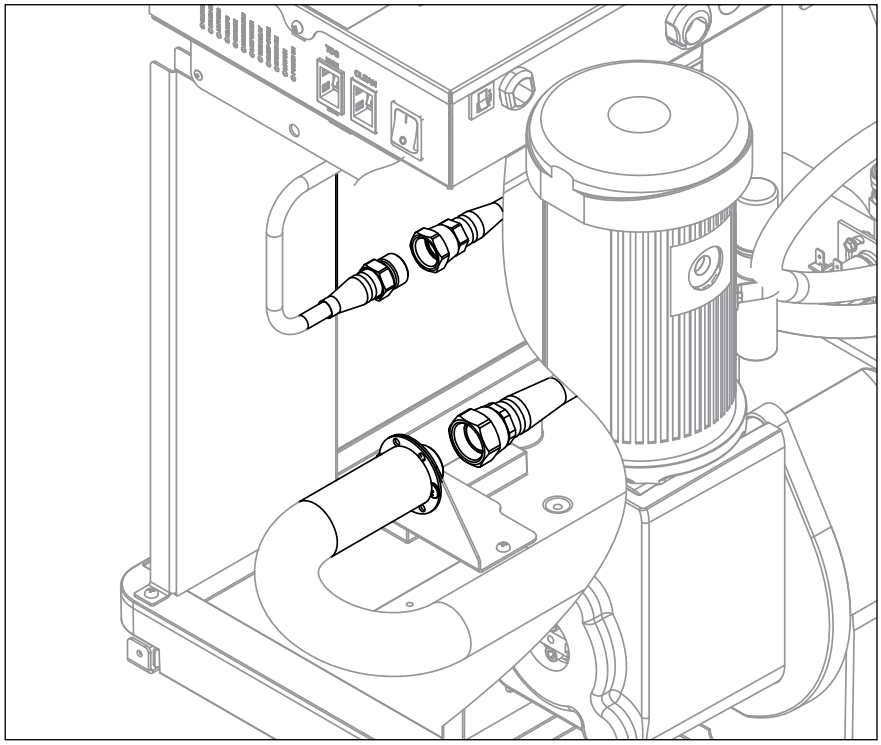


Fig. 31

Attention:

Access to the reservoir and rear bushing is accomplished by disconnecting the suction and liquid line quick disconnects. These disconnects are self-sealing and do not require unit to be pumped down. When disconnected, unit can be pulled forward for access.



Refrigeration system

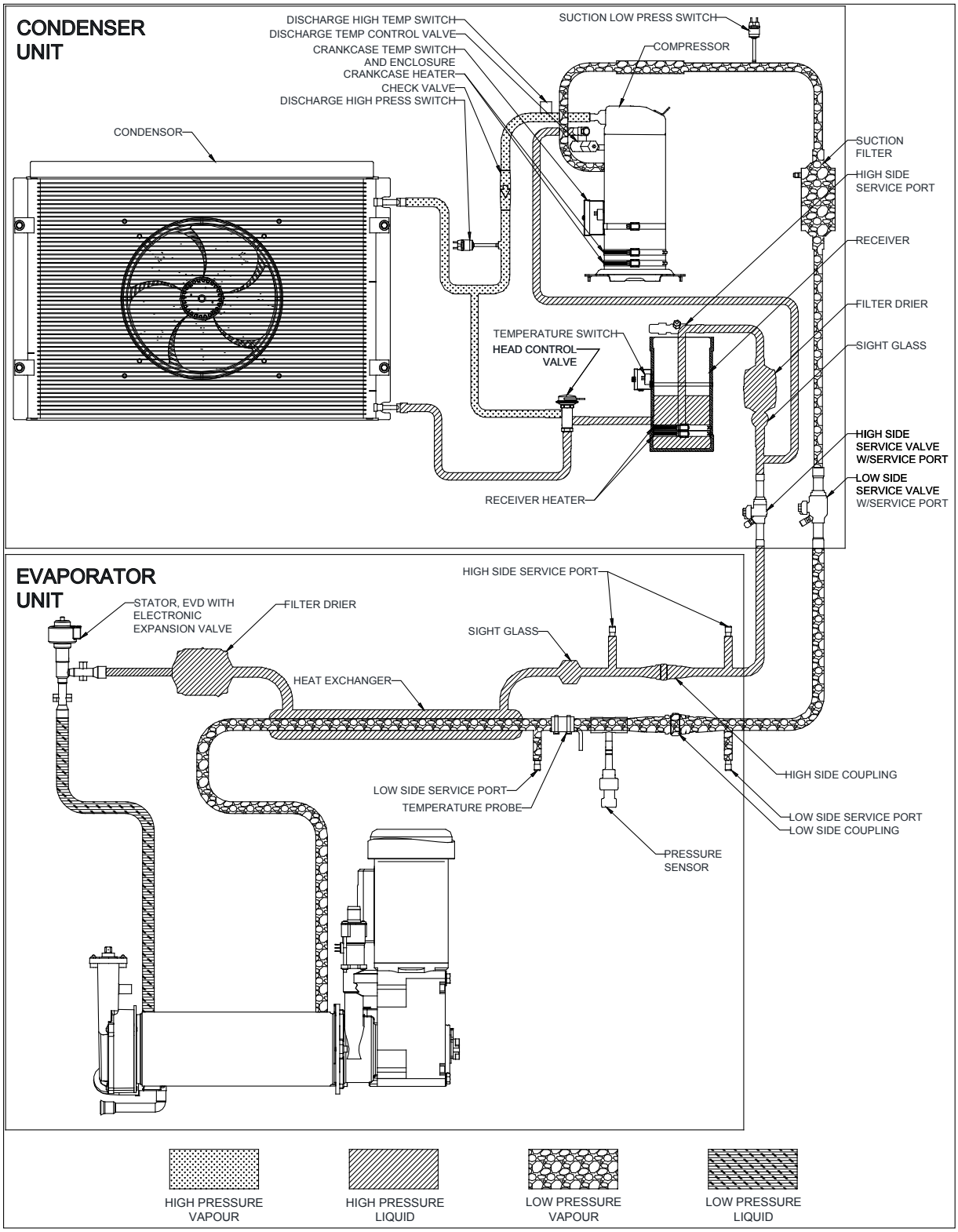
Condenser unit operation

The condensing unit is weatherproof and equipped to operate in ambient temperatures from –20 F to 120 F (–29 C to 48.9 C). The condensing unit is controlled by a low and high pressure switches, which works in concert with a refrigerant solenoid valve on the evaporator module. On start-up, the refrigerant solenoid valve opens and suction pressure rises above the “on” set point of the high pressure switch. The compressor and fan turn on and the refrigeration system operates. Upon shut down, the refrigerant solenoid closes. The compressor will pump down the ice machine evaporator and suction line until the low “off” set point of the low pressure switch is reached, at which point the compressor and fan will turn off.

Low ambient operation: Reliable operation at low outdoor ambient temperature is achieved with a pumpdown cycle, a crankcase heater and a head pressure control valve. When the outdoor ambient falls, the condensing pressure falls. This causes the discharge pressure to fall as well. When the discharge pressure falls below the dome pressure, the valve modulates open to the discharge port which allows discharge gas to bypass the condenser. Mixing the discharge gas with the liquid creates a high pressure at the condenser outlet, reducing the flow and causing liquid to back up in the condenser. Flooding the condenser reduces the area available for condensing. This reduction in effective condenser surface area results in a rise in condensing pressure. During summer conditions, the discharge pressure is high, thus closing the discharge port of the valve. Hence, there is full liquid flow from the condenser to the receiver.

A check valve is installed in the liquid line between the liquid receiver and the condenser to prevent liquid migration from the receiver to the condenser during the off cycle. A second check valve is installed in the discharge outlet of the motor compressor to prevent any oil from migrating onto the compressor head during an off cycle. A low pressure control will start the condensing unit anytime the low side pressure rises above the C/I setting of the control. The system contains a crankcase heater which is energized via the auxilliary contactor of the compressor during any off cycle. It is de-energized whenever the compressor is energized. This keeps the oil temperature in the compressor sump warmer than any other wetted surface to prevent liquid migration from settling into the compressor sump to prevent flooded compressor starts in extreme outdoor temperatures. The liquid receiver also contains a heater which is controlled by a thermostat and is de-energized above 80°F. This is to maintain sufficient refrigerant pressure at extreme outdoor temperatures to activate the pressure switch.

Refrigeration system diagram



Refrigeration charge

All service on refrigeration systems must be performed in accordance with all federal, state and local laws. It is the responsibility of the technician to ensure that these requirements are met. Recharging ice machine to other than factory specifications will void the warranty.

R449A Ice Machine Charge Specifications

Line Run	C1012CU single phase	F1012CU 3-phase	C1412CU single phase	F1412 CU 3-phase
0 - 100' (0 - 30.5 m)	8 lbs (3.63 kg)			
100' + (30.5 m+)	Consult Technical Service at (877) 612-5086 or (610) 252-7301.			

Note: Condensing unit shipped fully charged with 8 lb R449A.

Refrigerant replacement requirements

1. Non-contaminated refrigerant removed from any Follett refrigeration system can be recycled and returned to the same system after completing repairs. Recycled refrigerant must be stored in a clean, approved storage container. If additional refrigerant is required, virgin or reclaimed refrigerant that meets ARI standard 700-88 must be used.
2. In the event of system contamination (for example, a compressor burn out, refrigerant leak, presence of non-condensibles or moisture), the system must be repaired, evacuated and recharged using virgin or reclaimed refrigerant that meets ARI standard 700-88.
3. Follett Products, LLC does not approve of recovered refrigerants. Improper refrigeration servicing procedures will void the factory warranty.

Evacuation

Evacuate the system to a level of 500 microns. When the 500 micron level is reached, close all valves. Allow the system to sit for approximately 20 minutes. During this period the system pressure should not rise. If the system pressure rises and stabilizes there is moisture in the system and further evacuation is needed. If the pressure continues to rise check the system for leaks.

Evaporator Unit Low-side or ice making head

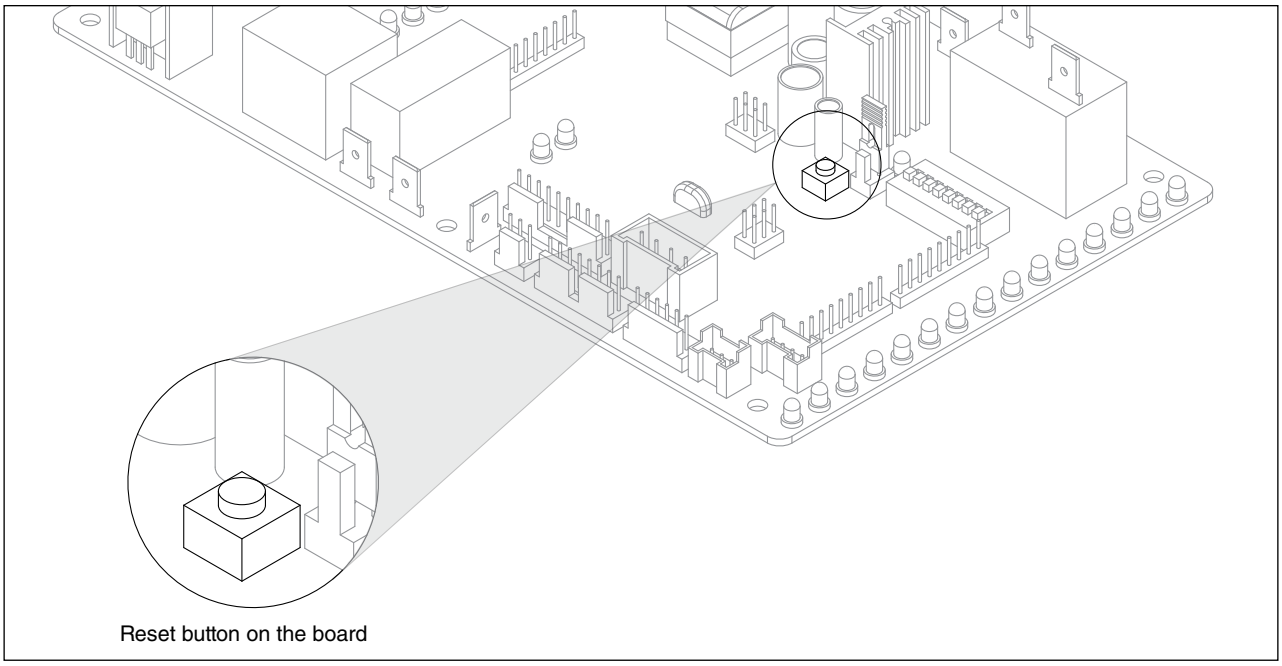
Ambients	Minimum	Maximum
Air temperature	50 F/10 C	100 F/37,8 C
Water temperature[1]	45 F/7 C	90 F/32,2 C

[1]Ambient water temperature is measured in the ice machine water reservoir.

Ice capacity test

Ice machine production capacity can only be determined by weighing ice produced in a specific time period.

1. Replace all panels on ice machine.
2. Run ice machine for at least 15 minutes.
3. Move TDS switch to LOW.
4. Press the reset button on the board.



Reset button on the board

5. Weigh and record weight of container used to catch ice.
6. Catch ice for 15 minutes.
7. Weigh harvested ice and record total weight.
8. Subtract weight of container from total weight.
9. Convert fractions of pounds to decimal equivalents (ex. 6 lbs 8 oz = 6.5 lbs).
10. Calculate production using following formula:

$$\frac{\text{1440 min. x wt. of ice produced}}{\text{Total test time in minutes}} = \text{Production capacity/24 hr.}$$

11. Calculated amount per 24 hours should be checked against rated capacity for same ambient and water temperatures in Ice Production Tables.
12. **Move TDS switch to the HI TDS position.**

Troubleshooting

Ice machine disposition	Possible causes	Corrective action
Legend: ● ON ○ OFF ◐ ON or OFF ⊠ FLASHING		
1. Ice machine is in running condition but not making ice. 	1. Defective compressor. 2. Defective main contactor. 3. No output from PC board. 4. Purge valve stuck open. 5. Low charge.	1. Replace compressor. 2. Replace main contactor. 3. Replace PC board. 4. Replace purge valve. 5. Fix leak, recharge system.
2. Machine in TIME DELAY without full bin. 	1. Ice jamming due to improperly installed transport tube causing a false shuttle. 2. Shuttle stuck in up position. 3. Damaged or improperly installed thermostat (open). 4. Transport tube backed-out of coupling.	1. Correct transport tube routing. 2. Repair or replace shuttle mechanism. 3. Replace or reposition thermostat. 4. Correct coupling installation.
3. Ice machine is not making ice. HI AMPS. 	1. Poor water quality causing ice to jam auger. 2. Damaged shuttle mechanism. 3. Intermittent drive output from PC board. Evaporator will freeze causing a HI AMPS error. 4. Gearmotor is unplugged.	1. Clean ice machine. Increase flushing frequency. Position TDS switch to High TDS setting. 2. Replace or repair shuttle mechanism. 3. Replace PC board. 4. Plug in gearmotor.
4. Ice machine is not making ice. HI PRESSURE. 	1. High ambient temperatures >100 F (38 C). 2. Poor ventilation or air recirculation. 3. Clogged condenser (air-cooled). 4. No water flow through condenser (water-cooled only). 5. Fan not working properly. No air flow. • Blocked fan blades • No fan output from PC board • Faulty fan motor	1. Air condition area to below 100 F (38 C). 2. Reposition ice machine or properly ventilate. Prevent ice machine exhaust from recirculating. 3. Clean condenser/grille (air-cooled). 4. Restore water flow to condenser. Ensure supplied condenser water flow direction is correct. 5. Correct air flow. • Remove any blockage from fan blades • Replace PC board • Replace fan motor
5. Ice machine is not making ice. SERVICE. 	1. Internal water leak touching chassis sensor. 2. Condensation.	1. Identify and repair leak. Clean/dry chassis and sensors and restart machine. 2. Ensure ice machine chassis condensate drain is plumbed and free flowing.
6. Drain clog. 	1. Improper flow in drain system. 2. Failed purge solenoid. 3. No output from PCB to purge solenoid.	1. Correct/clean drain system. 2. Replace purge solenoid. 3. Replace PC board.

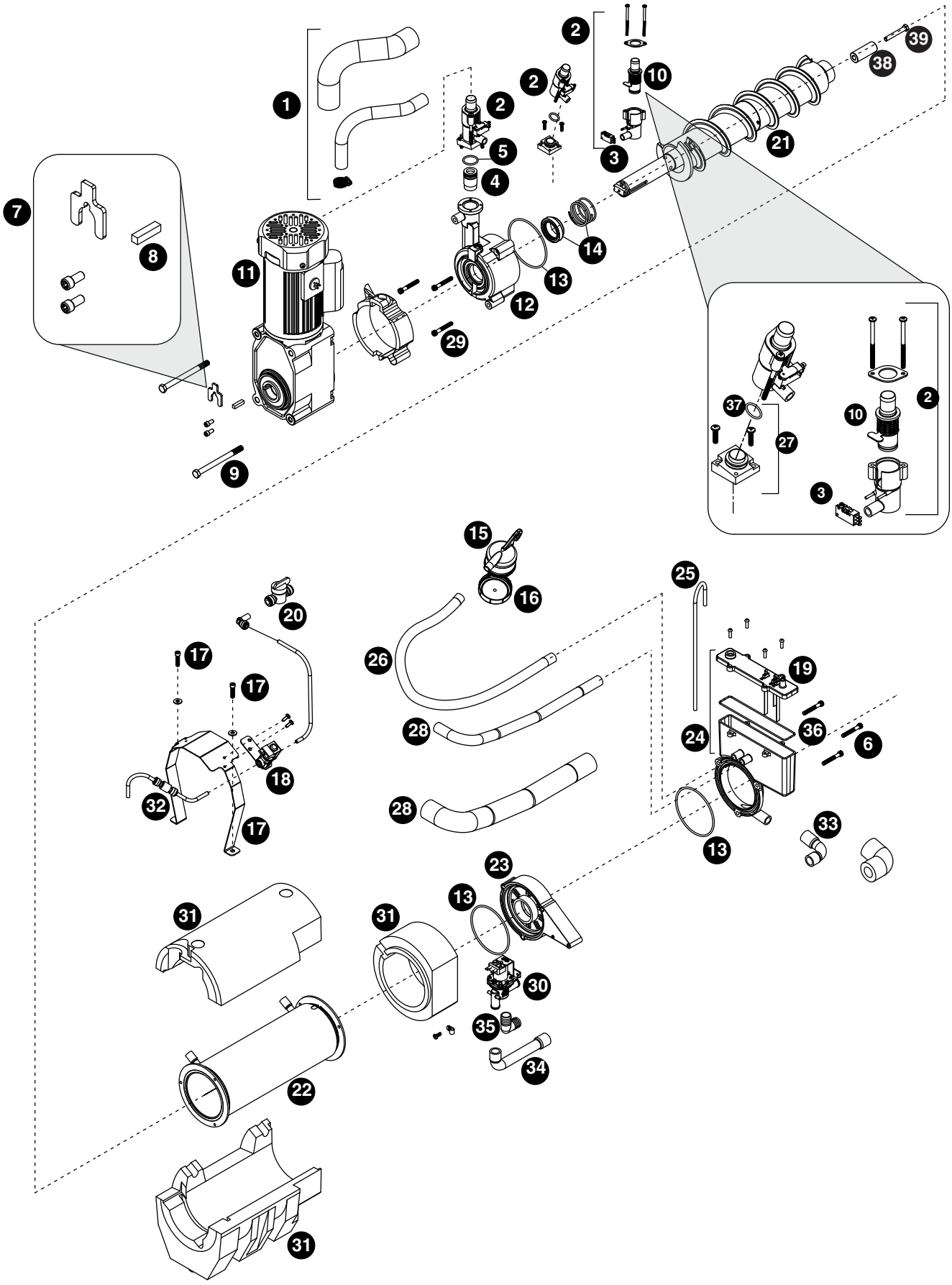
Ice machine disposition	Possible causes	Corrective action
Legend: ● ON ○ OFF ◐ ON or OFF ⊗ FLASHING		
7. Ice machine is making ice. Excessive water in bin or coming into bin from transport tube. 	1. Failed water sensors. Processor assumes there is no water when there is water. 2. Blocked reservoir vent. 3. Defective water feed solenoid valve. Stuck in open position. 4. Pressure over 70 psi. 5. Auger jammed with ice. 6. RO water under 10 ppm.	1. Clean or replace water probe assembly. Check wiring connections. 2. Clean or replace vent tubes. 3. Replace water feed solenoid valve. 4. Correct water pressure. 5. Clean ice machine/auger. 6. Correct RO supplied water to >10 ppm.
8. Ice machine is not making ice. Solid Low Water. 	1. Water supply is insufficient. 2. Low water pressure. 3. Defective water feed solenoid valve. Stuck in closed position. 4. No water feed output from PC board. 5. Plugged screen on inlet side of fill solenoid. 6. Plugged check valve.	1. Restore water supply and check water filters. If evaporator was completely empty the reset button may have to be pressed to restart the ice machine. 2. Ice machine will eventually start when water reaches normal low level. • Ensure water pressure to ice machine is >10 psi. 3. Replace water feed solenoid valve. 4. Replace PC board. 5. Remove and clean screen. 6. Replace check valve.
9. Blinking Low Water, power, time delay. 	Machine did not see water consumption while trying to make ice. 1. Lack of refrigeration/low refrigerant charge/leak. 2. Debris shorting reservoir probes.	1. Verify refrigerant pressures, compressor running, sight glass clear. 2. Clean probes and reservoir of debris.
10. Solid PM Due. 	1. Ice machine has been in service for 6 month interval without being cleaned.	1. Clean Ice machine.

ATTENTION!

To prevent circuit breaker overload, wait 5 minutes before restarting this unit.

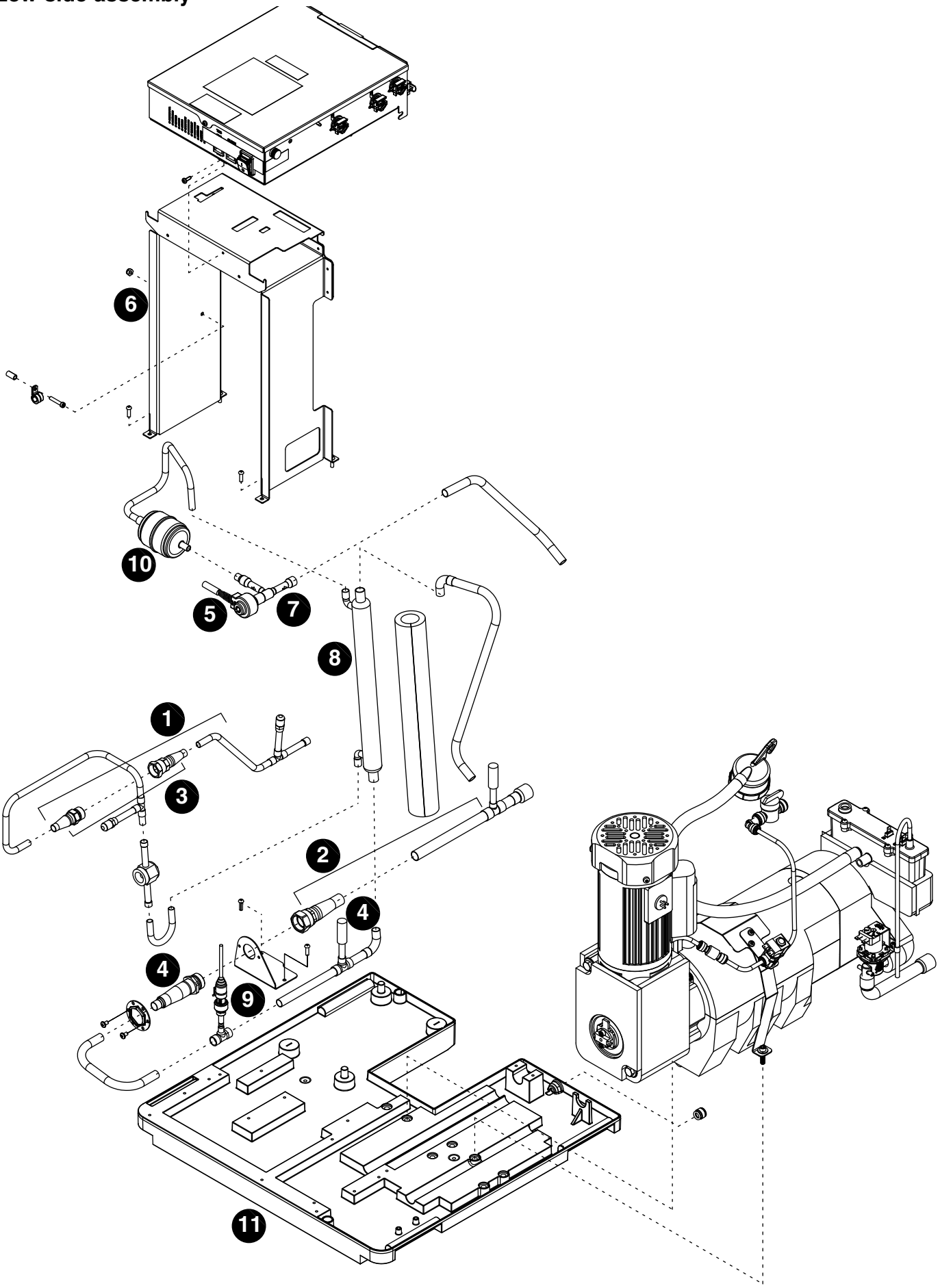
Replacement parts

Evaporator assembly



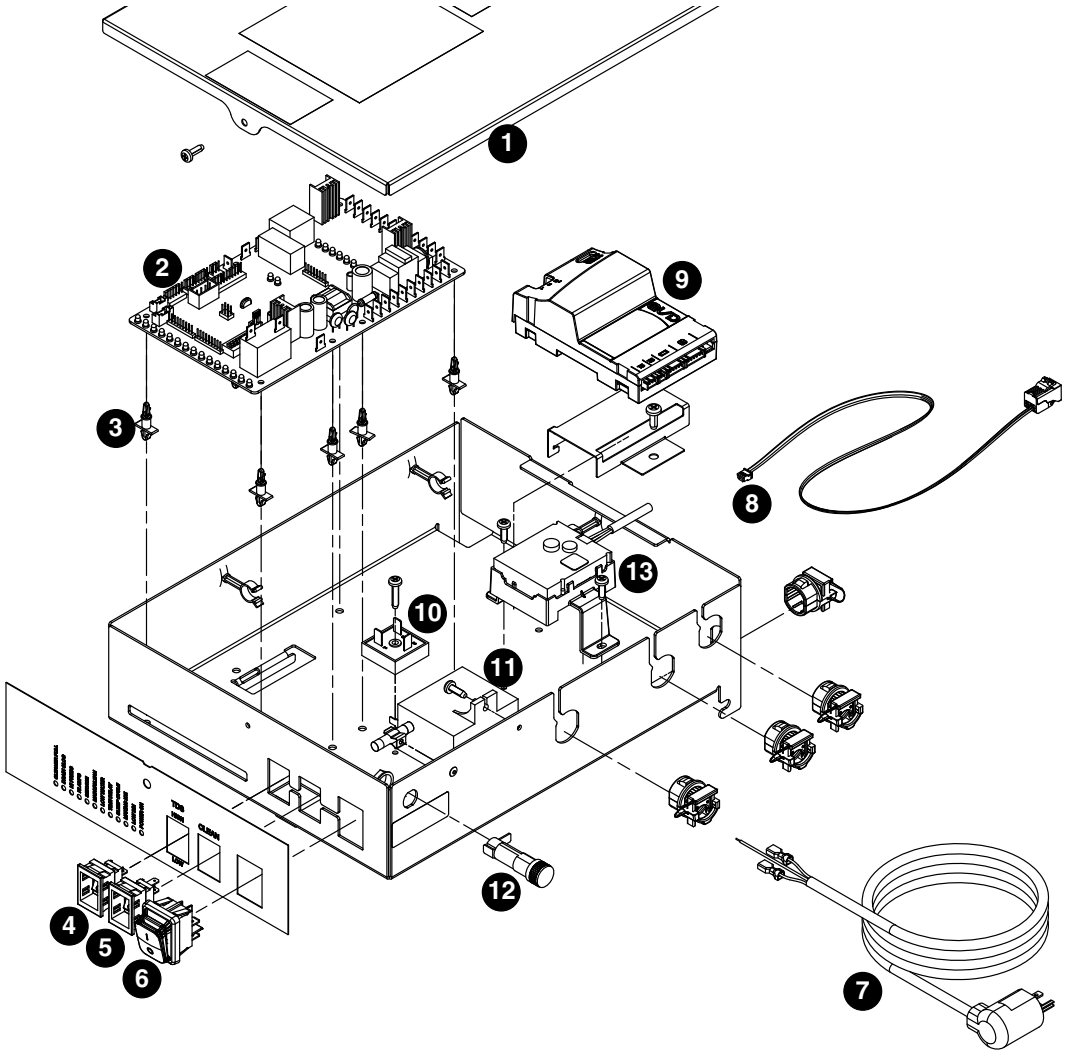
Reference #	Description	Part #
1	Tube, ice transport, insulated	01599166
2	Shuttle assembly	01118132
2	Shuttle assembly, IMDV	01118140
3	Switch, shuttle	01006261
4	Compression nozzle	01278654
5	O-ring, shuttle	01164920
6	Screw, reservoir (3 required)	01601228
7	Auger hardware (includes screws, key, retainer)	01118611
8	Key	01164938
9	Bolt, gearmotor mounting (2) (remote condensing units), includes washers	01118629
10	Cartridge assembly, shuttle spring	01118033
10	Cartride, shuttle spring, IMDV	01118041
11	Gearmotor, 120 V (includes capacitor)	01596063
12	Main housing, with insulation	01596147
13	O ring	01301720
14	Seal, auger shaft	01302249
15	Cup, sanitizer	01164995
16	Cap, sanitizer	01118637
Not shown	Tubing, water, 3/8" OD	502719
Not shown	Tubing, water, 1/4" OD	502079
17	Retainer kit, evaporator	01118652
18	Solenoid, water feed, 120 V	01223015
19	Reservoir lid and sensors (includes screws and o-ring)	01118108
20	Valve, shut-off, water	PD502921
21	Auger, 1012 (includes seal, key, journal, bolt and auger hardware)	01596105 (1012 only)
21	Auger, 1412 (includes seal, key, journal, bolt and auger hardware)	01596113 (1412 only)
22	Evaporator with insulation, 1012	01596162 (1012 only)
22	Evaporator with insulation, 1412	01596170 (1412 only)
23	Rear bushing housing and bushing (includes (1) o-ring) with insulation	01596360
24	Reservoir assembly, water (includes lid) with insulation	01596345
25	Tube, vent (20" required)	502079
26	Tube, sanitizer	01118660
27	Kit, MicroChewblet	01161843
28	Tube, shuttle drain, insulated	01118678
29	Kit, hardware, main housing	01601236
30	Solenoid, purge, 120 V	01337286
31	Insulation kit, evaporator, 1012	01596303 (1012 only)
31	Insulation kit, evaporator, 1412	01596311 (1412 only)
32	Check valve	01122381
33	Tube, drain, reservoir, insulated	01596238
34	Tube, drain, 1012	01596212 (1012 only)
35	Tube, drain, 1412	01596220 (1412 only)
36	O-ring, reservoir lid	01302298
Not shown	Kit, scale (includes reservoir, purge solenoid, drain tubes and fitting)	01596519
37	O-ring, Micro Chewblet	01161850
Not shown	Drain kit (includes 2 ft. x 1" OD silicone tubing, 3/4" x 1" slip, 3/4" barb 3/4" FPT (2), 3/4" barb x 3/4" FPT elbow)	01599463
38	Journal, threaded	01477538
39	Bolt, journal	01478759
Not shown	3/4" x 3/4" straight and 90 degree fitting	01598796

Low-side assembly



Reference #	Description	Part #
1	Tubing, liquid line, quick connect	01165554
2	Tubing, suction line, quick connect	01165562
3	Coupling set, liquid line, quick connect, 3/8"	01363910
4	Coupling set, suction line, quick connect, 5/8"	01363928
5	Sight glass	01165570
6	Electrical box support	01121292
7	Valve, EEV R449 1012/1412	01596501
8	Heat exchanger, includes insulation	01121409
9	Pressure sensor	
10	Filter drier	01596576
11	Base, split system	01333772

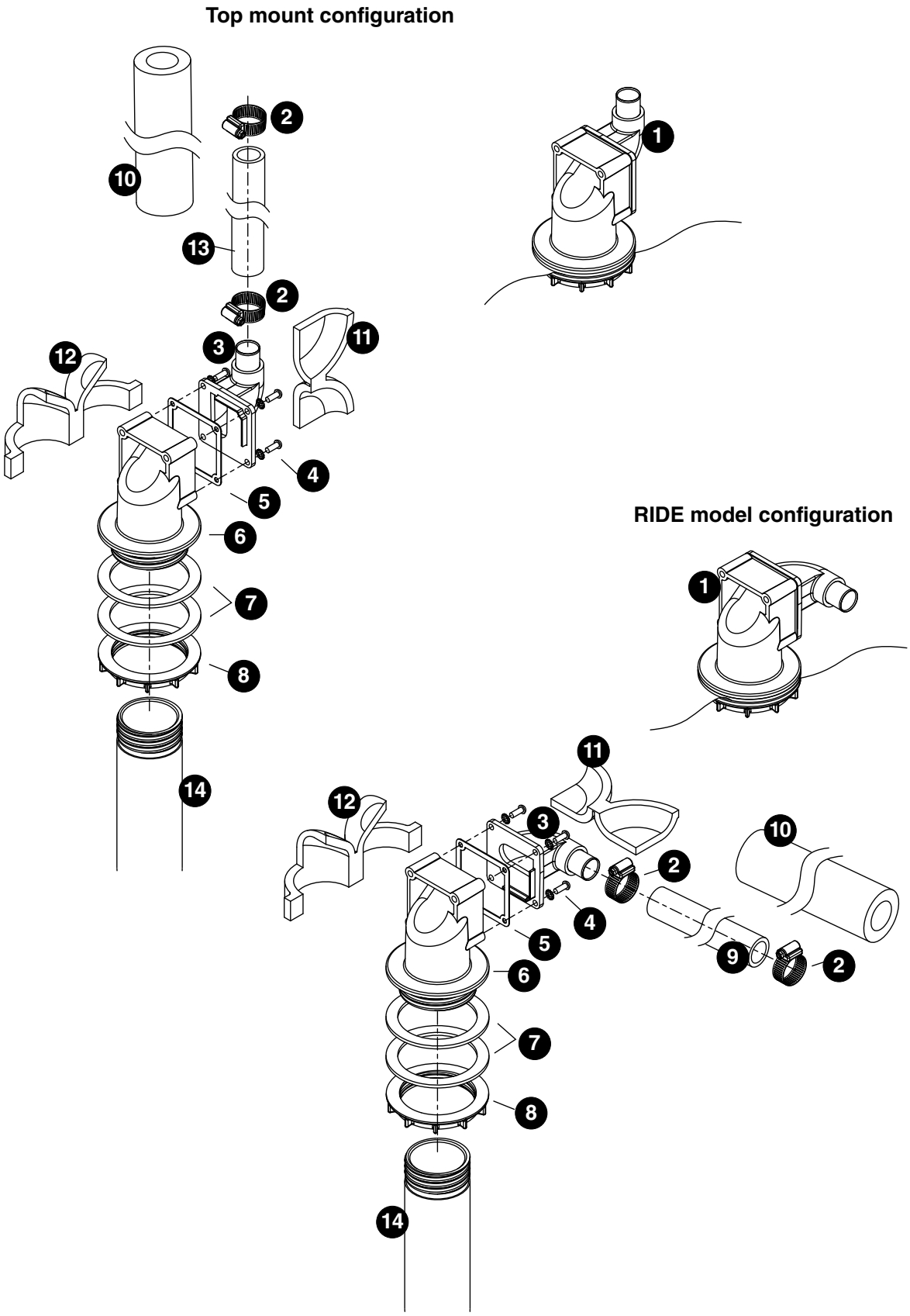
Electrical box



Reference #	Description	Part #
1	Cover, electrical box, air/water-cooled	01165729
2	Board, control, 120 V (includes stand-offs)	01596428
3	Stand-offs (set of 8)	00130906
4	Switch, TDS	01165695
5	Switch, evaporator clean	01165703
6	Switch, ice machine power	01568732
7	Cord, power, 120 V	01591817
8	Cable, IMDV	01116177
Not shown	Sleep Cycle Kit (top mount applications)	01528462
9	EEV controller, with harness	01596469
10	Centrifical start electronic switch	01568658
11	Run capacitor	01598754
12	Fuse, 8A	01599935
13	Ultracap module	01596550

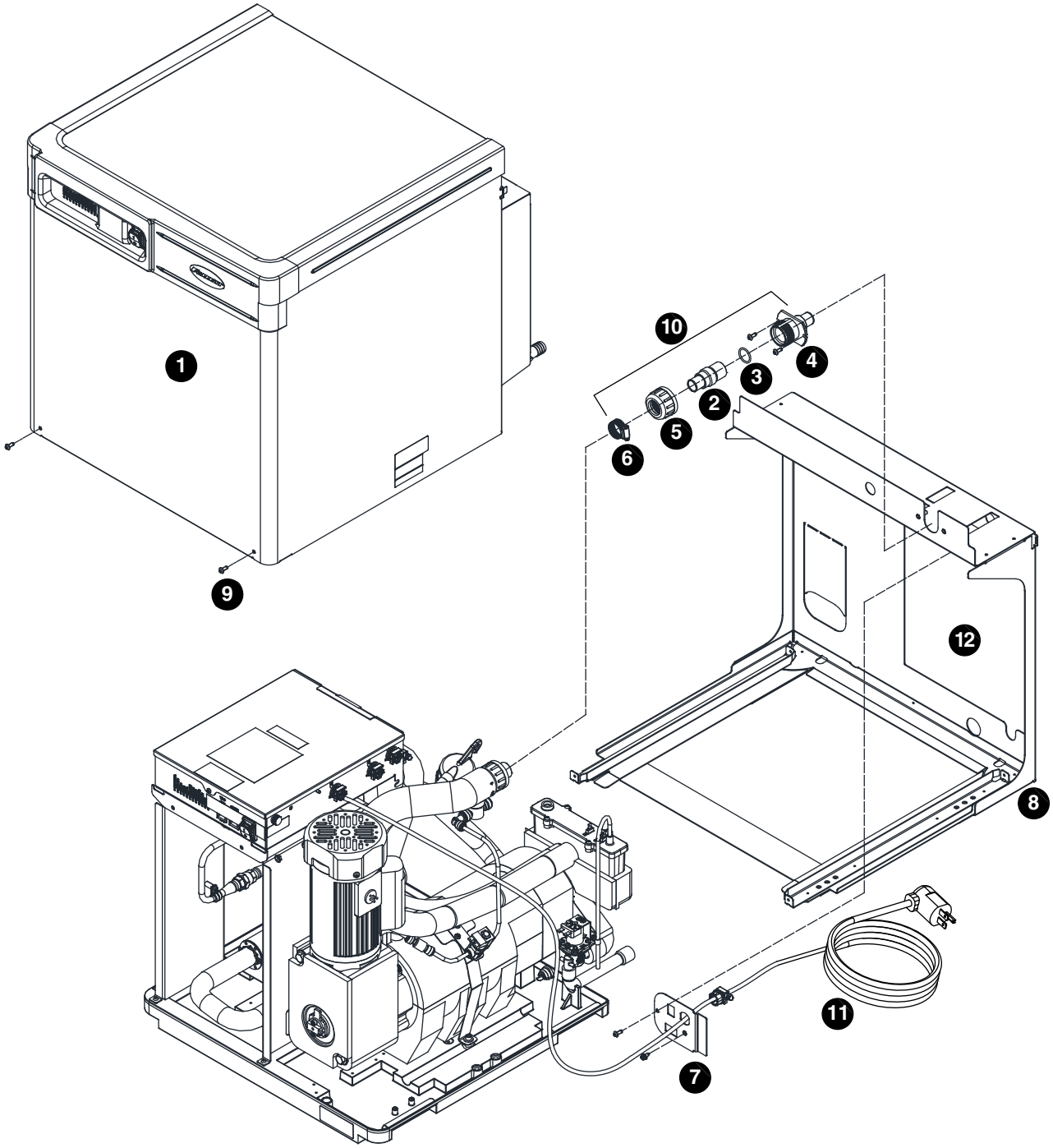
24 VAC EEV Controller Only		
Not shown	Controller, EEV Mini 24 VAC	01602770
Not shown	Transformer, EEV Controller 24 VAC	01602788
Not shown	Relay, EEV Controller 24 VAC	01602796

Integration kit – top-mount and RIDE remote ice delivery



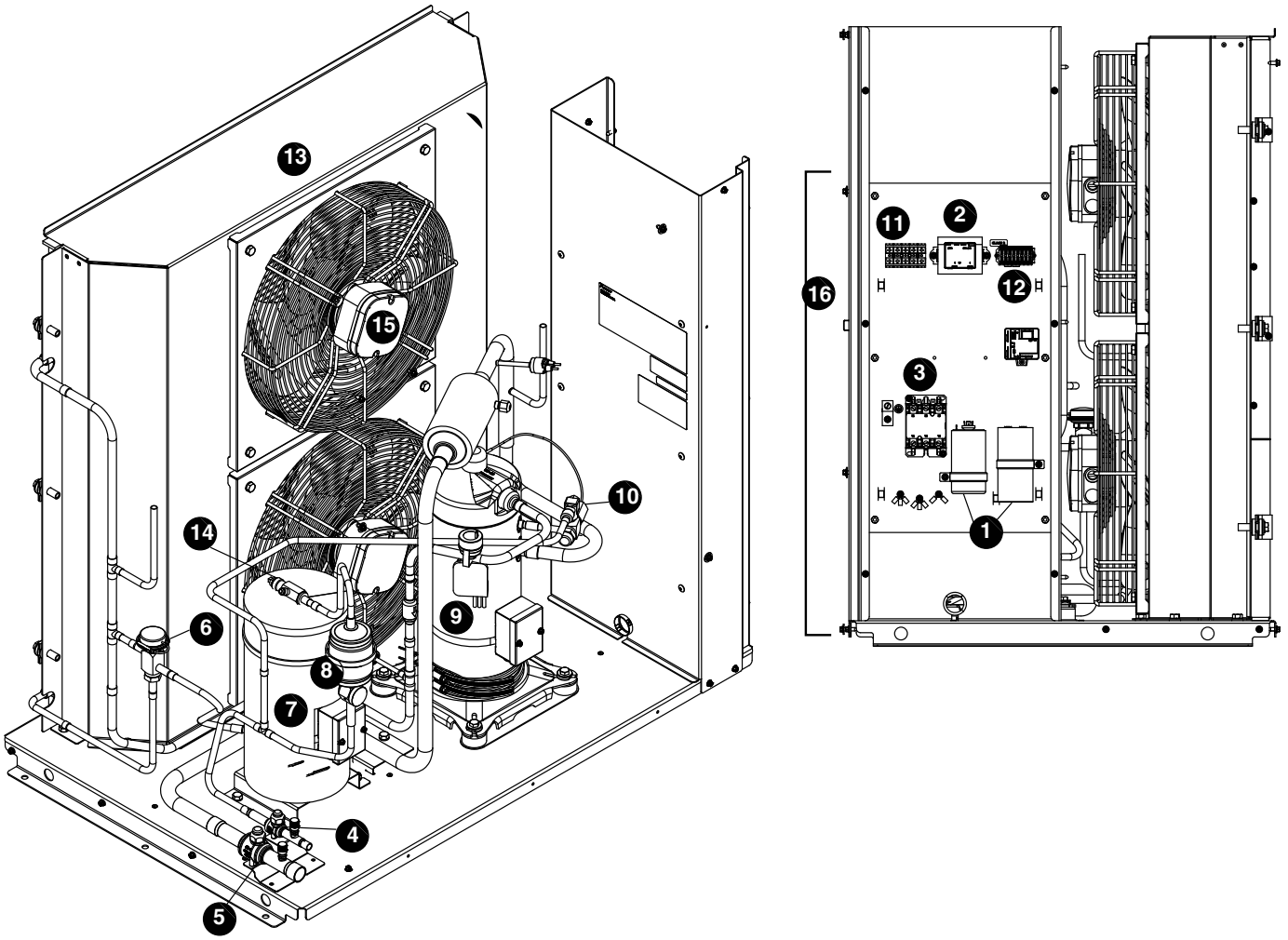
Reference #	Description	Part #
1	Shuttle actuator	00171322
2	Clamp	500377
3	Actuator elbow (includes 00167122 and 209100)	00171264
4	Screws	01303064
5	Gasket	01303072
6	Actuator body	00171272
7	Gasket, coupling	01303080
8	Ring, locking (includes 00126532)	00171371
9	Ice transport tube, 10' (3 m)	00171280
9	Ice transport tube, 20' (6 m)	00171298
10	Insulation, transport tube	501176
Not shown	Insulated polywire ice transport tube, per foot	00174896
11	Insulation, elbow	01303098
12	Insulation, actuator	01303106
13	Ice transport tube, top mount, 30" (762 mm)	00171306
14	Extension-fill tube, 9"	01303114
14	Extension-fill tube, 4"	01303122
Not shown	Integration kit, top mount, Harmony or Bin	00171389
Not shown	Integration kit, RIDE model, Harmony or Bin, (includes 10' (3 m) of tube and insulation)	00171397
Not shown	Integration kit, drop in	00145334
Not shown	Integration kit, Cornelius PR150	00144774
Not shown	Integration kit, Vision (does not include ice tube)	00997171
Not shown	Diverter plate (single agitator Cornelius dispensers and left-hand dispense chute on dual-agitator Cornelius dispensers)	01303130
Not shown	Diverter plate (right-hand dispense chute on dual-agitator dispensers)	00996207
Not shown	SafeCLEAN Plus, case of 6	01149954
Not shown	SafeCLEAN Plus, case of 24	01149962
Not shown	SafeCLEAN Plus, case of 4 one gallon bottles	01555077
Not shown	Sani-Sponge kit	00132068
Not shown	High-capacity filter system	CARBONHICAPSYSTEM
Not shown	Primary filter (1)	CARBONHICAPFILTER
Not shown	Primary filter (6)	CARBONHICAPFILTER6
Not shown	Pre-filter (1)	SEDIMENTPREFILTER
Not shown	Pre-filter (12)	SEDIMENTPREFILTER12
Not shown	IMSII or IMSIII sanitizer concentrate - 16 oz.	00979674
Not shown	Sponge, sanitary, pack of 24	01075431
Not shown	Cable, Comm, IMDV-2CM board interface	01551365
Not shown	Kit, Legacy IMDV Dual spring (included IMDV cartridge and communication cable)	01116177
Not shown	Tubing, silicone (per foot)	01303155

Skins assembly



Reference #	Description	Part #
1	Cover, front	01363936
2	Coupling (includes O-ring)	00171207
3	O-ring	01303171
4	Bulkhead fitting	00171215
5	Cap, nut, ice hose	01303189
6	Hose clamp	500377
7	Plate, strain relief	00192070
8	Docking assembly (includes strain relief plate, bulkhead fitting)	01383389
9	Screw	01303197
10	Bulkhead connector kit	00171223
11	Cord and plug, power	01111491
Not shown	Fitting, drain	01598796
12	Cover, Rear R449 All Models	01601376

1012/1412 Single-phase condensing unit



Reference #	Description	Part #
1	Start/Run Kit, 1012 (includes start relay, two run capacitors and a start capacitor)	01596279
	Start/Run Kit, 1412 (includes start relay, two run capacitors and a start capacitor)	
2	Transformer	01450345
Not shown	Valve, Check	01596626
3	Contactor	01450352
4	Valve, Ball, 3/8"	01596592
5	Valve, Ball, 7/8"	01596584
6	Control, Head Pressure (HPCV) 180 psig	01450519
7	Receiver Assembly, Heated	01596246
8	Filter/Drier, Liquid	01450493
9	Compressor, 1012, ZF04KAE-PFV118	01593672
9	Compressor, 1412, ZF05KAE-PFV118	01593664
10	Control, Pressure, Low	01596600
11	Terminal Block, 5 pole	01596642
12	Terminal Block, 8 pole	01596659
13	Coil, Condenser with fans asembly	01596089
14	Control, Pressure, High	01596618
Not shown	Heater, Crankcase (2)	01598820

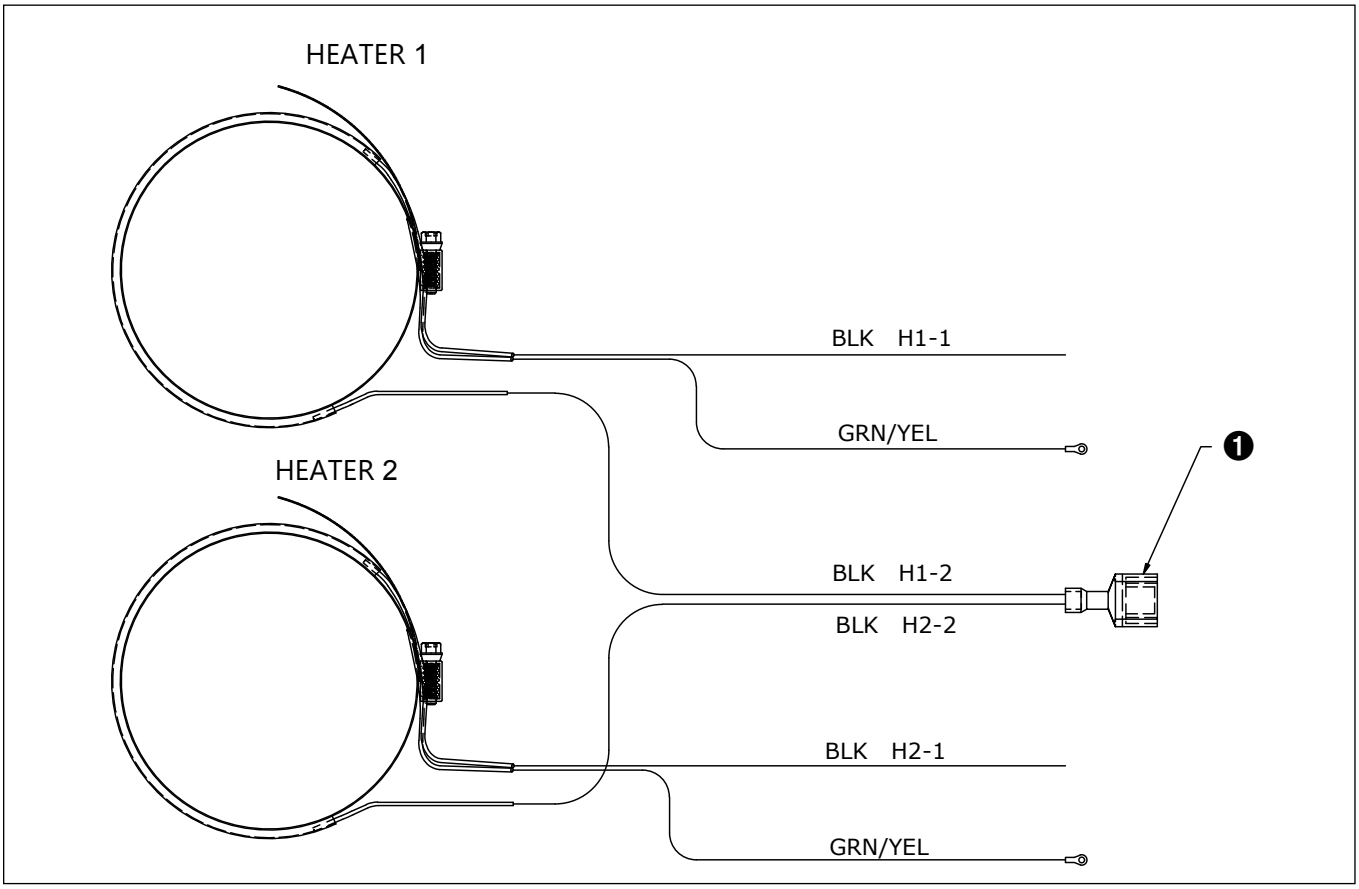
Not shown	Heater, Receiver (2)	01598820
Not shown	Thermostat, Receiver Heater	01450436
Not shown	Guard, Hail	01453653
15	Motor, Condenser Fan	01596634
Not shown	Capacitor, Start (all R449 models)	01596667
Not shown	Harness, Compressor Power	01598770
Not shown	Grill, OCU	01596253
Not shown	Panel, Control Assembly, 1PH. Includes start capacitor Note: Does not include run capacitor or relay: must order Start/Run Kit.	01596048
Not shown	Kit, Signal 24 Vac	01453745

Replacement Compressor and Receiver Heater Wiring

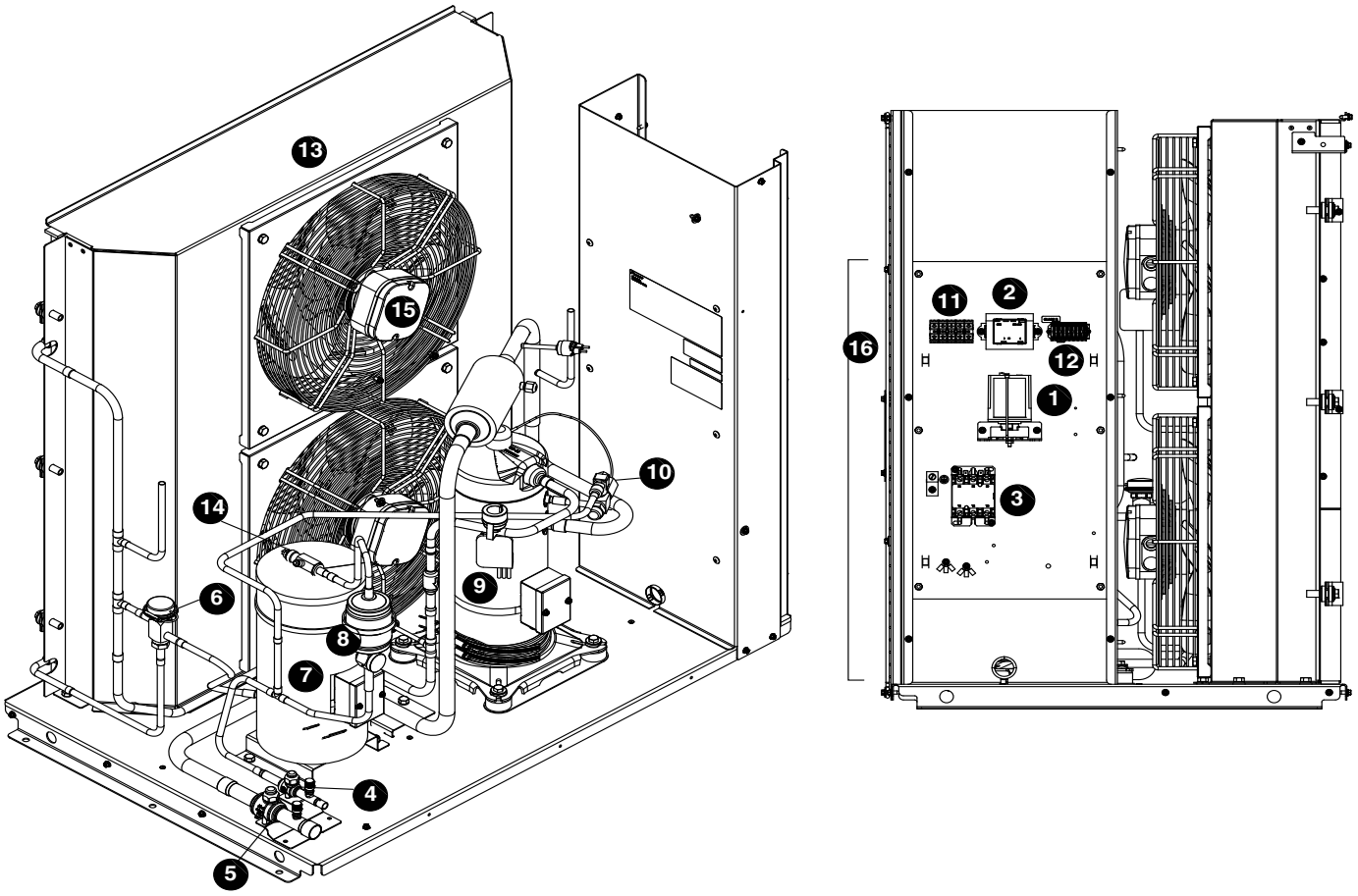
1. Crimp the stripped H1-2 and H2-2 heater wires together using the supplied female connector **(Fig 30.1)**.
2. Make connection to male connector at jumper of appropriate terminal block.
3. Install new heater band assemblies. Connect ground and H1-1/H2-1 to appropriate terminal block.

Please note, both the compressor and receiver utilize the same heater quantity (2).

Fig. 32



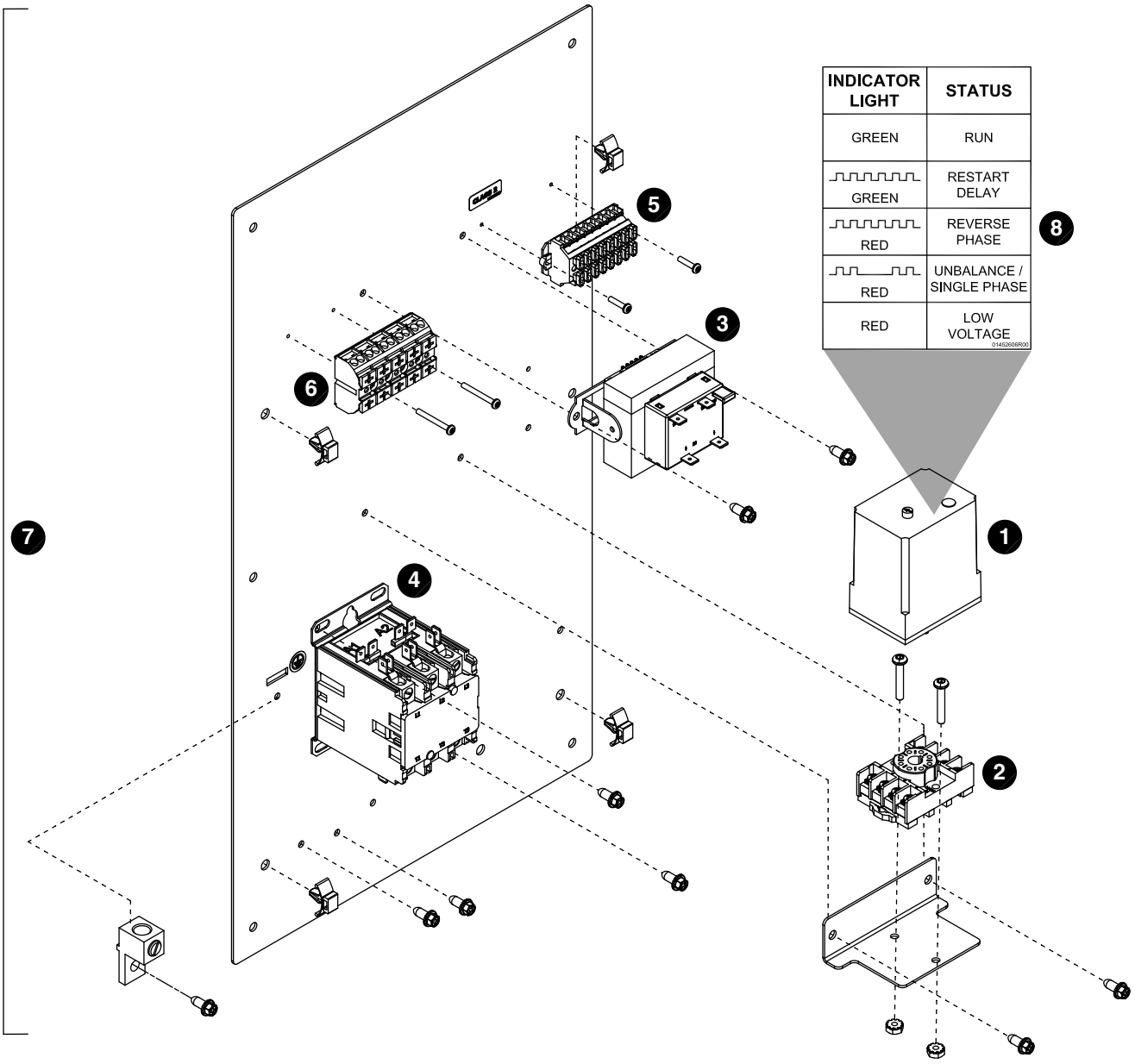
1012/1412 3-phase condensing unit



Reference #	Description	Part #
1	Monitor, Phase with label	01450337
Not shown	Filter, Suction	01450477
Not shown	Valve, Check	01596626
2	Transformer	01450345
3	Contactor	01450352
4	Valve, Ball, 3/8"	01596592
5	Valve, Ball, 7/8"	01596584
6	Control, Head Pressure (HPCV) 180 psig	01450519
Not shown	Heater, Crankcase (2)	01598820
7	Receiver Assembly, Heated	01596246
8	Filter/Drier, Liquid	01450493
9	Compressor, 1012, ZF04KAE-TF5118	01593631
9	Compressor, 1412, ZF05KAE-TF5118	01593623
10	Switch, Pressure, Low (LPS)	01596600
Not shown	Heater, Receiver (2)	01598820
Not shown	Thermostat, Discharge Line	01450436
11	Terminal Block, 5 Pole	01596642
12	Terminal Block, 8 Pole	01596659
13	Coil, Condenser with Fan Assembly	01596089
14	Pressure, High Switch (HPS)	01596618
Not shown	Guard, Hail	01453653
15	Motor, Condenser Fan Assembly	01596634

16	Panel, Control, 3PH	01596055
Not shown	Grill, OCU	01596253
Not shown	Kit, Compressor Mounting	01536663
Not shown	Phase Monitor Base	01453752
Not shown	Phase Monitor Label	01457613
Not shown	Kit, Signal 24 Vac	01453745
Now shown	Harness, Compressor Power	01598770

1012/1412 3-phase condensing unit



Reference #	Description	Part #
1	Phase Monitor and Label	01450337
2	Phase Monitor Base	01453752
3	Transformer 208/24 VAC	01450345
4	Contactor, 3-pole	01450352
5	Terminal 5 pole	01596642
6	Terminal 8 pole	01596659
7	Electrical panel, 3PH	01596055
8	Phase Monitor Label	01457613

Note: Overload is internal to compressor.

Electronic Expansion Valve (EEV) with UltraCapacitor Emergency Closure System

An Electronic Expansion Valve (EEV) equipped with an UltraCapacitor (UltraCap) backup system is a sophisticated refrigeration control arrangement designed to maintain precise refrigerant flow during normal operation and provide guaranteed 100% valve closure during a power loss event. This design eliminates the need for an additional liquid line solenoid valve while enhancing system protection and reliability.

The key concept is that the UltraCap does not keep the refrigeration system operating during a power outage. Instead, it stores sufficient energy to power the EEV controller and stepper motor long enough to drive the valve completely closed. This creates a fail-safe closed condition that helps protect the refrigeration system from undesirable refrigerant migration and evaporator-related issues during power interruptions.

This document explains the operation of an EEV coupled with an UltraCapacitor backup system that ensures full valve closure during a power failure.

Fundamentals of an Electronic Expansion Valve

The EEV is responsible for:

- Reducing refrigerant pressure and temperature.
- Metering refrigerant flow into the evaporator.
- Maintaining proper evaporator superheat.
- Optimizing evaporator performance under varying load conditions.

Major components include:

- Valve body
- Stepper motor actuator
- Lead screw and needle mechanism
- Suction pressure transducer
- Evaporator outlet temperature probe
- EVD Mini controller

The EVD Mini requires only two primary inputs:

1. Suction pressure transducer
2. Evaporator outlet temperature probe

Superheat Calculation

Superheat is calculated as:

Superheat = Evaporator Outlet Temperature – Saturation Temperature at Suction Pressure

The controller continuously uses this calculation to determine the required valve position.

Normal Operation

During normal operation, the EVD Mini controller continuously monitors:

- Suction pressure
- Evaporator outlet temperature

The controller calculates superheat and adjusts the EEV position through precise stepper motor movements. This maintains stable evaporator performance while delivering the correct refrigerant flow for varying operating conditions.

Power Failure Challenge

Most EEVs are non-spring-return devices. If power is lost, the valve would normally remain at its last commanded position.

This can result in:

- Liquid refrigerant migration to the compressor sump
- Refrigerant migration into the evaporator
- Increased risk of evaporator freeze-up
- Reduced system reliability during restart conditions

To address these concerns, an UltraCapacitor backup system is incorporated into the valve control strategy.

UltraCapacitor Technology

The backup power source is an EDLC (Electric Double Layer Capacitor), commonly referred to as an UltraCapacitor.

UltraCapacitors provide:

- Rapid charging capability
- High peak-current delivery
- Long operational life
- High cycle durability
- Minimal maintenance requirements
- Exceptional reliability compared to conventional battery backups

Unlike batteries, UltraCaps are optimized for delivering large amounts of power over short periods, making them ideal for emergency valve-closing applications.

EEV and UltraCap Integration

During normal operation:

- The UltraCap remains fully charged by the system power supply.
- The controller continuously monitors both supply voltage and capacitor voltage.
- The EEV modulates normally to maintain target superheat.

The stored UltraCap energy is reserved specifically for emergency shutdown events.

Emergency Closure Sequence

When a power interruption occurs:

1. Loss of input power is detected immediately.
2. The controller automatically transfers to UltraCap power.
3. The UltraCap supplies the energy required to operate the controller and stepper motor.
4. The controller commands the EEV to drive fully closed.
5. The valve is driven through its complete closing sequence as quickly as possible to protect the refrigeration system.
6. Carel's closure verification algorithm applies a 20-step overdrive after the valve reaches the mechanical seat to ensure complete closure.
7. Once the valve is confirmed closed, available stored energy is exhausted and the controller powers down.

Note: There is no feedback loop confirming valve position. Closure verification is achieved through the controller's step-counting algorithm and the additional 20-step overdrive strategy.

Valve Travel and Energy Requirements

A typical Carel EEV utilizes:

- 480 total steps from fully closed to fully open.

The UltraCapacitor is sized to ensure sufficient stored energy to:

- Power the controller
- Drive the stepper motor

- Complete all required closing steps
- Execute the closure verification overdrive

The UltraCap uses its stored energy specifically to close the valve as quickly as possible during a power failure, protecting the refrigeration system from refrigerant migration and evaporator-related issues.

Benefits

The EEV and UltraCap combination provides several important advantages:

- Eliminates the need for an additional liquid line solenoid valve.
- Improves compressor protection.
- Reduces liquid refrigerant migration to the compressor sump.
- Reduces refrigerant migration into the evaporator during outages.
- Helps prevent evaporator freeze-up.
- Improves restart reliability following a power interruption.
- Enhances refrigerant containment.
- Improves overall system safety and reliability.
- Reduces system complexity by integrating flow control and fail-safe shutoff functionality into a single valve assembly.

Power Loss Sequence Summary

Power Failure



Power Loss Detected



UltraCap Activated



Controller Remains Powered



EEV Close Command Issued



480-Step Valve Closure Sequence



20-Step Verification Overdrive



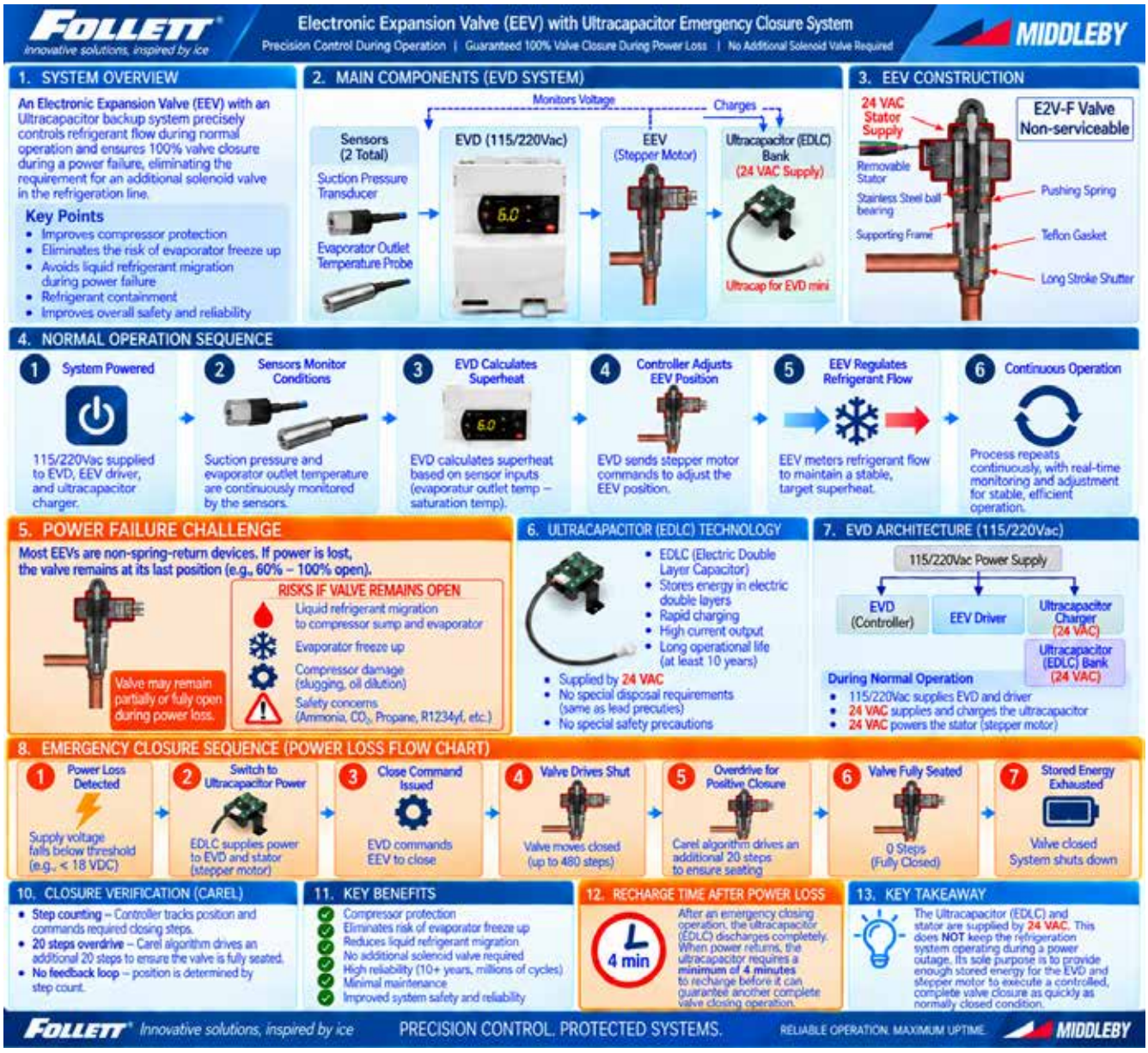
Valve Fully Seated (100% Closed)



Stored Energy Depleted / Controller Shutdown

Key Result

The EEV with UltraCapacitor backup system provides precise refrigerant flow control during normal operation while ensuring 100% valve closure during a power failure, eliminating the need for a separate liquid line solenoid valve and improving compressor protection, evaporator protection, refrigerant containment, and overall system reliability.


FOLLETT
Innovative solutions, inspired by ice
Electronic Expansion Valve (EEV) with Ultracapacitor Emergency Closure System
Precision Control During Operation | Guaranteed 100% Valve Closure During Power Loss | No Additional Solenoid Valve Required
MIDDLEBY
1. SYSTEM OVERVIEW
An Electronic Expansion Valve (EEV) with an Ultracapacitor backup system precisely controls refrigerant flow during normal operation and ensures 100% valve closure during a power failure, eliminating the requirement for an additional solenoid valve in the refrigeration line.
Key Points
Improves compressor protection
Eliminates the risk of evaporator freeze up
Avoids liquid refrigerant migration during power failure
Refrigerant containment
Improves overall safety and reliability
2. MAIN COMPONENTS (EVD SYSTEM)
Monitors Voltage
Charges
Sensors (2 Total)
Suction Pressure Transducer
Evaporator Outlet Temperature Probe
EVD (115/220Vac)
EEV (Stepper Motor)
Ultracapacitor (EDLC) Bank (24 VAC Supply)
Ultracap for EVD mini
3. EEV CONSTRUCTION
24 VAC Stator Supply
E2V-F Valve Non-serviceable
Removable Stator
Stainless Steel ball bearing
Supporting Frame
Pushing Spring
Teflon Gasket
Long Stroke Shutter
4. NORMAL OPERATION SEQUENCE
1 System Powered
115/220Vac supplied to EVD, EEV driver, and ultracapacitor charger.
2 Sensors Monitor Conditions
Suction pressure and evaporator outlet temperature are continuously monitored by the sensors.
3 EVD Calculates Superheat
EVD calculates superheat based on sensor inputs (evaporatur outlet temp – saturation temp).
4 Controller Adjusts EEV Position
EVD sends stepper motor commands to adjust the EEV position.
5 EEV Regulates Refrigerant Flow
EEV meters refrigerant flow to maintain a stable, target superheat.
6 Continuous Operation
Process repeats continuously, with real-time monitoring and adjustment for stable, efficient operation.
5. POWER FAILURE CHALLENGE
Most EEVs are non-spring-return devices. If power is lost, the valve remains at its last position (e.g., 60% – 100% open).
Valve may remain partially or fully open during power loss.
RISKS IF VALVE REMAINS OPEN
Liquid refrigerant migration to compressor sump and evaporator
Evaporator freeze up
Compressor damage (slugging, oil dilution)
Safety concerns (Ammonia, CO2, Propane, R1234yf, etc.)
6. ULTRACAPACITOR (EDLC) TECHNOLOGY
EDLC (Electric Double Layer Capacitor)
Stores energy in electric double layers
Rapid charging
High current output
Long operational life (at least 10 years)
Supplied by 24 VAC
No special disposal requirements (same as lead precuties)
No special safety precautions
7. EVD ARCHITECTURE (115/220Vac)
115/220Vac Power Supply
EVD (Controller)
EEV Driver
Ultracapacitor Charger (24 VAC)
Ultracapacitor (EDLC) Bank (24 VAC)
During Normal Operation
115/220Vac supplies EVD and driver
24 VAC supplies and charges the ultracapacitor
24 VAC powers the stator (stepper motor)
8. EMERGENCY CLOSURE SEQUENCE (POWER LOSS FLOW CHART)
1 Power Loss Detected
Supply voltage falls below threshold (e.g., < 18 VDC)
2 Switch to Ultracapacitor Power
EDLC supplies power to EVD and stator (stepper motor)
3 Close Command Issued
EVD commands EEV to close
4 Valve Drives Shut
Valve moves closed (up to 480 steps)
5 Overdrive for Positive Closure
Carel algorithm drives an additional 20 steps to ensure seating
6 Valve Fully Seated
0 Steps (Fully Closed)
7 Stored Energy Exhausted
Valve closed System shuts down
10. CLOSURE VERIFICATION (CAREL)
Step counting – Controller tracks position and commands required closing steps.
20 steps overdrive – Carel algorithm drives an additional 20 steps to ensure the valve is fully seated.
No feedback loop – position is determined by step count.
11. KEY BENEFITS
Compressor protection
Eliminates risk of evaporator freeze up
Reduces liquid refrigerant migration
No additional solenoid valve required
High reliability (10+ years, millions of cycles)
Minimal maintenance
Improved system safety and reliability
12. RECHARGE TIME AFTER POWER LOSS
4 min
After an emergency closing operation, the ultracapacitor (EDLC) discharges completely. When power returns, the ultracapacitor requires a minimum of 4 minutes to recharge before it can guarantee another complete valve closing operation.
13. KEY TAKEAWAY
The Ultracapacitor (EDLC) and stator are supplied by 24 VAC. This does NOT keep the refrigeration system operating during a power outage. Its sole purpose is to provide enough stored energy for the EVD and stepper motor to execute a controlled, complete valve closure as quickly as normally closed condition.
FOLLETT Innovative solutions, inspired by ice
PRECISION CONTROL. PROTECTED SYSTEMS.
RELIABLE OPERATION. MAXIMUM UPTIME.
MIDDLEBY

Evaporator Scale Removal

Topic

This procedure is to be used for manual/hand cleaning Horizon Elite evaporators with difficult to remove scale. Standard chemical cleans (as described in the operation and service manuals) should be performed first. In the event that a standard cleaning does not remove the scale, this procedure can be performed.

To watch the Manual Cleaning (hand cleaning) Service Video, scan the QR code and search the Horizon Elite videos.

Follett Service Video Library

Action

1. Follow the Evaporator disassembly instructions on Page 21.
2. Thoroughly dry the inside of the evaporator barrel and let it warm to room temperature. The evaporator must be warm and dry before you will be able to observe the scale formation.
3. Confirm there is a white/gray haze inside the evaporator (Fig. 35).

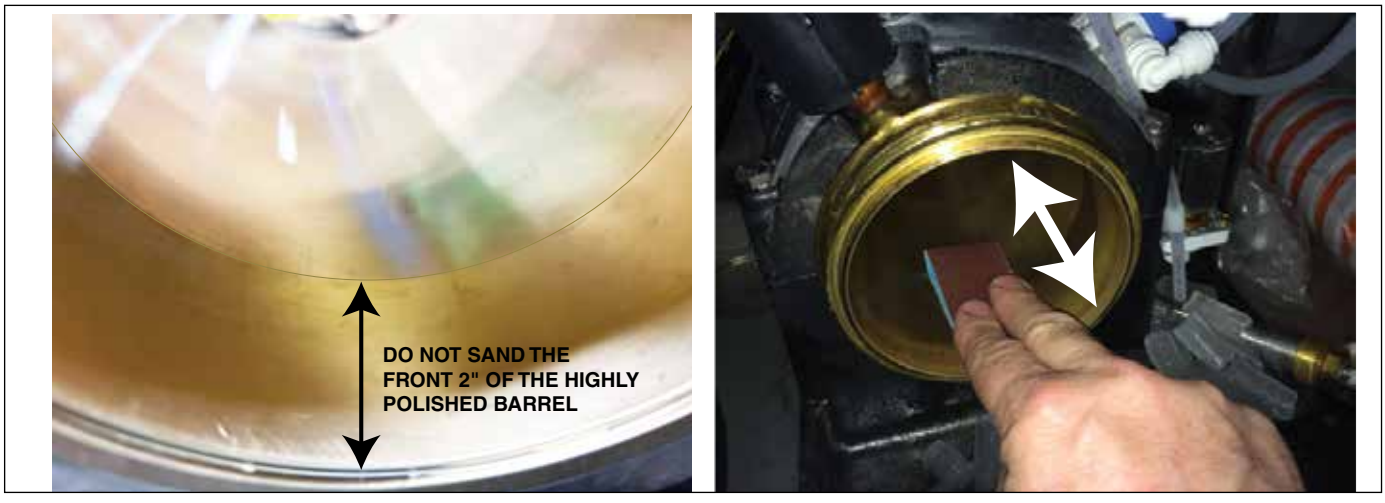
Fig. 33



4. If scale is present, use 120 grit sanding cloth in an in-and-out motion only, sand off any scale inside the evaporator (Fig. 36). *Do not sand the front 2 inches of the barrel - by design that portion has a highly polished surface.*

   Caution! *Failure to follow this motion will result in further machine errors. Do not use a circular motion*.

Fig. 34



5. Inspect the stainless steel auger. When it is warm and dry, check for signs of accumulated scale. Scale will appear as a white or gray haze (Fig. 37).

Fig. 35



6. If there is any indication of scale on the auger, it can be cleaned with ice machine cleaner and a Scotch brite pad.

   Caution! *Do not use anything more abrasive than a Scotch brite pad on the auger surface. Failure to heed this warning will cause irreversible damage to the auger's finish.*

7. Once clean, rinse and allow auger to dry again to confirm all scale has been removed, if scale is still present, repeat Step 6.

8. When evaporator sanding is complete, thoroughly wipe out the inside of the barrel (Fig. 38).

Fig. 36



1. Reassemble the evaporator as described on Page 24.

   Note: Before placing gear motor on auger shaft, coat auger shaft with food safe grease - *DO NOT USE petrol gel!*

2. Inspect the purge solenoid, clean as necessary and reassembe.
3. Inspect the drain line to the manifold and clean as necessary.
4. Perform the Cleaning/sanitizing and preventive maintenance procedure (Page 9). Confirm proper operation afterwards and place the machine back into operation.

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