HFO5 Service Manual

$50.00 USD

Manual Part Number 12A4171M21

(Revision 2/2025)

Important Safety Information

Any improper attempt to repair major equipment may result in personal injury, property damage, or loss of life. Before installing, operating, adjusting, or servicing the HFO5, please read this manual and become familiar with its contents, understand the operation of this machine, and be aware of possible dangers.

Safety Symbols and What They Mean

Heed the following safety symbols, which may appear in this manual and/or on the machine.

Symbol	Meaning
	**Danger:** Indicates an immediate hazard and that special precautions are necessary to avoid severe personal injury or death.
	**Warning:** Indicates a strong possibility of a hazard and that an unsafe practice could result in severe personal injury.
	**Caution:** Indicates that hazards or unsafe practices could result in personal injury or damage to product or property.

NOTICE

This manual belongs to the owner of the following Vogt Ice machine:

Model #_____ Serial #_____

This manual must remain on the premises with the above-listed machine at all times. After machine start-up, store the manual in a safe place where it can be readily available for future reference in maintaining, troubleshooting, or servicing the machine. Designate a person to be responsible for the manual.

Failure to comply with this notice will result in unnecessary inconvenience and possible additional expenses.

This manual is designed to assist with the installation, start-up, operation, maintenance, troubleshooting, and servicing of this equipment. This Tube-Ice® machine is designed to provide a lifetime of service when installed, maintained, and serviced properly.

This information is intended for use by individuals with adequate backgrounds in electrical, refrigeration, and mechanical expertise. Neither the manufacturer nor seller is responsible for the interpretation of this information, nor can they assume any liability in connection with its use.

If a situation calls for additional information not found in this manual, contact your distributor. If further assistance or information is needed, contact the factory by calling 1-502-635-3000 or faxing 1-502-635-3024.

Please read this manual carefully before attempting installation, operation, or servicing of this professionally designed piece of equipment.

The SuperCare group at Vogt Ice, LLC, provides assistance for all customer service needs, including part sales and warranty support. SuperCare also conducts training schools at the factory and can offer onsite training if needed.

The model and serial number of this Vogt equipment is located on the nameplate attached to the electrical control panel. If an electrical control panel was not furnished with this machine, the nameplate is located on the equipment frame or paneling. To enable SuperCare to handle your questions quickly and accurately, refer to the model and serial number when making inquiries about this machine.

Warranty Registration/Start-Up Form

The Warranty Registration/Start-Up Form on the next page must be completed and returned to Vogt Ice, LLC, within 2 weeks after the official start-up of the machine to initiate and ensure a full warranty. The form must be completed and either mailed to the address below, scanned and emailed to info@vogtice.com, or faxed to 1-800-770-8648. This form is also available online at www.vogtice.com/warrantyregistration/.

Please mail the completed form to:

Vogt Ice, LLC
1000 W. Ormsby Ave.
Suite 19
Louisville, KY 40210 USA

Vogt Ice, LLC **1000 W. Ormsby Ave, Ste. 19** **Louisville, KY 40210 USA** **Phone: 502-635-3235** **Fax: 502-635-3024**	Vogt Tube Ice	**Vogt Order No.:**	
		THIS FORM MUST BE SENT TO VOGT TO ACTIVATE WARRANTY	

Warranty Registration/Start-Up Form – Mid-Size Tube-Ice® Machines

Model Number:		**Serial Number:**	

This form must be filled out completely and signed by the customer in order to assure acceptance by Vogt.

Date of Start-Up:		**Form Completed By:**	

Distributor

Company Name:				**Phone:**			
Address:		**City:**		**State:**		**Zip:**	

Service Company

Company Name:				**Phone:**			
Address:		**City:**		**State:**		**Zip:**	

Customer (Location of Equipment)

Company Name:				**Phone:**			
Address:		**City:**		**State:**		**Zip:**	

PRE-OPERATION CHECK

- ☐ Machine room suitable (50°F [10°C] min./110°F [43°C] max.)
- ☐ Power Supply ____ V _____ Hz (machine not running)
- ☐ Compressor crankcase heater on 12-hour minimum (packaged only)
- ☐ All valves opened or closed as tagged
- ☐ Solenoid valve stems in auto position
- ☐ System checked for leaks and none found; all connections tight
- ☐ Auxiliary equipment overloads wired into control circuit
- ☐ Water supply and drains connected properly
- ☐ Sufficient makeup water supplied (minimum 30 psig [2 bar])
- ☐ Instruction manual and warranty certificate left onsite

Name of person left with:
_____

OPERATION CHECK

- ☐ Pump motor rotation direction correct
- ☐ Compressor motor rotation direction correct (packaged only)
- ☐ Power supply ____ V ____ Hz (machine running)
- ☐ Water pump amps RLA ____ Actual ____
- ☐ Condenser motor amps ____ (packaged only, if applicable)
- ☐ Incoming water temperature ____ °F (°C)
- ☐ Clear ice ☐ Yes ☐ No
- ☐ Suction pressure (psig [bar]): End of freeze ____
  End of defrost ____ (packaged only)
- ☐ Discharge pressure (psig [bar]): End of freeze ____
  End of defrost ____ (packaged only)

Comments:

I certify that I have performed all the above procedures.

Technician Signature:		**Customer Signature:**	

Table of Contents

HFO5 Mid-Size Ice Machine

Chapter 1 Introduction

Since Vogt introduced Tube-Ice® machines in 1938, the process of making Tube-Ice® ice has been widely recognized as the most economical means of ice production. These machines' economic and reliable operation has been proven repeatedly in a variety of installations throughout the world. The skill in engineering and fabrication Vogt Ice has learned in more than eight decades of experience is reflected in the HFO5 machine.

Using as little as one-third of the energy required by competing ice makers, Tube-Ice® machines produce the same amount of ice at great savings—in restaurants, sports arenas, packing plants, and wholesale operations around the world.

In addition, Tube-Ice® machines are renowned for their long service life, giving many customers more than 35 years of dependable service. Ask someone who owns one.

The first HFO machine was introduced in 2017 as the next evolution of the Tube-Ice machine. It was developed to provide end users with a long-term synthetic refrigerant solution.

Hydrofluorocarbon (HFC) refrigerants are experiencing a phase-out in a variety of markets across the globe because of their high Global Warming Potential (GWP). This forces Original Equipment Manufacturers (OEMs) to build forward-thinking business strategies when selecting a replacement refrigerant for use in their equipment.

The challenge with implementing synthetic refrigerants in ice machines is to find the perfect balance between something that will work well in the application and be available for purchase for the foreseeable future. Finding this balance has been Vogt's focus.

Vogt's long-term refrigerant solution is HFO (hydrofluoroolefin) blends with similar properties as R134a. These HFO-based refrigerants have very low GWPs, which are in line with the European Union F-Gas Regulation phase-down and with projected refrigerant regulations in the United States.

In November 2017, at the International Packaged Ice Association convention, Vogt introduced the HFO10 machine. It was the first Tube-Ice machine designed to run on an HFO blend (R-513A). The HFO5 was developed in 2020 utilizing the same HFO blend (R-513a). This blend, along with other R134a-like HFO blends, is expected to be a long-term synthetic refrigerant solution. However, HFO blends are likely to be replaced by pure HFO refrigerants of the R1234-family. These pure HFOs will be retrofittable to the HFO5 machine, giving it a secure and well-defined future as the market evolves.

In addition to environmental benefits, the HFO5 machines operate at lower head pressures (approximately 145psi or 10 bar), putting less overall stress on the system. Vogt uses Bitzer's innovative ECOLINE semi-hermetic reciprocating compressor.

Chapter 2 How the HFO5 Machine Works

Warning: Only service personnel experienced and certified in refrigeration and qualified to work with high-voltage electrical equipment should be allowed to install or work on this Tube-Ice® machine.

Principles of Operation

Manual operation of the machine is controlled by the **Off, Ice,** and **Start** touch screen buttons on the **Home** screen of the HMI. These buttons appear on the default screen when power is supplied to the machine.

Note: Further references in this manual to the **Off, Ice, Start,** or **Run Water Pump** buttons are found on the **Home** screen of the HMI. See Chapter 6.

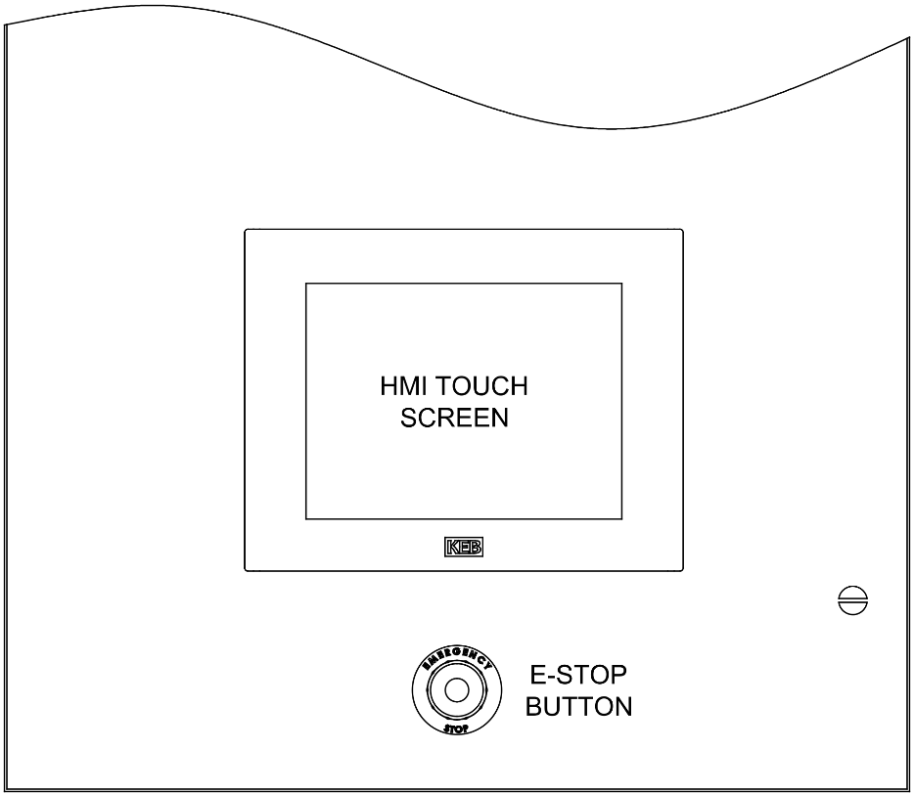


Figure 1: Control Panel Door

Automatic operation is controlled by the standard ice bin thermostats, which stop and start the ice maker based on the level of ice in the storage bin.

The type of ice produced, cylinder or crushed (optional), is determined by how the machine cutter is set up.

The unit will only stop when a thawing (harvest) period has been completed, whether by the pressing the **Off** touch screen button or the ice bin thermostat. To stop the machine instantly, push the **E-Stop** button. To restart the machine, turn the **E-Stop** button clockwise, clear the **E-Stop** fault on the touch screen, and push the **Start** touch screen button.

Air-cooled machines have a solenoid valve, sometimes referred to as the X valve, in the compressor discharge line and a check valve in the liquid return line to the receiver. These valves prevent the migration of refrigerant when the machine is not operating. The X valve is always open when the compressor is running.

Model Number

The machine nameplate is located on the left side of the control panel. The model number and machine description are located in the top left-hand corner. Figure 2 can be used to verify that the correct model has been received.

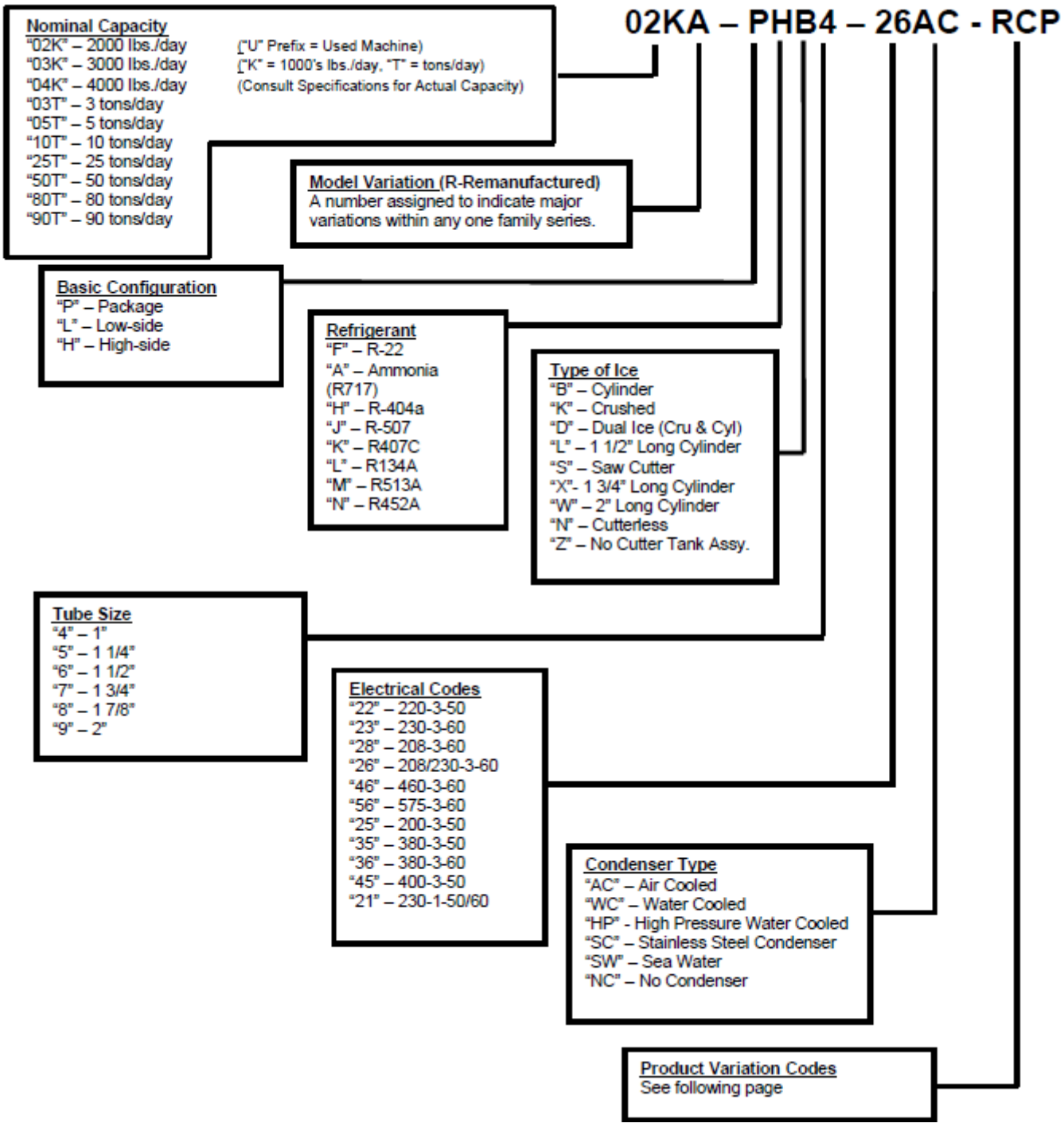


Figure 2: Vogt Model Nomenclature

Piping

Table 1 lists the piping nomenclature as labeled in Figure 3 and Figure 4, which illustrate the piping schematics of the refrigerant and water circuits of water- and air-cooled Tube-Ice® machines.

Table 1: HFO5 Piping Nomenclature

	Description		Description
1	Control Panel	**30**	Receiver Sight Glass
1PG	Suction Pressure Gauge	**31**	Gauge Glass Stop Valve
2PG	Discharge Pressure Gauge	**32**	A/C Condenser Service Connection
2	Freezer	**34**	Compressor Suction Service Valve
3	Compressor	**35**	Compressor Discharge Service Valve
4PS	Dual High/Low Pressure Switch	**37**	Oil Charging/Drain Valve
5M	Cutter Motor	**39**	Water Tank Drain Valve
5R	Gear Reducer	**40**	Automatic Water Tank Blowdown
6	Water Pump	**41**	Condenser Water Regulator (W/C Machines)
7	Water Tank (includes cutter assembly)	**41A**	Condenser Pressure Control (A/C Machines)
8	Water Distributing Chamber	**43**	Strainer
12	Makeup Water Float Valve	**44**	Receiver Drain Valve
13	Heat Exchanger	**46**	Filter Drier
14	Oil Separator	**50**	Receiver Safety Valve
15	Condenser	**51**	Freezer Safety Valve
15R	Receiver	**52**	Water Regulating Stop Valve (Water-Cooled Only)
16	Thawing Chamber	**53**	Cold Weather Solenoid Valve “X” (A/C Machines)
17	Expansion Valve	**55**	Discharge Line Stop Valve For A/C Machines
18	Thaw Gas Solenoid Valve (D)	**58**	Liquid Outlet Valve (King Valve)
18S	Thawing Gas Pressure Switch	**59**	Receiver Access Valve
20	Liquid Line Solenoid Valve (A)	**69**	Freezer Pressure Stop Valve
22	Float Switch	**70**	Oil Return Stop Valve
23	Condenser Water Inlet W/C Machines	**88**	Accumulator/Heat Exchanger
23A	Makeup Water Inlet 3/4 FPT	**90**	Thawing Gas Stop Valve
24	Condenser Water Outlet (W/C Machines)	**91**	Receiver Liquid Return Stop Valve
25	Water Tank Drain Connection 1-in. FPT	**94**	Compressor Oil Pressure Safety Control
28	Refrigerant Charging Valve	**101**	Check Valve

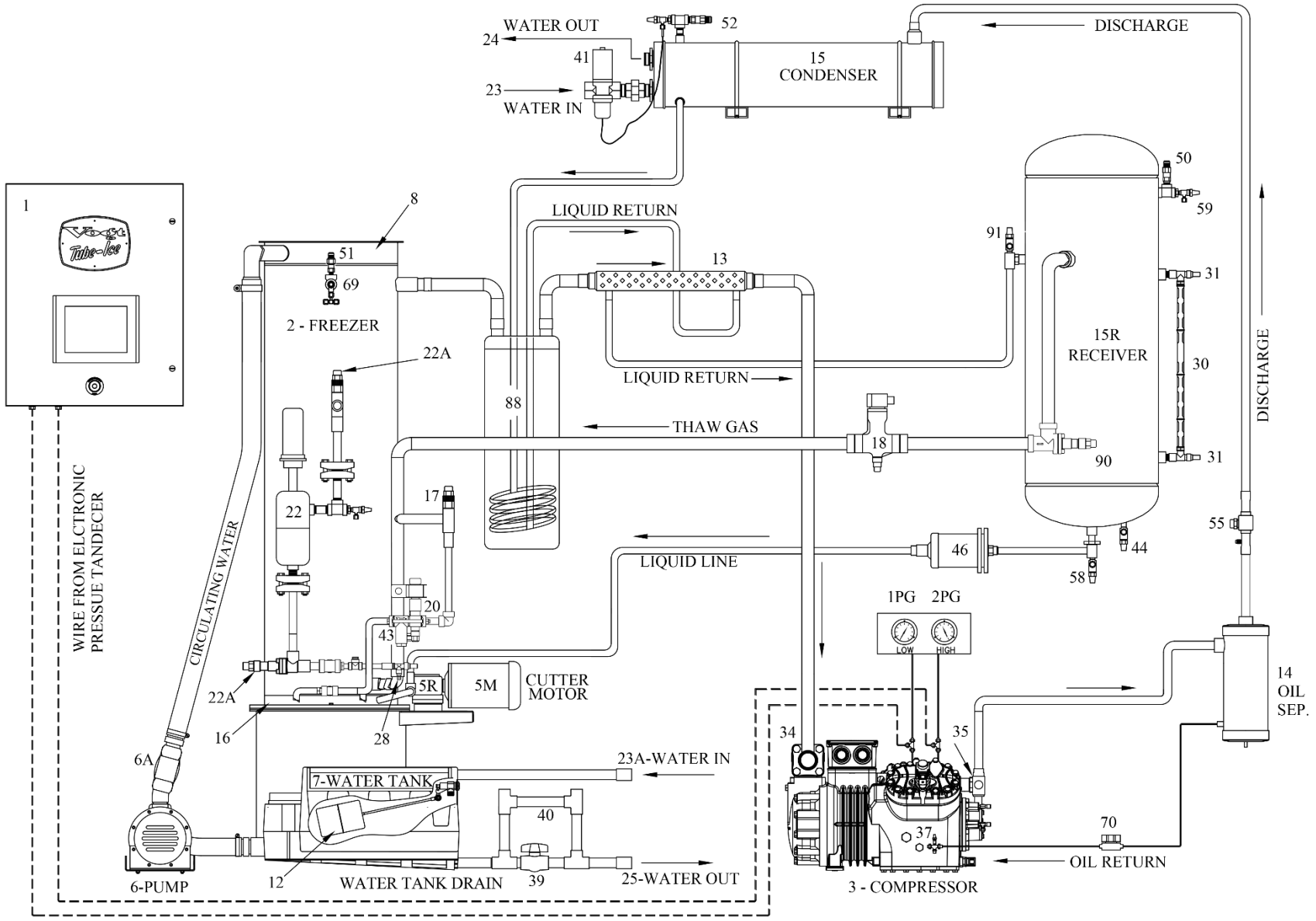


Figure 3: Water-Cooled Piping Schematic

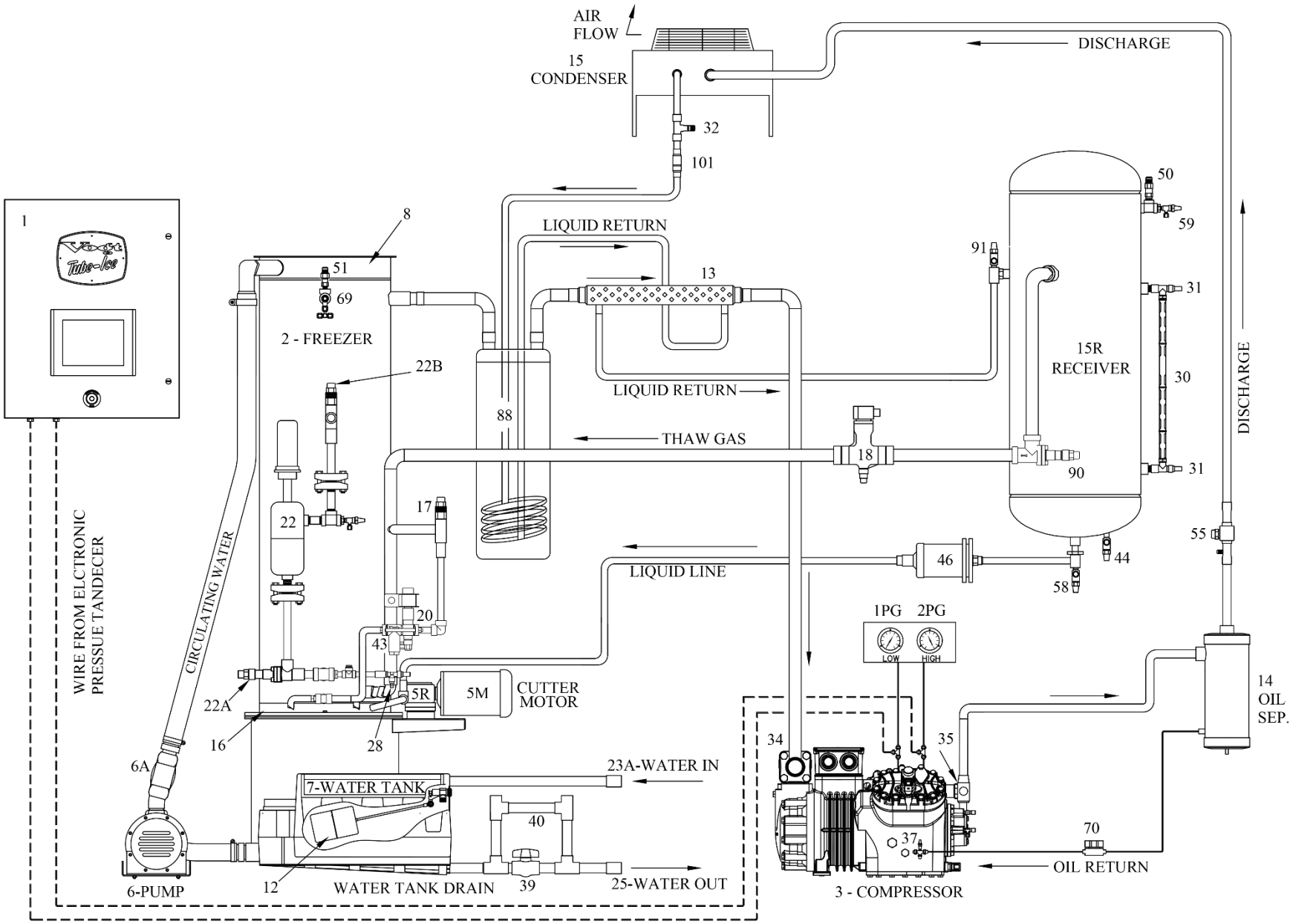


Figure 4: Air-Cooled Piping Schematic

Freezing Period

The freezer is a shell-and-tube type vessel, consisting of an outside shell with vertical tubes inside. Water freezes inside the tubes by the direct application of refrigerant to the shell side (outside) of the tubes. Ice is produced as the water continues to recirculate. As the ice thickens, the freezer suction pressure decreases. The **Freezer Pressure Switch** automatically initiates the thawing, or harvest, period as the freezer pressure reaches the setpoint in the PLC. Refer to *Freezer Pressure Switch on Touch Screen HMI*.

During the freezing period:

1. Water is constantly recirculated through the freezer tubes by a centrifugal pump.
2. Makeup water is maintained at the appropriate level by a float valve in the water tank.
3. A liquid line solenoid valve (A) is open, and a thaw gas solenoid valve (D) is closed.
4. Refrigerant gas from the top of the freezer passes through the suction accumulator, the heat exchanger, and the compressor.
5. The cool gas is compressed to a high-temperature, high-pressure gas that discharges through the oil separator and into the condenser.
6. In the condenser, heat is removed, and the gas is condensed to a high-temperature, high-pressure liquid.
7. This high-pressure liquid goes through the accumulator boil-out coil and suction line heat exchanger, where it gives up heat to the suction gas for compressor protection.
8. This liquid is subcooled and carried to the receiver.
9. Condensed liquid refrigerant from the receiver flows through the filter/dryer, the thawing chamber of the freezer, the liquid line solenoid valve (A), and then the expansion valve.
10. At the expansion valve and capillary feed, the refrigerant expands from a saturated liquid state of relatively high pressure to a very low-pressure, low-temperature liquid.
11. The float switch is wired to the liquid line solenoid valve (A).
12. The float switch energizes and de-energizes the liquid line solenoid valve (A) in response to the level of refrigerant in the freezer.
13. The cold liquid refrigerant enters the freezer, where it absorbs heat from the circulating water.
14. This cool gas is pulled out of the freezer at the suction outlet, thereby completing the circuit.

The freezing period is completed by the **Freezer Pressure Switch** in the PLC.

1. The water pump stops, and the liquid line solenoid valve (A) closes.
2. The thawing (harvest) period begins.

Harvest Period

During the harvest period:

1. The PLC stops the water pump, closes the liquid line solenoid valve (A) and starts the **Harvest Timer**.
2. The cutter motor starts after an adjustable **Cutter Delay** and the thaw gas solenoid valve (D) opens after an adjustable **Thaw Gas Valve Delay**.
3. The adjustable Thaw Gas Valve setpoints stored in the PLC open and close the thaw gas solenoid valve (D) valve to maintain the proper pressure for ice to release without adding unnecessary heat.
4. Warm gas from the receiver is discharged into the freezer through the valve, and the outer edge of the ice slightly thaws for sizing by the rotating cutter.
5. As the ice releases and drops through the rotating cutter and onto the cutter disc, it discharges through the side opening of the water tank.
6. The **Harvest Timer** is set for the time required to discharge all the ice plus 30 seconds (can be up to 5 minutes).

To prevent refreezing, make sure all ice clears the freezer with at least 30 seconds to spare before the next freezing period begins.

Refrigeration System Overview

The refrigeration system uses hydrofluoroolefin (HFO) blend refrigerant R-513A.

It contains:

- Bitzer ECOLINE semi-hermetic reciprocating compressor
- Oil separator
- Refrigerant float switch
- Expansion valve
- Flooded evaporator (freezer)
- Hot gas defrost

As shown in the piping schematic, the compressor discharge gas leaves the compressor and goes into the condenser. Here, the gas is condensed into liquid as heat is removed from the water as it passes through the condenser during the freezing period.

A reservoir of liquid is accumulated in the receiver and flows as required, passing through the filter /dryer then through the thawing chamber (located in the lower section of the freezer). The liquid line solenoid valve (A) opens and closes in response to the liquid level in the freezer, as determined by the refrigerant float switch mounted on the side of the freezer.

Liquid refrigerant floods the evaporator and comes in contact with the outside of the ice-making tubes through which water is being circulated. The heat contained in this water passes through the walls of the tubes, lowering the temperature of the water, causing it to freeze and to form a long tube of ice that adheres to the inside of each freezer tube. Since the purest water freezes first, the flowing water keeps the accumulated ice clear by washing separated solids down into the sump area of the water tank. The blowdown valve on the circulating water pump discharge helps to rid the water tank of increased dissolved solids found in harder water by flushing them out of the overflow during water pump operation.

During the harvest period, the water pump stops, therefore, all the water circulating in the freezer drops to the tank, the tank level increases, and the overflow will get rid of that extra water. The overflow is a hole at the top of the tank. Refer to Chapter 9 for more information about automatic blowdown.

The transfer of heat from the water to the liquid refrigerant causes it to boil and convert into a liquid-vapor mixture at the suction connection at the top of the freezer. This liquid-vapor mixture passes through the suction accumulator, where liquid droplets are removed and boiled off from the internal heating coil. The suction line heat exchanger boils off any residual droplets that may have passed through the suction accumulator, providing ample protection for the compressor.

As the ice forms in the freezer tubes, the suction pressure steadily decreases until it reaches the **Freezer Pressure Switch** setpoint, initiating the harvest period.

During the harvest period, the thaw gas solenoid valve (D) is open, allowing warm high-pressure gas from the receiver to enter the freezer. This heat melts a thin film from the outside of the ice, reducing the outside diameter slightly, allowing it to fall free from the freezer tubes. This period may last up to 5 minutes.

Note: Freezing times will vary, depending on makeup water temperature and setting of the freezer pressure switch. As you become more familiar with the operation of your machine, you will be able to recognize and correct minor irregularities as they occur, which will help prevent major problems.

Charging Refrigeration Systems

Only technically qualified persons, experienced and knowledgeable in the handling of refrigerant and operation of refrigeration systems, should perform the operations described in this manual.

All local, federal, and EPA regulations must be strictly adhered to when handling refrigerants. If a refrigeration system is being charged from refrigerant cylinders, disconnect each cylinder when empty or when the system is fully charged.

Included with the machine is the required charge of R-513A refrigerant (approximately 310 lb [141 kg]), isolated in the receiver. Before shipment of the machine, the compressor service valves and the stop valves in the various lines to the condenser and receiver were closed. These valves are tagged with instructions to be opened before start-up of the machine.

Before opening these valves, check all joints for leaks that may have developed during shipment. If no leaks are present, a positive pressure should show on the suction and discharge pressure gauges. They should indicate a pressure approximately equal to the ambient temperature, which can be found using the pressure temperature chart.

A gauge should be installed in the charging line to indicate refrigerant cylinder pressure. The cylinder may be considered empty of liquid refrigerant when the gauge pressure is 25 psig (1.7 bar) or less, and there is no frost on the cylinder. Close the refrigerant charging valve and cylinder valve before disconnecting the cylinder. Loosen the union in the refrigerant charging line carefully to avoid unnecessary release of refrigerant into the atmosphere. Refer to local and national regulations.

Immediately close the system charging valve at the commencement of the defrost or thawing cycle if a refrigerant cylinder is connected. Never leave a refrigerant cylinder connected to the system except during charging operation. Failure to observe either of these precautions can result in transferring refrigerant from the system to the refrigerant cylinder, over-filling it, and possibly causing the cylinder to rupture because of pressure from expansion of the liquid refrigerant.

It is not recommended that refrigerant be transferred from a refrigeration system directly into a cylinder. If such a transfer is made, the refrigerant cylinder must be an approved, clean cylinder that is free of any contaminants or foreign materials. The cylinder must be connected to an approved recovery mechanism with a safety shutoff sensor to ensure that contents do not exceed the net weight specified by the cylinder manufacturer or any applicable code requirements.

Chapter 3 Receipt of Machine

Only service personnel experienced in refrigeration and qualified to work with high-voltage electrical equipment should install or work on this machine. Eye protection must be worn by all personnel working on or around the machine. You must be familiar with and adhere to all local ordinances and laws regarding the handling, storing, and use of refrigerants. Refer to the safety data sheet.

State of New Machine

The HFO5 is a packaged ice-making machine, either water-cooled or air-cooled, complete with compressor, oil separator, receiver, and condenser (if water-cooled). The machine was shipped in a fully pumped down state with all refrigerant stored and isolated in the receiver. All valves on the machine are tagged as to their state (open or closed) and their purpose. The machine was cleaned with ice machine cleaner and flushed so that it is ready for ice production.

Inspection

Upon receipt of the Tube-Ice® machine, inspect it for any obvious damage. If damage is found or suspected, note it on the trucker's Bill of Lading. Immediately submit a separate written request for inspection by the freight line's agent. Any repair work or alteration to the machine without the permission of Vogt Ice, LLC, can void the machine's warranty. Also, notify your Vogt distributor or the factory.

Delivery Inspection Checklist

- Inspect outer casings (if provided)
- Inspect piping and valves
- Inspect refrigerant sight glass for damage

The machine was shipped with a full refrigerant charge stored and isolated in the receiver. Visually check all lines for mechanical damage. If a leak is suspected, check all joints with a refrigerant leak detector supporting HFO blend refrigerants. All leaks should be reported to Vogt Ice, LLC, to obtain authorization and instructions for repair.

The machine is factory tested before shipment and supplied with a Certificate of Test report confirming the conditions under which it operated at the factory and that the machine operated as designed. Minor adjustment may be required at the installation site to achieve optimal performance.

Safety Tags and Labels

Be sure to read and adhere to all special tags and labels attached to valves or applied to various areas of the machine. They provide important information necessary for safe and efficient operation of your equipment. The unit may have valves in the open or closed position and may be tagged with information about the required position for start-up.

Pressure Relief Valves

Pressure relief valves are included on this packaged Tube-Ice® machine. One is located on the freezer (low-side), one is located on the top of the condenser (high-side), and a third is located on the top of the receiver (high-side). Vent each of the pressure relief valves to the atmosphere in compliance with local and national codes.

Failure to do so creates a safety hazard that could cause injury or loss of life.

Machine Location

The machine must be located inside a suitable building and must not be subjected to ambient temperatures below 50°F (10°C) or above 110°F (43°C). Heat from other sources, such as sunlight, furnaces, condensers, or unusual air currents (including fans or air-conditioning air flow) may affect the operation of the machine and should be avoided. The electrical components of the Tube-Ice® machine are rated NEMA 1 or IP10. As such, the machine should not be located in a hazardous area or sprayed with water. The machine should be installed on a drainable condensate drip pan or in an area where there is no possibility of standing water, but readily drain away from the machine.

 **Warning:** The machine weighs approximately 3,100 lb (1,406 kg). Use only the appropriate equipment with adequate loading capacity to move and install the machine. See Space Diagram for clearances and utility connections, FIGURES 8 and 9. If a forklift is used, make sure its capacity is sufficient. The forks must be wide enough apart to prevent tipping sideways and must extend beyond the extremities of the frame base structure. The machine needs to be bound in place to prevent tipping.

Equipment Storage

If the equipment must be stored before installation, it should be indoors and protected from extreme temperatures and high humidity. These conditions can deteriorate the various components used in the manufacture and assembly of the equipment.

This equipment contains the HFO refrigerant blend R-513A under pressure. Do not store in an area exposed to temperatures above 115°F (46°C) or in direct sunlight at temperatures above 105°F (40°C).

Rated Capacity

This machine is rated to produce a given amount of ice when operating under the proper conditions as specified in this manual. Be prepared to handle the ice produced as it is discharged from the machine and move it to the storage or bagging area promptly.

Chapter 4 Installation of the HFO5

Machine Connections

Warning: Only service personnel experienced and certified in refrigeration and qualified to work with high voltage electrical equipment are allowed to install or work on this Tube-Ice® machine.

Preparing the machine for operation requires connecting the following to the appropriate locations on the machine:

- Electrical supply
- Makeup water supply
- Water blowdown drain
- Condenser water inlet and outlet

The diagrams on the following pages show the basic connection locations and orientation of the HFO5 machine.

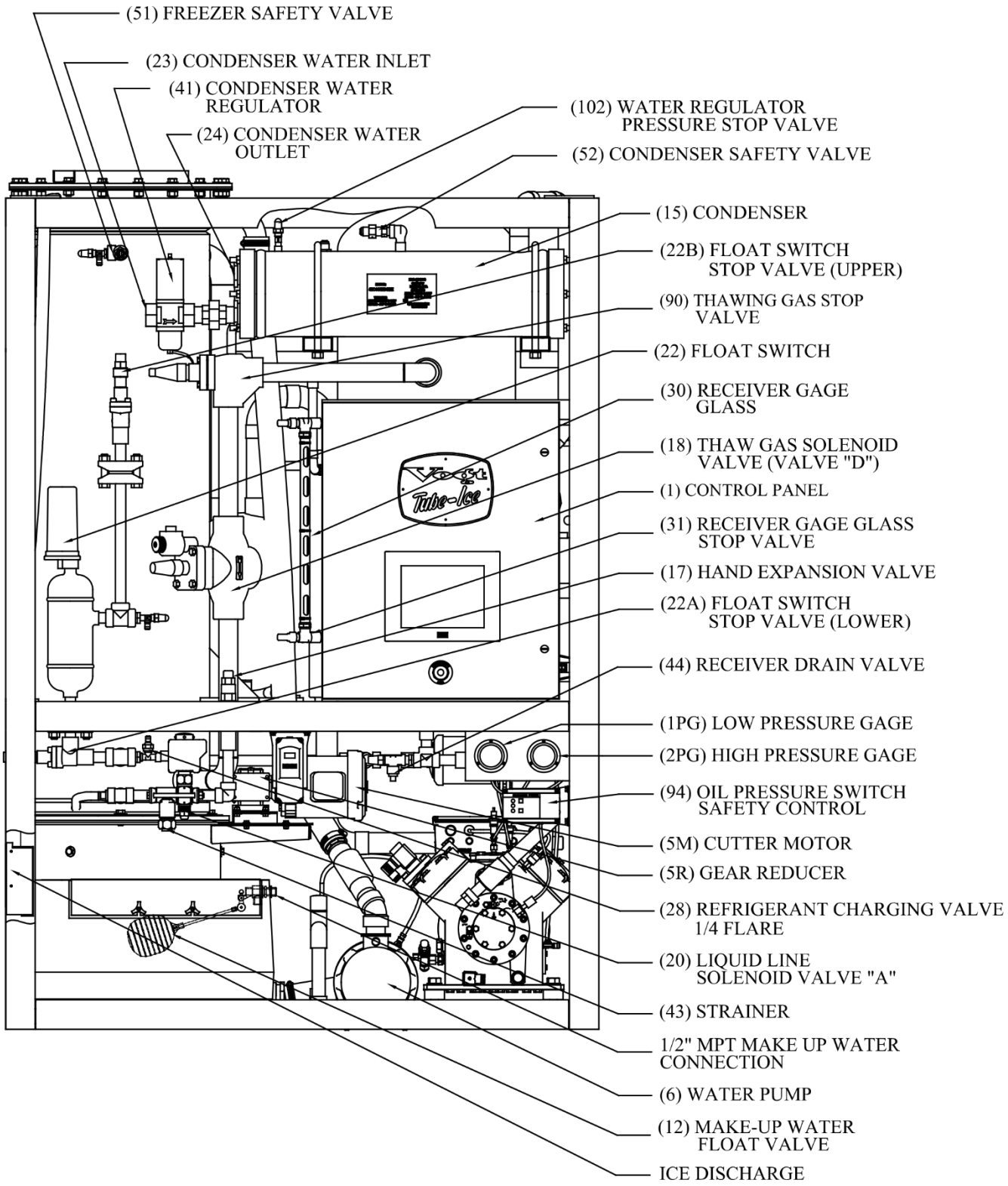


Figure 5a: HFO5 (Water-Cooled) Assembly
Front View

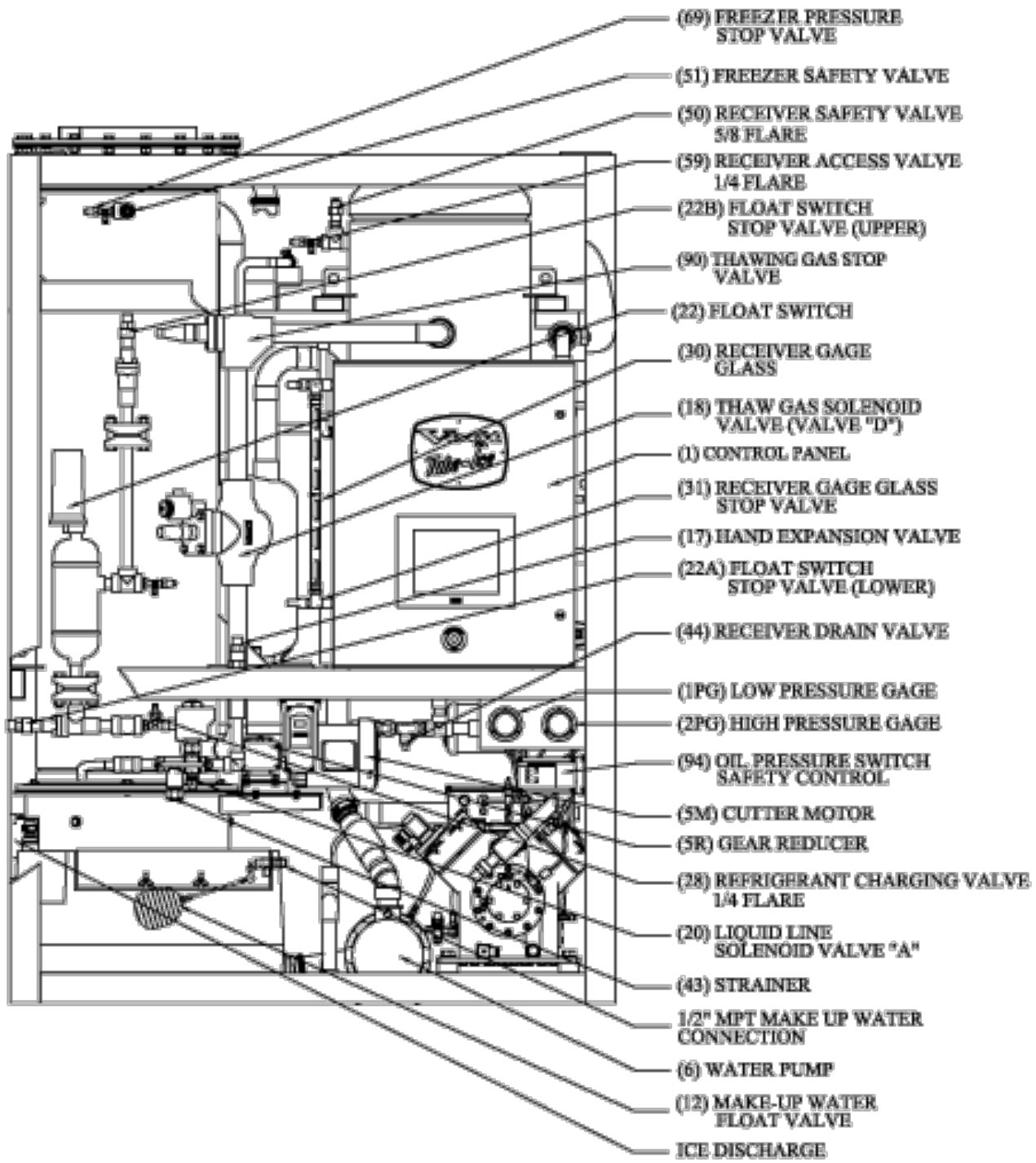


Figure 5b: HFO5 (Air-Cooled) Assembly
Front View

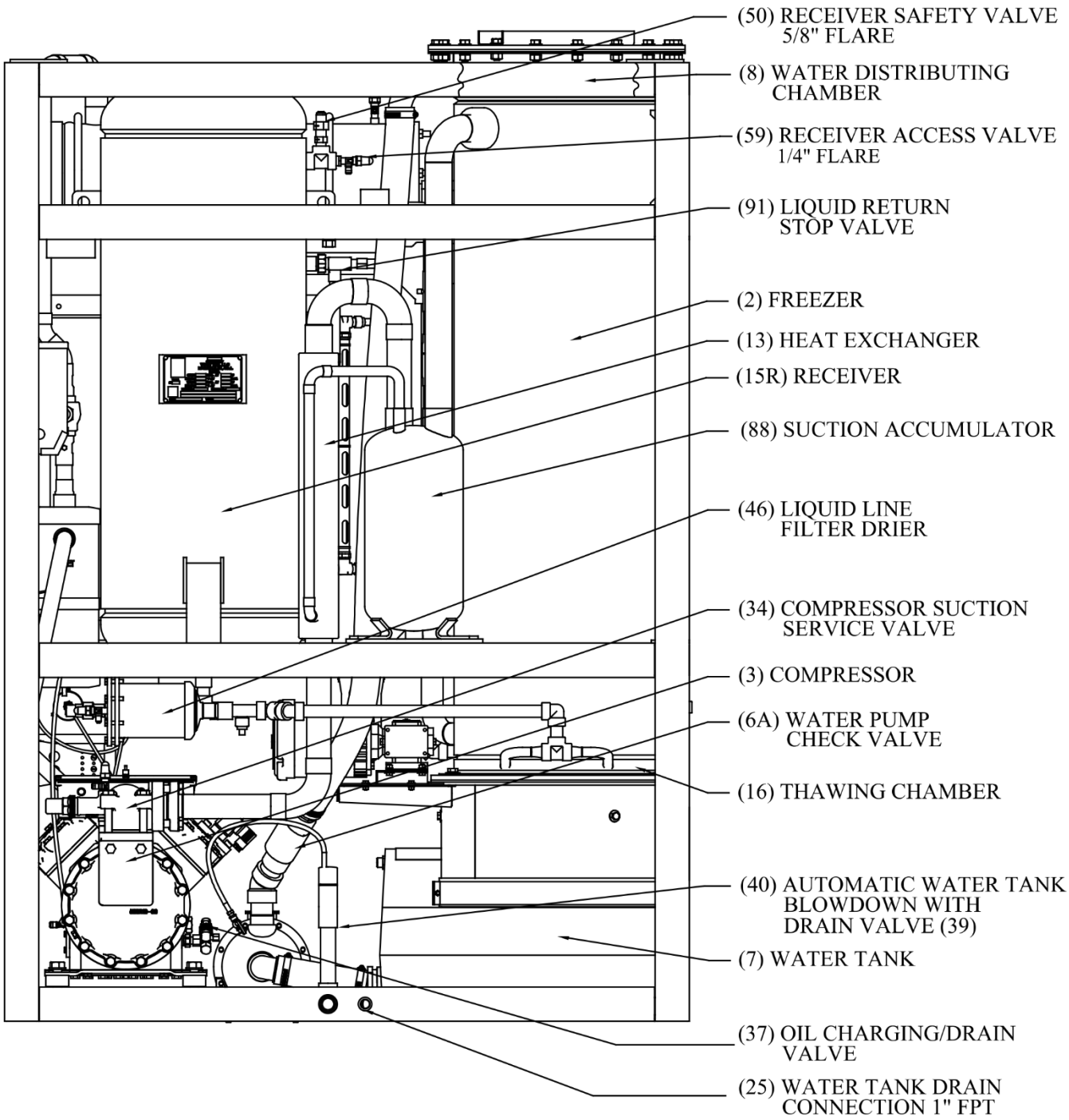


Figure 6A: HFO5 (Water-Cooled) Assembly
Rear View

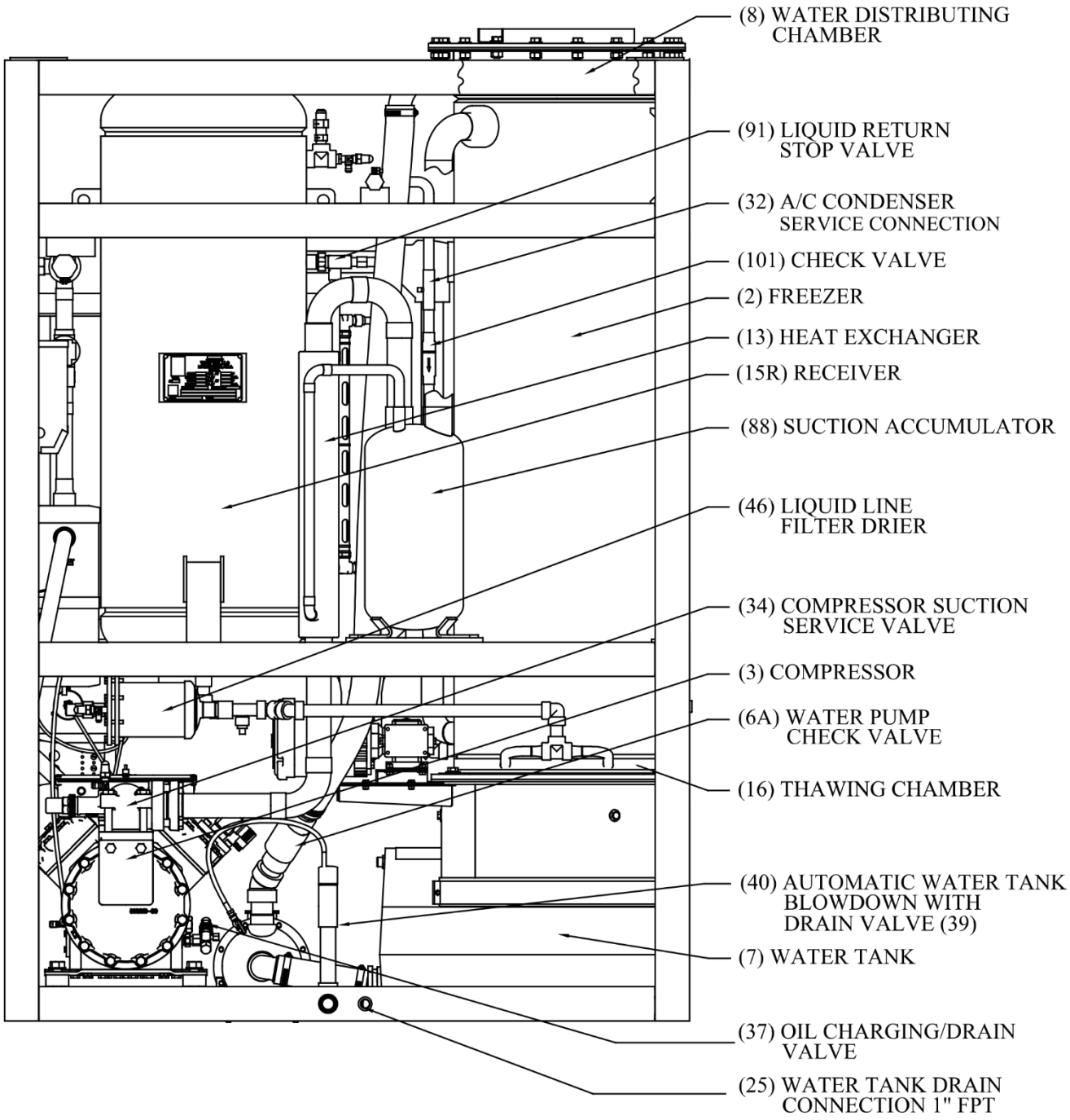


Figure 6B: HFO5 (Air-Cooled) Assembly
Rear View

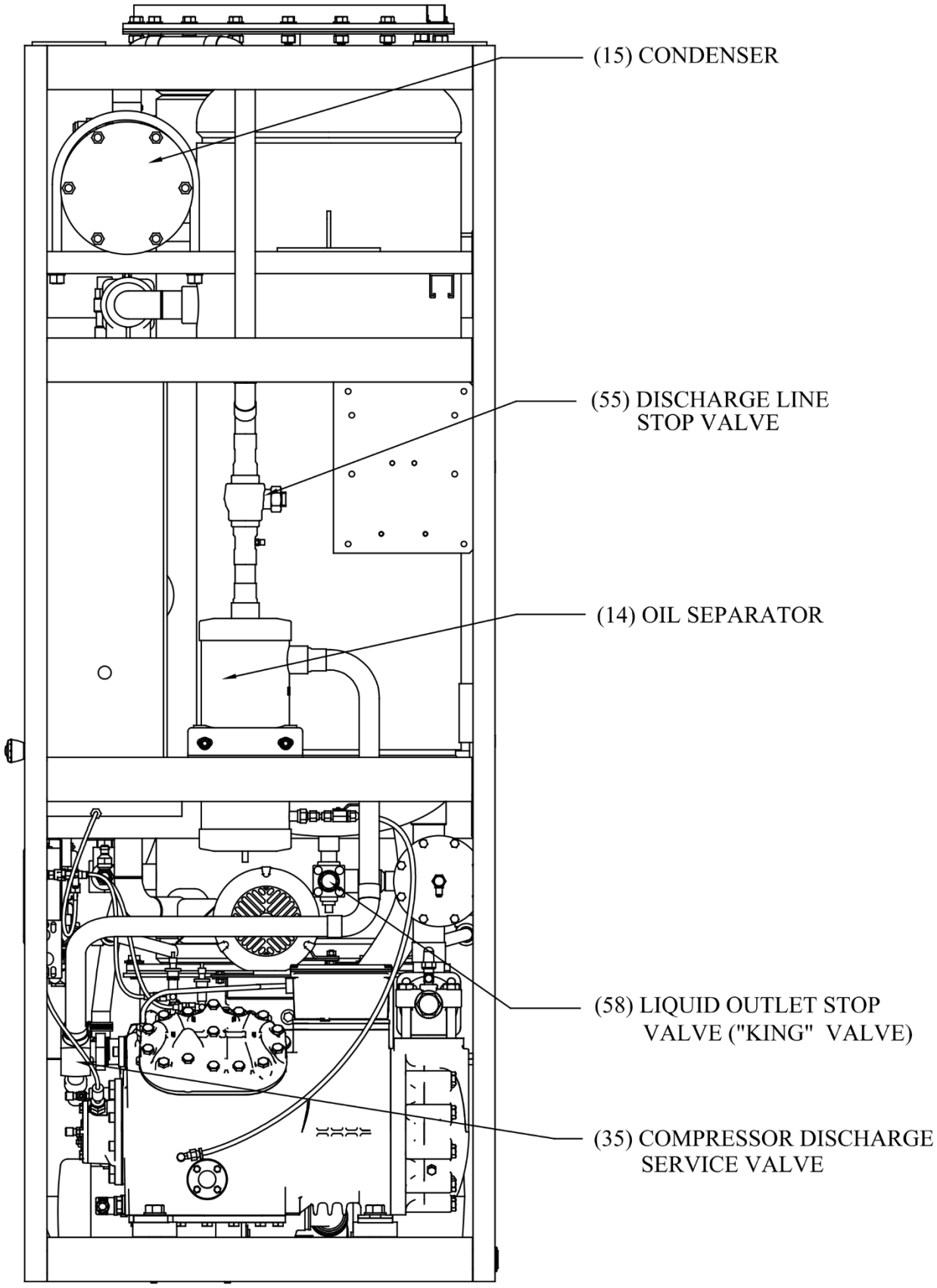


Figure 7A: HFO5 (Water-Cooled) Assembly
Right Side View

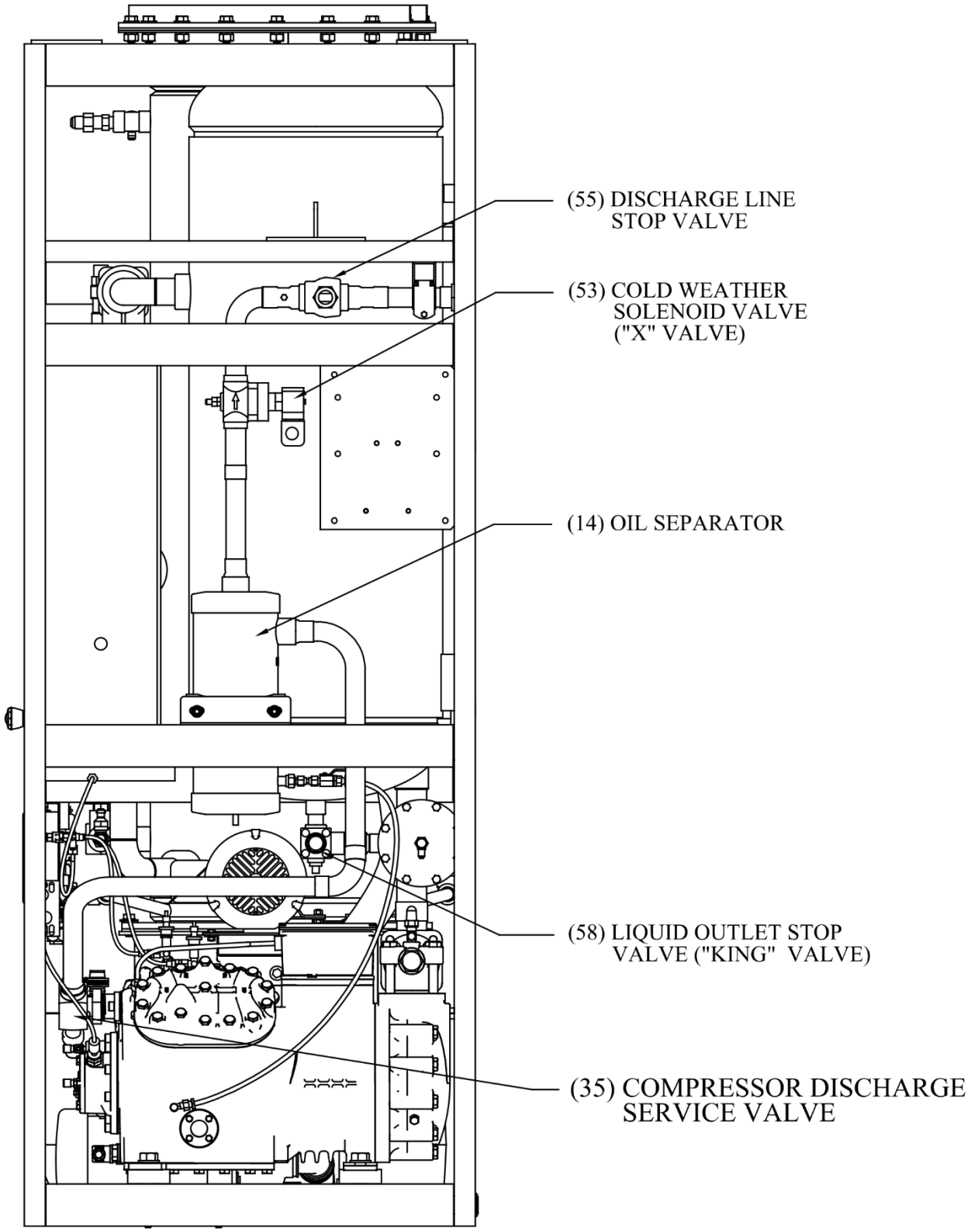


Figure 7B: HFO5 (Air-Cooled) Assembly
Right Side View

Equipment Layout and Service Access

The approximate operating weight for the HFO5 is 3,100 lb (1,406 kg). The HFO5 requires certain clearances around the unit for safety reasons and to provide access for servicing operations. The following figures 8 and 9 show clearance requirements.

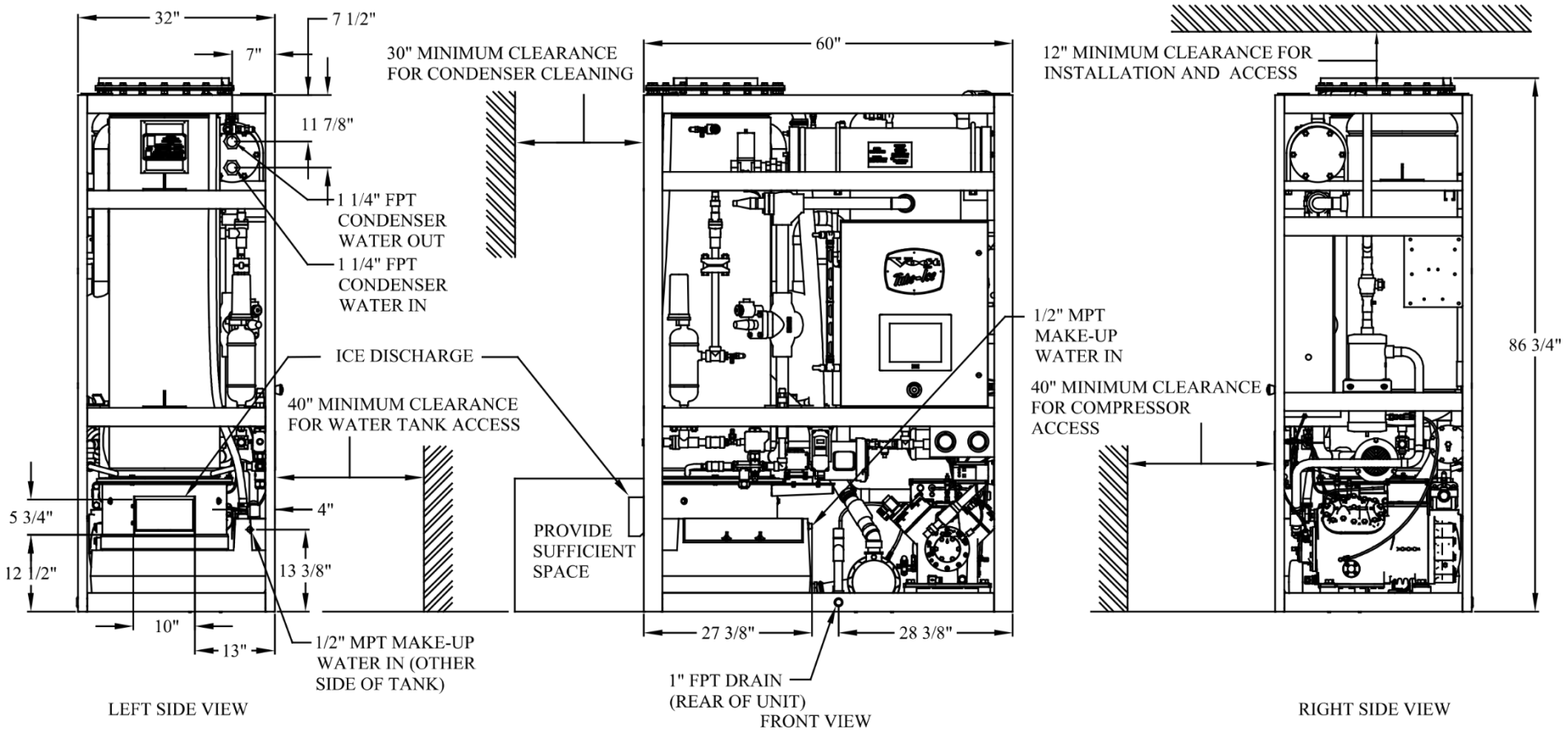


Figure 8: Connections and Clearance Diagram (Water-Cooled Machine)

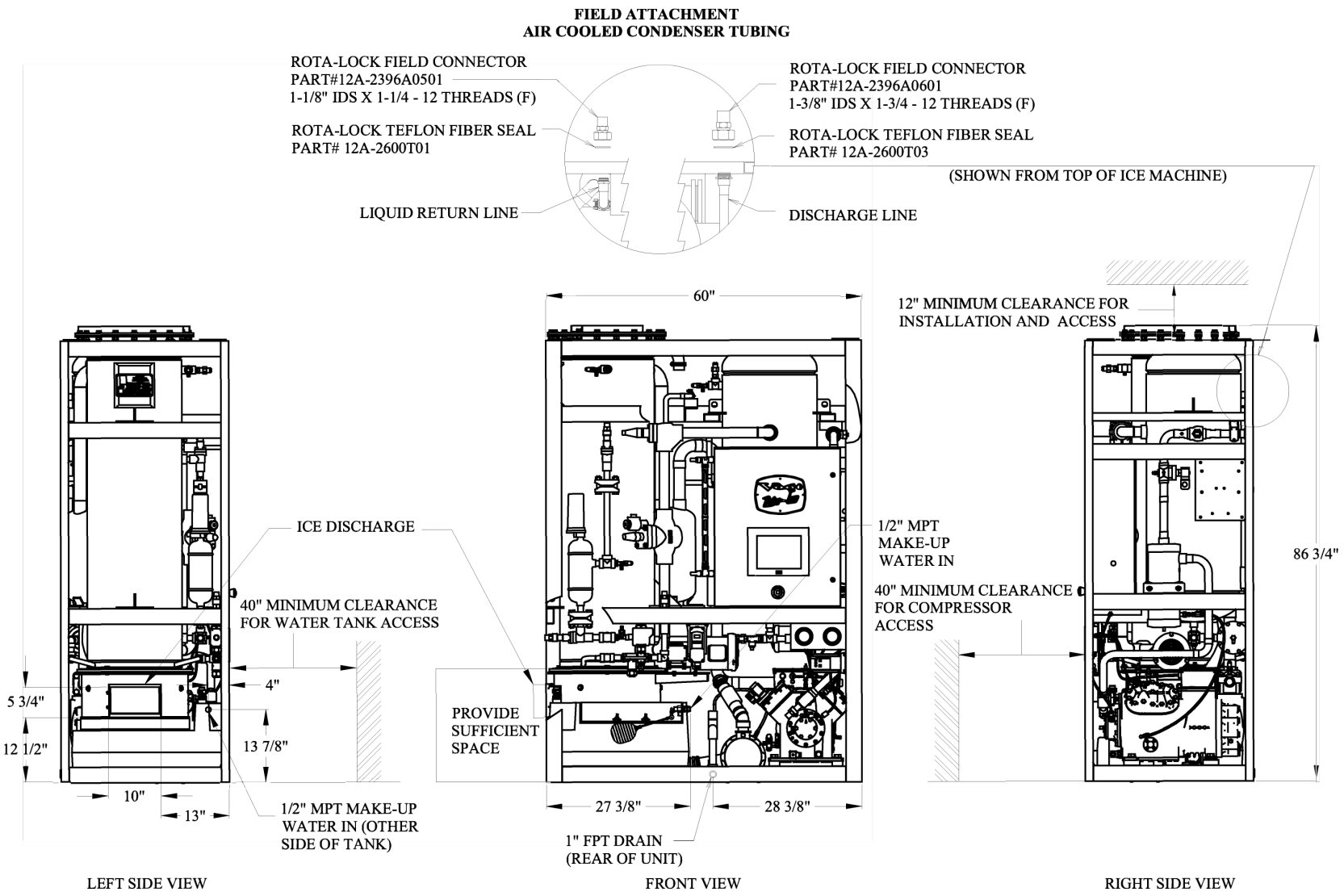


Figure 9: Connections and Clearance Diagram (Air-Cooled Machine)

Equipment Anchoring (Machine Footprint – Ice Discharge Location)

The supporting foundation should be constructed from concrete or similar material in accordance with all local and federal codes and building regulations. Figure indicates anchor bolt hole locations in the bottom frame of this Tube-Ice® machine. Consult local codes and regulations regarding seismic and wind load requirements. Additional bracing may be required.

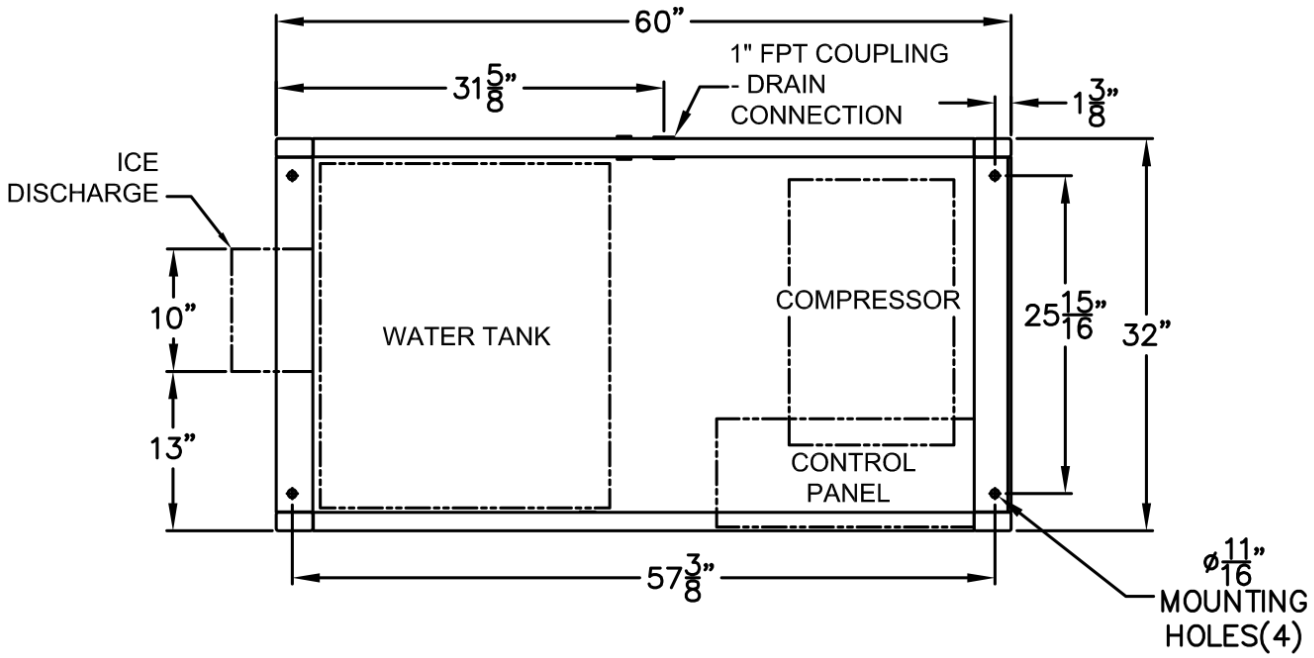


Figure 10: HFO5 Anchor Points

Piping and Drain Connections

CAUTION External shut-off valves must be installed in the water inlet lines. The minimum inlet water pressure for satisfactory operation of the machine is 30 psig (2 bar). The maximum allowable pressure is 90 psig (6.2 bar).

Figures 5 to 7 show locations for all connections. Table 2 shows drain sizes.

Table 2: Water Supply and Drain Sizes

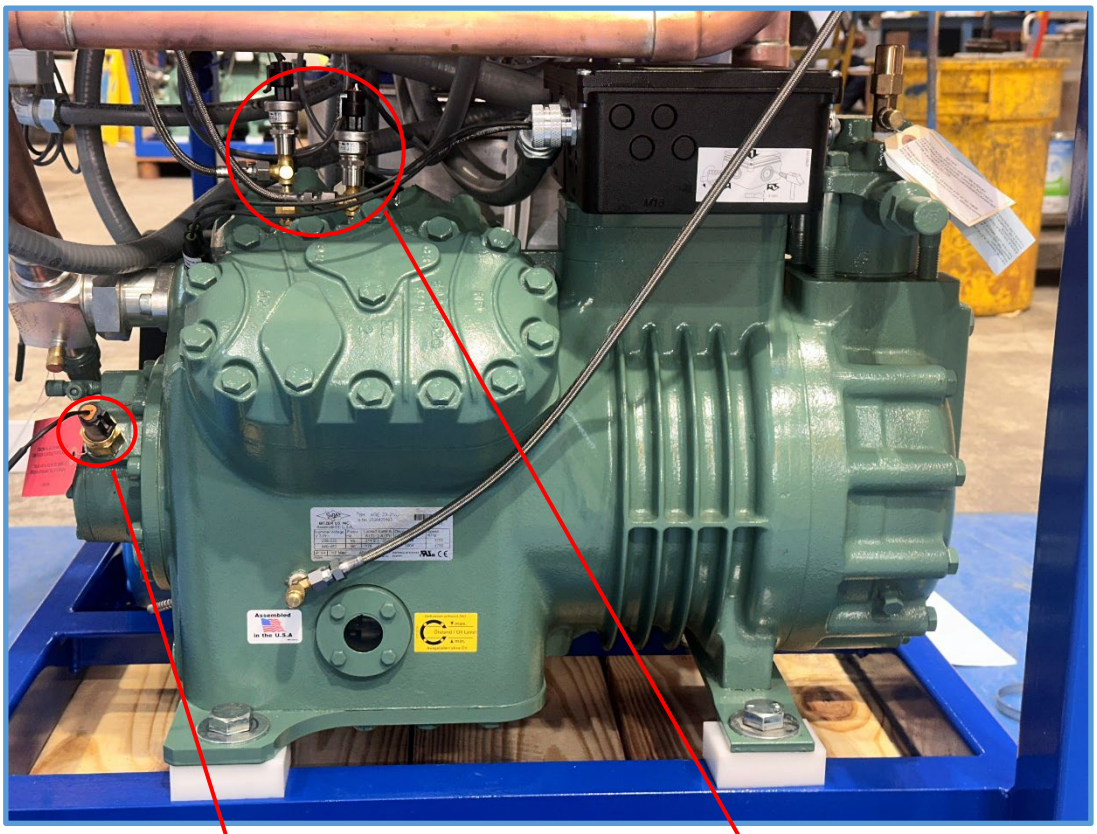
Makeup Water In	Water Tank Drain	Condenser Water In	Condenser Water Out
1/2 in. (DN 15) MPT	1 in. (DN 25) FPT	1-1/4 in. (DN 32) FPT	2 in. (DN 50) FPT

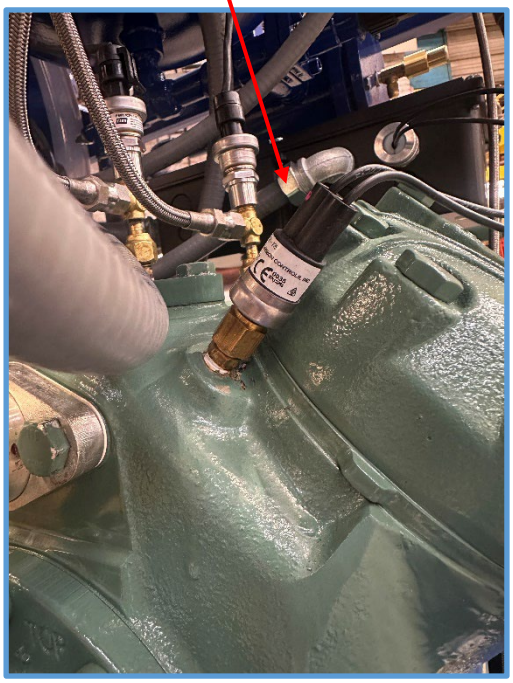
The condenser water outlet and water tank drain connections must be extended to an open drain or sump, arranged for visible discharge. Do not allow water to be trapped in the water tank drain line, because this will interfere with the operation of the automatic blowdown system.

CAUTION Do not connect these lines into a pressure-tight common header because warm condenser water may back up into the water tank. The condenser water outlet must be piped separately to the drain. Due to variations in water quality by geographic location, water filtering or treatment may be required to reduce maintenance and inhibit hardness buildup on machine components, such as freezer tubes and water valves.

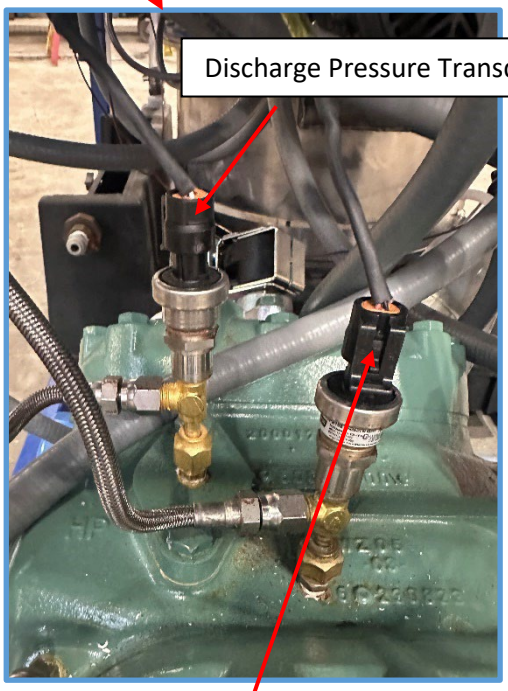
Compressor Components

The compressor is supplied with pressure switches and transducers. See pictures below for installation locations on the compressor body.





High Pressure Safety Switch (backup)



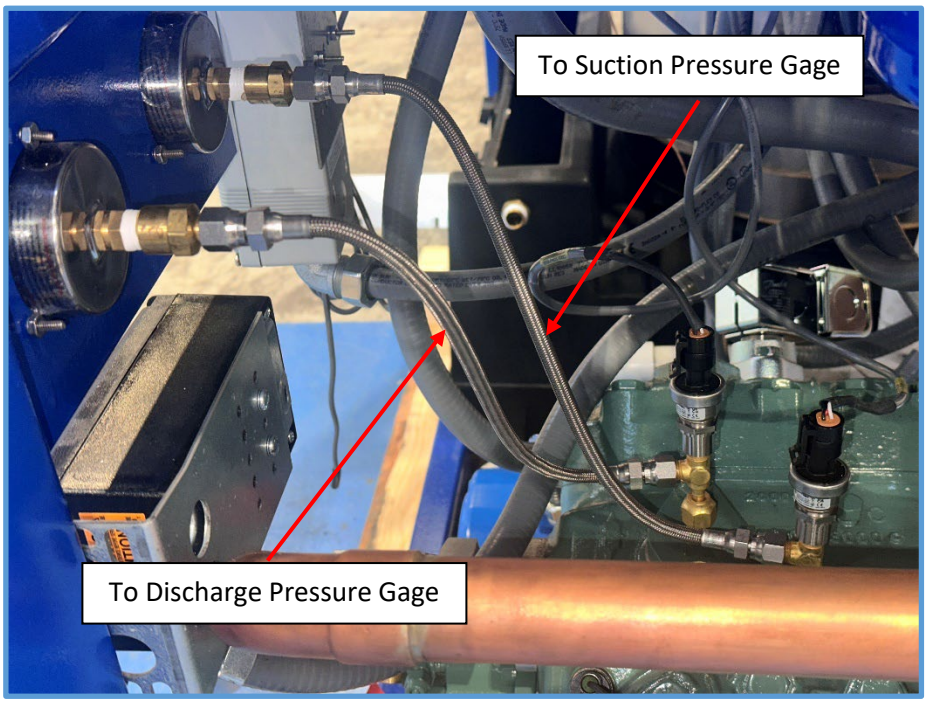
Discharge Pressure Transducer

Suction Pressure Transducer

Compressor Components (Cont'd)

Suction Pressure Gage

Discharge Pressure

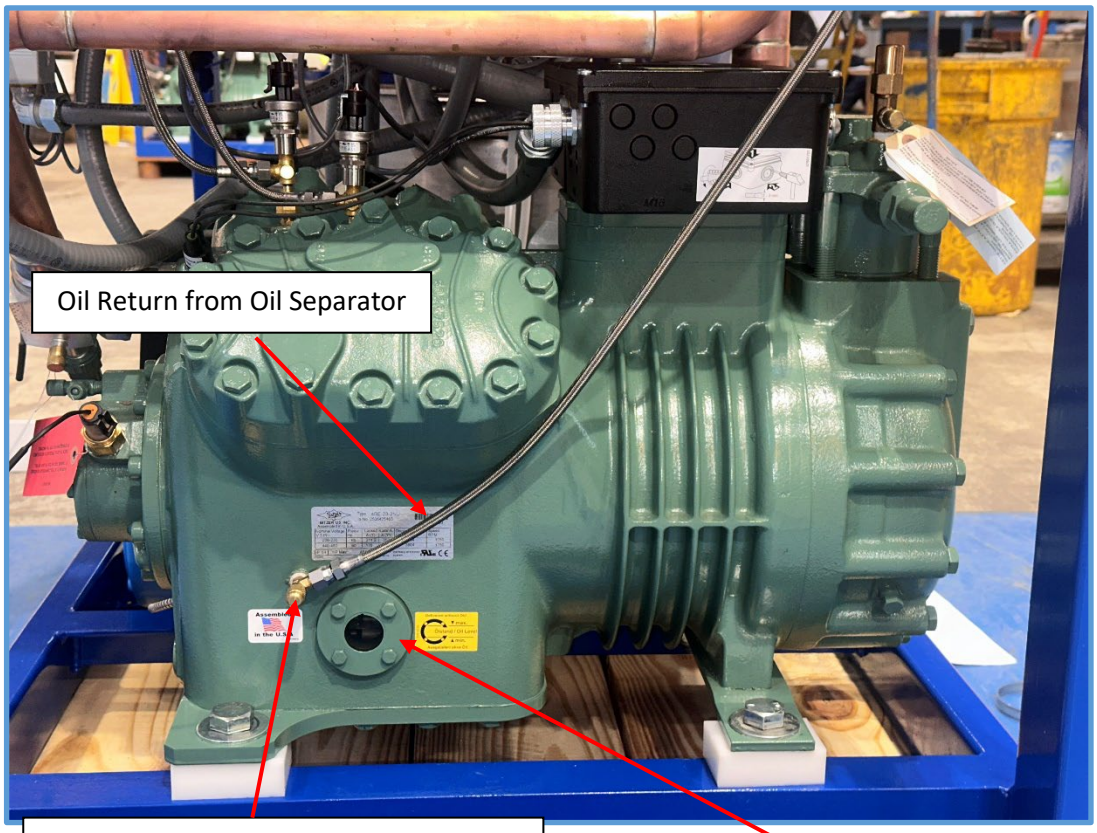


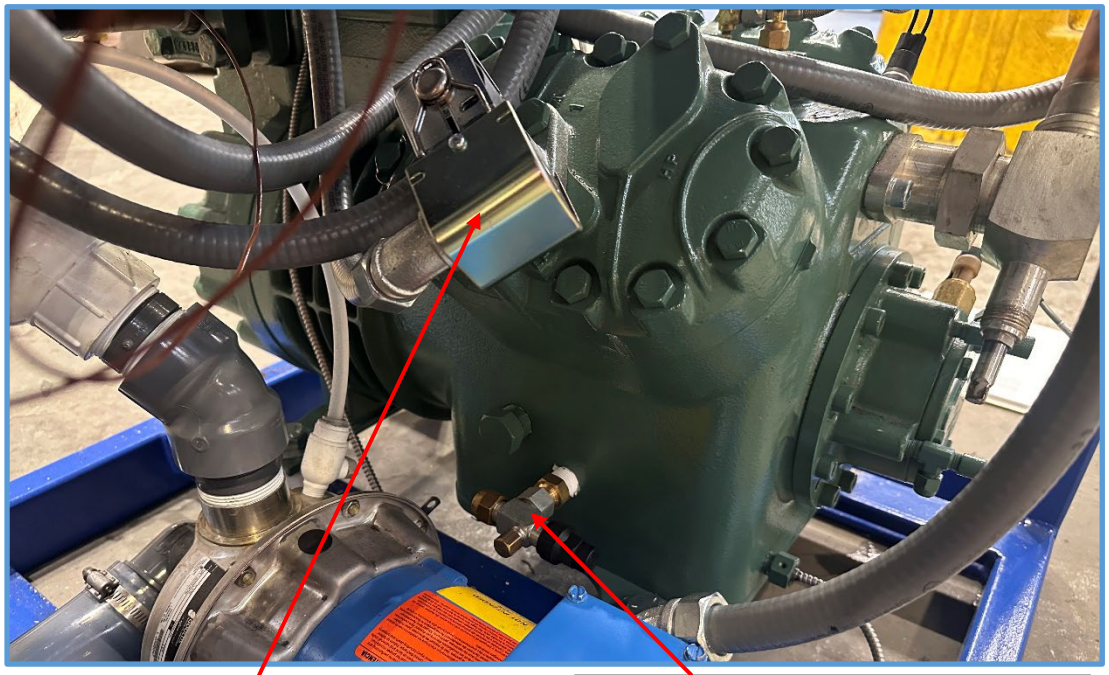
Oil Safety Switch P545

Crankcase Heater

Oil Safety Sensor P400

Compressor Components (Cont'd)





See Page 9-7 for Compressor Lubrication Detail

Water-Cooled Condenser Connections (Water-Cooled Machines Only)

The water regulating valve is not installed on the condenser when it is shipped from the factory. Install the regulating valve on the condenser water inlet connection (bottom connection on condenser). Connect the condenser water outlet line to the top connection on the condenser.

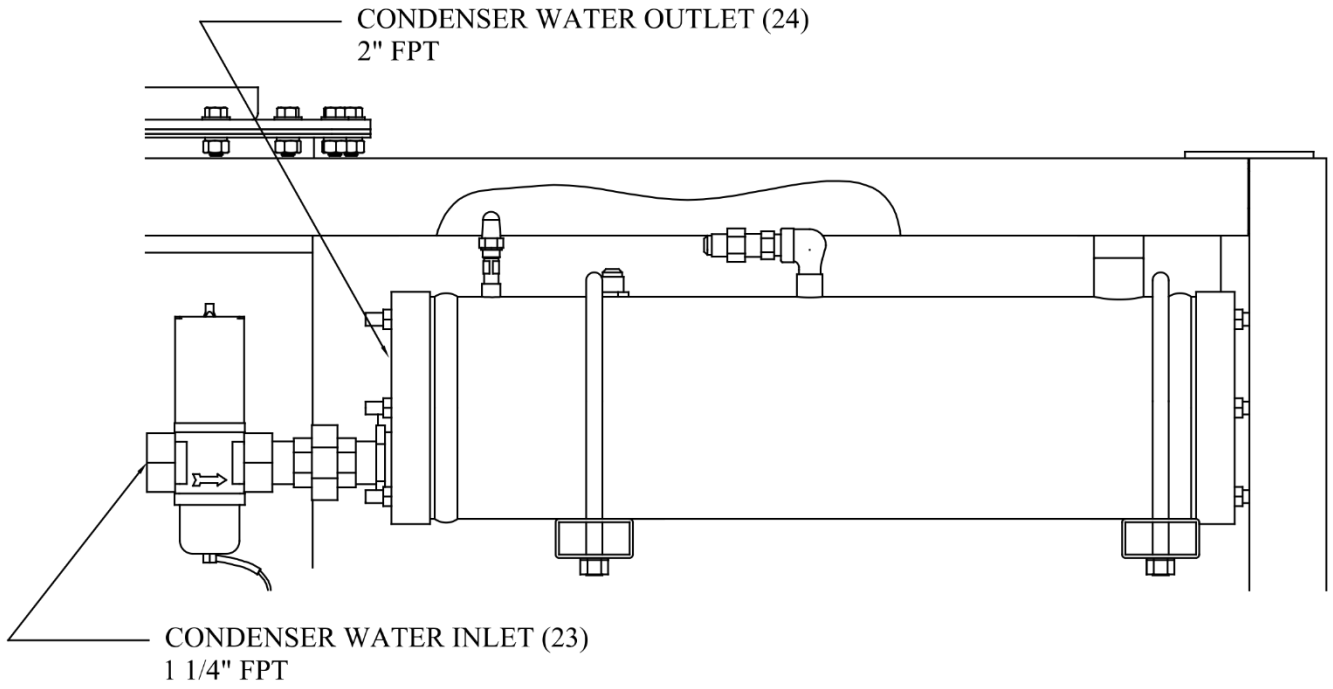


Figure 11: Water-Cooled Condenser Connections

Cooling Tower (Water-Cooled Machines Only)

When selecting a cooling tower, pay careful attention to operating wet bulb conditions. Check with your local cooling tower distributor for their recommendations based on actual operating conditions in your area. An average wet bulb temperature of 78°F (25°C) is typical in the United States, but many localities have design wet bulb temperatures as low as 72°F (22°C) or as high as 82°F (28°C).

The cooling tower water pump must be capable of delivering the required volume of water through the condenser. The pump must be sized for each installation, which depends on cooling tower location, pressure drop through water lines, and water regulating valves. The water piping for the cooling tower and the installation of the pump must be in accordance with the manufacturer's instructions.

Proper water treatment for the prevention of mineral and foreign matter accumulation in the condenser or cooling tower is recommended. A water analysis by an independent laboratory should be completed to determine the proper chemicals to use.

Air-Cooled Condenser Connections (Air-Cooled Machines Only)

Follow these procedures to make a tight joint:

1. Silver solder or braze condenser tubing ends to the female Rota-lock connectors.
2. Remove dust caps, if used, making sure that component plastic seals are intact.
3. Wipe off connector and spud threaded surfaces with a clean cloth to prevent the inclusion of dirt or any foreign material in the system.
4. Connector coupling nut should be screwed onto Rota-lock spud using the proper amount of torque.

Table 3 shows torque ratings for Rota-lock connectors.

Figure shows connection sizes.

Table 3: Rota-lock Connector Torque Ratings

Spud Size	Torque
7/8 in.	50-60 ft-lb (68-81 N-m)
1-1/8 in.	80-100 ft-lb (108-136 N-m)
1-3/8 in.	100-110 ft-lb (136-149 N-m)

Air-Cooled Condenser Installation Instructions

Warning: These installation guidelines must be followed to obtain reliable operation from air cooled ice machines. If these guidelines are not followed, the compressor warranty will not be honored.

1. Use only Vogt approved condensers. Any exceptions to this policy must be obtained in writing from Vogt prior to installation and operation of the ice machines.
2. Outdoor condensers must be installed with vertical air flow. Indoor condensers used for heat recovery may be installed with either horizontal or vertical air flow.

Note: The condenser must be ordered for horizontal air flow.

3. The condenser must be mounted above the ice machine.
4. Horizontal runs in the liquid return line should slope 1/4 in./ft. (1.2°) with liquid refrigerant draining freely in the direction of normal operating flow (back to the ice machine) with no traps in the liquid line.
5. Horizontal runs in the discharge line should slope 1/4 in./ft. (1.2°) in the normal direction of flow (away from the ice machine).
6. Traps must be installed in discharge lines at the base of all vertical risers. There should be no intentional traps in liquid lines. Trap volume should be kept to a minimum. Long vertical rises should have traps every 20 ft. (6 m). Figure 1 shows typical trap details.

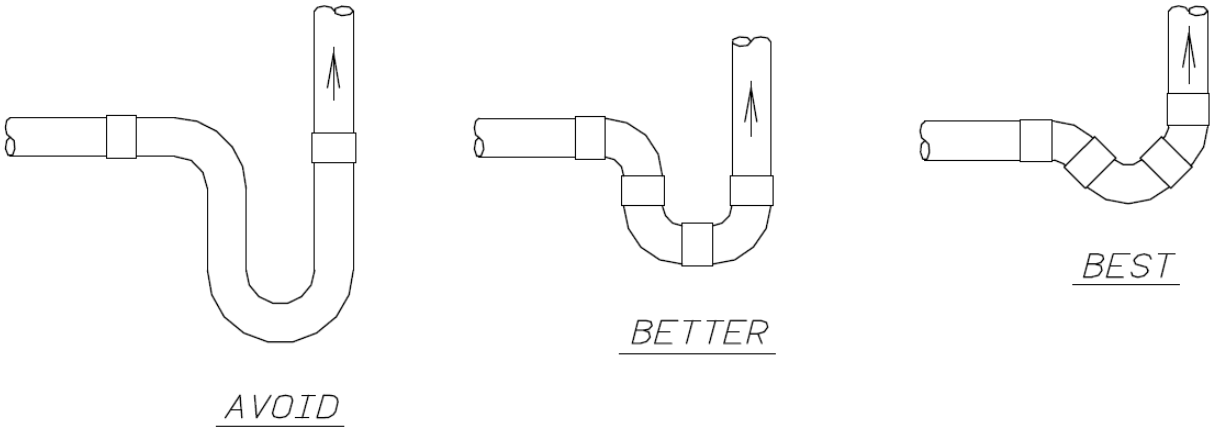


Figure 12: Minimum Traps for Discharge Lines

7. Flooding head pressure controls such as Alco Headmaster are not to be used since they cause excessive subcooling of the returned liquid refrigerant and interfere with reliable ice harvest.
8. The discharge and liquid lines must be insulated with 1/2 in. (13 mm) Armaflex insulation or equivalent.
9. Use only ACR grade copper pipe, Type L. Table 4 has recommended line sizes. Figure 14 shows a typical condenser.

Table 4: Pounds (Kilograms) of Refrigerant to Add vs. Line Length

Liquid Line Size	75 ft. (23 m)	100 ft. (30 m)	125 ft. (38 m)	150 ft. (46 m)
1/2" (12 mm)	-	-	-	2 (1)
5/8” (15 mm)	-	2 (1)	4 (2)	6 (3)
7/8” (22 mm)	-	4 (2)	8 (4)	12 (6)
1-1/8” (28 mm)	-	6 (3)	12 (6)	18 (8)

10. The distance between the ice machine and condenser must not exceed 150 ft. equivalent (45.8 m). Table 5 shows equivalent lengths of various copper fittings.

Table 5: Equivalent Feet (Meters) Due to Friction

Copper Tubing Type “L”	1-1/8 in. (28 mm)	1-3/8 in. (35 mm)	1-5/8 in. (42 mm)	2-1/8 in (54 mm)
Globe valve (open)	28 (8.5)	36 (11)	42 (12.8)	57 (17.4)
Angle valve (open)	15 (4.6)	18 (5.5)	21 (6.4)	28 (8.5)
90° Elbow	3 (0.9)	4 (1.2)	4 (1.2)	5 (1.5)
45° Elbow	1.5 (0.46)	2 (0.6)	2 (0.6)	2.5 (0.76)
Tee (90° turn through)	6 (1.8)	8 (2.4)	9 (2.7)	12 (3.7)
Tee (straight through)	2 (0.6)	2.5 (0.76)	2.8 (0.85)	3.5 (1.1)

11. Condensers must be provided with a cold weather valve kit. These valves allow one-half of the condenser to be disabled in cold weather. Running the ice machine with one-half of the condenser in cold weather allows for consistent condensing pressures, particularly in windy conditions. Figure shows a diagram of the cold weather valve kit.

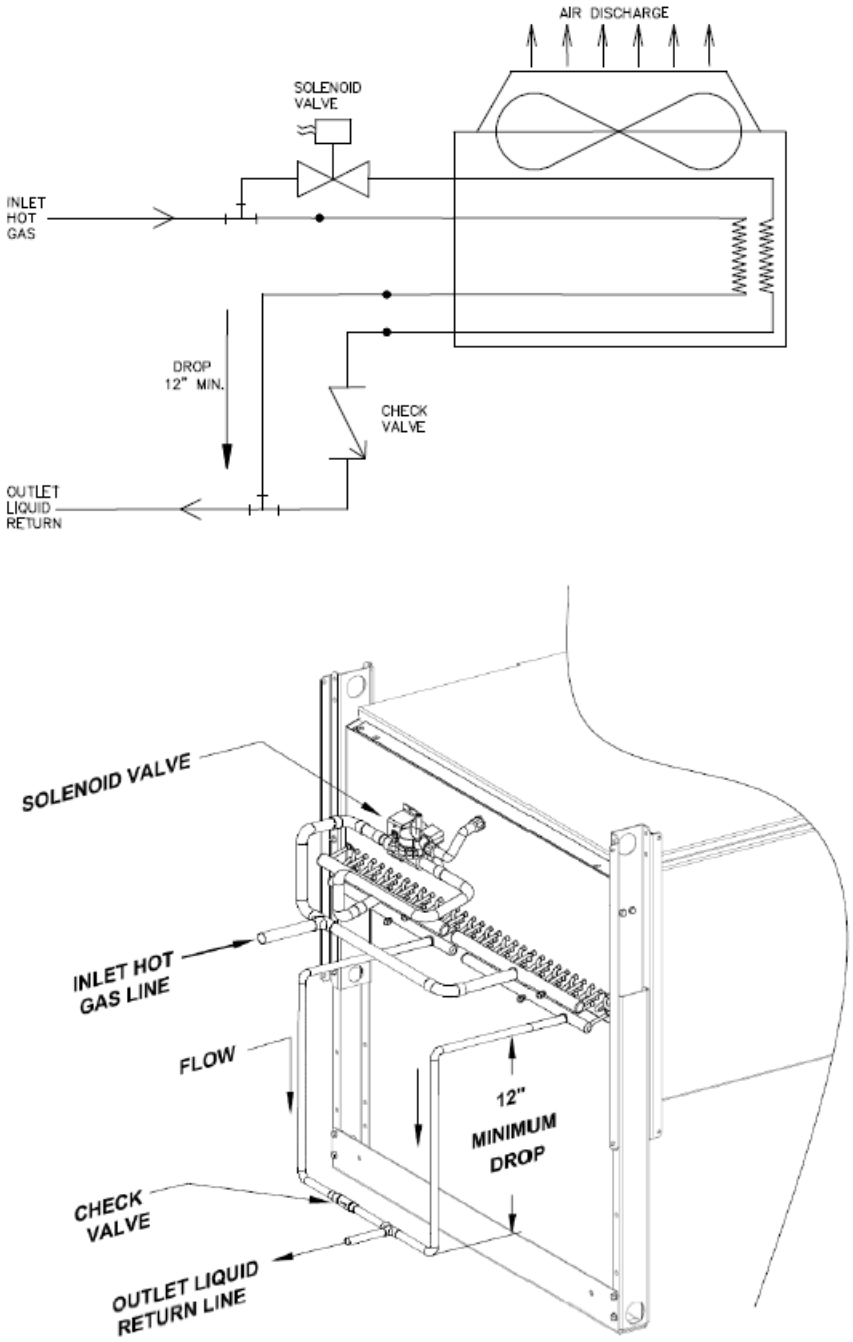


Figure 13: Condenser Field Piping (Cold Weather Valve Kit)

Note: Condenser return lines supplied by customer. Check valve supplied by Vogt.

12. Condensers with multiple fans must be provided with a thermostat to turn off unneeded fans in cold weather. Turning off unneeded fans reduces the on-off cycling of the fans and allows for consistent condensing pressures and warm gas for ice harvesting.

13. When extreme cold conditions are expected or encountered (outdoor temperatures below 0°F [-18°C] and wind speeds greater than 15 MPH [24 km/h]), it may be necessary to install a protective enclosure around the condenser. Louvers may also be used for varying conditions.
14. After installation, the field installed lines are to be evacuated to a vacuum of 500 microns or less and held for at least one hour. After the vacuum pump is removed, a vacuum of 500 microns or less should be held for at least 5 minutes.
15. The machine is shipped with a full operating charge of refrigerant sufficient to fill the condenser and connecting lines. If the condenser piping is longer than 50 ft. (15 m) in one direction, additional refrigerant may need to be added to retain enough refrigerant in the receiver for thawing purposes. Table X is a guide for additional charge to be added based on line length.
16. All piping must be done in accordance with applicable local and national codes.
17. The following guidelines are strongly suggested. While they do not affect the machine warranty, they may be required for safe operation and to comply with applicable electrical and mechanical codes:
    a. Check local electrical codes for wiring method.
    b. The installer must provide a disconnect switch(s) adjacent to the condenser.
    c. Electrical connections between the condenser and the Tube-Ice® machine require a minimum of 10 ga. wire for 200/230V motors and 14 ga. wire for 400/460V motors. For control wiring, a minimum of 14 ga. wire should be used.
    d. All electrical fittings and components exposed to the weather must be suitable for outdoor installation.

The design total heat rejection (THR) for this Tube-Ice® machine, the recommended air-cooled condenser, and condenser physical and electrical data are shown in

Table 6. Specified energy efficiency ratings for the ice machines are based on the use of the recommended condenser and approved piping practices.

Table 6: Air-Cooled Condenser Data

Recommended Condenser	**BNHS02A017**
Total Heat Rejection, Btu/hr (kW)	230,000 (67.4)
No. of Fans	2
Fan Power, HP (kW)	1.5 (1.1)
Total CFM (m3/h)	19,000 (32,281)
Full Load Amps (FLA), 3 ph., 460V, 60 Hz.	7
Net Weight, lbs (kg)	680 (308)
Shipping Weight, lbs (kg)	805 (365)
Max Operating Weight, R-513A, lbs (kg)	1,315 (596)
Condenser Dimensions, in. (mm) A (Width) B (Length) C (Height) D (Leg Centerline) E (Leg Centerline) F (Clearance below)	 45-3/8 (1153) 126-1/2 (3213) 49-1/8 (1248) 38 (965) 106-1/8 (2696) 20-9/16 (522)
Recommended Line Sizes, in. (mm) Liquid - All lengths and orientations Discharge Gas - Vertical Up, all lengths Discharge Gas - Horiz. Or Down < 75 ft. Discharge Gas - Horiz or Down > 75 ft.	 1-3/8 (35) 1-5/8 (42) 1-5/8 (42) 2-1/8 (54)
Condenser Liquid Connection	2-1/8 (54)
Condenser Discharge Gas Connection	2-1/8 (54)
Ice Machine Liquid Connection	1-1/8 (28)
Ice Machine Discharge Connection	1-3/8 (35)

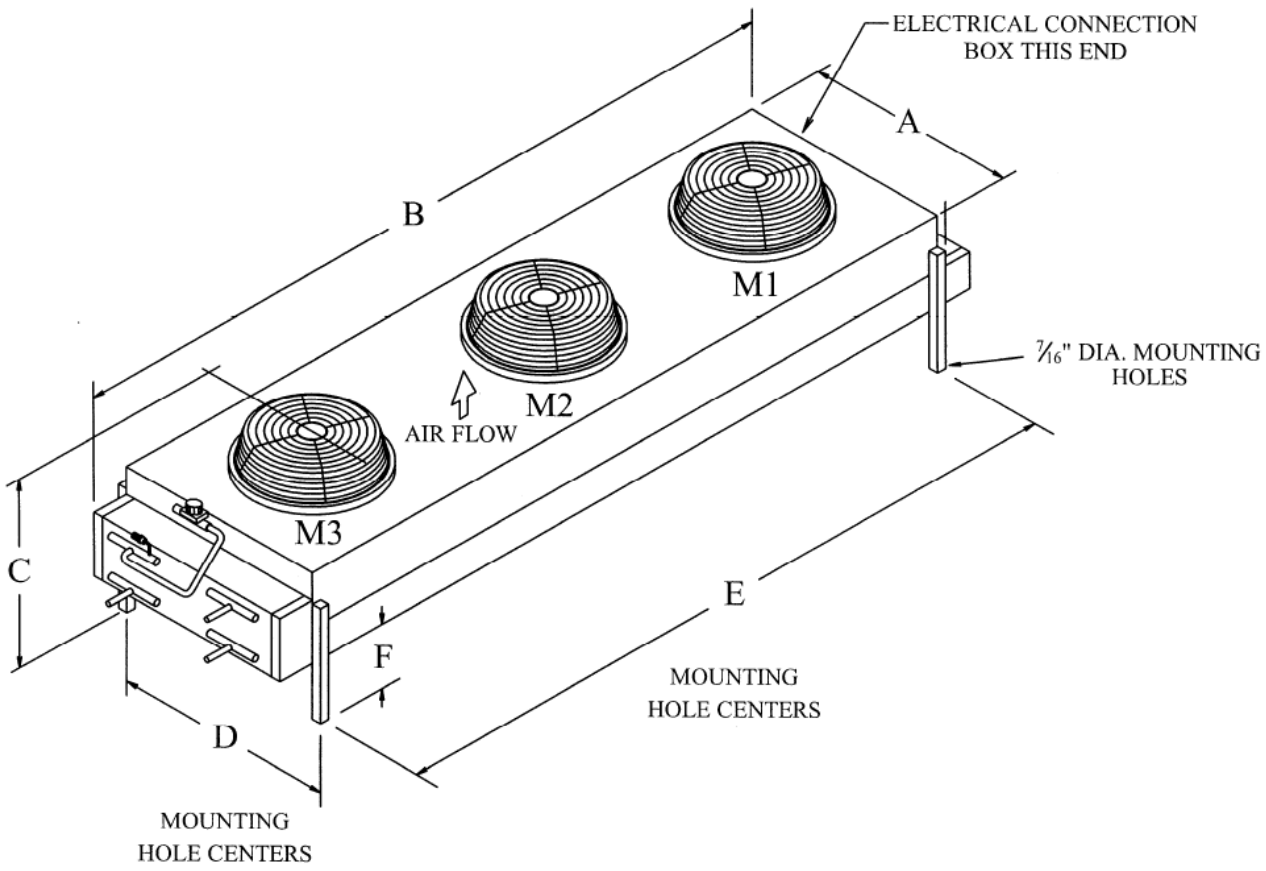


Figure 14: Condenser Dimensions

Recommended condensers provide the indicated total heat rejection at 90°F (32°C) ambient, 100°F (38°C) condensing. Vogt Ice, LLC is not responsible for head pressure problems if condensers other than those recommended are used. For continuous operation at ambient temperatures above 105°F (40°C), consult the factory for a larger condenser.

Air Cooled Condenser Wiring

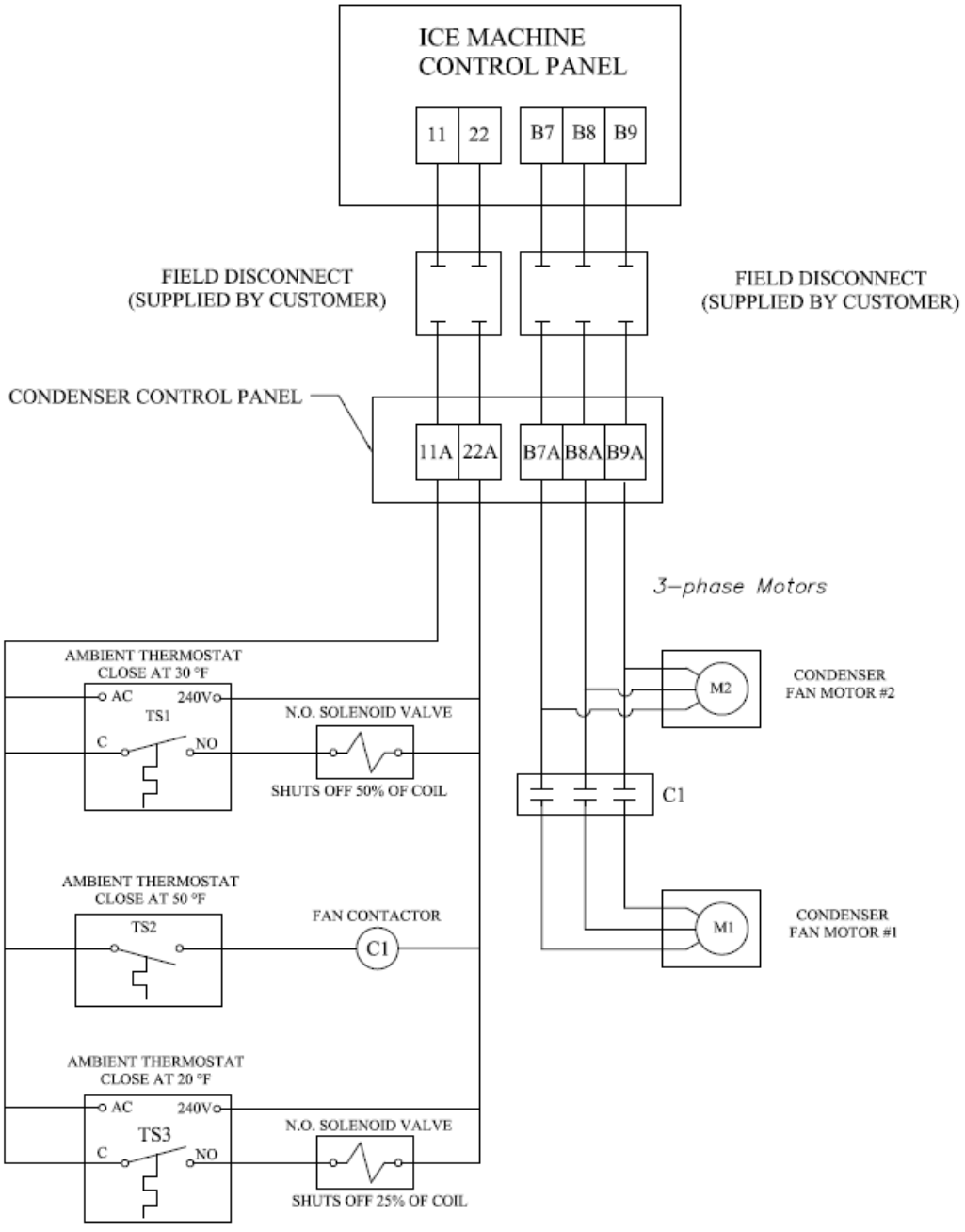


Figure 15: Wiring for Bohn BNHS02A017 with Cold Weather Valve, 2 Fans, 50/50 Split

Pressure Relief Valves

Pressure relief valves are included with this Tube-Ice® machine. One is located on the freezer (low-side), one is located on the top of the condenser (high-side), and a third is located on the top of the receiver (high-side). These valves are designed to vent in emergency conditions. This ensures that the vessel internal pressure does not exceed the maximum allowable pressures as stated on the vessel nameplates.

Vent each of the pressure relief valves to a safe outdoor location away from people and building openings in accordance with local and national codes.

Warning: Pressure relief valves must be replaced after five years of service. Before replacing relief valves, review requirements per current local and national codes. Valve replacement should be performed only by service personnel experienced and certified in refrigeration and qualified to work with high-voltage electrical equipment. If a relief valve discharges, the valve must be replaced before putting the machine back into service.

Relief valves do not properly reseat after a discharge event. Contact Vogt SuperCare Customer Service at 1-502-635-3000 or 1-800-853-8648 for replacement valves.

Wiring and Electrical Connections

Warning: Only service personnel experienced and certified in refrigeration and qualified to work with high-voltage electrical equipment are allowed to install or work on this Tube-Ice® machine.

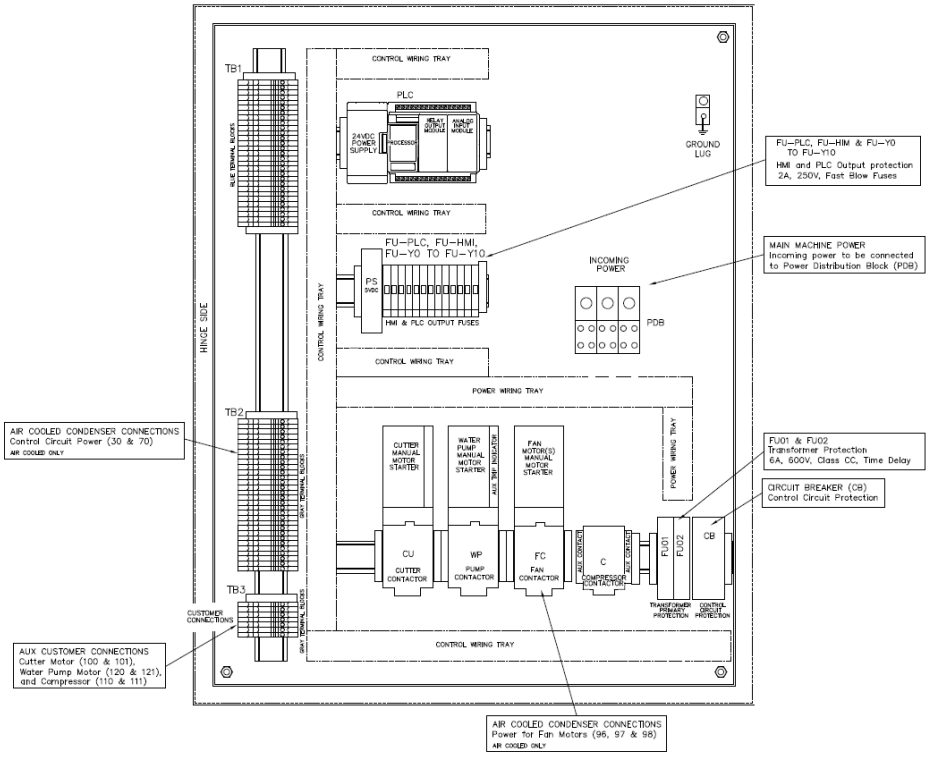


Figure 16: Control Panel Power Connections (60 Hz)

Table 7 shows how to properly size wiring connections. A fused disconnect must be provided near the Tube-Ice® machine. Connect three-phase power to Terminals L1, L2, and L3 on the power distribution block (PDB) for operation of the Tube-Ice® machine and its controls. Rotation checking of cutter motor and water pump is required. Also, if one leg of the three-phase power is higher or lower, then it should be connected to Terminal L2. Connect the ground wire to the provided ground lug (not shown).

Table 7: Electrical Specifications

Standard Voltages	Water-Cooled			Air-Cooled		
	Full Load Amperage	Min. Ampacity	Max. Fuse	Full Load Amperage	Min. Ampacity	Max. Fuse
208/230V, 3ph, 60 Hz	99.7	122.8	220	113.7	136.8	230

Phase Check

CAUTION Do not attempt to start the machine without priming the water pump and insuring proper rotation of both the cutter motor and pump motor.

Cutter and pump motor rotation are synchronized at the factory but must be checked at installation. For ice production, the cutter disc, as viewed at the ice discharge opening, should turn from left to right. The pump rotation should match the marking on the pump housing. The pump must be primed by starting the machine in Clean mode and allowing it to run for several minutes. To change the direction of rotation for the motors, disconnect the power and reverse L1 and L3 (incoming power wires) at the motor contactor in the control panel.

Voltage Imbalance

Voltage imbalance can cause motors to overheat and fail. Voltage imbalance between any two legs should be no greater than 2%.

Example: Supply voltage = 230V – 3-Phase – 60 Hz

Voltage Readings:

A-B = 220 Volts
B-C = 225 Volts
A-C = 227 Volts
} Average = 224 Volts

(A-B) 224-220 = 4 Volts (Highest Deviation)

(B-C) 225-224 = 1 Volt

(A-C) 227-224 = 3 Volts

% Voltage Imbalance = 100 x (4/224) = 1.78% “Acceptable”

CAUTION Contact your local electric utility company if the supply voltage phase imbalance is >2%.

Current Imbalance

Voltage imbalance causes a current imbalance, but a current imbalance does not necessarily mean that a voltage imbalance exists. A loose terminal connection or a buildup of dirt or carbon on one set of contacts would cause a higher resistance on that leg than on the other two legs. Current follows the path of least resistance; therefore, if Terminal L1 is loose or dirty, L2 and/or L3 will have higher current.

Higher current causes more heat to be generated in the motor windings. The maximum acceptable current imbalance is 10%.

Example:

Current Readings:

L1 = 96 Amps
L2 = 91 Amps } Average = 95 Amps
L3 = 98 Amps

(L1) 96-95 = 1 Amp

(L2) 95-91 = 4 Amps (Highest Deviation)

(L3) 98-95 = 3 Amps

% Current Imbalance = 100 x (4/95) = 4.2% "Acceptable"

Ice Bin Thermostat Sensor

An electronic thermostat, a standard feature on every HFO machine, automates the machine's various cycles.

To ensure proper protection for the machine or auxiliary equipment, the thermostat's sensor must be positioned so that the ice will contact it when the bin is full. The distance between the top of the ice bin and the sensor must allow space for the machine to make an additional discharge of ice after the ice contacts the sensor.

Note: The sensor should also be mounted on the back side of the bracket, opposite of the front of the bin to reduce the possibility of damage from ice removal equipment.

The control panel is electrically connected so that the ice bin thermostat will stop the machine only upon the completion of a harvest period (freezer is empty of any ice).

Note: Actual location of the sensor will vary based on bin layout and ice distribution system.

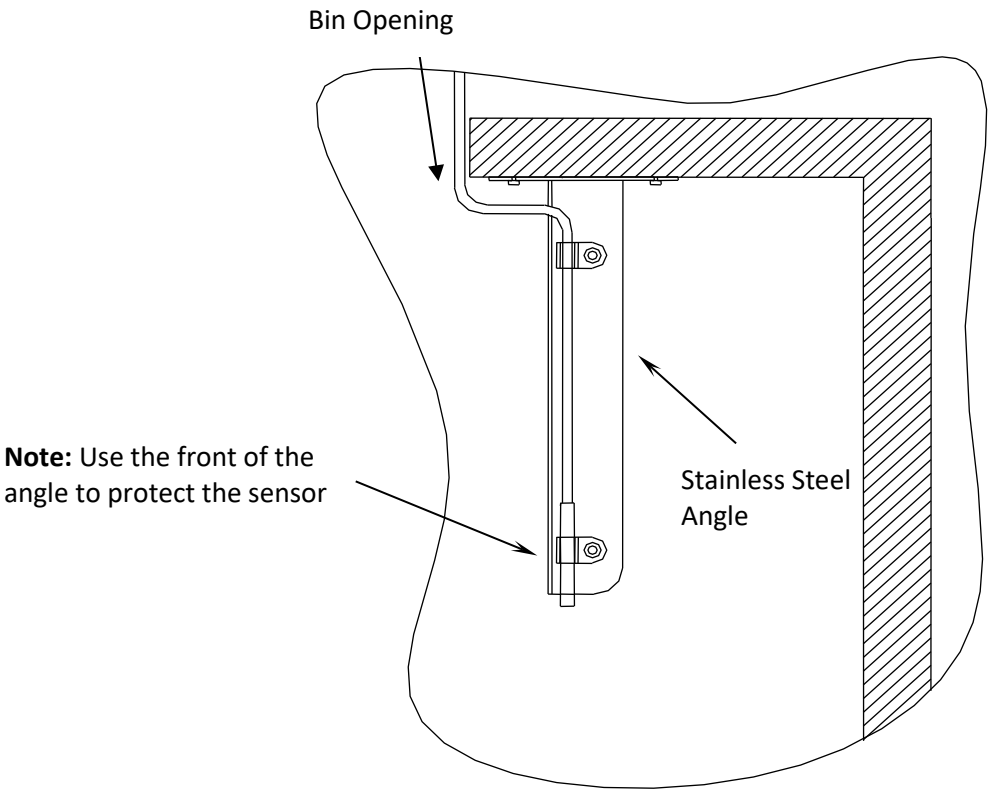


Figure 17: Typical Bin Sensor Mounting Bracket

Installation Checklist

Complete a visual check of the following before continuing or opening any valves:

- ☐ Check all joints for leaks that may have developed during shipment.
  Note: The machine was shipped in a pumped down state, but a small positive pressure should remain in the freezer (20–25 psig [1.4–1.7 bar]). Verify with the freezer pressure gauge.
- ☐ All refrigerant piping, water supply, and drain connections properly conform to the requirements in this manual and are properly connected to inlets and outlets.
- ☐ The electrical supply is properly sized for fuses and for compliance to local and national codes. Refer to the machine nameplate for minimum circuit ampacity and maximum fuse size.
- ☐ All field-installed equipment (augers, conveyors, cooling towers, bin level controls, etc.) is properly installed.
- ☐ The applicable portion of the **Warranty Registration/Start-Up Form** has been completed and sent back to Vogt Ice.
- ☐ Check the oil level of the cutter gear reducer.
- ☐ The water distributors at the top of the freezer should be in position and fit snugly against the tube sheet face.

CAUTION The compressor crankcase heater should be energized for a minimum of two hours, and the oil temperature should be 100°F–110°F (38°C–43°C) before attempting to start the compressor.

Chapter 5 Start-Up, Shutdown, and Operation

Start-Up Checklist

Warning: Only service personnel experienced and certified in refrigeration and qualified to work with high-voltage electrical equipment should be allowed to install or work on this Tube-Ice® machine.

Make sure all of the following items have been checked before starting the machine for the first time:

- ☐ Check that the water inlet connections are attached properly. The water inlet shutoff valves for the condenser and the water tank should be open. The water level in the water tank should be at a height where the makeup water float valve will be closed when the machine is idle.
- ☐ Make sure the cutter motor gear reducer is lubricated.
- ☐ Check that the compressor crankcase oil level is at the proper height as indicated by the compressor body sight glass.
- ☐ Open all necessary valves, including:
  - Compressor service valves
  - Thawing gas-line stop valve
  - King valve
  - Both float switch stop valves
- ☐ Except the charging valves, check that all stop valves in the refrigerant system are open, according to the attached tags. All valves are tagged with instructions.
- ☐ Immediately after opening the refrigerant valves, check the entire machine for refrigerant leaks with an electronic leak detector or by doing a bubble test.
- ☐ Check that all water supply lines are open to the water tank and all water tank drain valves are closed.
- ☐ Close the exterior disconnect switch to energize the crankcase heater, and check supply voltage against that on motor nameplate for compliance before switching on disconnect.

Note: The AutoStart Delay will begin a 2-hour countdown before allowing the machine to start to ensure that the oil in the compressor is warm enough to operate the machine. The operator can bypass the AutoStart Delay if needed.

Start-Up Procedure (Initial Start-Up)

Note: The machine will start in harvest mode when set to **Ice**. If the pump is already primed, skip to Step 4.

To perform the start-up of the machine, follow the steps below:

1. Press the **Run Water Pump** touch screen button on the HMI to start the water pump.
2. The pump can be stopped and started by pushing **Run Water Pump** touch screen button. The water should be circulated for a minimum of 5 minutes to prime the pump, purge the tubing of air, and lubricate the cutter bearing. By default, the pump will run for 10 minutes and shut off.
3. When there is good water flow, press the **Ice** touch screen button. The screen will change and show the **Start** touch screen button. Pressing the **Start** touch screen button will start the machine in a harvest (thaw) period with the compressor running.
4. At the termination of the harvest (thaw) period, the machine will begin the freeze period.
5. Be sure to observe a minimum of 4 cycles of ice production to confirm the satisfactory operation of the machine (approximate time for 4 cycles is about 200 minutes).
6. Complete the remaining part of the **Warranty Registration/Start-Up Report** upon initial machine start-up and return it to Vogt Ice, LLC.

Shutdown Procedure

CAUTION The red **E-Stop** button should only be used for emergency shutdown.

For normal shutdown, use the **Off** touch screen button on the HMI and follow the steps below:

1. Press the **Off** touch screen button. Do not use the machine disconnect or the red **E-Stop** to stop the machine. If the disconnect is used, the crankcase heater is de-energized, and liquid refrigerant migrates to the compressor.
2. During a freeze period, the machine will continue to run.
3. At the completion of the freeze period, the machine will harvest and stop. The completion of a cycle (1 freeze plus 1 harvest) ensures that all ice is removed from the freezer to prevent refreeze when the machine is restarted. Before turning off, the machine will perform a partial pumpdown.
4. During a harvest period, the machine will complete the harvest, perform a partial pumpdown, and stop.

Start-Up and Shutdown Tips

- If the operation of your machine is not controlled by a timer, bin level control, or some other mechanism to automatically start and stop ice production, you should use only the touch screen HMI to start and stop the machine.
- By pressing the **Off** touch screen button, the machine will stop after the next harvest period. It will perform a partial pumpdown before turning off.
- Do not use the **E-Stop** button or the machine disconnect for normal shutdown of the machine.
- Disconnect the machine only in an emergency or for safety when performing certain service or repairs to the machine. The compressor crankcase heater is de-energized when the machine is shut down.
- The **Manual Harvest** touch screen button can be used to initiate a harvest period. When it is pushed during a freeze period, it will immediately initiate a harvest period.

Ice Quality

Your HFO5 has been set up at the factory to produce the finest Tube-Ice® possible. The ice produced in the freezer should have a small hole in the middle of each tube to avoid permanently damaging the freezer. Table 8 shows recommended hole sizes for determining ice quality. For further information, refer to Chapter 9.

Table 8: Average Hole Size in Tube-Ice®

Tube Size in. (mm)	1 (25)	1-1/4 (32)	1-1/2 (38)
Hole Size in. (mm)	1/16–1/8 (1.6–3.2)	1/8–3/16 (3.2–4.8)	1/4–3/8 (6.4–9.5)

Adding Refrigerant

CAUTION Be sure to follow all local and federal regulations regarding the handling of refrigerants and their illegal emission into the atmosphere.

Check the refrigerant level after the machine has operated for a few cycles. It should be slightly above the minimum operating level, as indicated on the label on the receiver, a few minutes before the start of a thawing period.

If the level is low at this time, enough refrigerant should be added to the system to raise the level above this point.

Note: Refrigerant can only be added during the freeze period.

Add no more than 10 lb. (4.5 kg) of refrigerant and allow the machine to operate for several cycles before checking the level again.

It is also possible to check the refrigerant level by pumping down the machine (Refer to *Pumpdown*). When the machine is pumped down, some liquid should be observed in the receiver's sight glass.

Refrigerant must be added in liquid form through the machine's charging valve. No air or other non-condensable gases should enter the system when filling the machine with refrigerant. The compressor crankcase heater must be energized for a minimum of two hours before starting and running the compressor.

While the machine is running, add refrigerant according to the steps below:

1. Connect the charging valve on the machine to the refrigerant cylinder using a hose or pipe suitable for R-513A service. Refer to the instruction card attached to the refrigerant cylinder.
2. Open the valve on the refrigerant cylinder and purge air out of the charging line at the charging valve connection.
3. Open the charging valve on the machine.
4. The charging valve must be closed when the freezer is in a harvest period.

Immediately close the machine charging valve at the start of the harvest period if a refrigerant cylinder is connected. Never leave a refrigerant cylinder connected to the system except during charging operations. Failure to observe either of these precautions can result in transferring refrigerant from the system into the refrigerant cylinder, causing it to overfill and possibly rupture as the liquid refrigerant expands.

Chapter 6 Electrical Controls and Their Functions

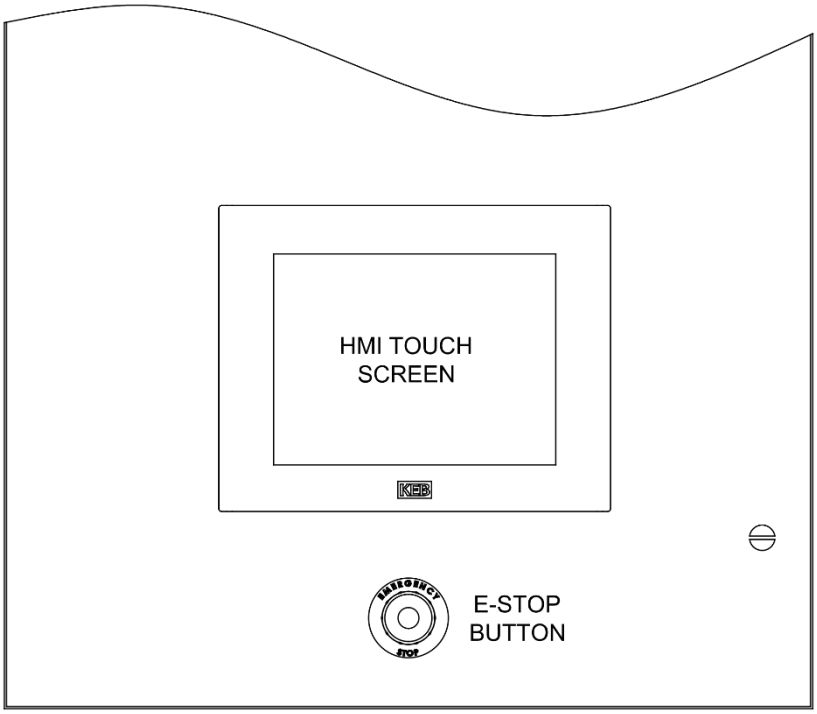


Figure 18: Control Panel (Exterior View)

This machine includes an Allen Bradley PLC with touch screen HMI. All machine control functions like the freezer pressure switch (FPS), the low-pressure safety, the high-pressure safety, the defrost pressure switch (DPS), and the condenser pressure switch (CPS), among others, are handled through pressure transducers and the touch screen.

Note: If damaged, the bin sensor can be replaced without replacing the entire unit. The sensor cable can be extended up to 500 feet (150 m) if using a 16 American wire gauge (AWG) wire. For more information, contact Vogt SuperCare Customer Service.

CAUTION To provide proper protection for the Tube-Ice® machine and its component parts, be sure to follow the wiring schematic and electrical specification table when incorporating overloads.

CAUTION The crankcase heater should be energized for a minimum of 2 hours. The crankcase must be free of liquid before attempting to operate the compressor.

The following diagrams show the electrical details for the panel layouts, control circuit, and 3-phase power.

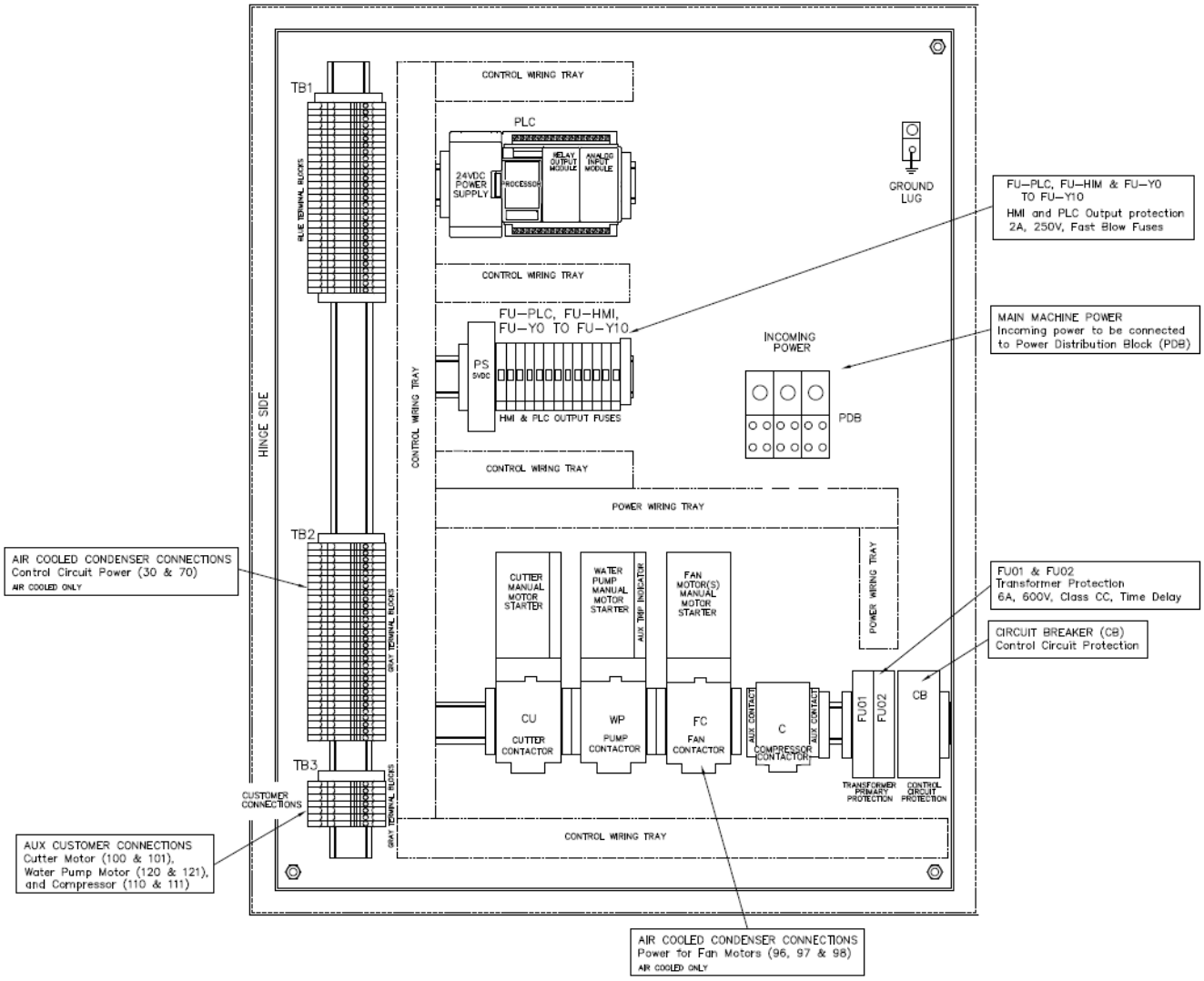


Figure 19: Panel Layout, 60-Hz Non-CE Machines

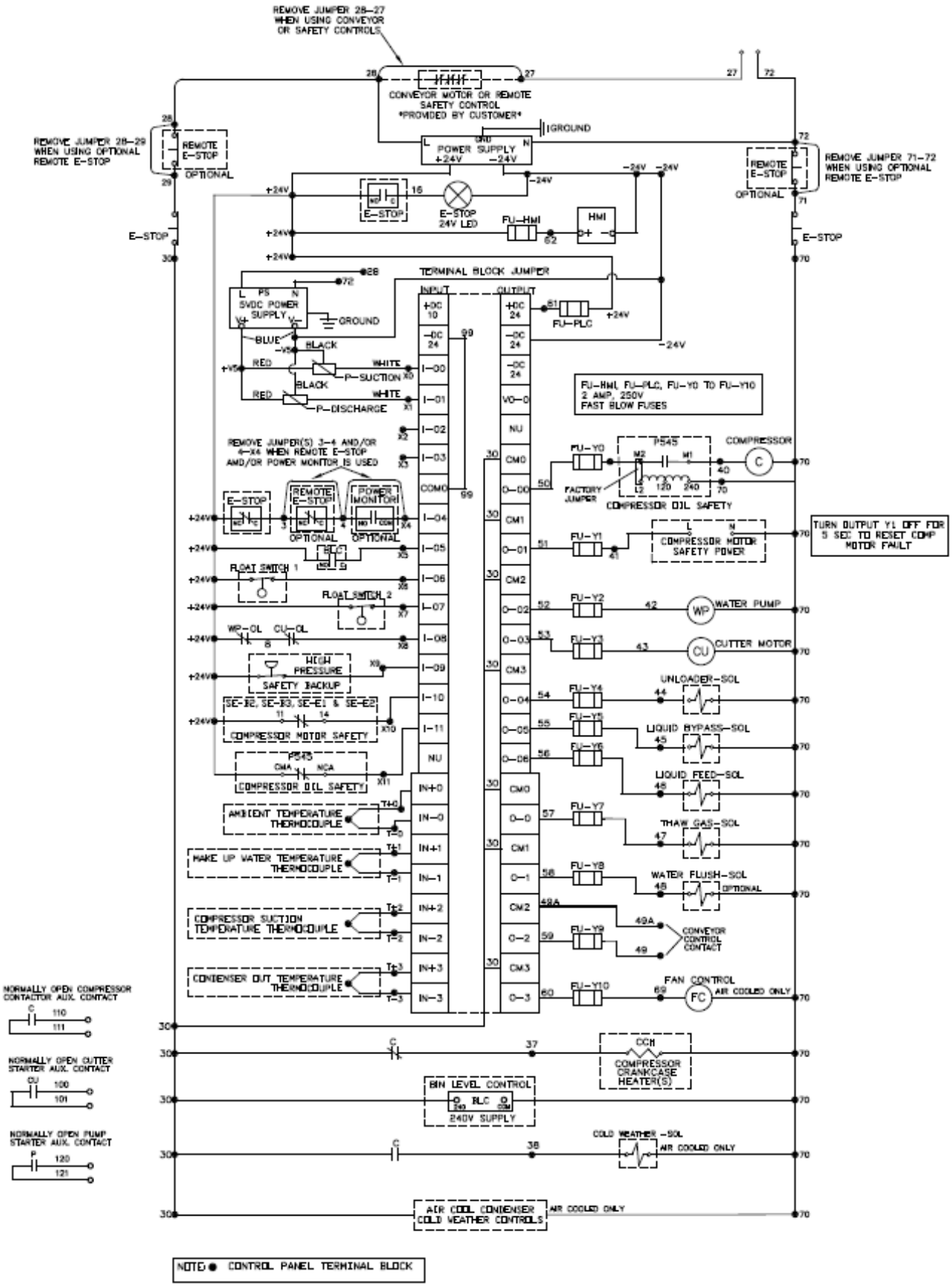


Figure 20: Electrical Schematic, Control Circuit, All Voltages, 60 Hz

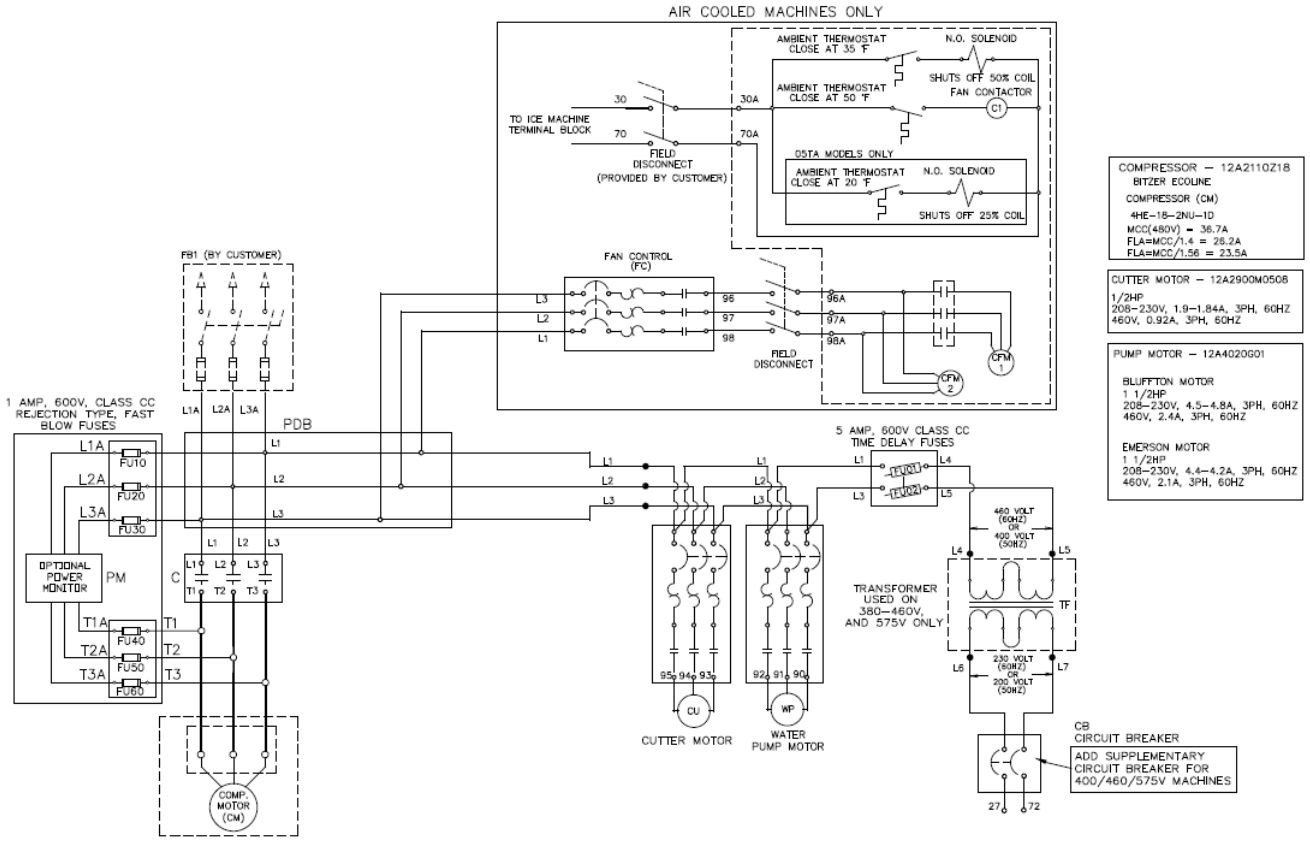


Figure 21: Electrical Schematic, 3-Phase Power, All Voltages 60 Hz

Table 9: Control Panel Parts

Label	Item	Vogt Part No.	Description
BLC	Bin Level Control	12A2117G09	Ice Bin Control
C	Compressor Contactor	12A7516E29	Contactor, 43A, 3 Pole, 1N.O. Aux, 208/240V
		12A7518E30	Aux. Contact, 10A, 1N.O., 1N.C., Side Mount
CB	Control Circuit Breaker	12A7515E22	Circuit Breaker, Supplementary, 6A, 2 Pole
CU	Cutter Motor Starter	12A7516E23	Contactor, 9A, 3 Pole, 1N.O. Aux, 208/240V
		12A7530E52UL	Manual Motor Starter, 0.63-1.0A
		12A7518E33UL	Aux. Trip Contactor, 6A, 1N.O., 1N.C.
E-Stop	Emergency Stop Button	12A7500E159	Illuminated Red, Push-Twist, E-Stop Button
		12A7500E160	Integrated White LED, w/Metal Latch, 24V AC/DC
		12A7500E161	Contact Block, 2N.C.
		12A7500E162	Contact Block, 1N.O., 1N.C.
FC	Condenser Fan Motor(s) Starter	12A7516E25	Contactor, 16A, 3 Pole, 1N.O. Aux, 208/240V
		12A7530E57UL	Manual Motor Starter, 6.3-10.0A
FU01, FU02	Transformer Primary Fuses	12A7504E13	Fuse, 6A, 600V, Class CC, Time Delay
FU-HMI, FU-PLC, FU-Y0, TO, FU-Y10	HMI & PLC Output Fuses	12A7504E23	Fuse, 2A, 250V, Fast Acting
HMI	PLC Interface	12A7536M72	KEB C6 HMI, 10.1” Wide, Color, Touch Screen
PLC	Processor / Base	12A7536M64	PLC, Micro820, 12 DC Inputs, 7 Relay Outputs, 24VDC
	24VDC Supply	12A7536M65	Power Supply, 120/240VAC In, 24VDC/1.6A Out
	Output Module	12A7536M67	Plug-In Module, Digital 4 Point Relay Output
	Input Module	12A7536M69	Plug-In Module, 4 Channel Universal Analog Input
PS	5VDC Power Supply	12A7537E05	Power Supply, 100/264VAC In, 5VDC/2A Out
WP	Water Pump Motor Starter	12A7516E23	Contactor, 9A, 3 Pole, 1N.O. Aux, 208/240V
		12A7530E54UL	Manual Motor Starter, 1.6-2.5A
		12A7518E33UL	Aux Trip Contactor, 6A, 1N.O., 1N.C.

Control Panel Parts, cont.

Label	Item	Vogt Part No.	Description
Misc Items	Oil Pressure Safety	12A2117A09	Oil Pressure Safety Control, P545, Single Point Diff
		12A2117A09S	Oil Pressure Switch, P400
	Temperature Sensors	12A2117G22	Thermocouple, Type K
	High Pressure Safety	12A2117H03	High Pressure Safety Switch, 250PSI Cutout, Backup
	Pressure Transducer	12A2117J09	Pressure Transducer, 0-500 PSI, 5VDC In, 12 to 33 VDC Excitation
	Ethernet Cable	T080300042	Cat 5 Cable, 36”, HMI to PLC

Allen Bradley PLC with Touch Screen HMI

The Allen Bradley PLC with Touch Screen HMI is replacing and integrating the former standalone freezer pressure switch (FPS), the bin thermostat, the low-pressure safety, the high-pressure safety, the defrost pressure switch (DPS), and the condenser pressure switch (CPS) with pressure transducers and thermocouples that interact with a touch screen interface. Features such as superheat trends, detailed fault history, and remote access have been added to aid in regular operation, maintenance, and service.

HMI Main Menu

The Touch Screen HMI is the visual representation of the control functions contained within the PLC. When the machine is first started, the user is presented with the **MENU** screen. The **MENU** screen is also accessed by pressing the grid touch screen button from any screen in the HMI.

The touch screen buttons on the **MENU** screen access different submenus within the system. Refer to Figure .

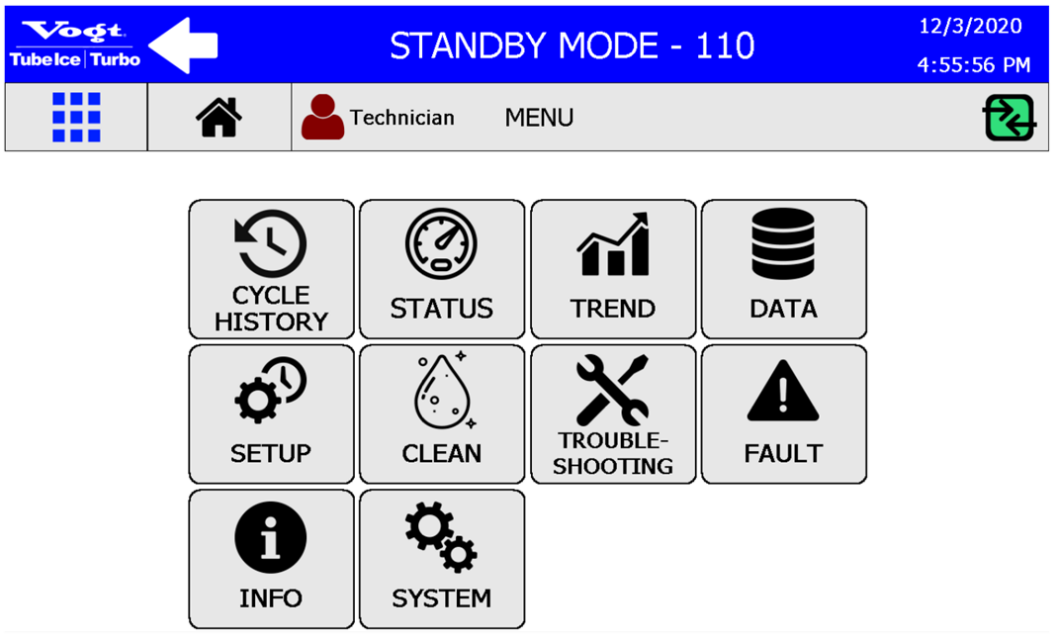


Figure 22: MENU Screen

The **MENU** screen gives access to the submenus below:

- **CYCLE HISTORY** – Displays the Cycle History for the last 50 cycles.
- **STATUS** – Displays the current Suction Pressure, Discharge Pressure, Ambient Temperature, Make-Up Water Temperature, Suction Temperature, and Superheat. Also displays the current setpoints for the **Freezer Pressure Switch** and **High Pressure Safety.**
- **TREND** – Displays graphs of the Suction Pressure, Discharge Pressure, Ambient Temperature, Make-Up Water Temperature, and Compressor Superheat for the last 8 hours.
- **DATA** – Allows the operator to download or email machine data collected by the HMI.
- **SETUP** – Displays the user adjustable setpoints, delays, and safeties such as **Freezer Pressure Switch, High Pressure Safety, Cutter Delay,** etc.
- **CLEAN** – Allows the operator to enter the clean mode on the machine.
- **TROUBLESHOOTING** – Allows the operator to perform a full pumpdown for before maintenance, check the status of PLC inputs and outputs, and to activate individual PLC outputs to test individual components on the machine (i.e. – water pump, cutter motor, etc). Includes a Log that records maintenance events.

- **FAULT** – Displays historical fault data for the machine.
- **INFO** – Displays information about the ice machine including Serial Number, Job Number, Manufactured Date, etc. Provides access to digital service manual.
- **SYSTEM** – Allows the operator to activate notifications and remote access capability. Provides access to the setup of machine user groups.

The top bar of the HMI displays shortcut menus and system status information. Refer to Figure.

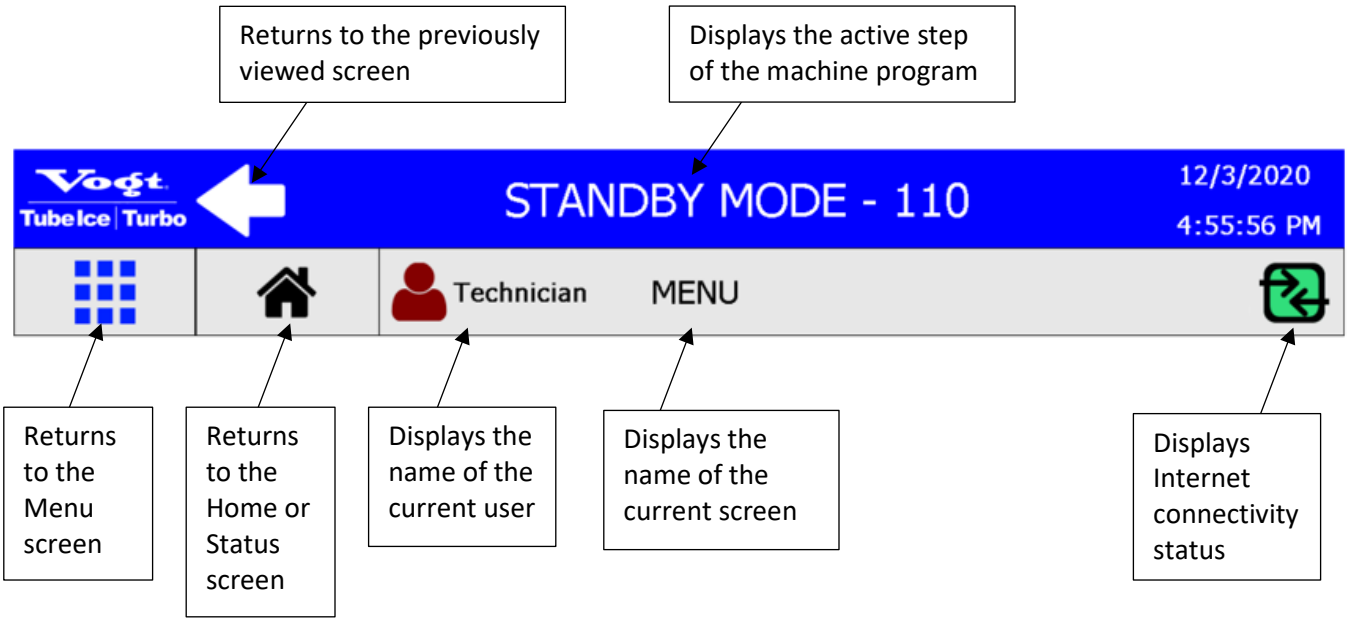


Figure 23: Top Screen Detail

For Internet connectivity status, the system status is according to the color code below:

- The machine is connected to the Internet and a remote user is logged in.
- The machine is connected to the Internet, but no remote users are logged in.
- The machine is connected to the internet and remote access is turned off.
- The machine is not connected to the Internet.
- The machine is not connected to the Internet and remote access is turned off.

The Current User icon color is according to this color code:

- Operator (Password: may28)
- Technician (Password: oslo47)
- Manager Password: pau33)
- Support
- Developer

HMI Primary Submenus

The HMI contains submenus that provide access to machine functions and reports. The primary submenus are accessed from the **MENU** screen, Figure , and are detailed below. Refer to Figure through **Figure**.

Cycle History — Page 1/10

Cycle Number	Current	2	3	4	5
Freeze Start Date & Time	16:00:17 12/11/2020	15:38:08 12/11/2020	15:15:43 12/11/2020	14:53:30 12/11/2020	14:32:04 12/11/2020
Freeze Time	18m32s	19m7s	19m24s	19m12s	18m25s
Freeze Avg Make Up Water (°F)	Data Logging in Progress	56.6	56.5	55.9	54.7
Freeze End Suction Pressure (PSI)		11.9	11.8	11.9	12.0
Freeze Avg Discharge Pressure (PSI)		137.1	137.2	137.3	137.2
Harvest Time		3m	3m	3m	3m
Harvest Max Suction Pressure (PSI)		44.7	44.3	45.3	44.9
Total Cycle Time		22m7s	22m25s	22m12s	21m25s

Figure 24: CYCLE HISTORY Screen

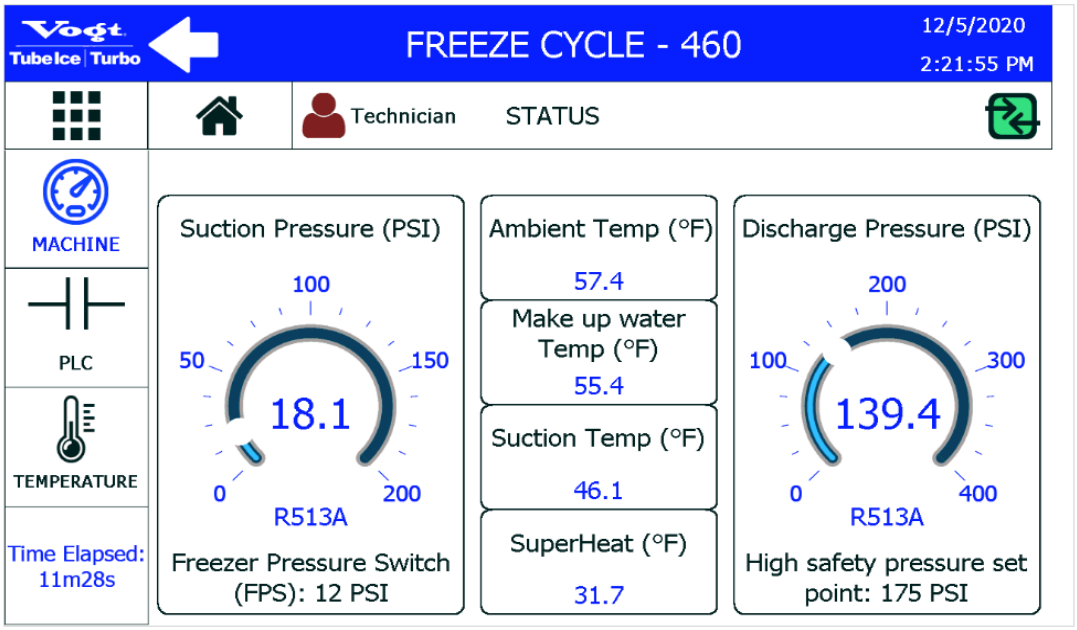


Figure 25: STATUS Screen

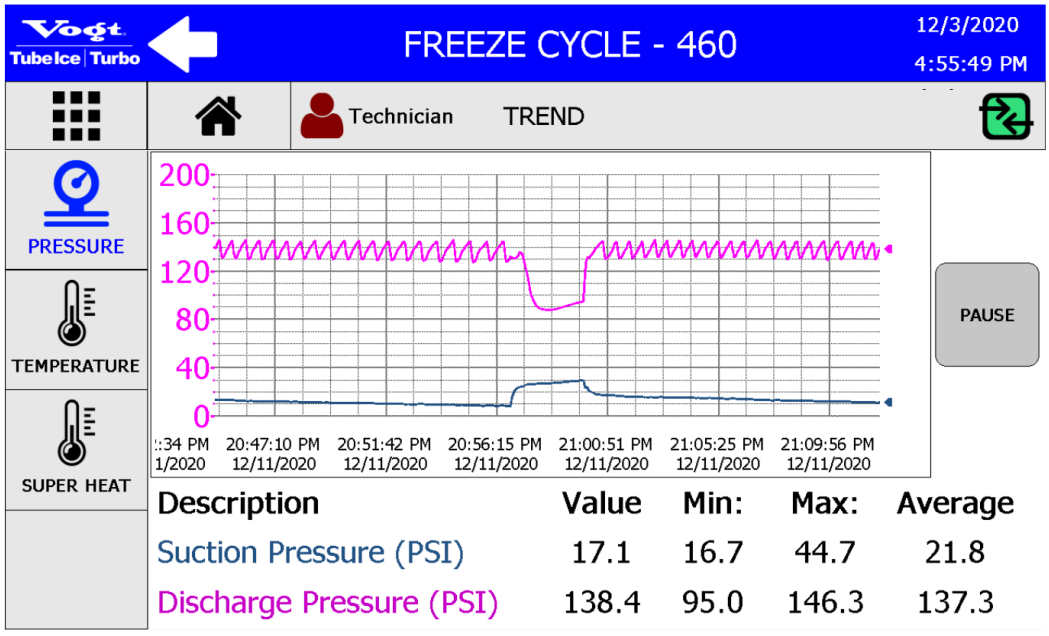
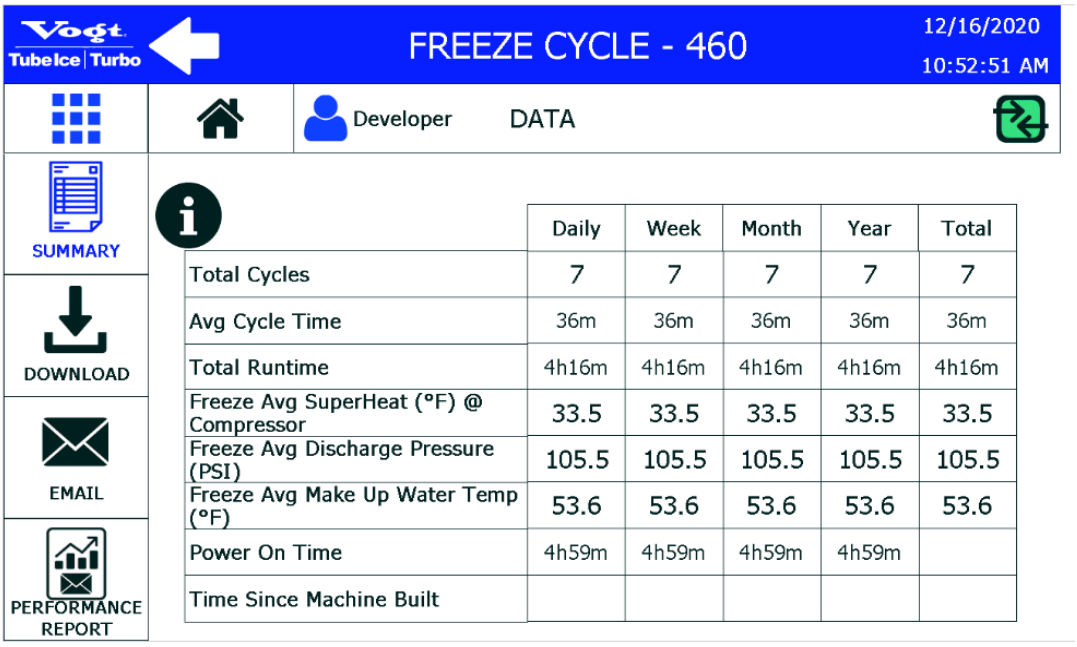


Figure 26: TREND Screen



	Daily	Week	Month	Year	Total
Total Cycles	7	7	7	7	7
Avg Cycle Time	36m	36m	36m	36m	36m
Total Runtime	4h16m	4h16m	4h16m	4h16m	4h16m
Freeze Avg SuperHeat (°F) @ Compressor	33.5	33.5	33.5	33.5	33.5
Freeze Avg Discharge Pressure (PSI)	105.5	105.5	105.5	105.5	105.5
Freeze Avg Make Up Water Temp (°F)	53.6	53.6	53.6	53.6	53.6
Power On Time	4h59m	4h59m	4h59m	4h59m	
Time Since Machine Built					

Figure 27: DATA Screen

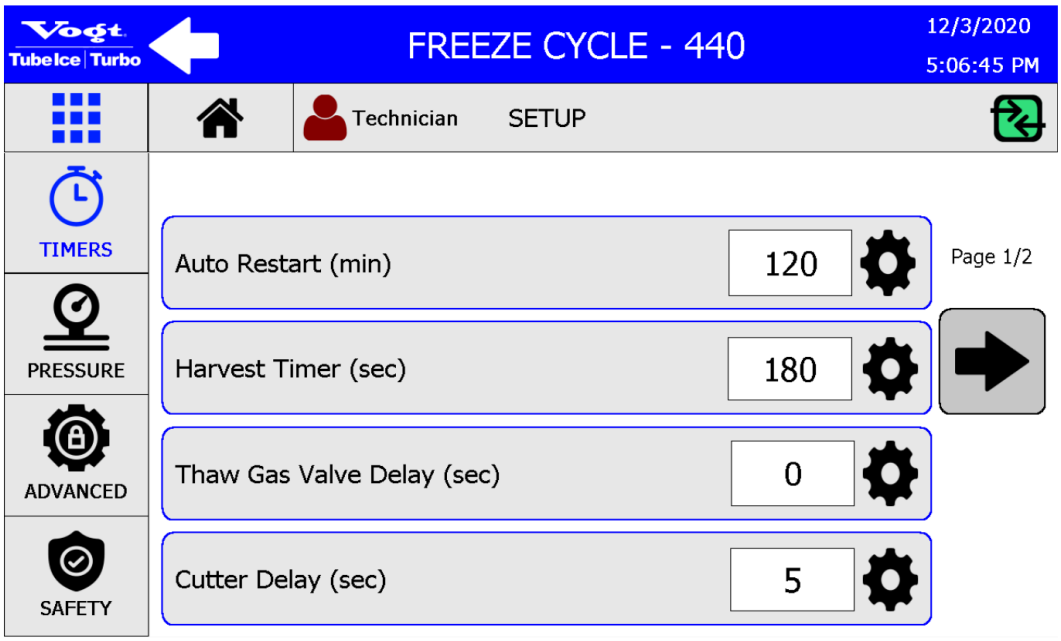


Figure 28: SETUP Screen

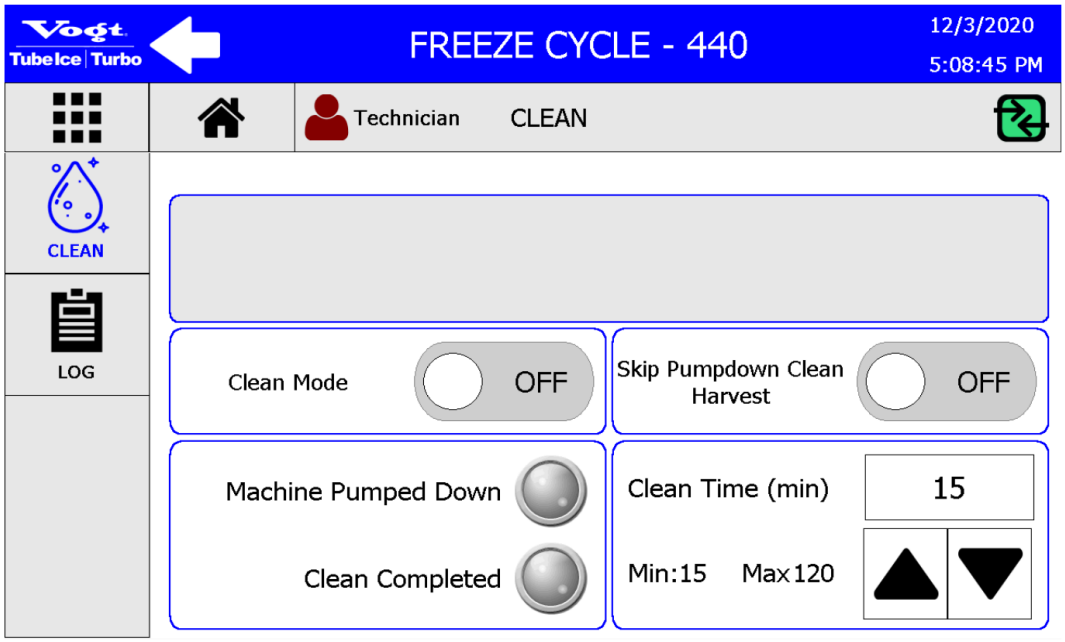


Figure 29: CLEAN Screen

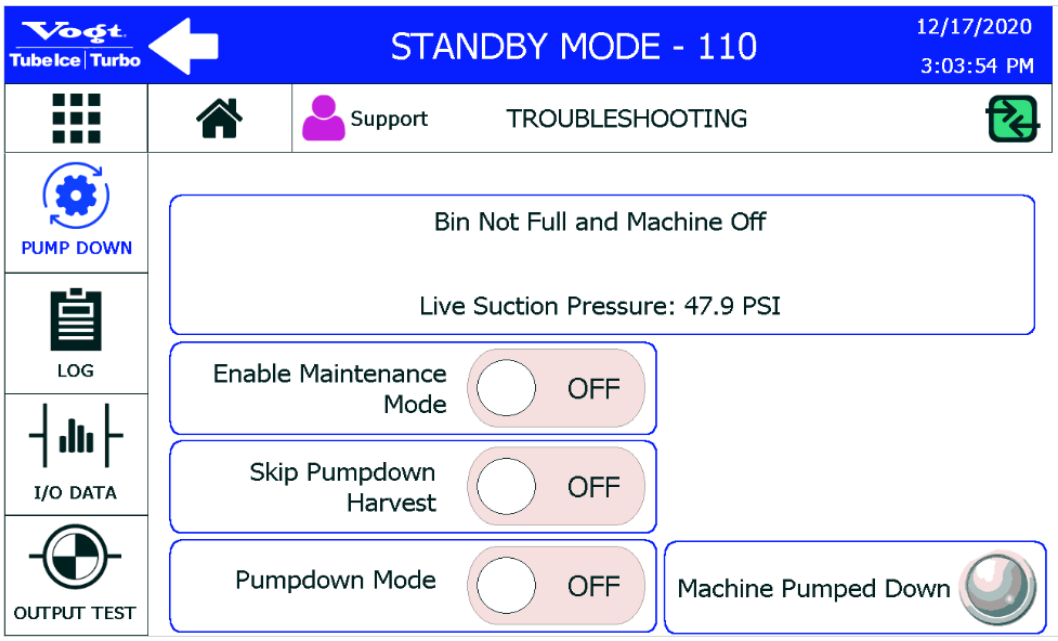


Figure 30: TROUBLESHOOTING Screen

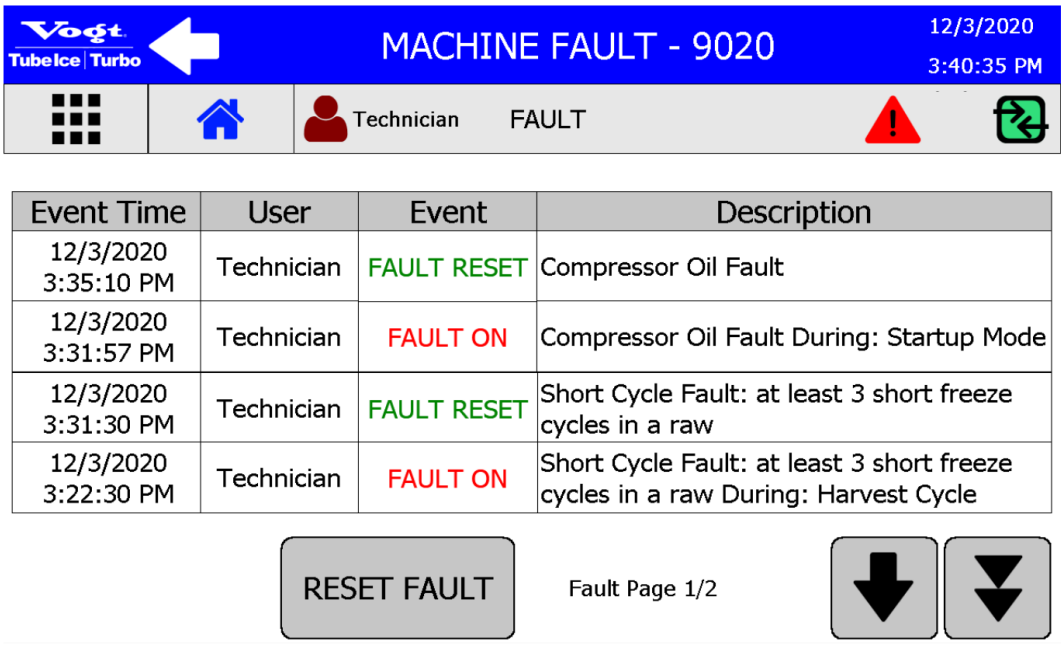


Figure 31: FAULT Screen

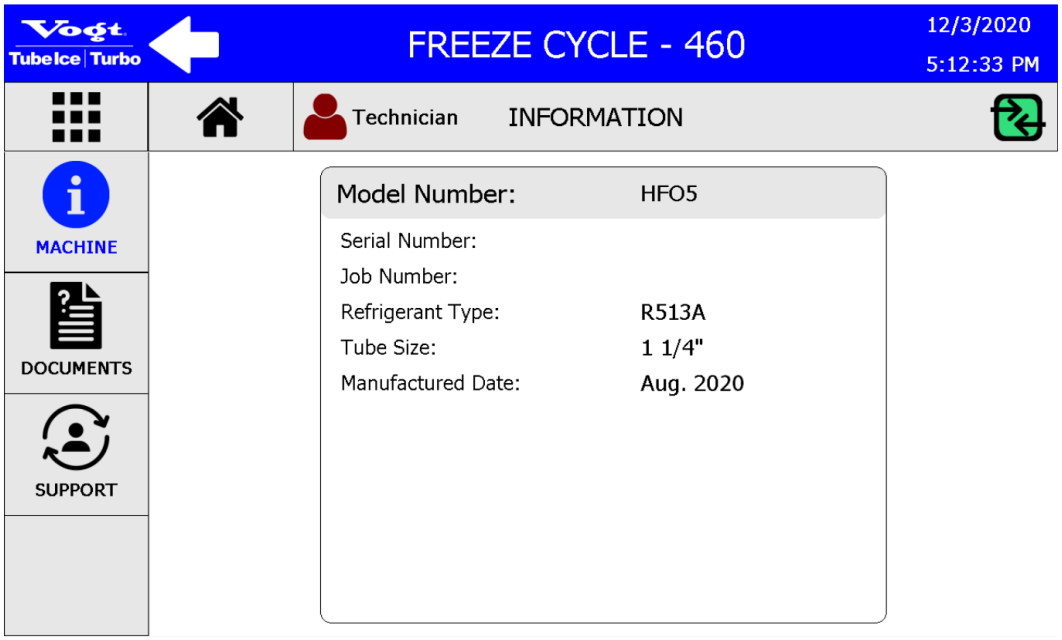


Figure 32: INFO Screen

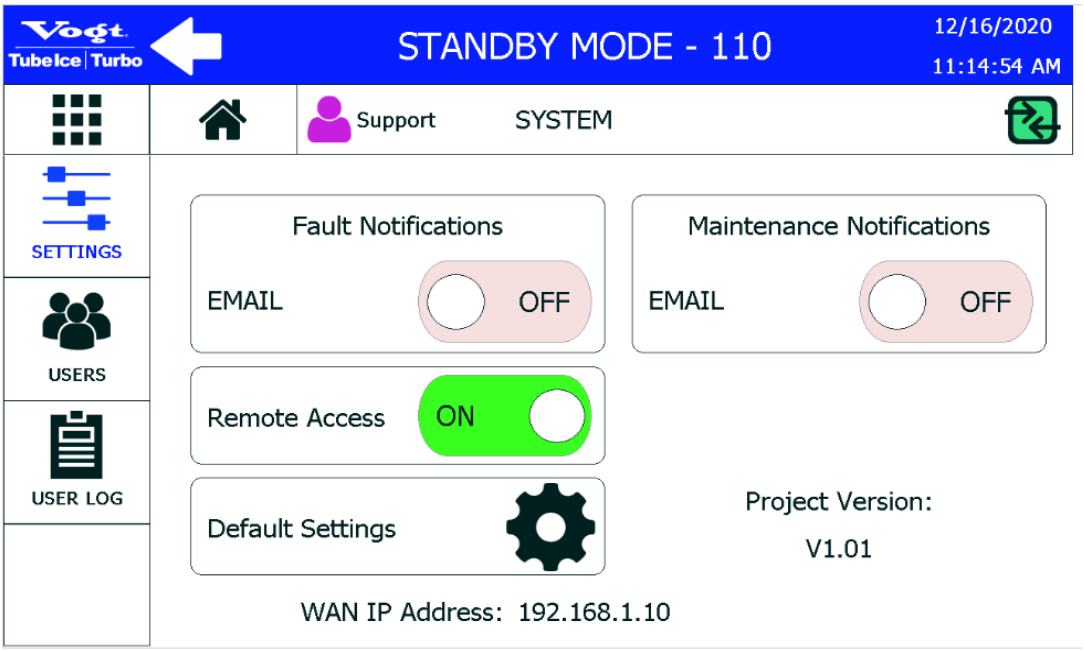


Figure 33: SYSTEM Screen

HMI Home Screen

Pressing the **HOME** touch screen button from any screen in the HMI will take the operator to the **HOME** screen that displays the primary operational information of the ice machine. Refer to Figure.

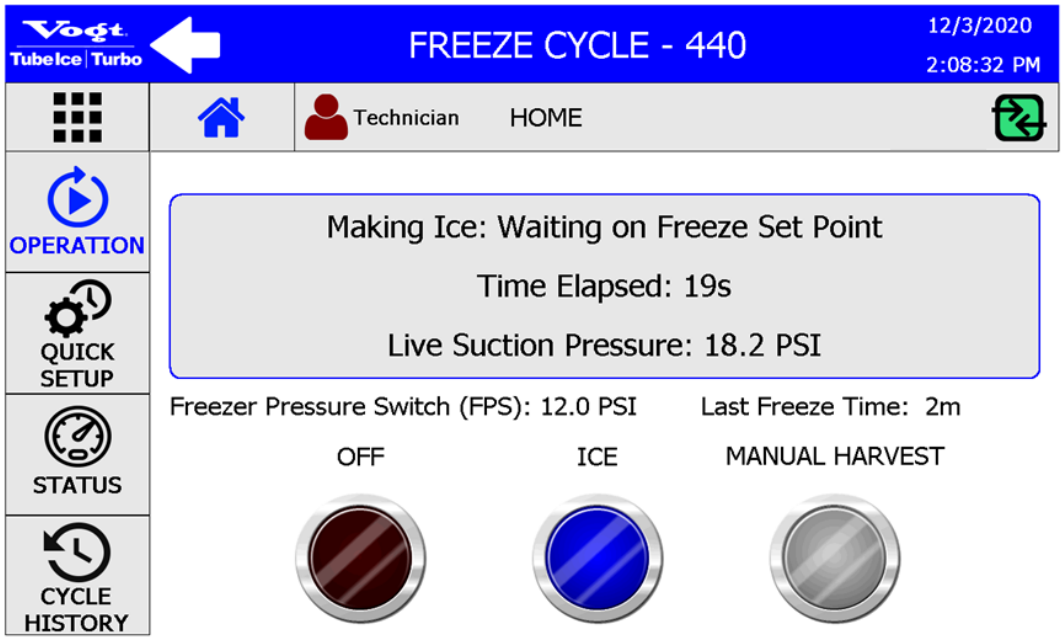


Figure 34: HOME Screen

Basic machine parameters such as the **Freezer Pressure Switch**, and the **Harvest Timer** can be quickly accessed in the **QUICK SETUP** submenu. See Figure.

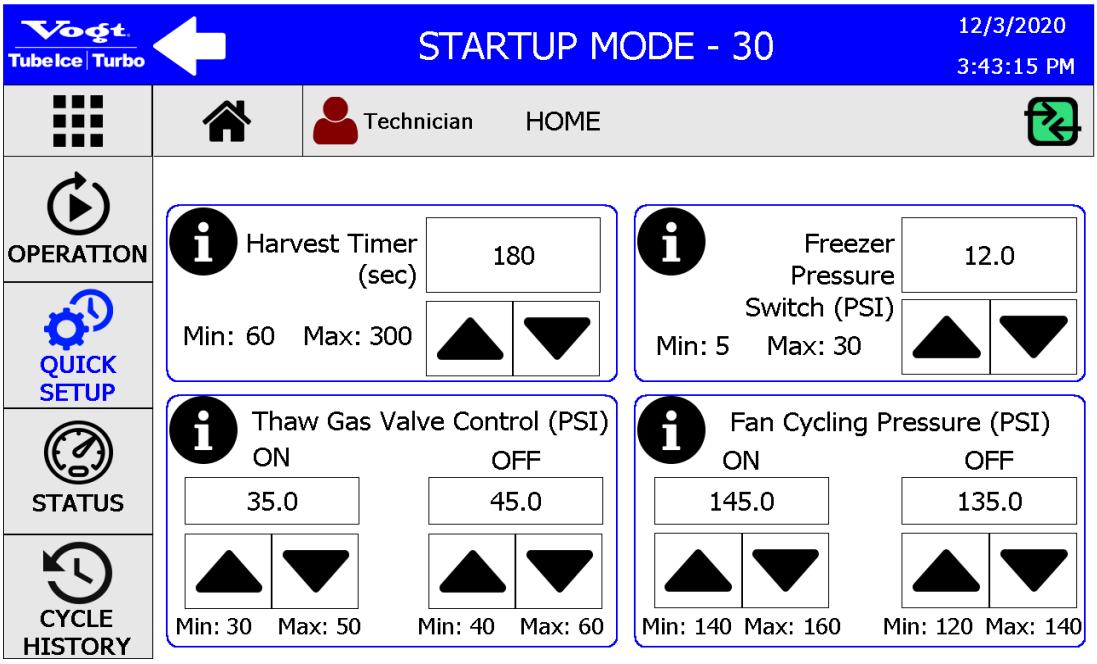


Figure 35: QUICK SETUP

Pressing the information icon provides additional information about each parameter. Figure shows the information available for the **Harvest Timer**.

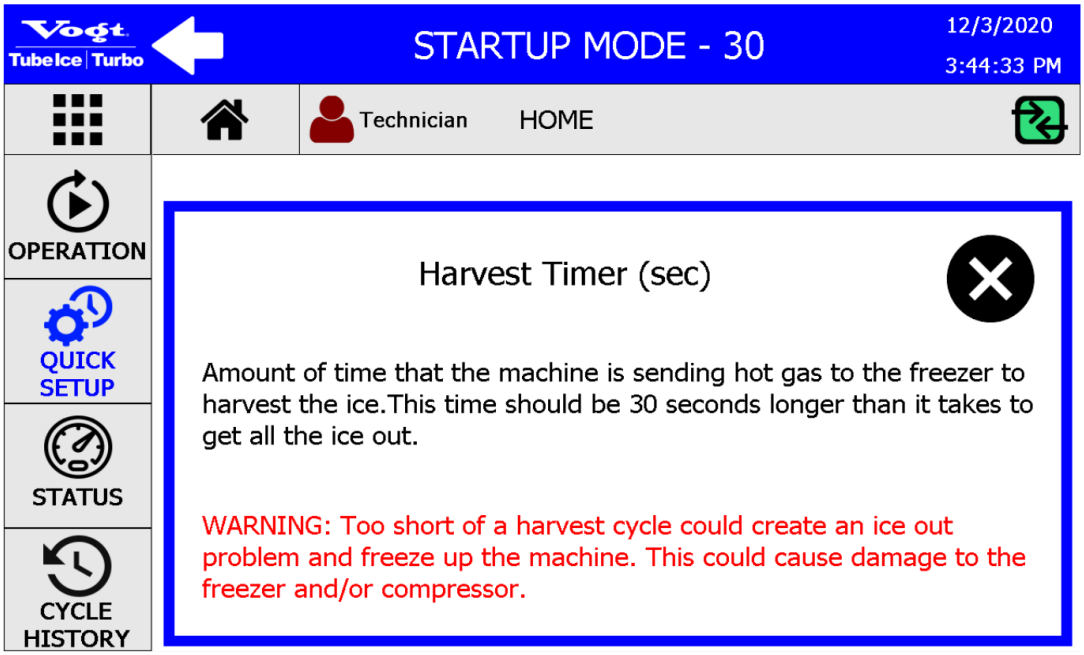
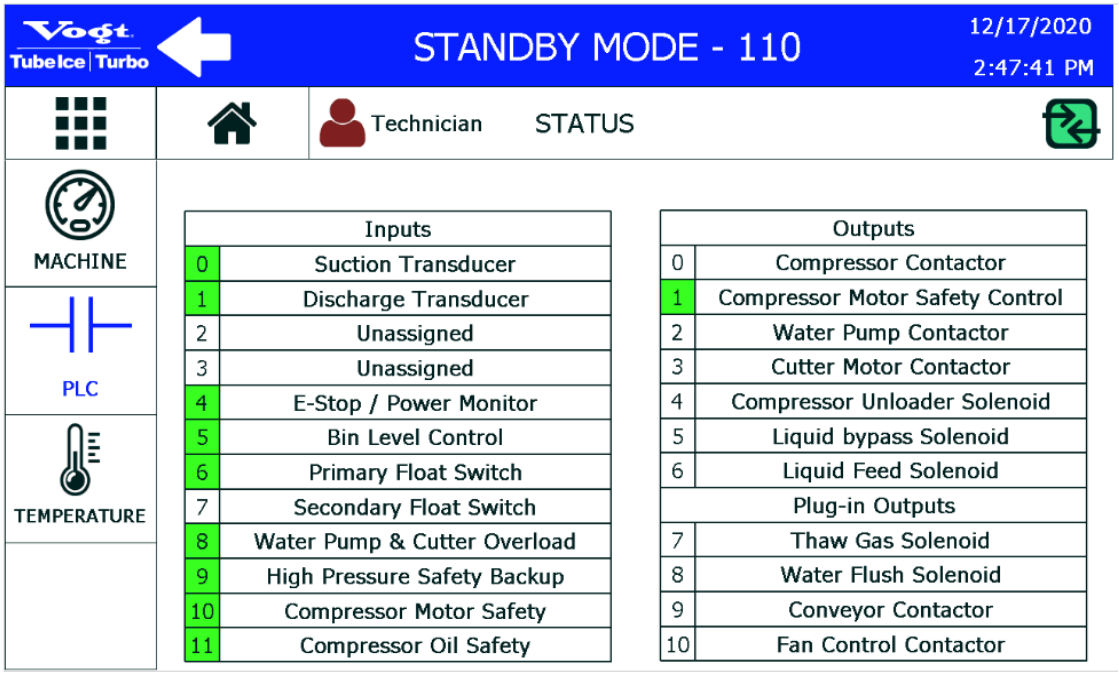


Figure 36: Information Icon Detail

HMI Detailed Screens

Within each primary submenu that is accessed from the main **MENU** screen, Figure , additional menus are available to view specific information about the machine, to access specific functions, or to change specific parameters.

The STATUS screen displays the current Suction Pressure, Discharge Pressure, Ambient Temperature, Make-Up Water Temperature, Suction Temperature, and Superheat. From this screen, PLC input and output status is viewed by pressing the PLC submenu touch screen button. See Figure 37.



Inputs	
0	Suction Transducer
1	Discharge Transducer
2	Unassigned
3	Unassigned
4	E-Stop / Power Monitor
5	Bin Level Control
6	Primary Float Switch
7	Secondary Float Switch
8	Water Pump & Cutter Overload
9	High Pressure Safety Backup
10	Compressor Motor Safety
11	Compressor Oil Safety

Outputs	
0	Compressor Contactor
1	Compressor Motor Safety Control
2	Water Pump Contactor
3	Cutter Motor Contactor
4	Compressor Unloader Solenoid
5	Liquid bypass Solenoid
6	Liquid Feed Solenoid
Plug-in Outputs	
7	Thaw Gas Solenoid
8	Water Flush Solenoid
9	Conveyor Contactor
10	Fan Control Contactor

Figure 37: PLC Submenu

The **TREND** screen, Figure, displays Pressure, Temperature, and Superheat graphs by pressing the touch screen buttons. Press the **TEMPERATURE** and **SUPERHEAT** touch screen buttons to view graphs of each. Trend history is available for up to 8 hours by pressing the **PAUSE** touch screen button for the graph. See Figur through Figure.

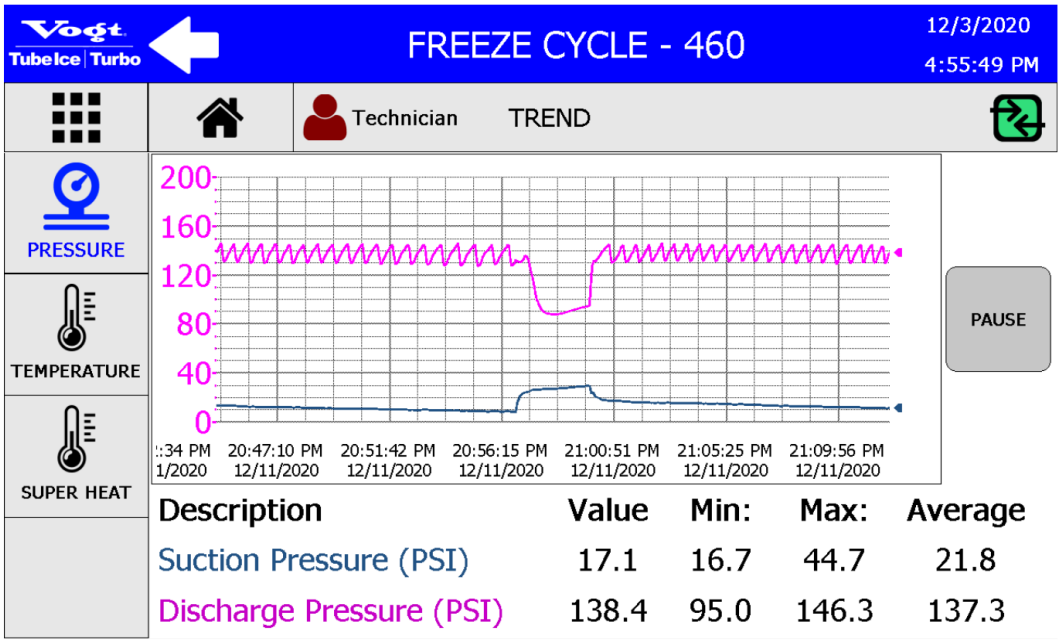


Figure 38: PRESSURE Trend

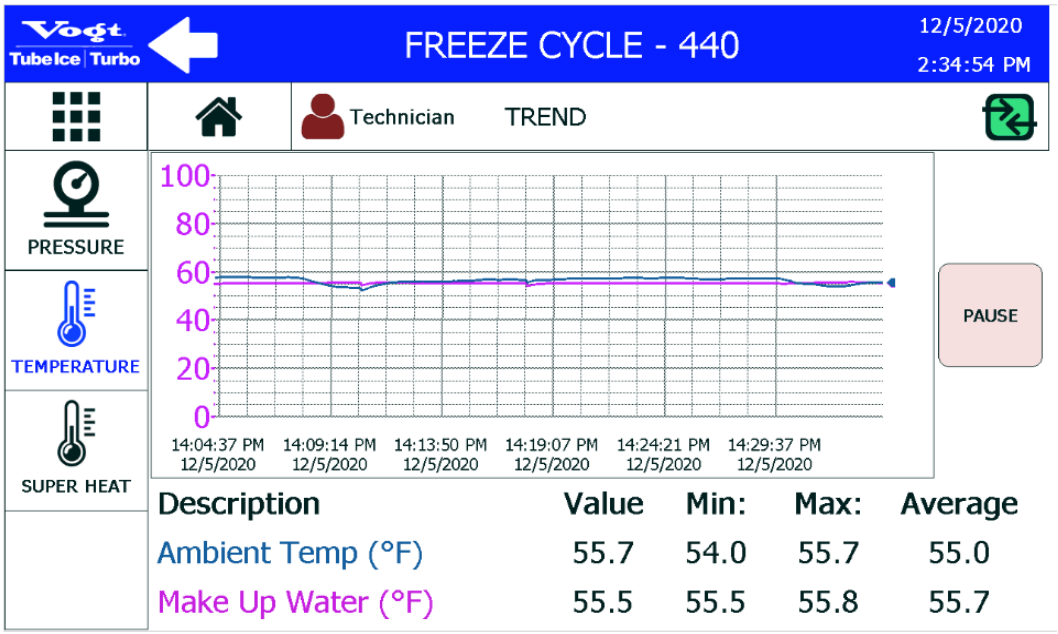


Figure 39: TEMPERATURE Trend

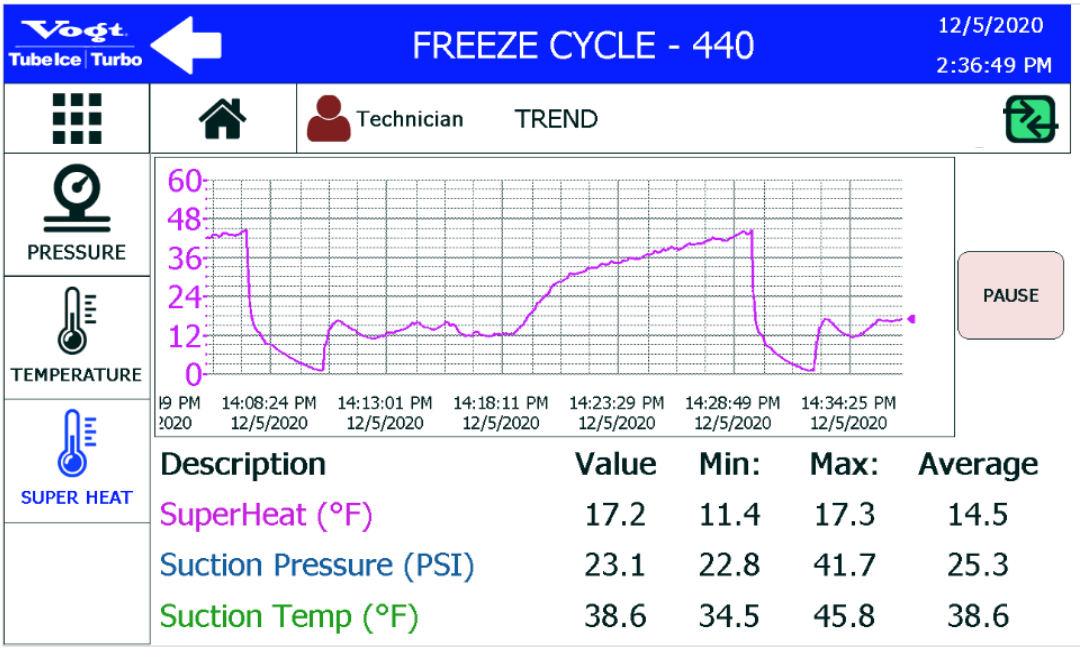


Figure 40: SUPERHEAT Trend

The DATA screen,

Figure, provides cycle data for various periods. The information collected by the HMI can be download to a storage device through the USB ports on the front of the control panel or it can be sent by email if the machine is connected to the Internet. See Figure through Figure.

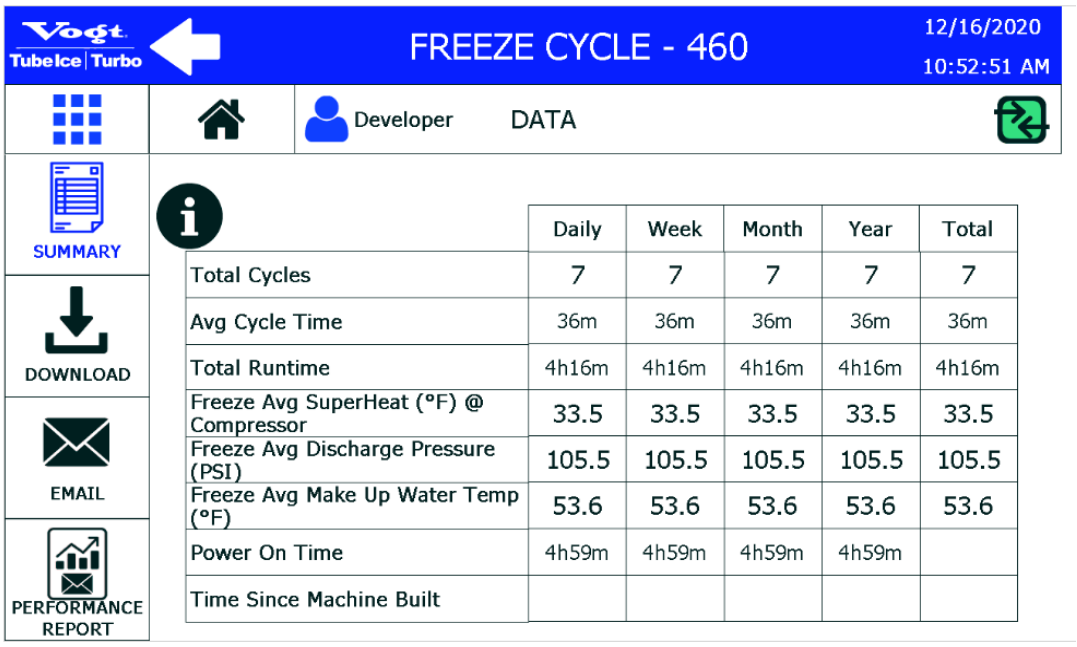


Figure 41: DATA Summary

To download data to an external storage device, follow these steps:

1. Press the **DOWNLOAD** submenu touch screen button on the left side of the **DATA** screen.
2. Insert a storage device in the USB port on the front of the control panel.
3. Select the boxes for the data that is to be downloaded.
4. Press the **DOWNLOAD** touch screen button on the right side of the screen.

The data will be sent directly to the storage device connected to the machine.

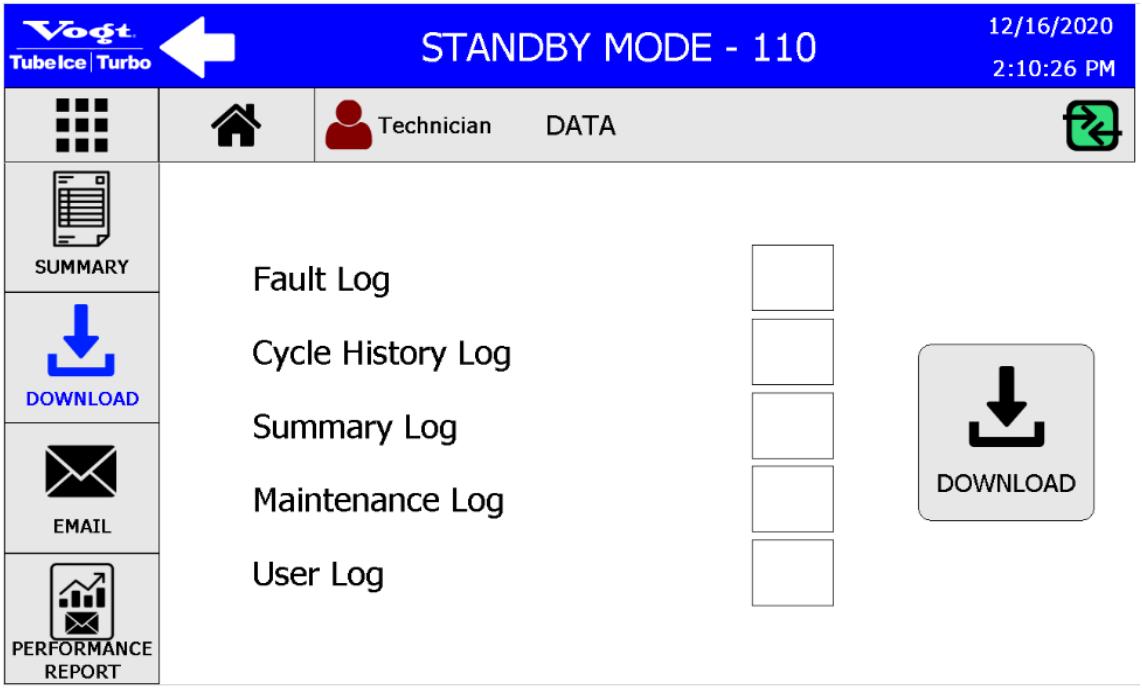


Figure 42: Download

To email data, follow these steps:

1. Press the **EMAIL** submenu touch screen button on the left side of the **DATA** screen.
2. Select the boxes for the data that is to be emailed.
3. Press the **SEND** touch screen button on the right side of the screen.

Note: The data will be sent by email only if the machine is connected to the Internet.

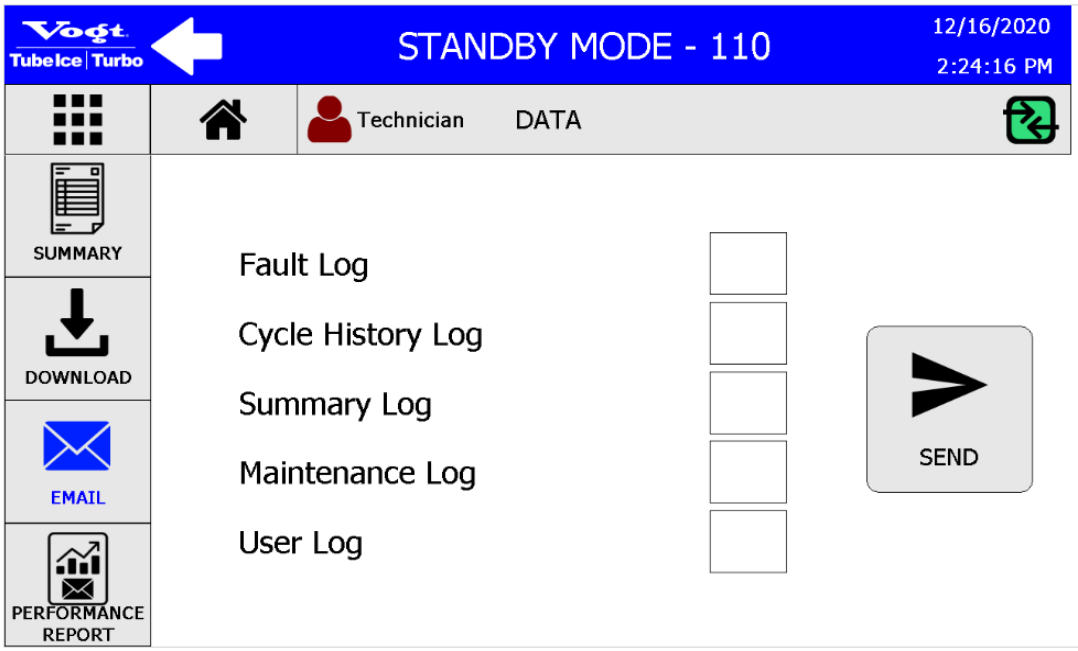


Figure 43: Email

A **PERFORMANCE REPORT** can be generated for each of the options listed in the **Select** window. Select the desired report and press

Figure 44: PERFORMANCE REPORT

The **SETUP** screen, Figure, allows the operator to adjust all of the parameters of the machine. Using the touch screen, select the gear icon next to the parameter to be changed and follow the prompts on the screen to adjust the value. Use the arrow buttons to access other pages within the submenus. See **Figure 6** through **Figure 9**.

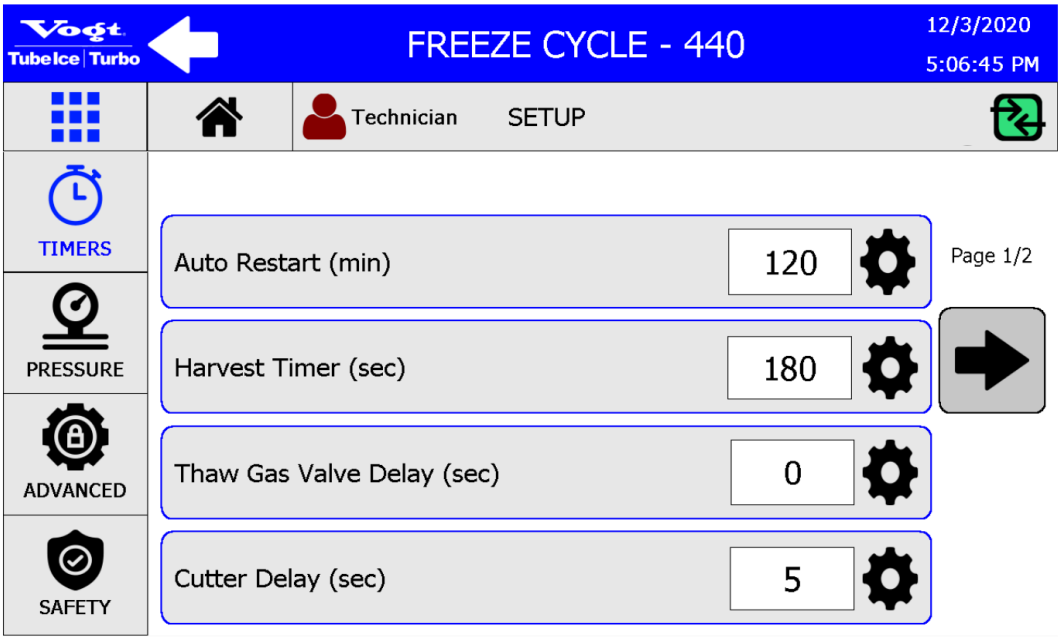
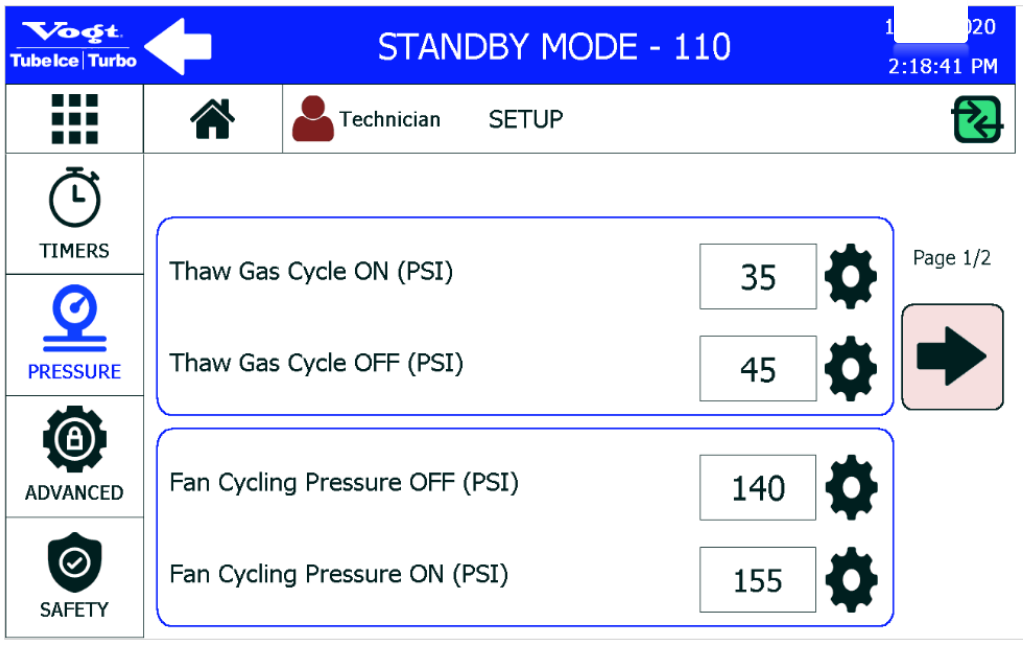


Figure 6: TIMER Settings



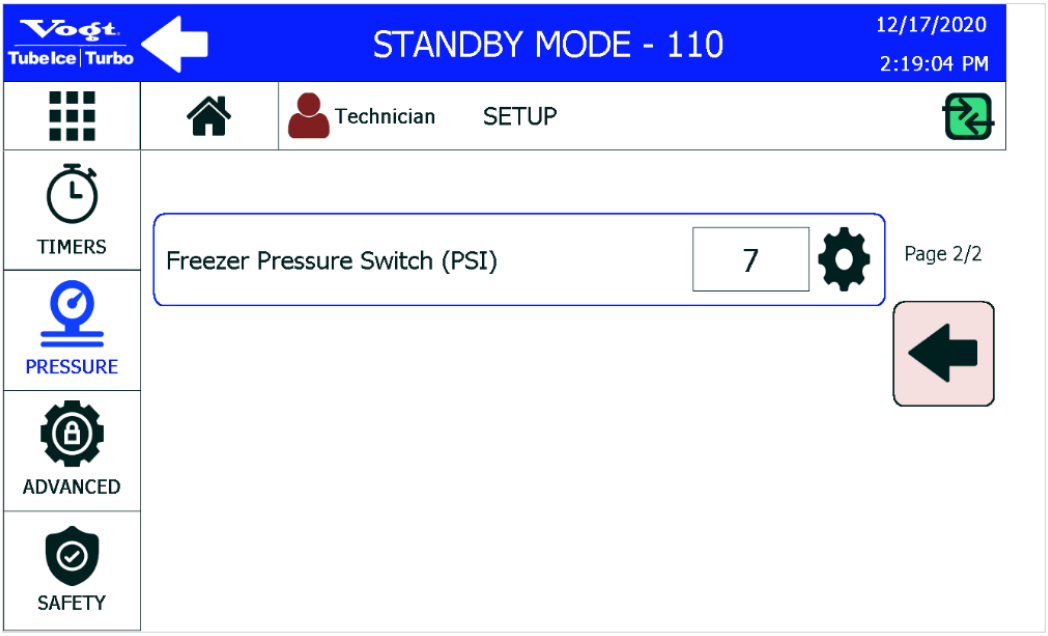


Figure 7: PRESSURE Settings

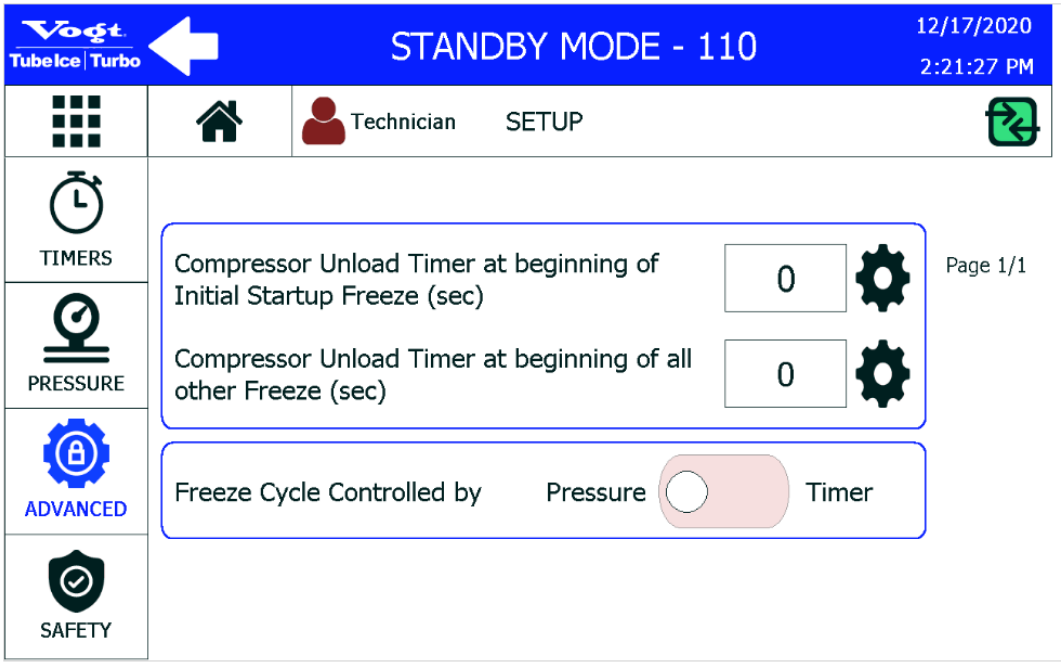


Figure 8: ADVANCED Settings

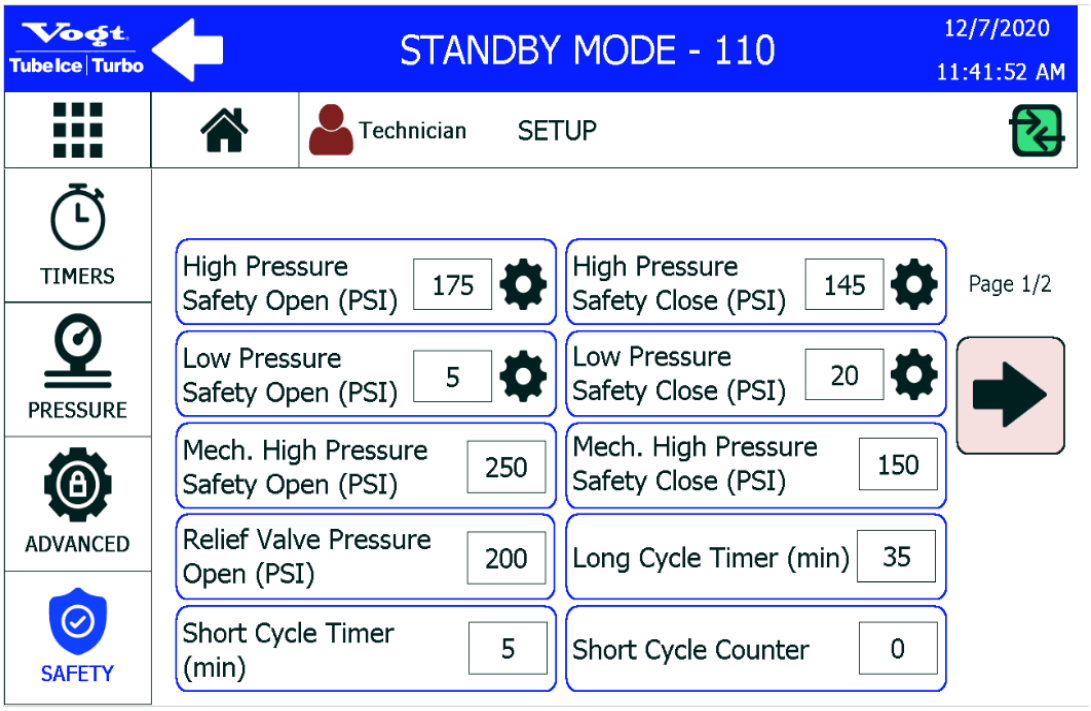


Figure 9: SAFETY Settings

The **CLEAN** screen, Figure, allows the operator to enter the cleaning mode of the machine. Refer to Chapter 7 for details on the cleaning process and the menu screens.

The **TROUBLESHOOTING** screen, Figure, allows the operator to perform maintenance and service functions. From the **PUMPDOWN** submenu, press the **Enable Maintenance Mode** touch screen button to access the machine maintenance functions. Refer to Chapter 9 for additional information on the **PUMPDOWN** submenu.

Press the **LOG** touch screen button to view records of actions that operators have taken on the machine. The **CREATE MAINTENANCE NOTE** touch screen button allows the operator to enter a separate note about service operations that have been performed, such as an oil change. See Figure 10.

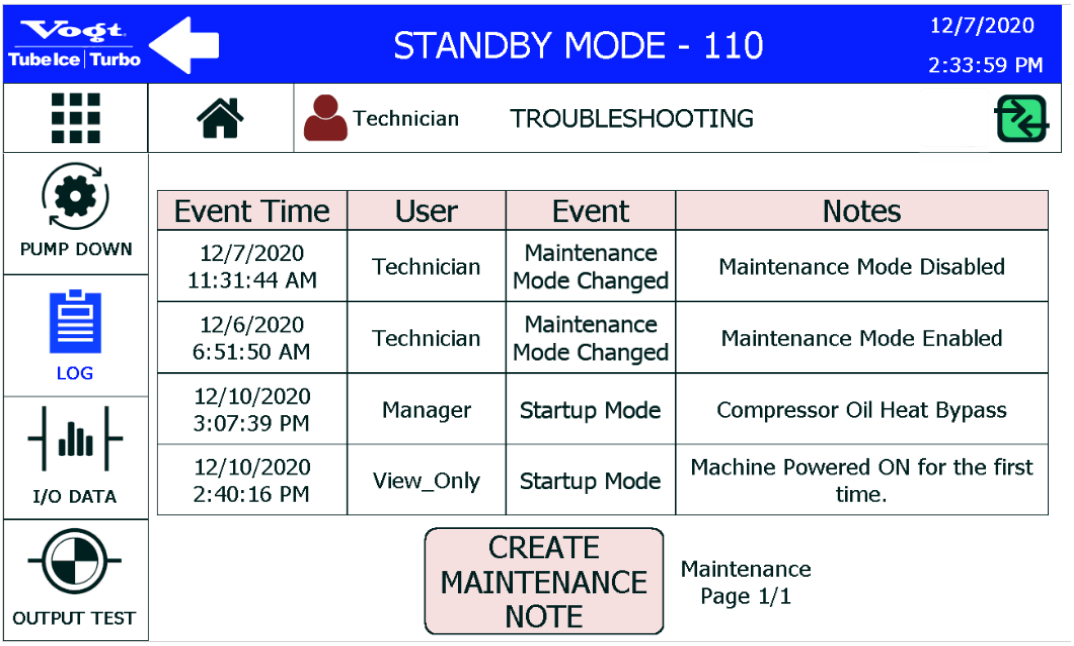


Figure 10: LOG Screen

Press the **I/O DATA** touch screen button to view the number of cycles and total run time for each input and output. See Figure 11.

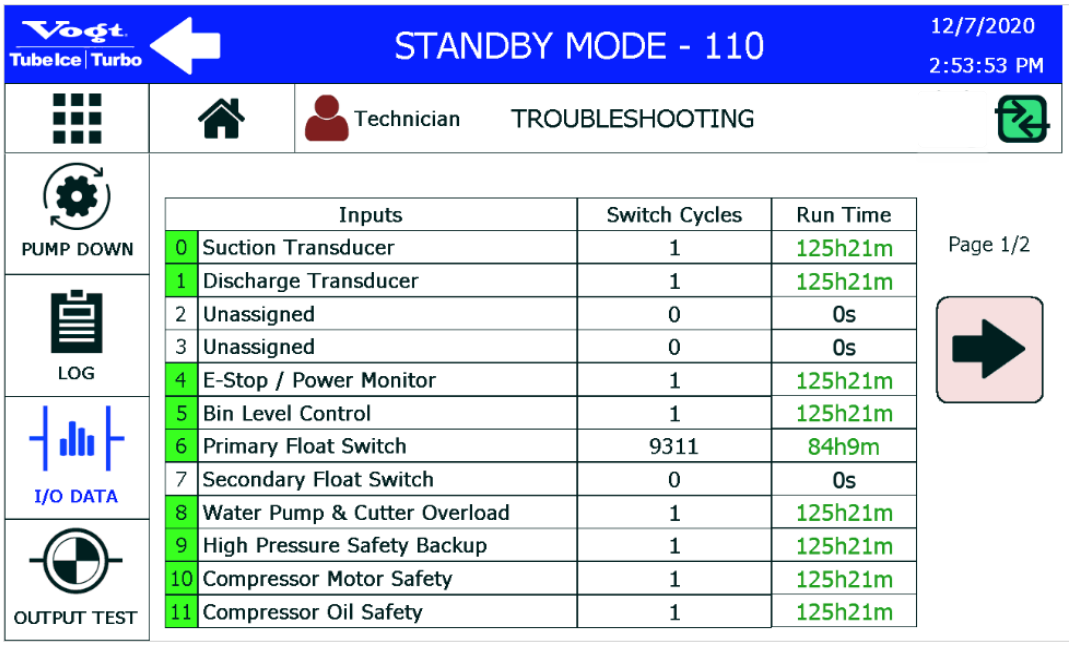


Figure 11: I/O DATA Screen

The **OUTPUT TEST** screen allows the user to turn on individual outputs to check for proper operation. Press the button next to the output to test. Press the gear icon to change the duration that the output is turned on. See Figure 12.

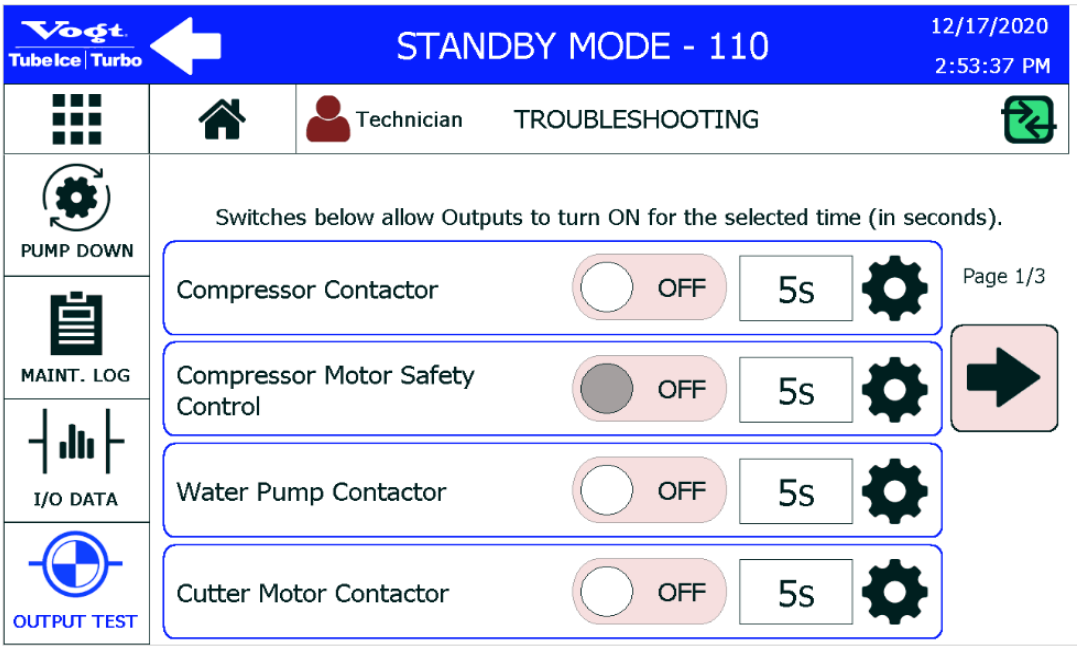


Figure 12: OUTPUT TEST Screen

The **FAULT** screen, Figure, displays the historical fault data for the machine. The last 20 fault records are stored.

The **INFO** screen, Figure, displays basic information about the ice machine. Press the **DOCUMENTS** touch screen button to access the machine service manual and specification sheet. Pressing the touch screen buttons will open the document within the HMI. See Figure 13.

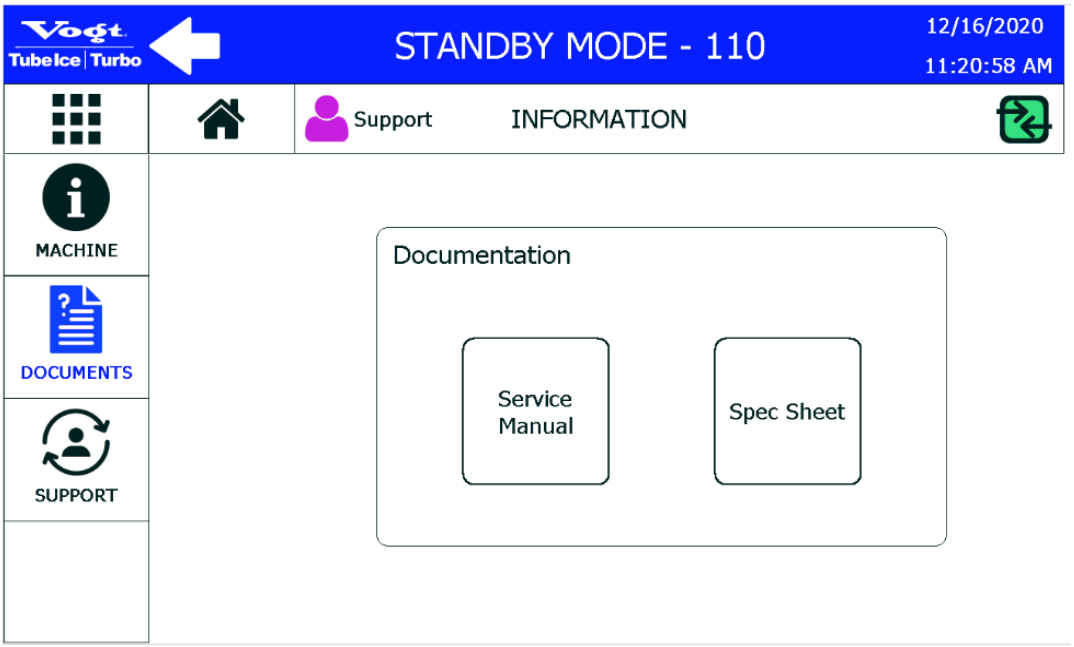


Figure 13: DOCUMENTS Screen

Press the SUPPORT touch screen button to display the contact information for Vogt SuperCare Technical Support and Parts. See Figure 14.

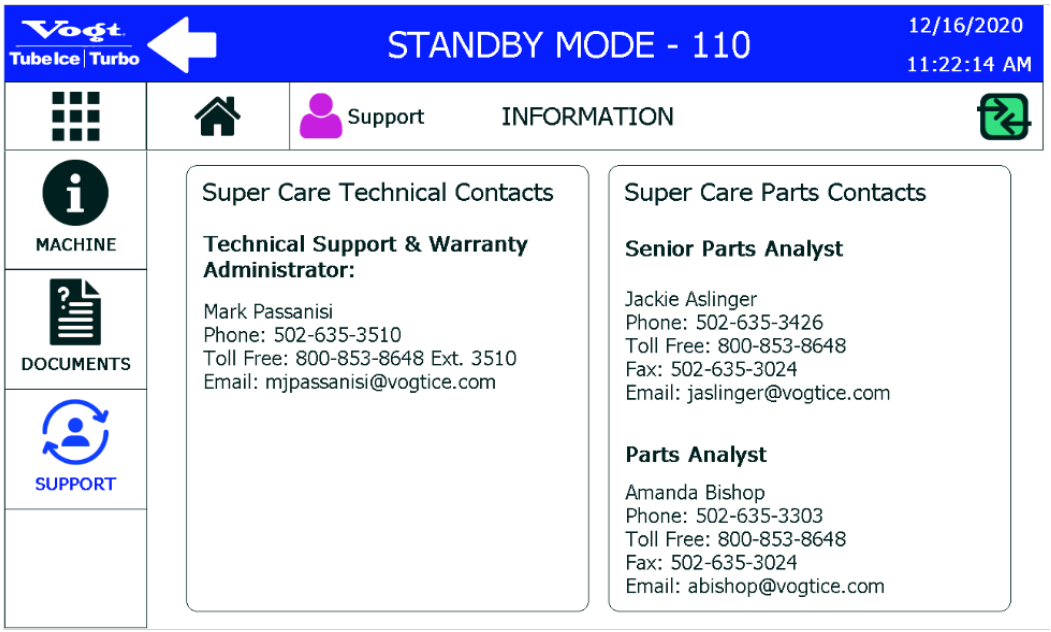


Figure 14: SUPPORT Screen

The **SYSTEM** screen, Figure, provides access to machine user groups and remote access capabilities. To enable **Fault Notifications** or **Maintenance Notifications** to be sent by email, press the button next to **EMAIL**.

Press the button next to **Remote Access** to enable remote users to connect to the machine.

Note: The machine must be connected to the Internet to enable email and remote access capabilities.

To return the machine to the factory settings, press the **Default Settings** touch screen button.

Press the **USERS** touch screen button to set up user groups for the machine, if desired. See Figure 15. Four user groups are available:

- **Operator**
- **Technician**
- **Manager**
- **Vogt**

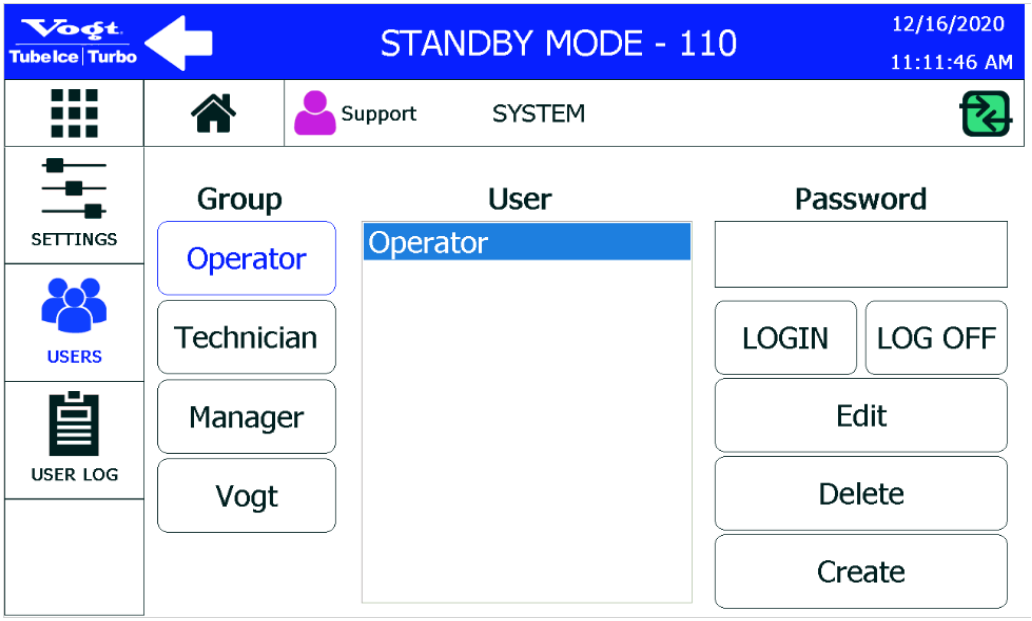


Figure 15: USERS Screen

To log in as a specific user, follow these steps:

1. Select the **Group** and the **User** to log in.
2. Press anywhere in the **Password** box and enter the **User** password.

Specific users can be added to each group. To add a user, follow these steps:

1. Select the **Group** touch screen button for the new user.
2. Press the **Create** touch screen button and follow the prompts to set up a new name and password. The new name will appear under the **User** section of the screen.

To edit the permissions of a specific user or group, follow these steps:

1. Log in as a specific user according to the instructions above.
2. Press the **Edit** touch screen button.
3. Select the desired permissions and settings for the user according to the prompts.

Press the **USER LOG** touch screen button to access records of the users that have accessed the system. See Figure 16.

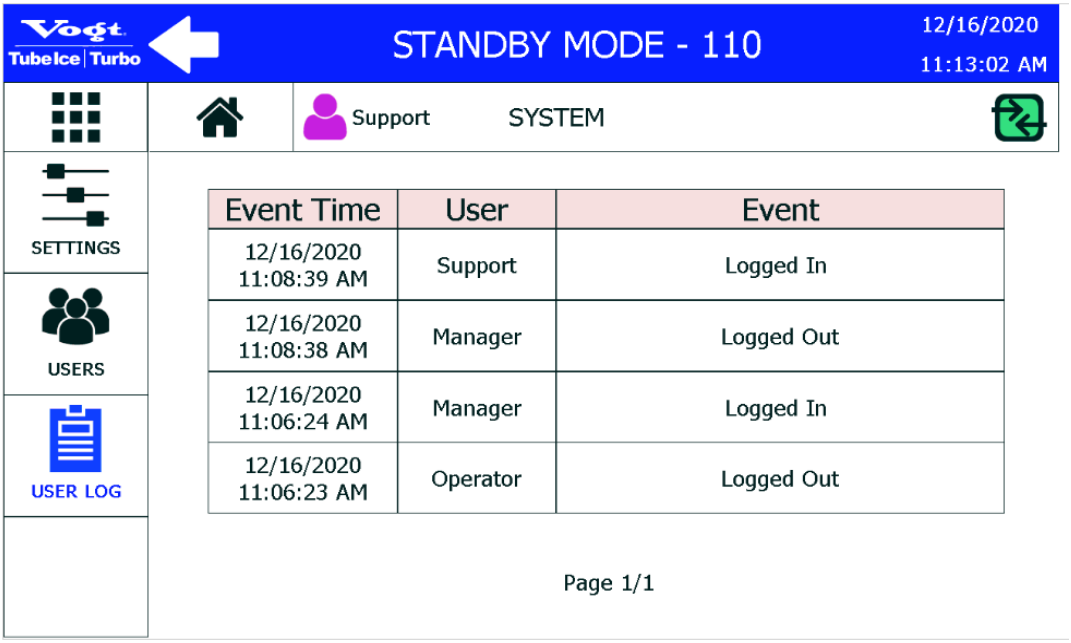


Figure 16: USER LOG Screen

Control Panel Details

The control panel contains additional components that allow the machine to operate properly. Table 10 explains these components and their functions.

Table 10: Control Panel Component Functions

Component	Function
AX	Auxiliary trip indicator for manual motor starters. Switch opens, turning off the motor when cutter or pump motor starter trips.
CB	Overload and short circuit protection for control circuit and crankcase heater. (400/460V machines only)
C	Provides power to the compressor motor. Continuously energized during freezing and thawing. Auxiliary contacts control main power for control circuit components, crankcase heater, control relay, and harvest timer.
CU	Fan motor starter (manual motor starter and contactor). Starts and stops cutter motor. Provides short circuit and over current protection. Stops cutter motor and ice machine in the event of a mechanical or electrical malfunction that results in excessive motor amperes.
E-STOP	Emergency Stop button. When pressed, the button lights and power to the PLC outputs is removed, shutting machine off. Note: Power to the PLC & Touch Screen HMI will remain ON. The button must be manually reset (twist) and the E-Stop fault reset on the Touch Screen.
FC	Fan Control motor starter (manual motor starter and contactor). Cycles the fan motor(s) of air-cooled condenser on and off. Automatically activated by the PLC (air-cooled machines only). Provides short circuit and over current protection. Stops fan motors in the event of a mechanical or electrical malfunction that results in excessive motor amperes.
FU01&02	Overload and short circuit protection for the control circuit transformer.
FU-HMI & PLC	Short circuit protection for Touch screen HMI & PLC
FU-Y0 to Y10	Short circuit protection for PLC outputs
HMI	Touch Screen. Allows you to control the ice machine. This device allows you to view and/or input machine operating parameters, view machine cycle, maintenance, fault history, etc.
P	Pump motor starter (manual motor starter and contactor). Starts and stops pump motor. Provides short circuit and over current protection. Stops water pump motor in the event of a mechanical or electrical malfunction that results in excessive motor amperes.
PLC	Programmable Logic Controls. Controls all sequencing operations of the ice machine.
TB1	Low Voltage terminal block, is for 24VDC & 5VDC connections. Used primarily for PLC Input device, sensor & switch connections. Allow for component wire connections and ease of troubleshooting.
TB2	Main Control Voltage terminal block is for 120/240V control circuit components. Used primarily for PLC Output connections. Allow for component wire connections and ease of troubleshooting.
TB3	Customer Connection terminal block, is of water pump, cutter motor and compressor interlock connections.

Chapter 7 Maintenance

To achieve the best performance from the HFO5, follow the maintenance instructions listed in this chapter. For questions concerning the maintenance or upkeep of your equipment, contact Vogt Ice, LLC.

Cleaning

The ice-making section of the Tube-Ice® machine should be cleaned at least twice a year (more often if water conditions cause mineral build-up). Use an approved food-grade ice machine cleaner. The machine is equipped with a cleaning mode, which circulates the cleaning solution through the freezer to remove mineral scale using the water pump. Detailed instructions are also attached to the machine.

To clean your Tube-Ice® machine, follow these steps:

1. Press the **HOME** touch screen button to return to the **HOME** screen. Turn off the machine by pressing the **OFF** button on the **HOME** screen. Allow the machine to cycle off.
2. Press the grid touch screen button to return to the **MENU** screen. press the **CLEAN** touch screen button to access the cleaning submenu. See Figure 17.

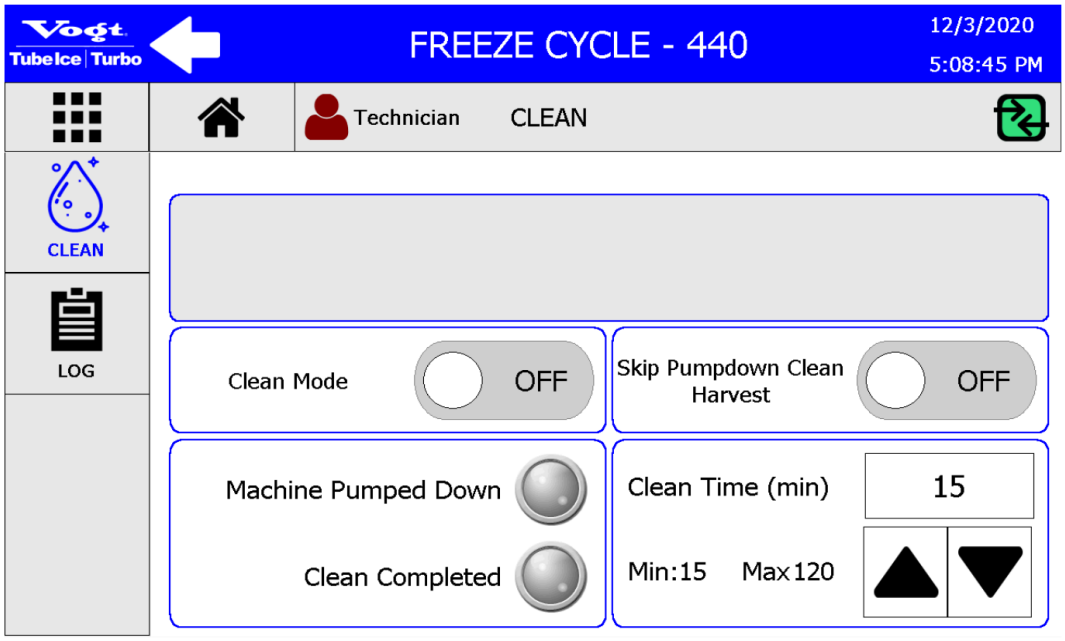


Figure 17: CLEAN Screen

3. Select the amount of time to clean the machine by pressing the arrows in the **Clean Time** section of the screen. The cleaning cycle time can be set from 15 minutes to 120 minutes.
4. Remove ice from the storage area or cover the storage opening.
5. Shut off the water supply and drain the water tank by opening the drain valve. Remove any loose sediment from the tank.
6. Close the drain valve and fill the water tank with warm water. Close the petcock valve on the water pump during the cleaning period. The tank holds approximately 15 gal (57 L).
7. Add the ice machine cleaning solution to the water tank according to the directions of the cleaning solution manufacturer. Vogt recommends Nu-Calgon® Ice Machine Cleaner, which is a food-grade liquid phosphoric acid.
8. Inspect the water distributors by looking through the transparent freezer cover. It may be necessary to clean the cover before inspecting. If required, remove the cover. Clean and remove any solid particles from the two orifices in each distributor. Clean the rubber cover gasket and reinstall the cover.

9. Press the button next to **Clean Mode** to enter the cleaning mode. The machine will begin with a pumpdown cycle. The operator can choose to bypass the pumpdown harvest cycle by pressing the button next to **Skip Pumpdown Clean Harvest**.
10. After the machine has pumped down, the icon next to **Machine Pumped Down** will turn blue, the compressor will turn off, and the water pump will begin circulating the cleaning solution. See **Error! Reference source not found.**.

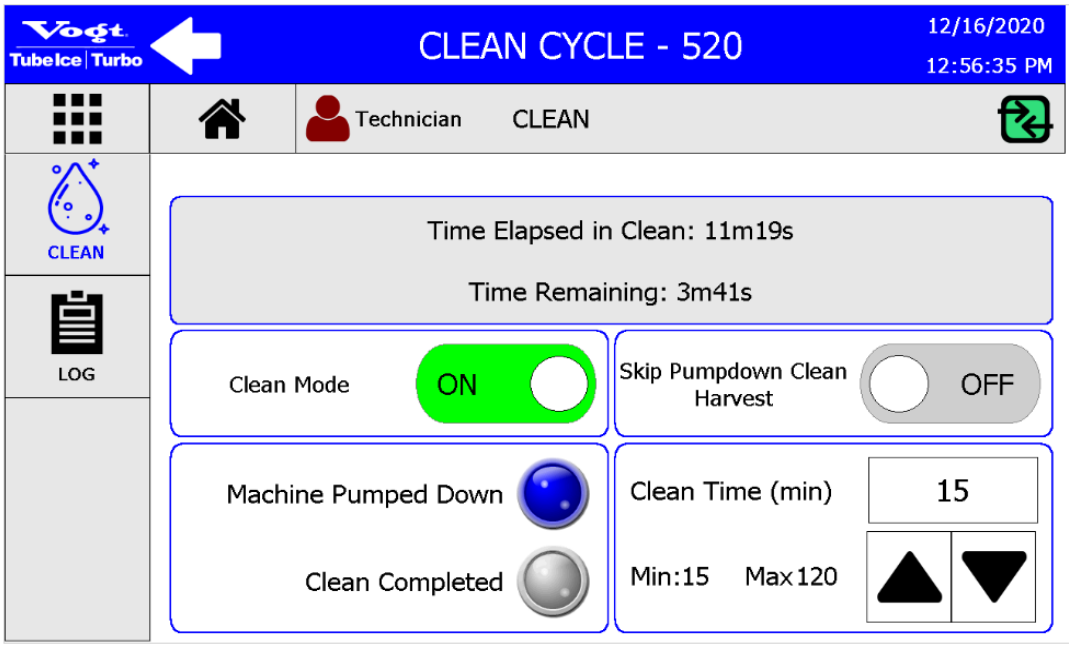


Figure 18: CLEAN Screen – Machine Pumped Down

11. When the machine has completed a cleaning cycle, the icon next to **Clean Completed** will turn blue and the machine will automatically turn off the **Clean Mode**. See Figure 19. Repeat cleaning if necessary.

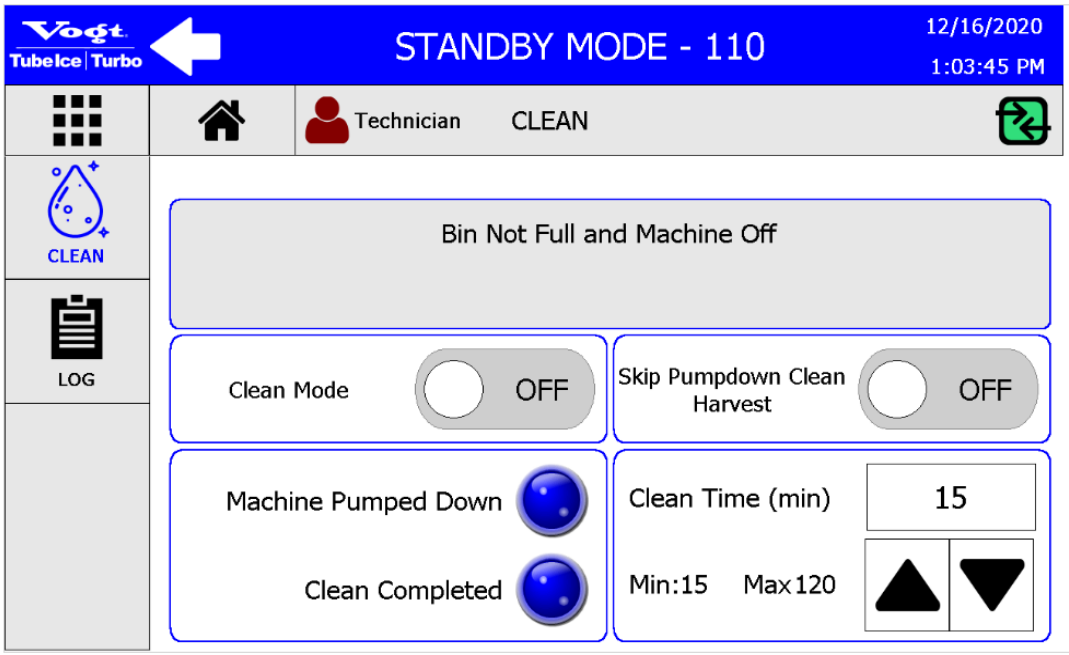


Figure 19: CLEAN Screen – Clean Completed

Note: To exit the cleaning mode at any time during the cleaning cycle, press the button next to **Clean Mode**.

12. After the cleaning cycle is complete, drain and flush the water tank with fresh water.
13. Open the water supply to the machine.
14. Drain, flush tank again, and refill it with fresh water.
15. Clean the inside of the ice storage area and remove any solution that entered during the cleaning process. Remove the cover, if one was installed, over the opening into the storage area.

To return the machine to ice-making operation, follow the steps below:

1. Make sure the water tank drain valve is closed.
2. Turn on the water supply and refill the tank with clean water.
3. When the water tank is full, press the **HOME** touch screen button to return to the **HOME** screen.
4. Press the **ICE** touch screen button to start the machine. The PLC automatically opens the liquid feed valve briefly to re-pressurize the evaporator. No additional action, such as valve adjustment, is required by the operator.
5. Once the evaporator has re-pressurized automatically, the machine will immediately resume normal operation.

Check that the adjustable blowdown petcock valve on the recirculating water pump is adjusted properly. The valve should be adjusted to the minimum rate required to maintain production of clear ice. This should be no more than 1 gal (3.8 L) per minute for most water sources.

Sanitizing

To sanitize your Tube-Ice® machine, follow these steps:

1. Press the **HOME** touch screen button to return to the **HOME** screen. Turn off the machine by pressing the **OFF** button on the **HOME** screen. Allow the machine to cycle off.
2. Press the grid touch screen button to return to the **MENU** screen. press the **CLEAN** touch screen button to access the cleaning submenu. See Figure 17.
3. Select the amount of time to clean the machine by pressing the arrows in the **Clean Time** section of the screen. The minimum suggested cycle time for sanitizing is 30 minutes.
4. Remove ice from the storage area or cover the storage opening.
5. Shut off the water supply and drain the water tank by opening the drain valve. Remove any loose sediment from the tank.
6. Close the drain valve and fill the water tank with warm water. Close the petcock valve on the water pump during the cleaning period. The tank holds approximately 15 gal (57 L).
7. In a clean container, mix 15 gal (56.8 L) of warm water at 90°F–115°F (32°C–46°C) with 24 oz (0.71 L) of Nu-Calgon® IMS-II Sanitizing concentrate (or equivalent, according to the manufacturer's instructions). The concentration should be 200 parts per million (ppm) (8 oz [227 g] per 5 gal [18.9 L]) of active sanitizing solution.
8. Close the drain valve and fill the water tank with the sanitizing solution.
9. Close the adjustable blow down petcock valve on the water pump.
10. Press the button next to **Clean Mode** to begin sanitizing the machine. The machine will begin with a pumpdown cycle. The operator can choose to bypass the pumpdown harvest cycle by pressing the button next to **Skip Pumpdown Clean Harvest**.
11. Mix an additional 5 gal (18.9 L) of warm water at 90°F–115°F (32°C–46°C) with 8 oz (227 g) of Nu-Calgon® IMS-II Sanitizing concentrate (or equivalent, according to the manufacturer's instructions) in the clean container. The concentration should be 200 ppm of active sanitizing solution.
12. Wearing appropriate gloves, submerge a clean sponge in the sanitizing solution and wipe all inside surfaces of the water tank and tank cover, including the makeup water float valve.
13. With the water pump running, add the additional 5 gal (18.9 L) of sanitizing solution to the water tank. Install the water tank cover and allow the sanitizing solution to circulate for at least 20 minutes.

14. While circulating the sanitizing solution, open the adjustable blow down petcock valve and allow the solution to flow down the drain. With the petcock valve open, allow the water to circulate for at least 3 minutes.
15. When the machine has completed a sanitizing cycle, the icon next to **Clean Completed** will turn blue and the machine will automatically turn off the **Clean Mode**. See Figure 19.
16. Drain and flush the water tank with fresh water.
17. Open the water supply to the machine.
18. Drain, flush tank again, and refill with fresh water.
19. To sanitize the inside of the ice storage area, flood the area with the sanitizing solution, making sure to wet all surfaces completely for at least 60 seconds. The concentration should be 200 ppm of active sanitizing solution.

To return the machine to ice-making operation, follow the steps below:

1. Make sure the water tank drain valve is closed.
2. Turn on the water supply and refill the tank with clean water.
3. When the water tank is full, press the **HOME** touch screen button to return to the **HOME** screen.
4. Press the **ICE** touch screen button to start the machine. The PLC automatically opens the liquid feed valve briefly to re-pressurize the evaporator. No additional action, such as valve adjustment, is required by the operator.
5. Once the evaporator has re-pressurized automatically, the machine will immediately resume normal operation.

Check that the adjustable blowdown petcock valve on the recirculating water pump is adjusted properly. The valve should be adjusted to the minimum rate required to maintain production of clear ice. This should be no more than 1 gal (3.8 L) per minute for most water sources.

Water Distributors

The water distributors are located under the freezer cover at the top of the freezer. These distributors may require occasional or periodic cleaning to remove solids and foreign particles accumulated from the makeup water. The frequency of this cleaning operation will depend on the characteristics of the water supply (refer Vogt Ice's water quality bulletin). The cleaning operation is needed when:

- Inside diameter of a large proportion of the ice becomes irregular
- Some of the ice is opaque
- There is a notable decrease in ice capacity

To clean the water distributors:

1. Shut down the machine and remove the freezer cover on the top of the freezer.
2. Remove the water distributors (one per tube) with pliers.
3. Use the pliers on the top part of the distributor with a twisting upward motion, taking care not to damage the orifices or the distributor body.
4. Soak the distributors in ice machine cleaner to remove mineral buildup if needed.
5. Rinse distributors thoroughly before reinstalling, tapping them in lightly with a rubber mallet to seat them in the freezer tubes.

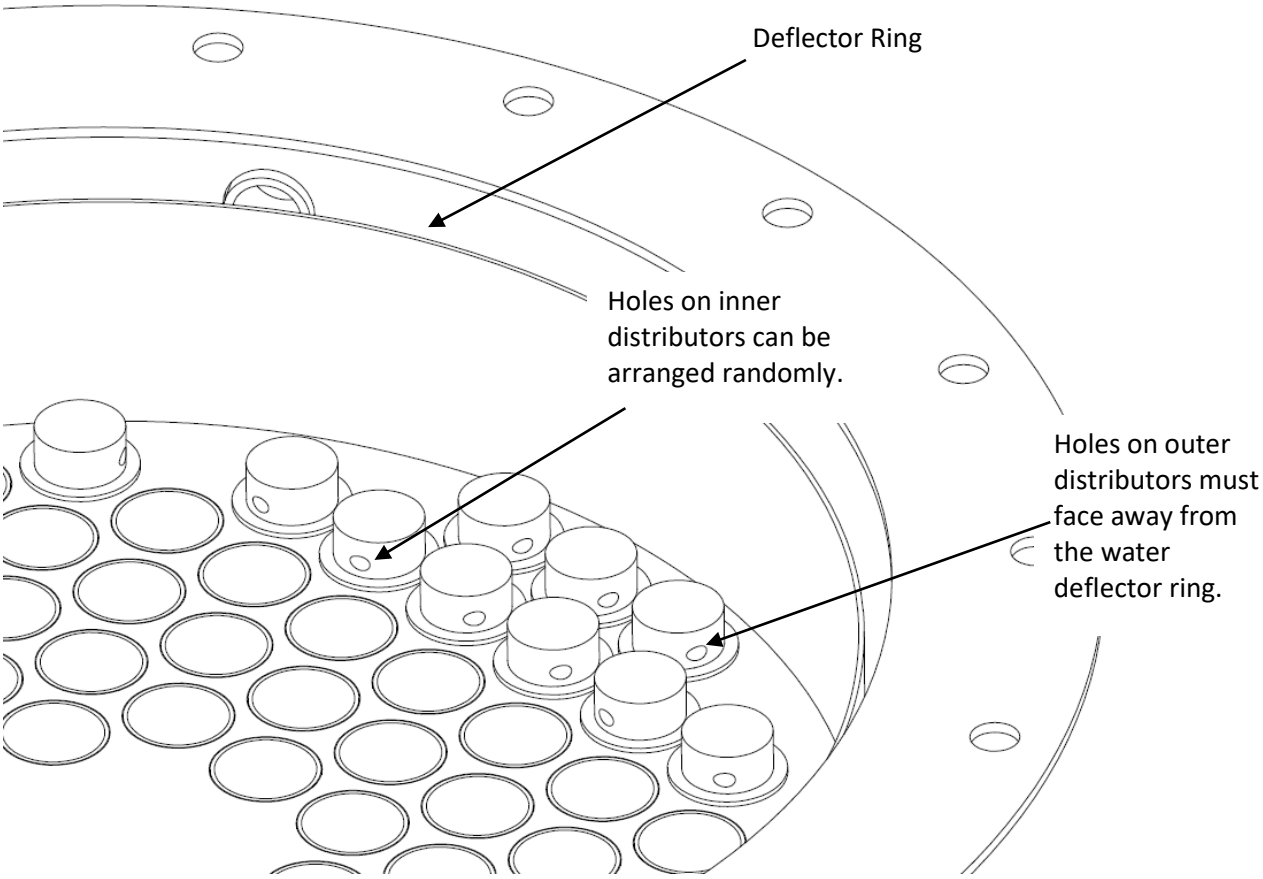


Figure 20: Water Distributor Detail

Table 11 shows the part numbers and tube quantities for water distributors on the HFO5.

Table 11: Water Distributor Information

Tube Size in. (mm)	Number of Tubes	Vogt Part Numbers		
		Water Distributor	Freezer Cover	Freezer Cover Gasket
1 (25)	156	12B2185N11	12B2145C03	12A2600G15
1-1/4 (32)	102	12B2185N21		
1-1/2 (38)	72	12B2185N31		

Water Tank

The production of opaque ice indicates the water in the water tank contains a concentrated number of solids or salts. To remedy this problem, follow the steps below:

1. Shut down the machine.
2. Remove the cover plate on the water tank and open the drain valve.
3. Clean the tank thoroughly by flushing it out with a hose and scrubbing it with a stiff brush. It may be necessary to completely remove the water tank in order to clean all internal surfaces.
4. After cleaning, reinstall the tank if necessary, close the drain valve, and fill the tank with fresh water.
5. Press the **HOME** touch screen button to return to the **HOME** screen and press the **Run Pump** touch screen button to check if the pump is working properly. Air may have collected in the impeller housing, and the pump may have to be stopped and started several times to expel this air.
6. After the pump is checked for proper flow, press the **Run Pump** touch screen button to turn the pump off.
7. Press the **ICE** touch screen button to resume ice production.

Freezer Cover

A clear polycarbonate freezer cover is provided for visual inspection of the water box and water distributors located at the top of the freezer. The cover should be removed and cleaned if it becomes coated with deposits. Generally, if this cover is coated with solids, this is a major indicator that other water contact areas (i.e., water tank and distributors) also require cleaning.

Water-Cooled Condensers

The interval in which condensers require cleaning varies. Some installations seldom need cleaning, while others may require cleaning at least once a year or even several times a year.

Proper operation of cooling towers increases the interval between cleaning considerably. Check the tower overflow rate frequently. If a tower operates with insufficient overflow (nominal 1.5 to 3 gph [5.7 – 11.4 Lph], depending on water quality), the resulting mineral concentration in the water can cause rapid and heavy fouling inside the condenser tubes, requiring excessively frequent cleaning. Also, these conditions often lead to severe corrosion.

Chemical additives, including those used to stop algae and related growths, should be obtained only from a reputable, established supplier. Always follow manufacturer's directions. Excessive treatment of the water can cause more harm than good, and the condensers, pumps, piping, and towers themselves may be damaged.

Double check the system to make sure that fouling is actually causing the trouble. High head pressure alone does not mean a fouled condenser.

Before cleaning, always check for the following conditions:

- Non-condensables in the system or a faulty head pressure gauge—Check standby pressures against refrigerant tables.
- Incorrectly set or defective water regulator valve—Check setting and operation.
- Partly closed compressor discharge service valve—Check the stem position to confirm that it is backseated.
- High-temperature water entering the condenser. Check the cooling tower fan and system.

If none of these problems exist, or they have been resolved, determine the temperature difference between the water leaving the condenser and the refrigerant condensing temperature (saturation temperature [refer to Table 25: Pressure-Temperature Chart], corresponding to the head pressure). If this difference exceeds 10°F (5.6°C), cleaning is required because the difference indicates that good heat transfer is not occurring.

If the difference is less than 8°F (4.5°C), something other than a fouled condenser may be the cause of high head pressure. During normal operation, the temperature difference stays between 5°F and 10°F (2.8°C and 5.6°C) regardless of water inlet temperature, when the water flow is regulated by a pressure-operated water valve. If the difference is less than 5°F (2.8°C), restricted water flow or a low supply pressure is likely. A restriction can be caused by foreign matter in the condenser, but it is likely to be elsewhere in the system.

Draining

Draining of water-cooled condensers is recommended in climates where units may be left exposed to ambient temperatures below 32°F (0°C). Although condensers usually have a vent and drain fittings, the opening of these fittings is not sufficient for a natural gravity flow of water. Water is thus retained in the tube due to the surface tension between the tube and the water and the normal curvature between tube supports.

Experience shows that as much as 20% of the water in the condenser is retained. To break the surface tension between the water and the tubes and to drain all tubes completely, the condenser must be tilted a minimum of 5 degrees. Whether water left in the tubes causes damage depends on how quickly the water freezes and its location inside the condenser. Condenser manufacturers recommend that each tube is blown out individually with compressed air to remove the water. Alternatively, a minimum of 25% ethylene glycol in the system will also prevent the water from freezing, which can rupture the tubes.

Chemical Cleaning

Vogt Ice, LLC, makes no recommendation for any particular chemical preparation because the same chemical may not be effective in all circumstances.

The warranty on condensers is void if they are damaged by improper cleaning tools or methods. If harsh chemicals are used, be sure to follow the manufacturer's recommendations regarding safe handling of those solutions.

Follow these directions and precautions when cleaning:

- Use only preparations from an established, reliable source.
- Follow directions exactly, particularly regarding amounts to use, and flushing or neutralizing procedures after cleaning.
- Close the water supply to the stop valve and remove the condenser water regulating valve.
- Circulate the solution through the condenser until it is considered clean (no excess scale on tubes or tubesheets).
- Flush the condenser according to the directions provided by the chemical manufacturer.
- Reinstall the water regulating valve and associated piping.
- Open the water-supply stop valve and check for leaks.

Mechanical Cleaning

The following steps should be followed during mechanical cleaning.

1. Close the stop valve in the water supply line.
2. Drain the water from the condenser.
3. Remove the water regulating valve and associated piping from the condenser.
4. Remove the nuts, water plates, and gaskets from both ends of the condenser.
   - If the gasket does not lift off with the end plate, do not attempt to pry it off. This can damage the sealing surface, causing a water leak. To free a sticking gasket, replace the water plate and tap the outside face of the plate with a rubber mallet or block of wood. After a few taps, the gasket will spring free and slip off with the water end plate.
5. Rinse gaskets with running water and use a rag or soft brush to remove foreign matter.
   - Rust, scale, and dirt will not stick to the gasket material.
6. Use clean water and a rag or soft bristle brush to clean the inside of the water end plates and the outer tube sheet surfaces.
   Note: Never use a wire brush or strong caustic on these surfaces.
   - These surfaces have been coated with a special material that will give years of protection against corrosion unless damaged.
7. Flush the condenser tubes clear with air, water, or a piece of rag on the end of a stick or wire. This will sufficiently clean the tubes in many cases.
   - If the inside surfaces are smooth, further cleaning is not necessary, even though the surfaces may be discolored. Do not attempt to achieve a bright copper finish on the tubes as they will quickly discolor when in service. The condenser is designed to handle moderate fouling on these surfaces.
   - If a rough coating remains on the insides of the tubes after flushing and wiping, further cleaning is required. The color will vary depending on water conditions. In these circumstances, use a nylon, brass, or copper brush to clean the tubes. Do not use any tool that will score, mark, flake, or otherwise cut into the tubes.

Compressor Lubrication

The HFO5 is built with the industry leading Bitzer ECOLINE semi-hermetic reciprocating compressor. This robust and energy-efficient compressor requires a special synthetic refrigeration compressor oil to reduce friction, the Bitzer BSE 32 oil.

When starting and charging the unit, the oil in the sight glass of the compressor crankcase should be watched carefully for the first hour to ensure that the proper amount of oil is remaining in the crankcase (between the lines on the sight glass). The oil level may be low on initial start-up if electrical current to the crankcase heater was interrupted.

The compressor oil drain connection utilizes a 3-way valve that enables use of a 3/8" connection **or** 1/4" connection. The valve fully closed (clockwise) opens up the 1/4" connection and closes the 3/8" connection. The valve fully open (counterclockwise) enables use of the 3/8" connection closing off the 1/4" connection. Make sure the valve is in the correct position before removing the cap on the desired connection as there are no Schrader valves in the connections.

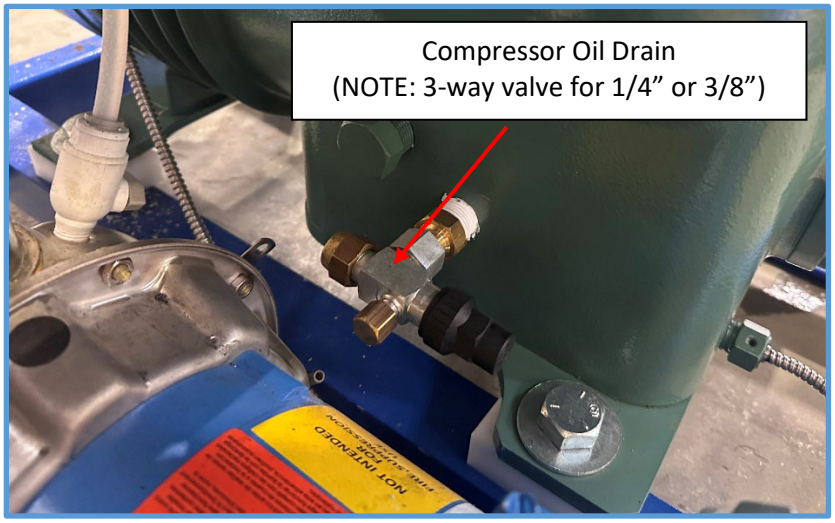


Figure 60: Compressor Oil Drain

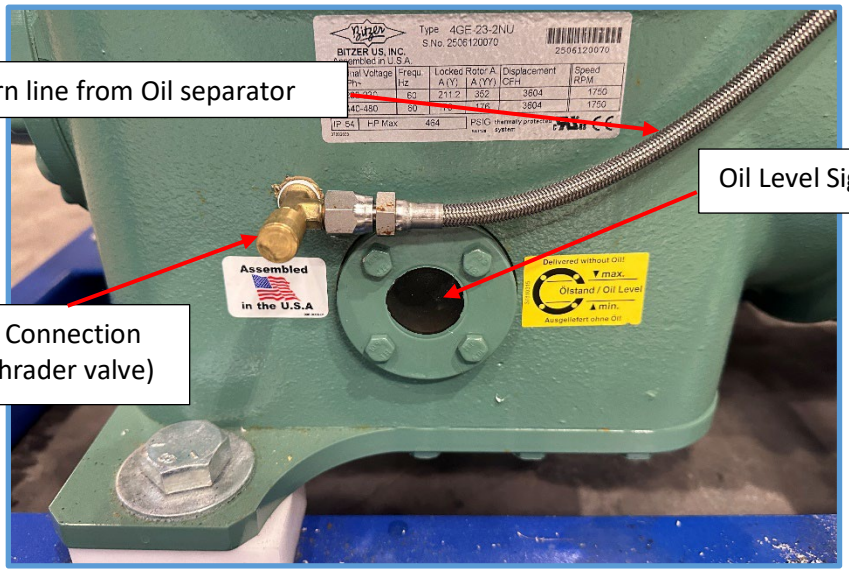


Figure 61: Compressor Oil Return, Oil Charge & Sight Glass

If there is a power interruption to the crankcase heater, the heater should be energized for at least two hours before restarting the machine. This allows for evaporation of refrigerant that may have condensed in the crankcase during the shutdown period. If the level is low after start-up, it should begin to return after a short period of operation.

The oil level should be checked frequently, particularly during the start-up operation, to make sure a sufficient amount of oil remains in the crankcase. While it is important to observe the oil splash during operation, the true level can be obtained only when the compressor is stopped. With the compressor idle, the oil level should be at a height of 1/4 to 3/4 of the sight glass but never out of sight above it.

The machine is shipped with the proper amount of oil for operating water-cooled systems. However, it may become necessary to add some oil if new refrigerant is added to the system at a later date. Generally, air-cooled machines will require additional refrigerant and oil to compensate for long piping runs to the condenser.

The tables below detail the type of oil required for the HFO5 compressor. Using any other types of oil will void the machine warranty.

Table 12: Required Compressor Lubricants and Capacity

Refrigerant	Required Lubricants	Lubricant Type	Water-Cooled Oil Charge oz (l)
R-513A	Bitzer BSE 32	Polyol Ester Oil	192 (5.7)

Note: The oil specified for this machine is very hygroscopic (it attracts and holds water molecules from the surrounding environment) and should be protected from the atmosphere to all extents possible.

If the compressor needs more oil, use an oil pump. To add oil, close the Shut-off Valve and remove the brass seal cap on the Compressor Oil Charging Connection in Figure . This connection contains a Schrader fitting. Once the seal cap is removed, connect a refrigerant hose to the 1/4-in. (DN 8) port. Using an oil pump, add oil directly to the compressor crankcase until the oil reaches the oil fill mark on the side of the compressor body.

After oil is added, remove the refrigerant hose from the 1/4-in. (DN 8) port, replace the brass seal cap on the Compressor Oil Charging Connection. Check for leaks at the Schrader fitting. If no leaks are found, open the Shut-off Valve.

To drain oil from the compressor, remove the large refrigerant valve cap on the Compressor Oil Drain valve in Figure . Backseat the valve (large stem out) to close off the 1/4-in (DN 8) side port on the valve body. Remove the 1/4-in. (DN 8) brass seal cap to access the oil fill port on the valve body. Once the seal cap is removed, connect a refrigerant hose to the 1/4-in. (DN 8) port and front seat the valve (large stem in) to open the 1/4-in. (DN 8) port. Allow the oil to drain from the compressor crankcase.

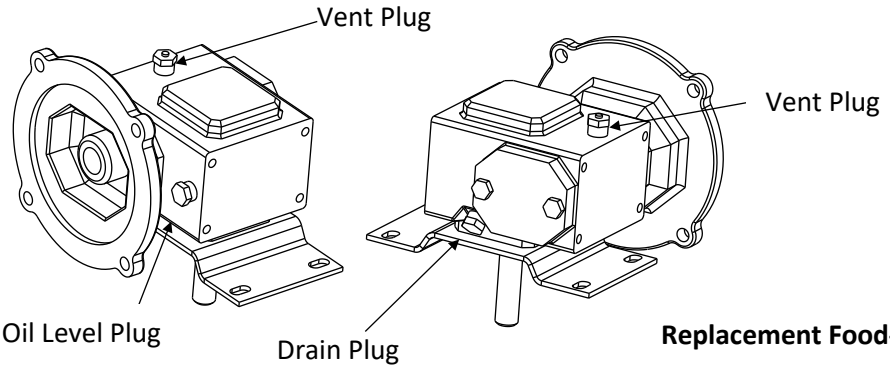
After all oil is removed, backseat the valve (large stem out) to close off the 1/4-in. (DN 8) side port on the valve body, remove the refrigerant hose, and replace the 1/4-in. (DN 8) brass seal cap. Front seat the valve (large stem in) and check for leaks at the brass seal cap. If no leaks are found, replace the large refrigerant valve cap on the Oil Drain/Fill valve.

The Bitzer ECOLINE reciprocating compressor is equipped with a differential pressure oil sensor, which monitors the compressor's oil pressure and automatically stops the machine if the differential oil pressure remains too low for 90 seconds. This helps avoid damage to the compressor.

For other compressor maintenance procedures, refer to the Bitzer service bulletin KB-104-7 operating manual.

Lubrication of the Cutter Motor Gear Reducer

The oil level for the gear reducer should be checked to see if a leak exists. The oil level should be at the bottom of the plugged opening in the side of the gear housing. Use Mobile 600W cylinder oil or equivalent. Change the oil once a year.



Gear Reducer (10:1)

Part #: 12A4030R12

Replacement Food-Grade Oil:

- Part #: 19T3020C01
- Texaco Cygnus 220
- Oil Capacity: 8 oz (227 g)

Figure 21: Cutter Motor Gear Reducer

Preventive Maintenance

A preventive maintenance program is recommended for optimum and efficient operation and a long service life. It is recommended that you or a delegated employee make a daily visual check of your Tube-Ice® machine. When you are aware of the proper operating conditions and observe them on a daily basis, changes in these conditions can alert you to changes in the operation of the machine that may require maintenance long before a service situation arises.

The following schedule is suggested as a minimum:

Daily Checklist

- ☐ Is the machine running, or is the bin full?
- ☐ Bin doors are closed.
- ☐ Thermostat bulb is in the bracket.
- ☐ All ice discharges during harvest period.
- ☐ Machine and components are clean.
- ☐ No unusual noises.
- ☐ Operating pressures (suction, discharge, hot gas, oil) are within acceptable limits.
- ☐ Ice quality (clarity and uniformity) is correct (refer to water conditioning bulletin).
- ☐ Harvest period continues at least 30 seconds after the last ice is out.
- ☐ Compressor oil level is appropriate.
- ☐ Refrigerant operation level is within acceptable limits.
- ☐ The frost pattern extends from the suction outlet on the freezer to the inlet of the suction accumulator.
- ☐ Water float valve is properly adjusted (water should not pour out of the tank during operation or cause the water pump to cavitate).

Weekly Checklist

- ☐ Weekly or Monthly Calibration and operation of all controls (high- and low-pressure switches, oil pressure switch, etc.) are within limits.
- ☐ Cooling tower spray nozzles and pump suction screen are free of scaling and algae (consult water treatment suppliers for corrective measures).
- ☐ Water distributors at the top of the freezer are free of scale accumulation.
- ☐ Remove solids that have collected in the water tank.
- ☐ Check all motor drive units (compressor, pump motors, cooling tower fan, and pump, etc.) for abnormal noise and/or vibrations.
- ☐ Observe one complete ice making cycle, record data, and compare with the **Warranty Registration/Start-Up Form**.

Monthly or Yearly Checklist

- ☐ Check entire system for leaks.
- ☐ Check system for leaks after 400 hours or 4 weeks of operation.
- ☐ Drain water from the condenser and cooling tower and check condenser tubes. Inspect for damage by corrosion or scale.
- ☐ Remove all rust from all equipment, clean, and paint.
- ☐ Check all motors for shaft wear and end play.
- ☐ Check operation and general condition of all electrical controls, relays, motor starters, and solenoid valves.
- ☐ Observe one complete ice making cycle, record data, and compare with the **Warranty Registration/Start-Up Form**.
- ☐ Change oil in cutter motor gear reducer.

Warning: Pressure relief valves must be replaced after 5 years of service. Before replacing relief valves, review requirements per current local and national codes. Valve replacement should be performed only by service personnel experienced and certified in refrigeration and qualified to work with high-voltage electrical equipment. If a relief valve discharges, the valve must be replaced before putting the machine back into service. Relief valves do not properly reseat after a discharge event. Contact Vogt SuperCare Customer Service for replacement valves.

Preventive Maintenance Form

This form can be removed and duplicated for record keeping. This page is a complete Preventive Maintenance Schedule that should be performed every 90 days. The Preventive Maintenance page may be copied and given to your service person. It should be signed, dated, and returned to you for permanent record.

Date:	**Model No.:**	**Serial No.:**

The following service was performed and checked:

	Service
☐	Last maintenance performed (approx. date) ____ / ____ / ____
☐	Scale condition of water tank and tubes (good - fair - poor)
☐	All drains freely draining (water tank, drip pan, ice bin)
☐	Water distributors cleaned
☐	Ice machine cleaner circulated through system
☐	Condenser clean (water-cooled, if applicable)
☐	Voltage at machine (actual reading) _____, _____, _____
☐	Compressor amps (halfway through freeze cycle) _____, _____, _____
☐	Cutter motor amps while cutting ice _____, _____, _____
☐	Water pump amps while pump running _____, _____, _____
☐	AC condenser motor amps (if applicable) _____, _____, _____
☐	Crankcase heater heats oil
☐	Refrigerant leaks (okay - high - low)
☐	Leak-checked entire system; number of leaks found _____
☐	Compressor oil level in sight glass (1/4 - 1/2 - 3/4 - low - high)
☐	Gear reducer oil level (correct level - low level)
☐	Low-pressure switch setting, psig _____
☐	High-pressure switch setting, psig _____
☐	Bin stat(s) installed and operating properly
☐	Makeup water float valve adjusted properly (pump not cavitating, water tank not overflowing)
☐	Adjustable blowdown adjusted for clear ice
☐	Suction psig at end of freeze CYL_____ CRU_____
☐	Suction psig during harvest (high / low) CYL_____ CRU_____
☐	Discharge psig at end of freeze CYL_____CRU_____
☐	Ambient temperature at machine (°F/ °C)
☐	Outside ambient temperature (at air-cooled condenser or cooling tower, °F/ °C)
☐	Makeup water temperature (°F/ °C)
☐	Freeze period time (minutes)
☐	Harvest period time (minutes)
☐	Total cycle time (Freeze period time + harvest period time, minutes)
☐	First ice out time (seconds)
☐	Last ice out time (seconds)
☐	Ice weight per cycle (lb/ kg)
☐	24-hour production capacity ($\frac{Ice\ weight\ per\ cycle}{Total\ cycle\ time} \times 1440$)

Comments:

Signature:

Chapter 8 Troubleshooting

Warning: Only service personnel experienced and certified in refrigeration and qualified to work with high-voltage electrical equipment should be allowed to install or work on this Tube-Ice® machine.

DANGER Follow all lock-out and tag-out procedures before servicing any electrical equipment.

Note: With the exception of bin control, anytime the machine stops, it must be manually restarted by pushing the **Start** button. If the machine stops during a freeze period, it restarts in a thawing (harvest) period.

This section lists potential problems and suggests solutions for this Tube-Ice® machine. Some of the problems and solutions apply to optional equipment supplied by others and may vary. Many problems are easy to solve if you know what caused them. If your problem is not covered in this section, call the factory directly at 1-502-635-3000 or 1-800-853-8648.

Your machine's electrical system has several built-in safety and overload protection features to stop operation when a single component fails or there is a problem from an outside source, such as a power supply. Make sure all auxiliary equipment is connected to safety and overload circuits so all related equipment is protected.

Always check the machine thoroughly after addressing the problem to prevent the same cause from reoccurring.

Machine Not Running

Possible Causes	Possible Solutions
Power failure and intermittent power interruption	Check electrical fused disconnect or circuit breaker supplying power to the machine. If power has been off for a period of time, make sure the compressor crankcase heater is energized, the crankcase is warm (100 - 110°F [38 - 43°C]), and there is no liquid refrigerant in the crankcase before running the machine. Push the **Start** touch screen button to initiate startup in a thawing period.
3.0-amp circuit breaker in the control panel trips	Check compressor crankcase heater, coils of relays, contactors, starters, solenoid valves, and thawing timer for a ground. Repair or replace any defective part and replace fuse. Make sure there is no liquid refrigerant in the compressor crankcase before restarting the machine.
High/low safety pressure switch trips	If the machine stops because the pressure is too low, the switch resets automatically when the pressure increases to the appropriate setting. If the machine stops because the pressure it too high, the switch automatically resets after the pressure drops below the appropriate setting. Check switch settings. Push the **Start** touch screen button to start the machine in a thawing period. Check the head pressure during the next freeze period. Refer to Chapter 9, (High/Low Pressure Switch).
Differential oil pressure safety trips	If the machine stops because the differential oil pressure is too low, check the safety on the compressor. A solid red light comes on if tripped. To reset the sensor, press the **Reset** button. The switch can only be reset after a 100 second delay after shutting off. The oil level should be 1/4 – 3/4 in the sight glass. Add oil if necessary.

Machine Not Running, cont.

Possible Causes	Possible Solutions
Cutter motor overload trips	Check and clear the cutter area and ice discharge path of all ice. Check voltage and overload range adjustment against motor rating. Reset the manual motor starter, reset the fault on the touch screen and restart the machine by pushing the **Start** touch screen button. Check the cutter operation and motor amp draw. If tripping repeats, but there is no ice clogging the cutter area or ice discharge path, check the cutter bearing for wear, the gear reducer for resistance, and the motor for defects or single phasing.
Pump motor overload trips	Check voltage and overload range adjustment against motor rating. Reset the manual motor starter, reset the fault on the touch screen, press the **Run Water Pump** touch screen button. Check the pump operation and motor amps. If tripping repeats, check for a defective overload, defective motor, or single phasing.
Bin thermostat or bin level control stops machine	Adjust or replace the bin thermostat or level control. Make sure the bin thermostat bulb or level control is located properly in the bin. Refer to *Ice Bin Thermostat Sensor*.
Defective component in control panel	Check for open circuit. Refer to Figure to identify parts. Replace defective part, restart machine, and check power supply and current draw.

Freeze-Up from Extended Freeze Period

Possible Causes	Possible Solutions
Freezer pressure switch setting too low	Adjust freezer pressure switch or replace if defective.
Water tank drain valve or makeup water solenoid open too long	Close, repair, or replace valve as needed.
Thaw gas solenoid valve leaking during the freeze period	Check the manual opening stem to make sure it is in the automatic position (stem screwed out). Check for leakage through the valve by measuring the sound and temperature differences. Close the stop valve at the receiver to confirm leakage. Repair or replace the valve as needed.
Float switch sticks or fails to close	Check to make sure the float switch is opening and closing.
Liquid line solenoid valve (A) is stuck open	Check to make sure the valve is not in the manual open position. Disassemble valve and inspect for debris. Clean valve if required.

Freeze-Up from Ice Failing to Discharge

Possible Causes	Possible Solutions
Insufficient heat for thawing because of low condensing pressure, non-condensable gases (usually air) in system, low refrigerant charge, or thaw gas pressure switch adjusted too low	The head pressure should be maintained at approximately 145 psig (10 bar) for R-513A, which relates to 105.8°F (41.0°C) by adjusting the water regulating valve (water-cooled units) or fan cycling switch (air-cooled units). If non-condensable gases are present in the refrigerant, the saturated temperature will not relate to the pressure reading at the receiver. The refrigerant level in the receiver should be near the operating level (marked by the sticker) at the end of a freezing period to provide enough volume for harvesting. (1-in. [2.54 cm] = approx. 10 lb. [4.5 kg] of R-513A).
Thawing time too short	Check the **Harvest Timer** which should be changed to allow all the ice to clear the cutter and ice discharge opening with at least 30 seconds to spare.
Cutter or cutter disc does not turn	Check cutter reducer and drive gear for proper operation and alignment. Check for broken cutter disc or drive pin and replace as necessary.
Ice backs up into cutter or discharge opening, jamming cutter	Ice mushy due to concentration of solids in the water tank. Perform "Cleaning Procedure" and check automatic and adjustable blowdown. If the machine discharges ice into a chute, it should slope at an angle of 30 degrees for cylinder ice, and 45 degrees for crushed ice. Check bin stat or level control to make sure it will stop the machine before ice backs up into the cutter.
Extended freeze period	Check the **Freezer Pressure Switch**, refer to Chapter 9, (Freezer Pressure Switch on Touch Screen HMI) and **Error! Not a valid result for table.** Normal Operating Criteria.
Compressor not unloading	Check compressor amps during harvest. A noticeable drop in amperage should occur. Check unloader solenoid coil. If coil is okay, replace unloader head assembly.
Thawing time too short	Check the **Harvest Timer**, which should be adjusted to allow all the ice to clear the cutter and ice discharge opening with at least 30 seconds to spare.

Poor Ice Quality

Possible Causes	Possible Solutions
Excessive concentration of solids in the water tank, indicated by a build-up of mineral deposit on the sides and bottom of the tank	Clean the water tank. Remove the freezer cover and clean the water distributors. Adjust continuous blowdown.
Insufficient water supply indicated by a low level in the tank	Check water pressure—30 psig [2 bar] is the recommended minimum. Check for a water line restriction, partially closed valve, or defective makeup water float valve. Make sure the water tank drain valve is closed.
Water pump rotation wrong direction	Check rotation by referring to the arrow on the pump housing and reverse two wires at the motor if necessary.
Low refrigerant charge	Check refrigerant level mark on the receiver and on the red portion of the gauge glass guard. Perform a pumpdown if necessary. Keep the gauge glass cocks closed when finished checking the level.
Insufficient blowdown during harvest	Check for proper operation of the siphon vacuum break valve. Check for restrictions or traps in the water tank drain assembly.

Low Ice Capacity

Possible Causes	Possible Solutions
Low refrigerant charge	Check for and repair leaks. Add refrigerant.
Restriction in liquid line	Check for a partially closed valve or an obstruction at the dryer, strainer, solenoid valve, or expansion valve. The liquid line will normally have frost on the downstream side of a restriction, especially as the suction pressure decreases.
Float switch stuck or failed in open position	Make sure the float switch is opening and closing. Make sure the A valve is getting power.
Thaw gas solenoid valve leaking during the freeze period	Check the manual opening stem to make sure it is in the automatic position (stem screwed out). Check for leakage through the valve by measuring sound and temperature differences. Close the stop valve at the receiver to confirm suspicion of leakage. Repair or replace the valve as needed.
Water distributors at top of freezer are clogged	Remove freezer cover and clean the distributors. Refer to *Water Distributors* in Chapter 7.
Not enough water for ice making	Check water pressure (30 psig [2 bar] minimum is recommended). Check for a water restriction in the supply line or at the makeup water float valve.
Makeup water float valve stuck open, adjusted too high, or water tank drain valve open or leaking	Repair, replace, or adjust float valve as needed. Close, repair, or replace water tank drain valve as needed.

Low Ice Capacity, cont.

Possible Causes	Possible Solutions
Controls for regulating freezing and thawing periods not adjusted properly	For highest capacity, cylinder ice should have a small hole and crushed ice should be about 3/16-in. [4.8-mm] thick. Adjust the **Freezer Pressure Switch** and **Harvest Timer** as needed. Refer to Chapter 9
Excessively high head pressure	Check water regulating valve or fan control adjustment. Clean the condenser if needed. Check refrigerant table for appropriate pressures and temperatures.
Warm makeup water for ice making	Capacity of the machine is proportional to the water temperature during ice making. Warmer water will reduce the ice-making capacity.
Drain valve open	Close drain valve.
Low refrigerant charge	Check for and repair leaks. Add refrigerant as needed.
Restriction in liquid line	Check for a partially closed valve, or for an obstruction at the dryer, strainer, solenoid valve, or expansion valve. The liquid line will normally have frost on the downstream side of a restriction, especially as the suction pressure decreases.

High Head Pressure (Water-Cooled Machines)

Possible Causes	Possible Solutions
Misadjusted or defective water regulating valve	Adjust or replace valve. Never adjust the valve stem as far open as it will turn, because it will not close when the head pressure drops.
Insufficient water supply	Check size of water line and pump output at the condenser. Refer to the specification sheet for water requirements. Check cooling tower sump level and makeup water supply.
Cooling tower needs maintenance	Check cooling tower fan belt and tighten or replace as needed. Check spray nozzles and sump screen and clean as needed.
Non-condensable gas (usually air) in system	Check refrigerant tables for appropriate pressures and temperatures. If non-condensable gases are present, perform a total pumpdown. Let stand for at least 6 hours, allowing non-condensable gases to collect in the upper part of the receiver. Evacuate the freezer and attach a recovery unit to the top receiver purge valve. Open the valve and recover the vapor for about five minutes. When the freezer is evacuated, open the thaw gas solenoid valve (D) manually for about 15 seconds, letting the top vapor in the receiver blow into the freezer. Close the solenoid valve and evacuate the freezer again. Evacuate to 500 microns and restart the machine.
Fouled (dirty) condenser	Visually inspect condenser and clean as necessary.
Misadjusted or defective water regulating valve	Adjust or replace the valve. Never adjust the valve stem as far open as it will turn, because it will not close when the head pressure drops.

High Head Pressure (Air-Cooled Machines)

Possible Causes	Possible Solutions
Condenser fan(s) not running; defective motor, fan control switch, fan contactor, or tripped fan motor overload	Replace any defective parts. Check condenser fan disconnect for thrown switch or blown fuse. Replace fuse and reset switch. If the condenser is split, check the normally open solenoid valve to make sure it is open. Also check the fan sequencing thermostats and fan motor contactors to make sure they are functioning properly.
Dirty condenser causing restricted air flow	Visually inspect condenser and clean as necessary.
Non-condensables (usually air) in the system	Follow same procedure as specified for removing non-condensable gases from water-cooled machines and evacuate the air-cooled condenser as well.

Chapter 9 Servicing Operations

Adjustable Blowdown (for Clearer Ice)

A petcock valve, located at the overflow level of the water pump, provides adjustable blowdown from the water tank during the freezing period. The petcock is set at the factory to discharge enough water during the freeze period to produce clear ice. After installation, the petcock should be adjusted to the minimum rate (open as little as possible) required to maintain clear ice and checked after a few days of ice making to confirm ice is still clear. Figure 22 shows the overall blowdown assembly.

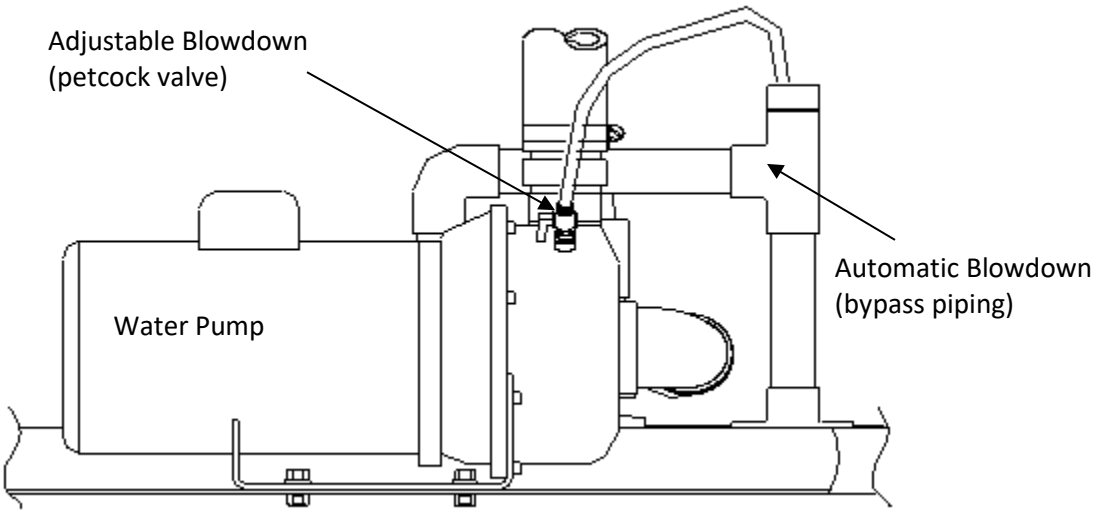


Figure 22: Water Pump/Blowdown Assembly

Automatic Blowdown

The automatic blowdown or harvest period eliminates or reduces the need for frequent flushing or cleaning of the water tank. This blowdown also removes accumulated salts or solids in the water as a result of the freezing action. During the harvest period, water returning from the freezer raises the tank level and causes an overflow of water. The overflow creates a siphon to remove a fixed amount of water (20% of tank capacity) from the tank.

Makeup Water Float Valve

The makeup water float valve maintains the proper pumping water level for ice making. The valve is set to maintain an appropriate level (high enough to prevent pump cavitation and low enough to prevent tank flooding) in the water tank during the freezing period so there will be a quantity of bypass or blowdown only during the thaw mode. The water level during the freeze mode must always be below the bypass piping to prevent excessive waste of cold water; otherwise, loss of ice capacity results.

If cleaning the float valve is required, close the stop valve in the makeup water line to the machine and remove the float valve. After the valve is cleaned and reinstalled, ensure the proper water level is being maintained. After the machine stops, and the water in the tank reaches its normal level, there should be no water flow through the float valve or drain bypass.

Installation of a 40-mesh strainer in the water supply line is recommended. The strainer protects the float valve from dirt or solids in the water and helps reduce the amount of cleaning.

Refrigerant Float Switch

The float switch is installed on a header assembly attached to the freezer shell. Valves provide isolation of the float switch assembly if replacement or servicing is necessary. The float switch closes as the level of refrigerant in the freezer rises, and it opens as the level falls.

The float switch is connected to the liquid line solenoid valve (A) coil (refer to piping schematics and wiring diagrams). This solenoid valve is located in the pipeline directly before the hand expansion valve. When the refrigerant level in the freezer drops, the float switch opens and de-energizes this normally open solenoid valve until the liquid level in the freezer rises enough to close the float switch. The float switch has a fixed 1/2-in. (13-mm) differential.

The float switch is installed at the correct height at the factory to provide the highest ice-making capacity. No adjustment is needed.

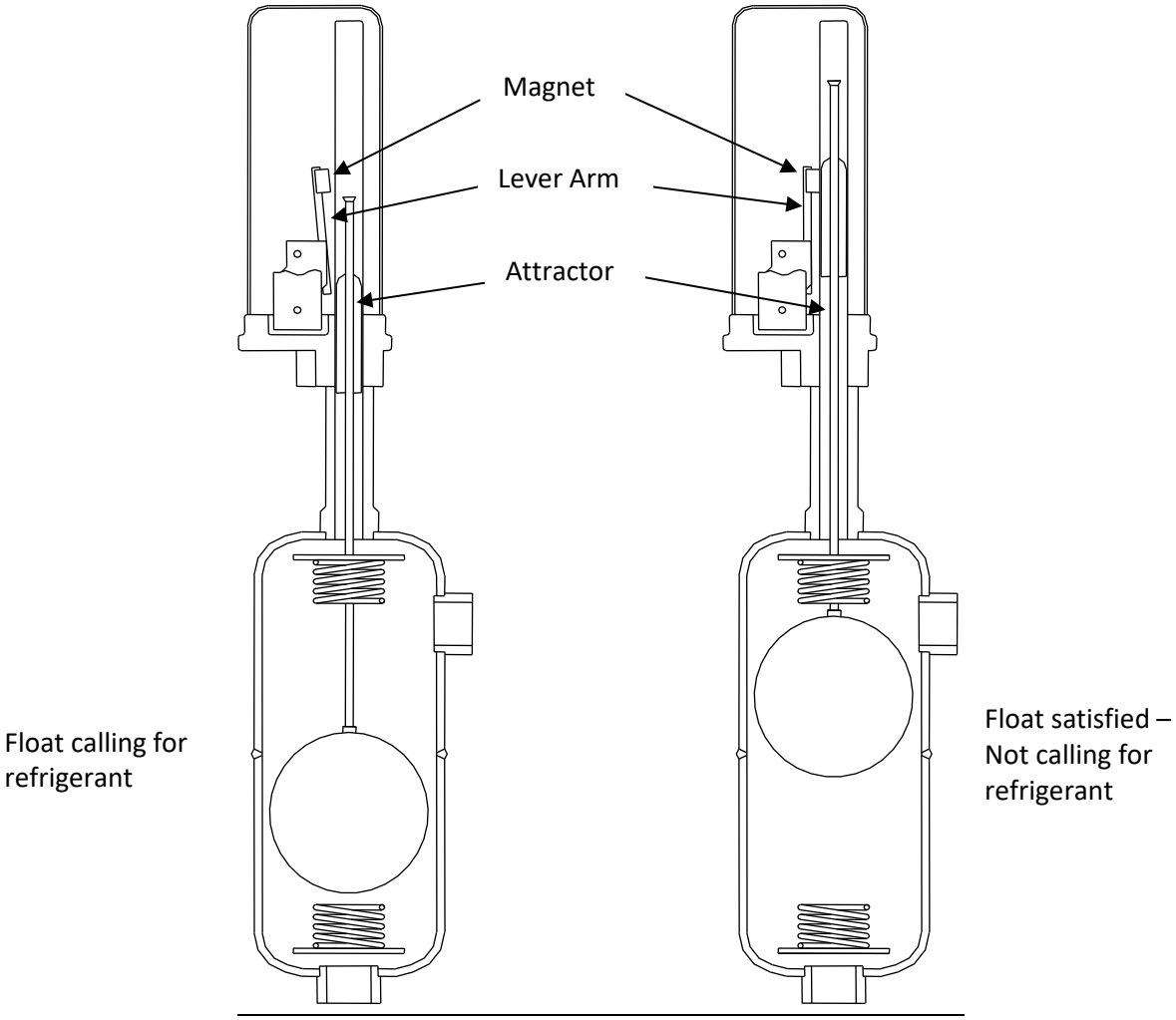


Figure 23: Refrigerant Float Switch

Hand Expansion Valve

The hand expansion valve is located after the liquid line solenoid valve (A). This should be set at a point where the float switch is open for a length of time approximately equal to the time it is closed. The factory setting is about three turns closed from full open.

Freezer Pressure Switch on Touch Screen HMI

The **Freezer Pressure Switch** controls the freezing time period for the production of cylinder or crushed ice. It is adjusted on the **Quick Setup** screen when viewing the **Home** screen on the HMI.

This setpoint is selected at the factory to produce ice of recommended thickness. Refer to the Certificate of Test, which was provided with the machine for a sample set of pressure readings with corresponding time periods and water temperatures. Do not make adjustments until several ice discharging cycles have been completed.

Low Pressure Safety on Touch Screen HMI

The **Low Pressure Safety** will shut the ice machine off if the compressor suction pressure drops below the setpoint. The factory setpoint for the low-pressure safety is 4 psig (0.27 bar). The setpoint where the machine can restart is 20 psig (1.4 bar).

High Pressure Safety on Touch Screen HMI

The **High Pressure Safety** will shut the ice machine off if the compressor discharge pressure reaches the setpoint. The factory setpoint for the maximum safe pressure is 200 psig (13.8 bar). The setpoint where the machine can restart is 145 psig (10 bar).

Head Pressure Control

For R-513A, the head pressure should be maintained at 145–155 psig (10–10.6 bar) during the freeze cycle. This pressure can be checked at the compressor discharge valve. It is also displayed on the **Home** screen of the HMI.

Fan Cycling Pressure on Touch Screen HMI

For air-cooled machines, the condenser fan cycling is controlled by the PLC and adjusted on the **Quick Setup** screen when viewing the **Home** screen on the HMI. **ON** sets the pressure at which the fans turn on, **OFF** sets the pressure at which the fans turn off. Best performance is achieved with a head pressure range of 145–155 psig (10–10.6 bar). See Figure 24.

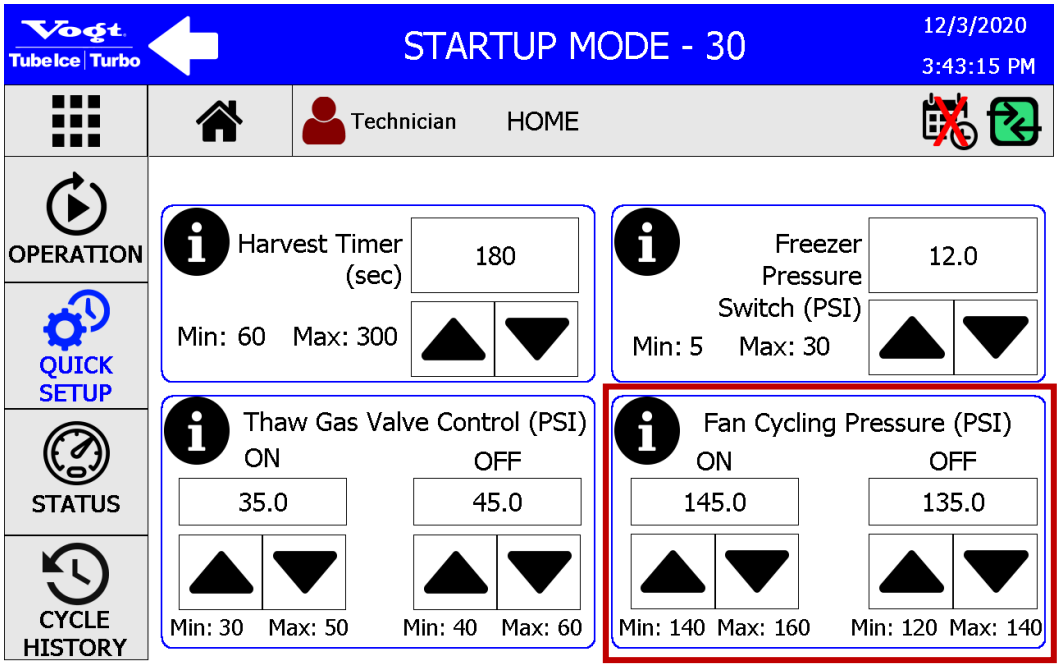


Figure 24: Fan Cycling Pressure on Quick Setup Screen

Water-Regulating Valve (Water-Cooled Machines)

A water-regulating valve located in the condenser water inlet controls the water flow through the condenser. This valve should be adjusted to maintain a head pressure of 145–155 psig (10–10.6 bar) for R-513A. Increasing the water flow will lower the head pressure, while decreasing the water flow will raise the head pressure. The valve is set at the factory during testing. The valve stem should not be opened all the way because it will not close completely when the head pressure drops below its setting.

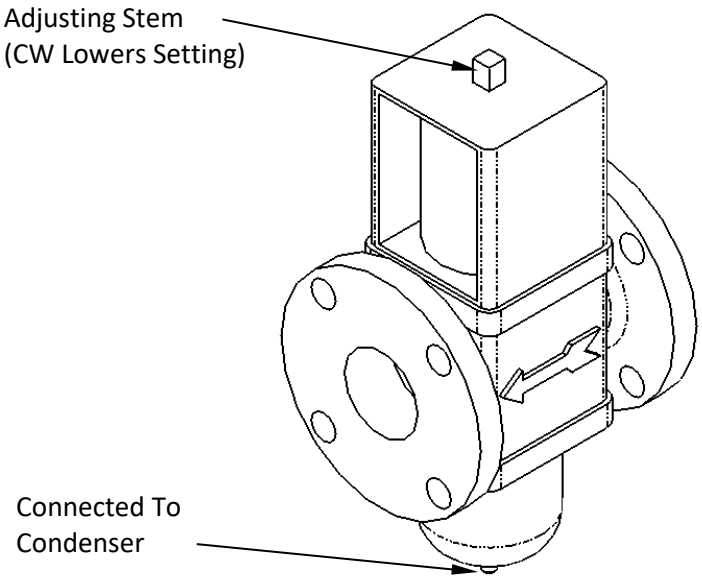


Figure 25: Water Regulating Valve

Cleaning Water-Cooled Condenser

The shell and tube condenser require occasional cleaning to maintain peak performance.

Compressor Motor Protection

The Bitzer ECOLINE reciprocating compressor motor is protected by an electronic motor protection module. If this module fails, it must be replaced. The motor protection is provided by the Bitzer SE-B3 module. (Vogt part number 12A2115P0509)

Table 13: Compressor Parts

Item	Vogt Part No.	Description
Oil Pressure Control	12A2110P0507	Oil Pressure safety, single point diff, 230V Control Power
Unloader Coil	12A2110P0503	Coil, Unloader, 230V, 17W
Crankcase Heater - 230v	12A7509E22	Crankcase Heater, 230V, 140W, for 4GE-23 & 4HE-18
Electronic Motor Protection	12A2110P0509	SE-B3 Protection Module for 4GE-23 & 4HE-18, 115/230V
Reciprocating Compressor	12A2110Z07	Compressor, ECOLINE reciprocating, 18HP

Compressor Motor Protection—Field Diagnosis

The protective devices SE-B3 monitor motor and discharge gas temperatures.

- **Temperature monitoring**. Locks out immediately if pre-set temperatures for the motor, discharge gas, or the oil are exceeded. Acceptable temperature range is -22° to 140°F (-30 to 60°C).
- **Reset.** To reset after a lock out, press the **Reset Fault** touch screen button on the HMI. This resets power to the module to allow the machine to restart.

Compressor Motor Burnout

Compressor motor burnout can have several causes, including:

- **Low Line Voltage**. A compressor motor is designed to operate within the range of ±10% of its nameplate voltage. Low voltage requires the motor windings to carry more current at the same compressor load. When this current becomes too high or is applied for an extended period, the motor windings overheat, resulting in a failure.
- **Loss of Refrigerant**. The semi-hermetic compressor motor is maintained at proper operating temperature by passing cool suction gas over the motor windings. A loss of refrigerant can cause the winding to overheat, resulting in a failure or burnout.
- **High Head Pressure**. The system is designed to operate at 145 psig (10 bar). Excessive head pressure increases the refrigeration load on the compressor. This increase can cause the windings to overheat, resulting in a failure or burnout.
- **Moisture**. Moisture in contact with refrigerant oil and the presence of heat will form hydrochloric or hydrofluoric acid. The acid will destroy the insulation on the motor windings, causing a short circuit, which can increase motor temperatures in excess of 3,000°F (1,649°C). This extreme temperature will also create a sludge or black residue in the system.
- **Mechanical Failure**. Mechanical failure has been determined to be a major cause of motor burnout. Bearing wear or wipe-out may allow the rotor to drag, overheating the windings and causing a burnout.

Whenever a compressor fails because of a motor burnout, it is important to thoroughly clean the system before replacing the damaged compressor, or a new compressor may also become damaged.

Oil Level Safety

The Bitzer ECOLINE reciprocating compressor used on the HFO5 uses a single-point differential pressure switch, P400 with the P545 Control for oil protection. If oil pressure drops below the manufactures recommended net pressure longer than the recommended lube oil time delay (90 seconds), the machine will shut off. The safety can be reset 100 seconds after being tripped. See Figure 26 and Figure 27 for location on the machine.

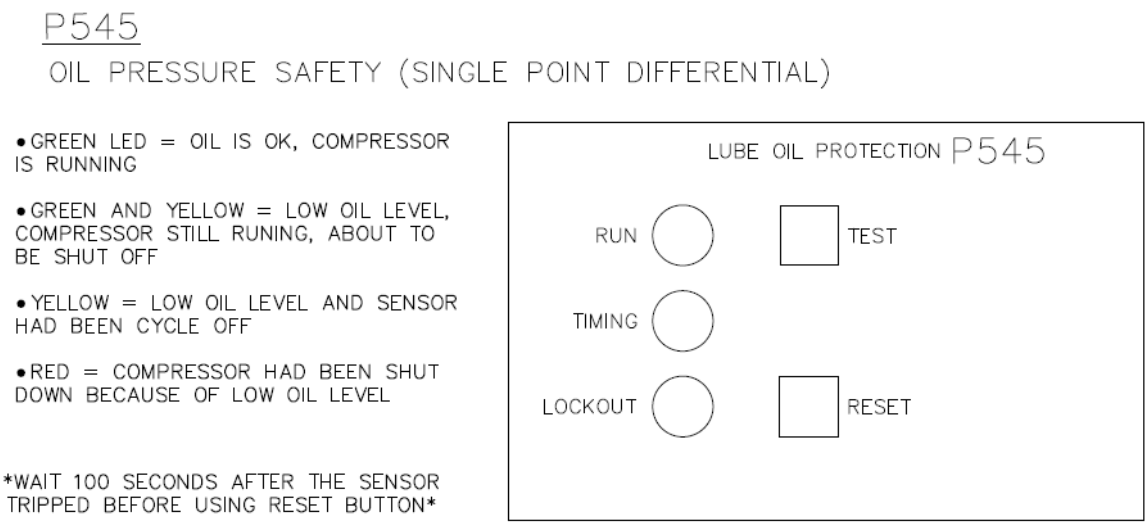


Figure 26: Oil Level Switch

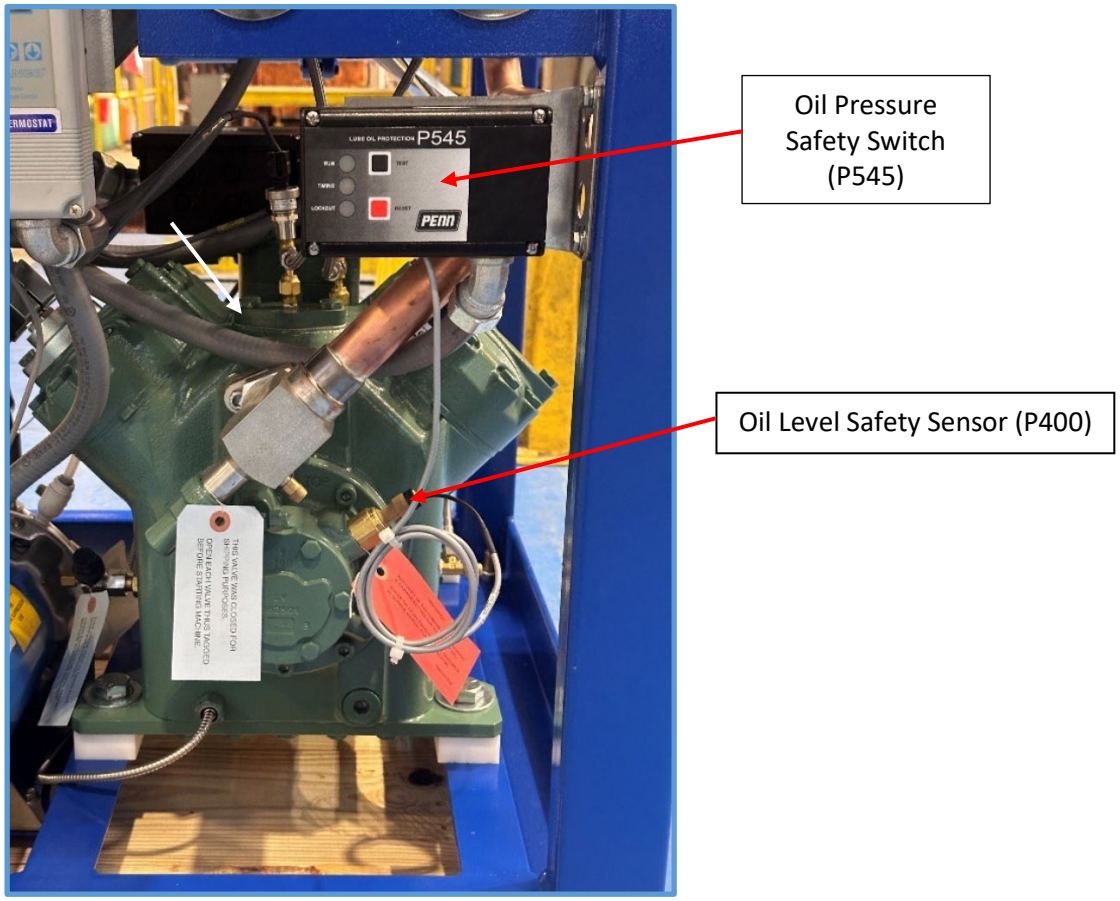


Figure 27: Oil Level Switch Location

Compressor Crankcase Heater (140 Watt)

When electrical power is supplied to terminals L1, L2, and L3 of the control panel, the crankcase heater is energized when the machine is not operating. It is de-energized when the compressor contactor is energized.

In case of a power interruption, or crankcase heater failure, the crankcase heater should be powered on for a minimum of 2 hours before restarting machine manually. See Figure 28 for location on the machine.

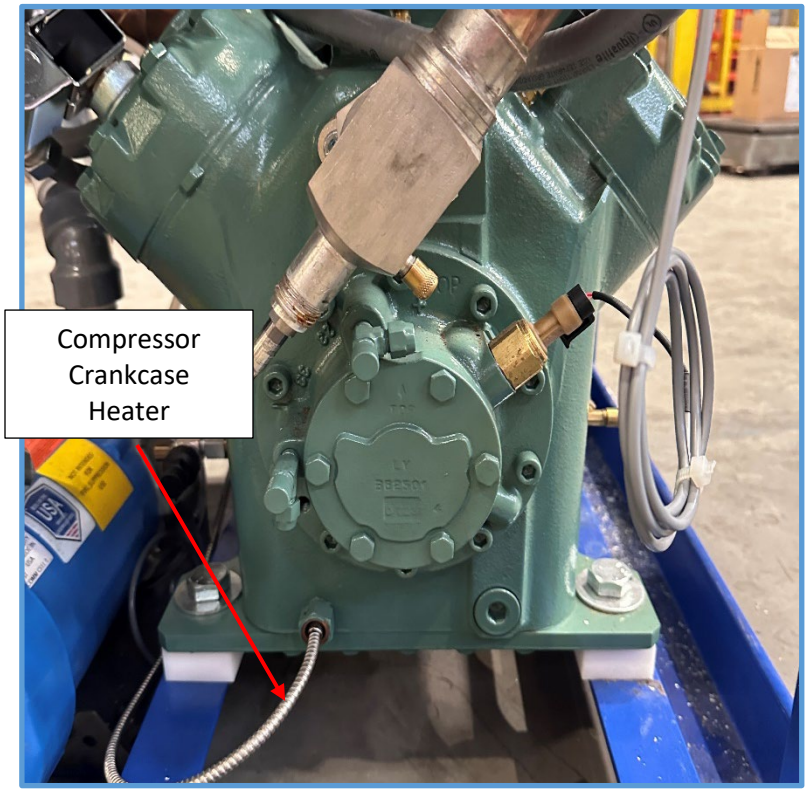


Figure 28: Crankcase Heater Location

Oil Separator

To handle all oil management needs, a helical oil separator is used to separate the oil from the discharge gas and return it to the compressor. Oil may be drained from the separator through the angle valve located on the bottom of the oil separator. If necessary, the oil return float mechanism may be accessed for cleaning or replacement by removing the bottom flange.

Note: Make sure oil is drained and pressure is removed from oil separator before disassembling.

Control Circuit Protection

The electrical control circuit of the machine is protected by a 2-pole, 3A circuit breaker. If the breaker opens, the machine stops immediately. Before opening the panel to reset the breaker, open the disconnect switch to the machine first.

When power is restored to the machine, follow the prompts on the HMI to restart the machine.

Harvest Timer

The **Harvest Timer** governs the length of the ice thawing period.

The **Harvest Timer** is set from the factory for a time that is at least 30 seconds longer than the time required to harvest the entire discharge of ice. Should it become necessary to change the duration of a thawing period, the **Harvest Timer** can be adjusted through the **Quick Setup** submenu from the **Home Screen** of the HMI. After adjustment, verify the new setting is at least 30 seconds longer than the time required for the last piece of ice to be discharged from the machine.

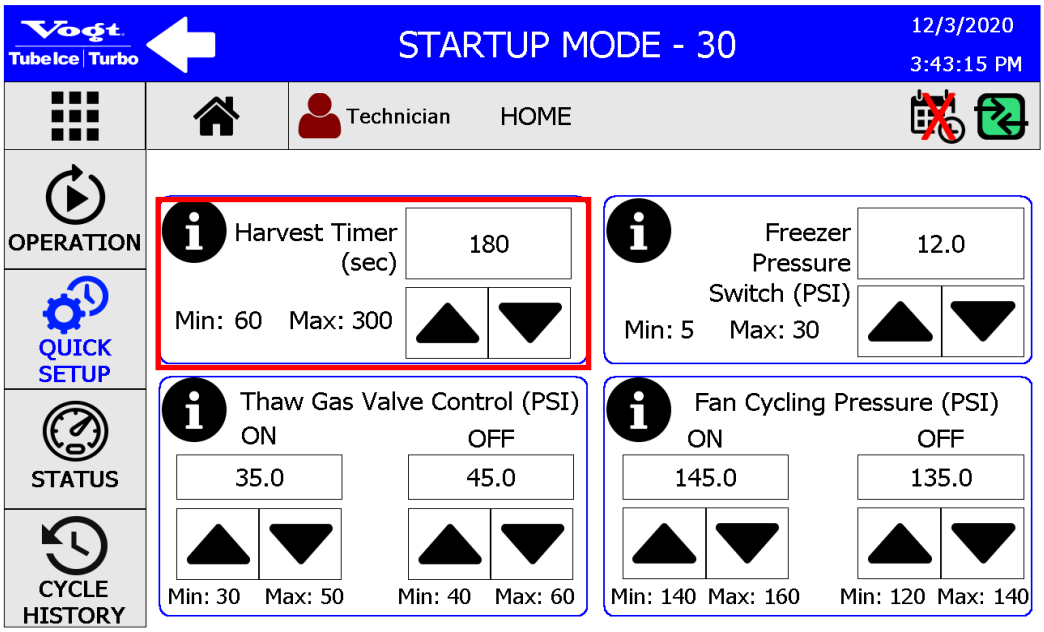


Figure 29: Harvest Timer

Pumpdown

The pumpdown function transfers all the liquid refrigerant from the freezer (evaporator) into the receiver. This function is only performed when the freezer is clear of ice and before or during the following operations:

- Checking the total refrigerant charge
- Performing service or repair work on the machine
- Winterizing the machine
- Preparing the machine for disconnecting and moving
- Before cleaning

To perform a pumpdown, follow these steps:

1. Close the liquid stop valve (king valve) at the receiver during a freeze cycle.
2. Allow the machine to enter into a thawing cycle and empty the freezer of all ice.
3. While in the harvest, open the water tank drain valve partially to allow a continuous flow of warm makeup water into the tank while still maintaining the appropriate water level. An auxiliary supply of warm water (not to exceed 100°F [38°C]) may be used if available.
4. On the touch screen HMI, access the **Troubleshooting** menu from the **Menu** screen.

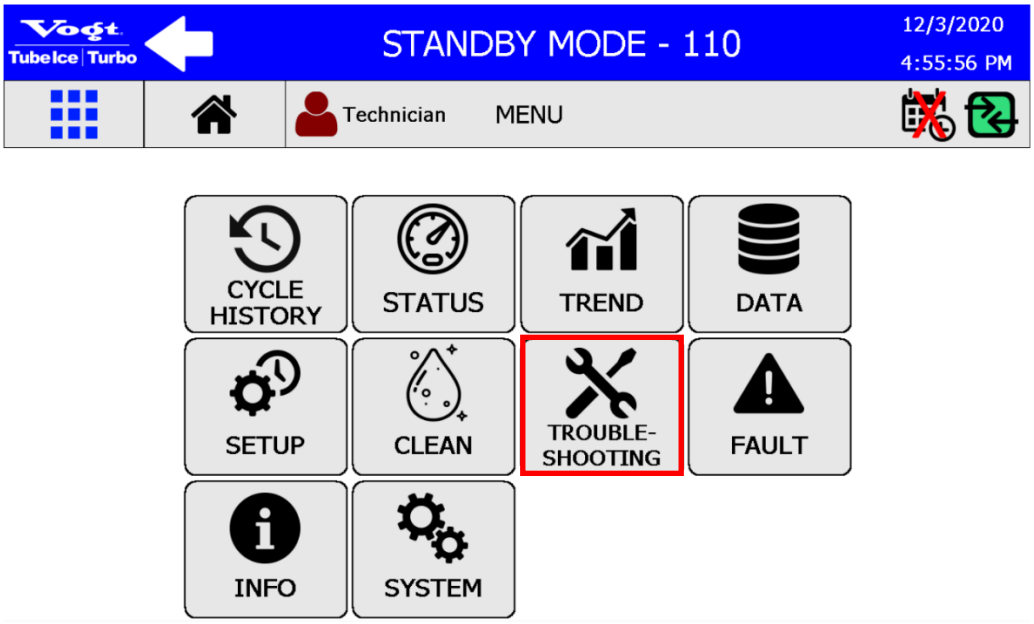


Figure 30: Troubleshooting Icon

5. When the machine begins to enter the next freeze cycle, press the **Pumpdown Mode** touch screen button in the **Troubleshooting** menu.

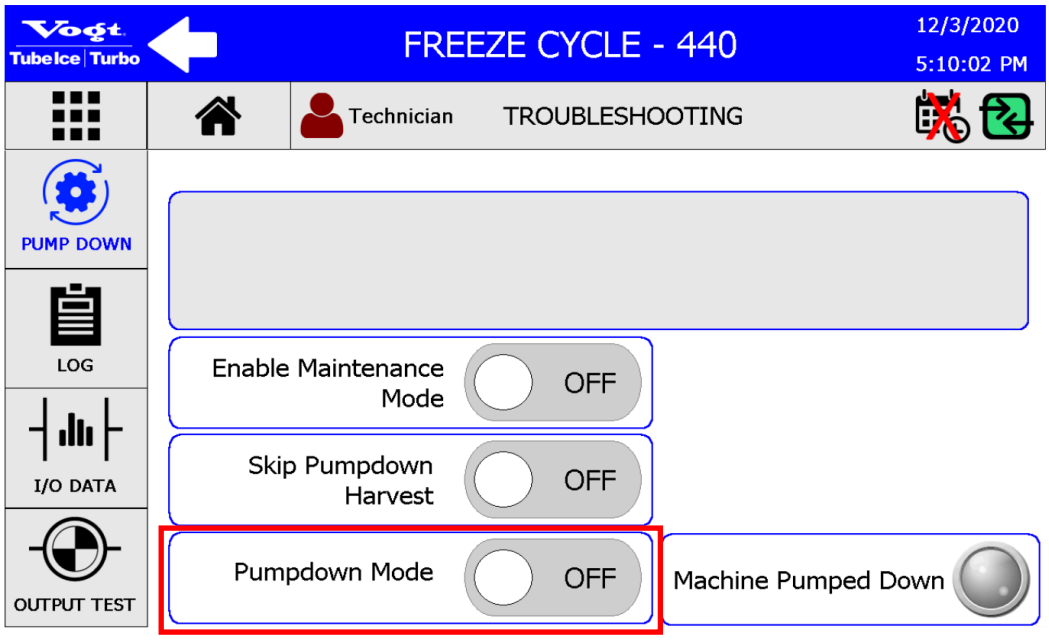


Figure 31: Pumpdown Mode Touch Screen Button

6. Allow the machine to operate until the **Freezer Pressure Switch** reaches the normal setpoint and enters a 60 second **Pumpdown Harvest.**
7. After completion of the **Pumpdown Harvest**, the machine will operate until it reaches 3 psi. The machine will shut off.
8. Close the thawing gas stop valve, the receiver liquid return stop valve, the compressor suction valve, and the compressor discharge valve.

Removing Refrigerant

To transfer the refrigerant charge from the machine into a separate cylinder or tank, proceed as instructed above under *Pumpdown*. This will isolate most of the refrigerant in the receiver, and the refrigerant recovery unit can be connected to the 1/2-in. (DN 15) receiver drain valve connected to the tee below the receiver. The access port of the liquid stop valve (king valve) is at the bottom of the receiver. Open the valve by turning the valve stem out, and operate the refrigerant recovery unit until the system is considered empty.

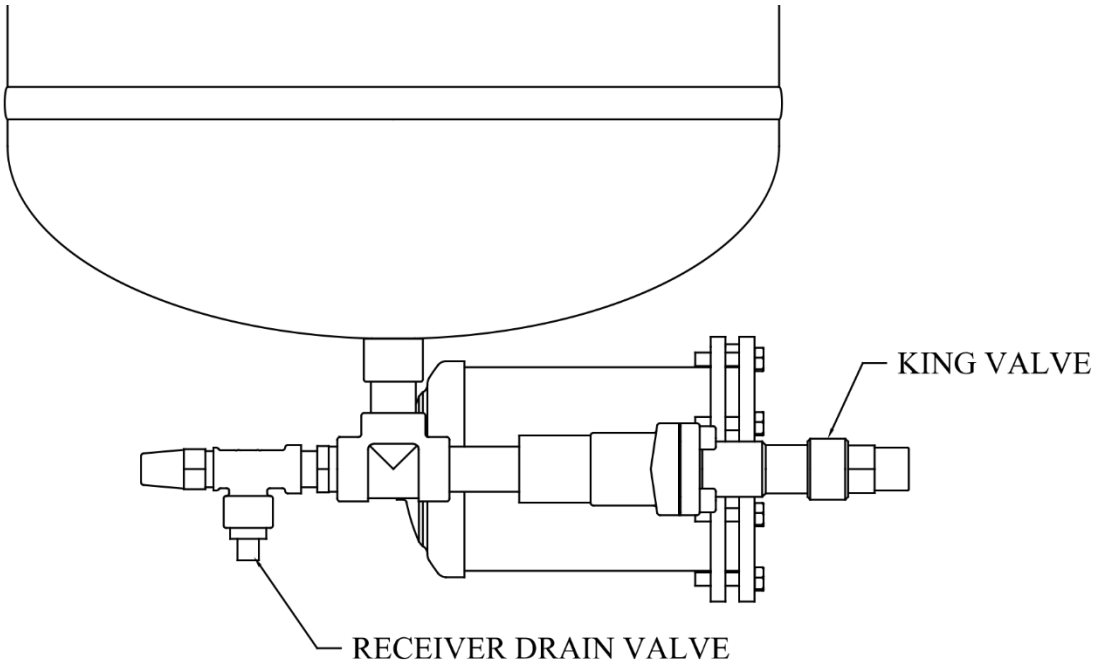


Figure 32: Receiver Drain Valve

Warning: Approved refrigerant recovery equipment, hoses, gauges, and refrigerant containers must be used in compliance with all local and federal regulations. Only qualified personnel should perform refrigerant servicing and recovery processes. Follow these instructions carefully. Severe personal injury can result from improper discharge of refrigerant. It is not recommended to transfer refrigerant from a refrigeration system directly into a cylinder unless this cylinder is an approved, clean cylinder (free of any contaminants or foreign materials). The cylinder must be weighed continuously to assure contents do not exceed the net weight specified by the cylinder manufacturer or any applicable code requirements.

Note: Observe all local codes when handling and discharging refrigerant.

Refrigerant Leaks

It is recommended to complete a leak test after the unit has been in operation for approximately one week. Any noticeable change in operating conditions, other than shown on the Certificate of Test, may indicate a loss of refrigerant due to a leak. Always completely evacuate and recover the refrigerant from the vessel or tubing before repairs are attempted.

Non-Condensable Gases

Air and other non-condensable gases in a refrigeration system are not desirable and can cause unsatisfactory machine performance. Non-condensable gas effects are:

- Higher condensing pressure than what should match the condensed liquid temperature according to a pressure-temperature chart
- Greater electrical power consumption
- Reduced refrigeration capacity
- Longer than normal compressor running time
- Slow ice release
- Long thaw cycle

Air collects mostly in high-pressure condensers, receivers, and other high-pressure components. It is most commonly found in the coolest, lowest-velocity area of these components.

Evaporative condensers usually have purge points at the top of the outlet header of each circuit. Receivers usually have a purge point at the top, away from the inlet, where it is coolest, and the gas velocity is the lowest.

Excessive condensing pressure in water-cooled condensers may also be due to:

- Accumulation of scale in the cooling coil
- Insufficient cooling water
- Excessive water temperature

Solenoid Valves

All solenoid valves are pilot operated with floating-type diaphragms. For satisfactory operation, make sure the manual opening stem is in the automatic position (stem is fully backseated or out). Correct direction of stem rotation is shown on the stem seal nut with an arrow, as shown in Figure 33.

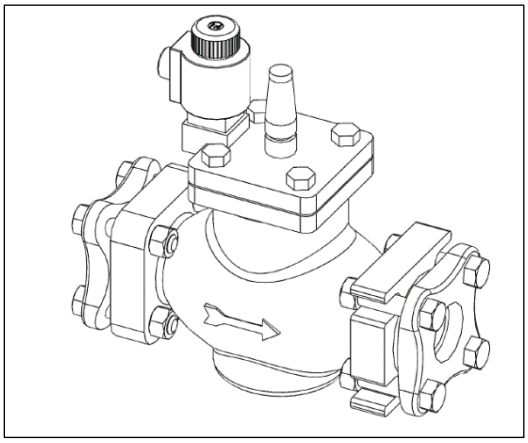


Figure 33: Thaw Gas Solenoid Valve (D Valve)

Table 14 shows replacement part numbers for the thaw gas solenoid valve:

Table 14: Thaw Gas Solenoid Valve (D) Replacement Pats

Part Description	Vogt Part Number
Complete Valve Without Coil	12A4200A1204
Coil	126229 (208/230V, 50/60 Hz)

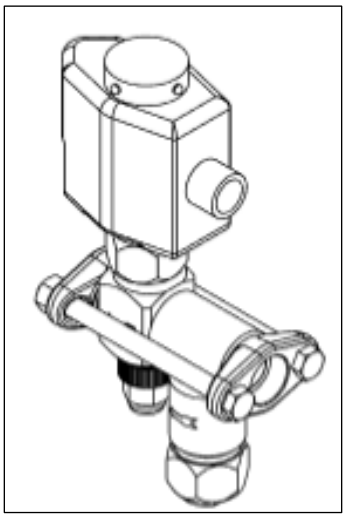


Figure 34: Liquid Line Solenoid Valve (A)

Table 15 shows replacement part numbers for the liquid line solenoid valve (A):

Table 15: Liquid Line Solenoid Valve (A) Replacement Parts

Part Description	Vogt Part Number
Complete Valve w/strainer & 240V Coil	12A4200A0604RS
Coil	126246 (240V, 60 Hz), 126247 (230V, 50 Hz)
Rebuild Kit (Cartridge Assy, Gasket Kit & Solenoid Tube/Plunger Kit)	N/A

Capacity Control Valves (Unloader)

The Bitzer ECOLINE semi-hermetic reciprocating compressor features capacity control solenoids that disable the valves in the head to use only a portion of the compressor's capacity. This reduces the amount of load at which the compressor operates, which allows the ice machine to release all the ice in a timely manner during the harvest period. The solenoids block the flow of suction gas to the compressor head to control capacity., and the amount that it moves. This compressor is set up for stepped capacity of 100% and 50%.

- **100% Loaded Operation (Freeze Period)**—During the freeze period, capacity valve Y4 (100% loaded) is de-energized, which allows the compressor to operate fully loaded.
- **50% Loaded Operation (Harvest Period Only)**—During the harvest period, capacity valve Y4 is energized, to block the flow to the head to unload the compressor.

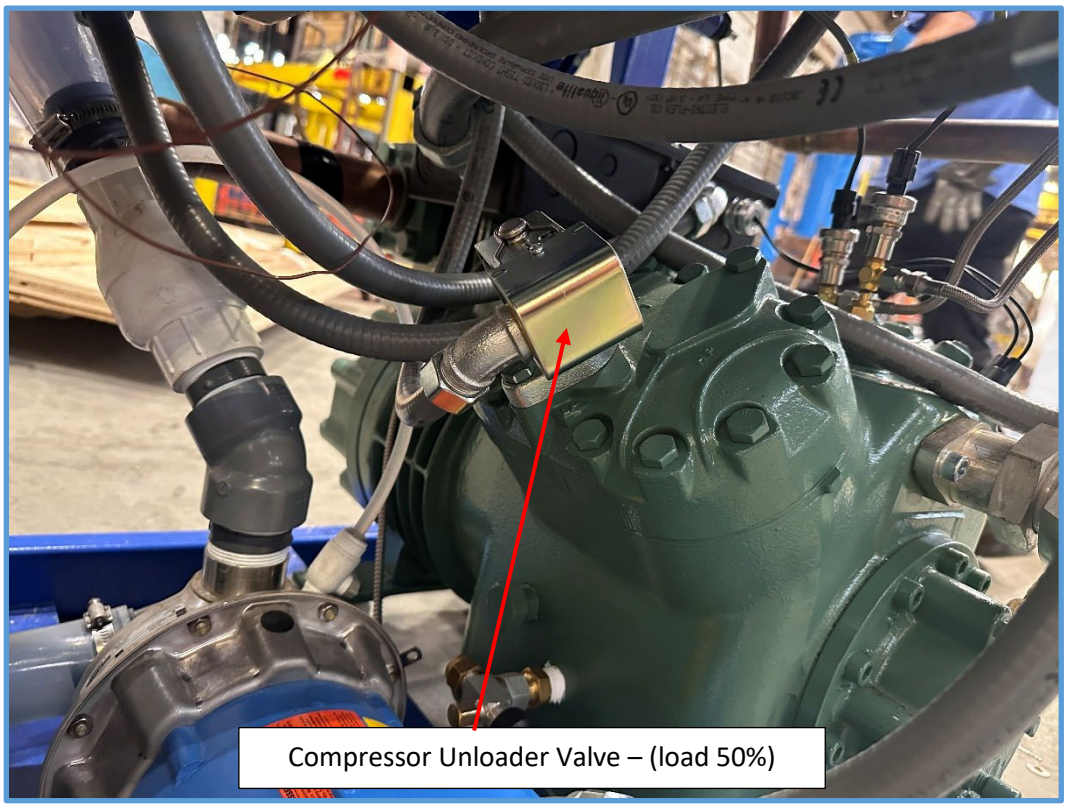


Figure 35**: Bitzer ECOLINE Semi-Hermetic Reciprocating Compressor Capacity Control Valve**

Circulating Water Pump Motor

The motor bearings are pre-lubricated and sealed. They require no further lubrication. The pump should operate with the water level above the impeller housing. The pump also has a mechanical seal that requires no lubrication and is self-adjusting. However, the pump should not be operated unless it is circulating water. The pump manufacturer recommends that a mechanical seal be kept as a spare. When ordering a seal, specify pump size, type, serial number, and manufacturer's name as indicated on the nameplate.

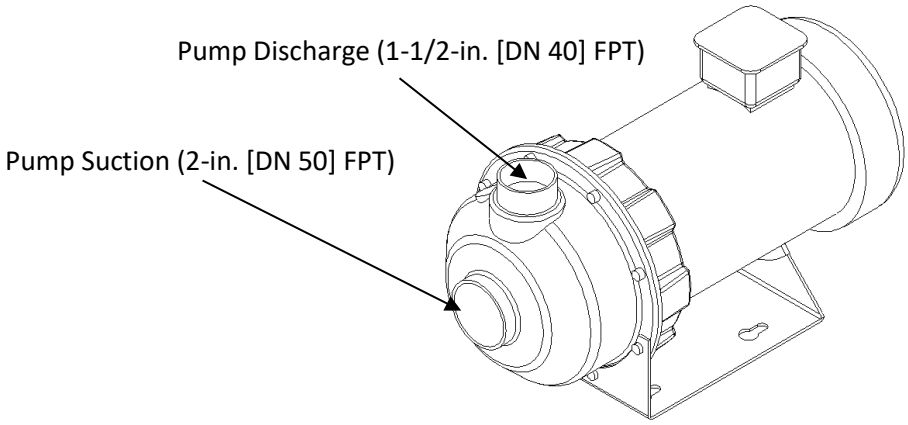


Figure 36: Circulating Water Pump

Table 16 shows replacement part numbers for the water pump and seal kit:

Table 16: Circulating Water Pump Parts

Part Description	Vogt Part Number
Water Pump Seal Kit	12A4080S12
Water Pump, 60 Hz	12A4020G01
Water Pump, 50 Hz	12A4020G08

Cutter Gear Reducer

The oil level for the gear reducer should be level with the plugged opening in the side of the gear housing. If not, this is evidence of a leak. Use food-grade oil and change oil once a year. The motor bearings are pre-lubricated and require no further lubrication.

Gear Reducer (10:1)

Part #: 12A4030R12

Replacement Food-Grade Oil:

- Part #: 19T3020C01
- Texaco Cygnus 220
- Oil Capacity: 8 oz (227 g)

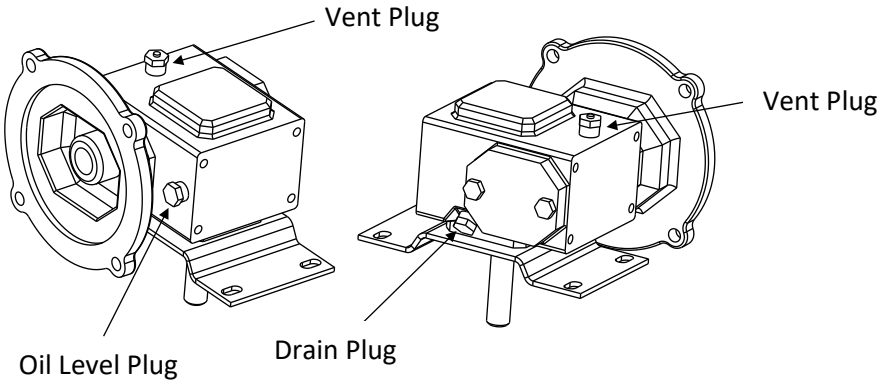


Figure 37: Gear Reducer

Table 17 shows replacement part numbers for the gear reducer and lubricating oil:

Table 17: Gear Reducer Service Parts

Part Description	Vogt Part Number
Gear Reducer, 10:1, Cylinder Ice	12A4030R12
Food-Grade Lubricating Oil (8 Oz [227 g])	19T3020C01

Cutter Motor Replacement

The cutter motor bearings are pre-lubricated and sealed, requiring no further lubrication or maintenance. If the motor requires replacement, follow the steps below:

1. Turn the power off and lock out the disconnect.
2. Check terminals with voltmeter to confirm the power is off.
3. Remove motor terminal cover and disconnect wires. Mark wires for ease of replacement.
4. Remove four cap screws around the motor flange and separate the motor from the reducer. Watch for shaft key that must be reinstalled later. Replacement motor does not come with a new key.
5. Check the motor electrically for shorts to confirm that it is defective.
6. Apply anti-seize lubricant to the shaft of the replacement motor.
7. Position the shaft key in the motor keyway, align it with the reducer keyway, and install the motor. Make sure that the key stays in position as the shaft is inserted.
8. Install the four cap screws to hold the motor in place on the reducer.
9. Connect the wires and install the terminal cover.

10. Check motor rotation to verify that the cutter turns counterclockwise. Reverse two wires at the motor if necessary, to change rotation direction.

Cutter Gear Reducer Removal and Replacement

To remove the gear reducer, follow the steps below (refer to Figure 39):

1. Turn the power off and lock out the disconnect.
2. Remove the motor from the gear reducer.
3. Slightly loosen the 4 bolts and nuts holding the gear reducer in place.
4. Remove the four bolts holding the mounting plate to the water tank gear enclosure and remove the gear reducer and mounting plate from the tank.
5. Measure the distance between the top of the drive gear and the mounting plate for future reference.
6. Remove the three cap screws from the gear and hub and install 2-1/4-in. [57 mm] -20 x 2-in. [51 mm] long cap screws in the threaded holes of the drive gear. These two screws can be used as jacking bolts to remove the gear from the taper split hub.
7. The split hub is removed by placing a screwdriver in the split and sliding the hub off the shaft.
8. The new gear reducer is installed by reversing the removal procedure.
9. Check that the gear and hub are properly positioned on the shaft. The driver and cutter ring gears must mesh completely along the gear thickness as installed in the machine.
10. Adjust the final gear mesh so that only a slight amount of play exists between the drive gear and the ring gear.
11. Check that all bolts are tightened securely and that there is no excessive gear noise when the cutter motor is running.

Water Tank Removal

To remove the water tank from the machine, follow the steps below:

1. Turn off and lock out power to the machine.
2. Turn off water supply and disconnect lines from the tank.
3. Drain the tank and disconnect pump suction tube and drain line tubing and water lines.
4. Disconnect the ice discharge chute if installed.
5. Loosen water tank clamp that couples the plastic tank to the cutter housing assembly.
6. The tank can then be removed from the side of the machine where the float valve is installed.

Cutter and Bearing Removal and Reinstallation

Follow the steps below. Refer to Figure 38 and Figure 39.

1. Turn off the power and lock out the disconnect.
2. Remove the cutter motor from the reducer.
3. Remove the water tank from the machine.
4. With a 1/4-in. (8 mm) or smaller punch, reach into the ice discharge opening and drive the spiral pin out of the disc assembly. Push or drive the disc off the shaft.
5. Lift the cutter assembly out of the bearing surface of the cutter. The surface should be smooth and free of nicks or burrs.
6. Inspect the bearing for wear. No side movement between the shaft and bearing should exist. The bearing thrust flange should be no thinner than 3/16 in. (5 mm). Replace if worn.
7. Before removing the bearing, reference mark the location of the cutter support arms on the side of the tank. The cutter support orientation is specific to the tank.
8. Loosen and remove the three cap screws from the cutter support ends and lift the support out of the water tank.

9. Drive out the 3/16-in. (5-mm) pin located in the side of the cutter support hub that holds the bearing in place.
10. Push the bearing out of the cutter support hub.

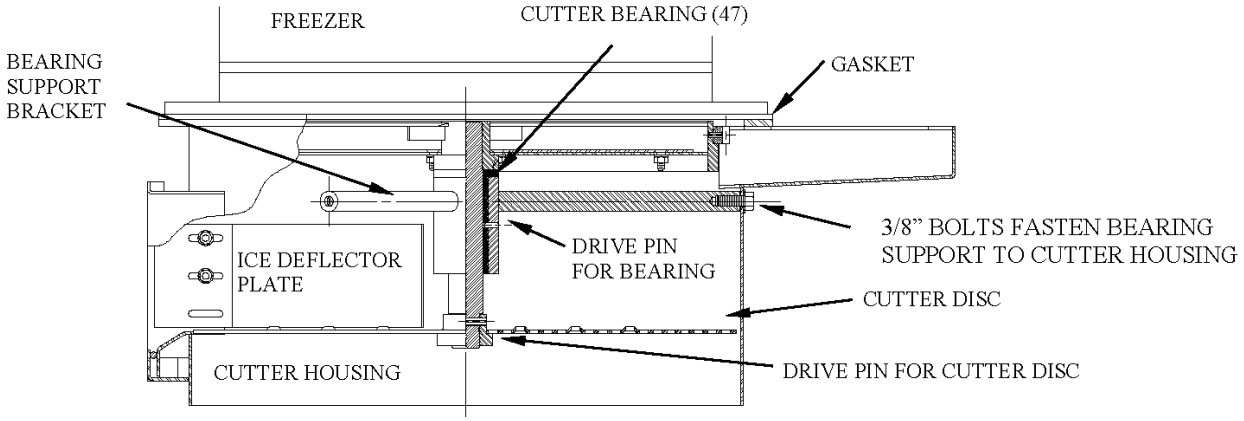


Figure 38: Cutter Assembly

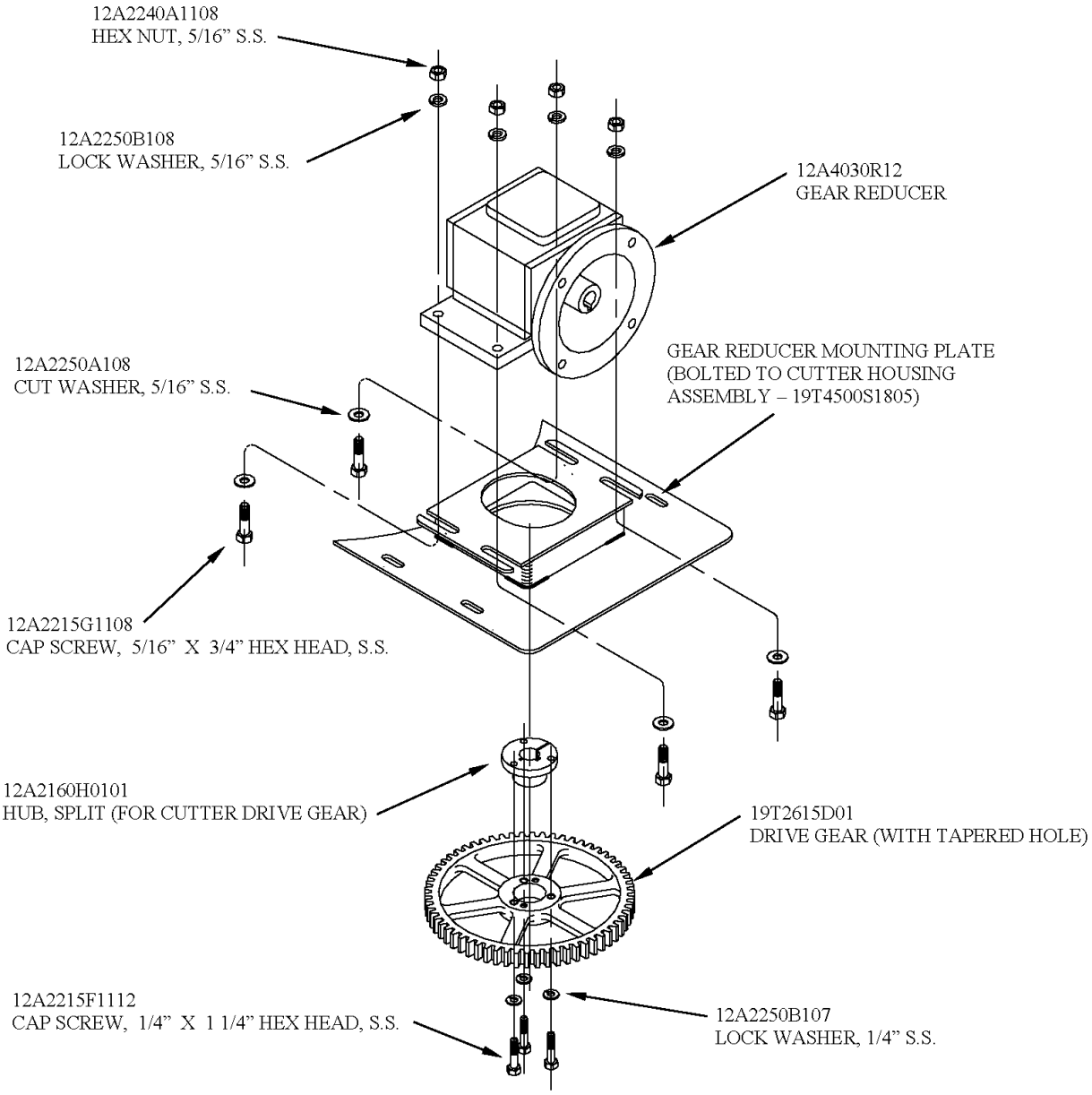


Figure 39: Cutter Drive Parts

To re-install the breaker cutter and bearing, follow steps 1-8 below:

1. Push the new bearing into the cutter support hub.
2. Using the pin hole in the side of the cutter support hub as a guide, drill a 3/16-in. (5-mm) hole through the wall of the bearing.
3. Drive in the 3/16-in. (5-mm) pin through the drilled hole until it is flush with the outside wall of the cutter support hub. Check that the pin does not extend into the surface inner diameter (ID) of the bearing.
4. Slide the new bearing and cutter support onto the cutter shaft and check that it spins freely. If the fit is tight, carefully ream the inner surface (ID) of the bearing until it turns freely.
5. Install the bearing support in the water tank, using the reference marks you made as a guide.

6. Slide the cutter and shaft into the bearing and check the cutter alignment. Lay a straight edge across the top flange of the tank and verify that the clearance between the rim of the cutter and the top of the tank flange is between 0 and 1/16 in. (2 mm). Loosen the bearing support cap screws and move the support arms up or down to achieve proper alignment.
7. Tighten the support screws securely and reinstall the cutter and cutter disc.
8. Install the tank and other parts, reversing the procedure of removal.

Crushed Ice Production

The HFO5 is available to make crushed ice with an option crushed ice cutter.

Appendix A Optional Accessories

The following sections describe the optional accessories available.

Power Monitor, Wagner Model DTP-3

All Vogt Tube-Ice® machine models are available from the factory with a three-phase line voltage power monitor, incorporating an LCD display, called the DTP-3, as shown in Figure 40. The units are also available for aftermarket or retrofit installation. These units monitor line voltage inputs from 190 to 610 volts and provide protection against line voltage variances, which can damage or destroy the compressor motor.

Features include:

- Non-volatile system memory to retain settings when power is lost.

If the machine is ordered with this option, the power monitor can be factory set to customer specifications. The Vogt part number for a power monitor retrofit kit is 12A7700K01.

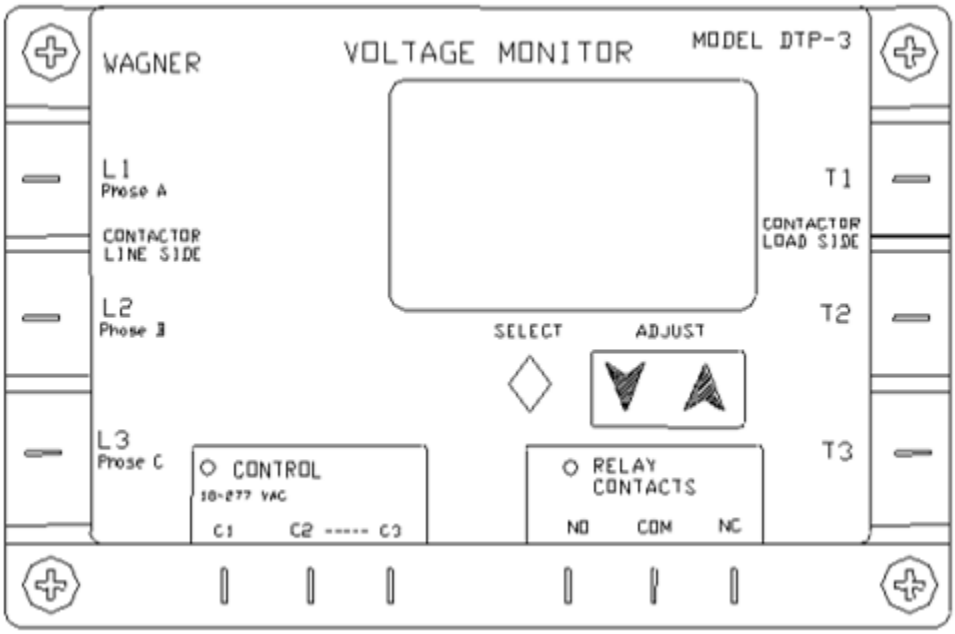


Figure 40: Power Monitor (Voltage Monitor)

The Display

The display normally shows phase A to B, phase B to C, and C to A line voltages. If the unit is on a timer, that timer will be displayed. The timer display may be switched off by pressing **SELECT**. The LCD will then display the normal A-B, B-C, C-A line voltage pairs.

Pressing **SELECT** once shows the contactor load side voltages (if the load side option is connected). The display automatically returns to the display of line side voltage after a few seconds.

Press **SELECT** to step through the parameters, as shown in Table 18. The selected parameter will flash. Use the up and down arrow keys to select the desired operating value.

Table 18: Power Monitor Parameters

Parameter (Description, units)	Min.	Max.	Default	Recommended Settings
Line Side Voltage (Nominal Voltage, volts)	90	650	208	Supply voltage
Over Voltage (tolerance, %)	6	18	12	10
Under Voltage (tolerance, %)	6	18	12	10
Phase Unbalance (%)	2	25	6	5
Lockout Time (Delay on Break, seconds)	0.1	25	0.5	120
Delay Time (Delay on Make, seconds)	0	30	0	0
Response Time (Delay on Fault, seconds)	0.1	20	2	2
Control Mode (none)	Off / Auto / On		Auto	On
Contactor Test (Volt Diff)	OFF	5	OFF	OFF

Adjustment of Parameters in Order of Display

The following describes how to adjust the power monitor parameters in order of display if adjustment is needed.

- **Line Voltage**—This gives an active display of the line voltage to the machine. By default, this is the normal display.
- **Load Side Voltage**—If connected, this provides an active display of the load side voltage in the machine.
- **Voltage Setpoint** (VAC Flashes)—Press the UP and DOWN arrows. This may be set to the normal operating voltage of the device being protected. Adjustment increments are 1 volt.
- **Under/Over Voltage Tolerance** (UNDERVOLTAGE/OVERVOLTAGE Flashes)—Press the UP and DOWN arrows. The tolerance is displayed in percentages.
- **Imbalance Voltage Tolerance** (% IMBALANCE Flashes)—This value may be adjusted by pressing the UP and DOWN arrows.
- **Lockout Time** (SECONDS Flashes)—This value may be adjusted by pressing the UP and DOWN arrows. This is the delay-on-break timer value.
- **Delay Time** (RESP. SECONDS Flashes)—This display shows time in seconds and tenths of seconds. This value may be adjusted by pressing the UP and DOWN arrows. This is the time that a fault is allowed before shutdown occurs.
- **Control Mode** (ON OFF AUTO Flashes)—This value may be adjusted to OFF (load will not turn on), ON (load will turn on whenever no faults exist and timers are finished), and AUTO (load will turn on when a control input is active).
- **Contactor Fault Monitor Mode** (CONTACTOR FAULT Flashes)—This option allows for monitoring of the contactor and provides lock-out if the line voltage and load side voltage vary by more than five (5) volts. Pressing the UP or DOWN arrow will toggle between OFF (default) and ON. The load side of the contactor must be connected to the load terminals of the power monitor to use this option.
- **Display of Fault Memories** (MEM Flashes)—Pressing UP or DOWN arrow displays the last fault conditions that shut down the machine. The first 25 faults are recorded. The top number displayed represents the fault memory. The middle number represents the total number of faults that have occurred since the fault memory was cleared. To clear the memory, press and hold both the UP and DOWN arrows until the display is cleared.

Notes

- If the SELECT button is pressed and no parameters are changed by pressing the UP or DOWN arrow keys, the DTP-3 will automatically return to a display showing the line voltage.
- New settings are saved in permanent memory when the display returns to showing the line voltage. New settings may be verified by pressing the SELECT button to scroll through the parameters.
- To prevent tripping on a one (1) volt change, the DTP-3 automatically calculates cut-in voltages for the return from undervoltage conditions. The cut-out out voltage is always based on user voltage and tolerance settings, while the cut-in voltage is 3% closer to the nominal voltage setting. This quality is referred to as hysteresis. This is to help reduce oscillation that may occur on a weak power distribution system. When the load is switched off due to undervoltage, the line voltage will increase. Without hysteresis, the monitor would switch the load back on, the line voltage would again drop, and cause continuous on-off-on cycling.

Appendix B Tables

Table 19: HFO5 Specifications (208/230V, 3-phase, 60 Hz)

Nominal Capacity[1]		lb/day (kg/day)	10,000 (3,175)
Overall Dimensions (L x W x H)		in. (cm)	64 x 41 x 94 (1626 x 1041 x 2388)
Shipping Weight		lb (kg)	3,300 (1,497)
Operating Weight		lb (kg)	2,975 (1,349)
Refrigerant Charge (R-513A)		lb (kg)	308 (140)
Total FLA Water Cooled[2]	60 Hz	Amps	99.7
Total FLA Air Cooled[2]	60 Hz	Amps	113.7
Maximum Fuse	60 Hz (WC/AC)	Amps	220/230
Minimum Ampacity	60 Hz (WC/AC)	Amps	122.8/136.8
Water Requirements			
-makeup[3]		gpm (LPM)	1 (3.78)
-condenser[4]		gpm (LPM)	53 (200.3)
Connection Sizes			
-makeup water		MPT in. (DN mm)	1/2 (15)
-tank drain		FPT in. (DN mm)	1 (25)
-condenser water inlet (standard)		FPT in. (DN mm)	1-1/4 (32)
-condenser water outlet (standard)		FPT in. (DN mm)	2 (50)
-AC condenser inlet		ODC in. (mm)	1-3/8 (35)
-AC condenser outlet		ODC in. (mm)	1-1/8 (28)
Compressor	60 Hz	HP/RLA/LRA [6]	18/92.4/352
Water Pump	60 Hz	HP/FLA	1.5/4.8
Cutter Motor	60 Hz	HP/FLA	0.5/1.9
THR		BTU/hr	170,000
Bohn Air-Cooled Condenser[5]			BNHS02A017
- # of Fans / HP			2/1.5
- electrical data		total KW/FLA	2.2/7
-inlet connection		ODC in. (mm)	2-1/8 (54)
-outlet connection		ODC in. (mm)	2-1/8 (54)
-shipping weight		lb (kg)	750 (340)
-operating weight		lb (kg)	680 (308)

(1) Nominal capacity is based on 70°F (21°C) makeup water, 100°F (38°C) condensing temperature, 70°F (21°C) amb, and 0% blowdown.

(2) FLA for 460-volt models is approximately .5x that of 208/230-volt models. Total FLA does not include cooling tower.

(3) Makeup water is maximum value and includes 5 gallons (19 liters) per cycle blowdown.

(4) Condenser flow rate is for 85°F (29°C) entering water temperature and 95°F (35°C) condensing.

(5) Recommended air-cooled condenser is based on 15°F (8°C) TD.

(6) RLA=MCC/1.56

Vogt reserves the right to change designs and specifications without notice.

Table 20: HFO5 Capacity Chart, 50/60 Hz

Makeup Water Temp. (°F)	Rated Capacity (lb/day)						Makeup Water Temp. (°F)	Rated Capacity (lb/day)					
	Cylinder			Crushed				Cylinder			Crushed		
	1 in.	1-1/4 in.	1-1/2 in.	1 in.	1-1/4 in.	1-1/2 in.		1 in.	1-1/4 in.	1-1/2 in.	1 in.	1-1/4 in.	1-1/2 in.
40	21700	19100	17600	N/A	19864	18304	**60**	20600	18400	16900	N/A	19136	17576
41	21660	19080	17580	N/A	19843	18283	**61**	20540	18360	16860	N/A	19094	17534
42	21620	19060	17560	N/A	19822	18262	**62**	20480	18320	16820	N/A	19053	17493
43	21580	19040	17540	N/A	19802	18242	**63**	20420	18280	16780	N/A	19011	17451
44	21540	19020	17520	N/A	19781	18221	**64**	20360	18240	16740	N/A	18970	17410
45	21500	19000	17500	N/A	19760	18200	**65**	20300	18200	16700	N/A	18928	17368
46	21440	18960	17460	N/A	19718	18158	**66**	20240	18160	16660	N/A	18886	17326
47	21380	18920	17420	N/A	19677	18117	**67**	20180	18120	16620	N/A	18845	17285
48	21320	18880	17380	N/A	19635	18075	**68**	20120	18080	16580	N/A	18803	17243
49	21260	18840	17340	N/A	19594	18034	**69**	20060	18040	16540	N/A	18762	17202
40	21700	19100	17600	N/A	19864	18304	**70**	20000	18000	16500	N/A	18720	17160
41	21660	19080	17580	N/A	19843	18283	**71**	19830	17850	16350	N/A	18564	17004
42	21620	19060	17560	N/A	19822	18262	**72**	19660	17700	16200	N/A	18408	16848
43	21580	19040	17540	N/A	19802	18242	**73**	19490	17550	16050	N/A	18252	16692
44	21540	19020	17520	N/A	19781	18221	**74**	19320	17400	15900	N/A	18096	16536
45	21500	19000	17500	N/A	19760	18200	**75**	19150	17250	15750	N/A	17940	16380
46	21440	18960	17460	N/A	19718	18158	**76**	18980	17100	15600	N/A	17784	16224
47	21380	18920	17420	N/A	19677	18117	**77**	18810	16950	15450	N/A	17628	16068
48	21320	18880	17380	N/A	19635	18075	**78**	18640	16800	15300	N/A	17472	15912
49	21260	18840	17340	N/A	19594	18034	**79**	18470	16650	15150	N/A	17316	15756
50	21200	18800	17300	N/A	19552	17992	**80**	18300	16500	15000	N/A	17160	15600
51	21140	18760	17260	N/A	19510	17950	**81**	18130	16340	14850	N/A	16994	15444
52	21080	18720	17220	N/A	19469	17909	**82**	17960	16180	14700	N/A	16827	15288
53	21020	18680	17180	N/A	19427	17867	**83**	17790	16020	14550	N/A	16661	15132
54	20960	18640	17140	N/A	19386	17826	**84**	17620	15860	14400	N/A	16494	14976
55	20900	18600	17100	N/A	19344	17784	**85**	17450	15700	14250	N/A	16328	14820
56	20840	18560	17060	N/A	19302	17742	**86**	17280	15540	14100	N/A	16162	14664
57	20780	18520	17020	N/A	19261	17701	**87**	17110	15380	13950	N/A	15995	14508
58	20720	18480	16980	N/A	19219	17659	**88**	16940	15220	13800	N/A	15829	14352
59	20660	18440	16940	N/A	19178	17618	**89**	16770	15060	13650	N/A	15662	14196
							90	16600	14900	13500	N/A	15496	14040

- Capacity rating based on 70ºF ambient conditions, 100°F SDT temperature.
- Capacity rating is average for the model. Individual machines may vary up to 5% above or below.
- Capacity rating is for clear ice production with makeup water containing no more than 200 ppm total dissolved solids.

Table 21: Condenser Water Usage

Condensing	Entering Water	Leaving Water	Water Flow	Pressure Drop	Average Total Heat
Temp. °F	Temp. °F	Temp. °F	gpm		of Rejection
100	50	92	8	1	170,000
100	55	92	9	1	170,000
100	60	92	11	1	170,000
100	65	92	13	1	170,000
100	70	93	15	1	170,000
100	75	93	19	1	170,000
100	80	94	25	2	170,000
100	85	94	37	5	170,000
105	90	95	68	15	170,000
110	95	100	68	15	170,000

Table 22: Makeup Water Usage (GPM)

	Cylinder Ice			Crushed Ice		
Make-Up Water	Tube Size			Tube Size		
Temp. °F (°C)	1”	1 1/4”	1 1/2”	1”	1 1/4”	1 1/2”
40 (4)	1.15	1.1	1.09	1.19	1.15	1.14
50 (10)	1.1	1.05	1.04	1.14	1.09	1.09
60 (16)	1.04	0.99	0.98	1.08	1.02	1.02
70 (21)	1	0.94	0.93	1.03	0.98	0.97
80 (27)	0.94	0.89	0.88	0.98	0.92	0.92
90 (32)	0.9	0.84	0.83	0.94	0.88	0.87

Table 23: HFO5 Normal Acceptable Ranges, English Units

Tube Size	*Cylinder Ice*				Defrost Press Switch Setting DPS		*Air cooled*		*Water Cooled*		Harvest		Low		High	
	Ice Weight / Cycle		Harvest Pressure				Discharge Pressure		Discharge Pressure *Regulator Setting*		Time * (30 sec>ice out)		Pressure Safety Cutout		Pressure Safety Cutout	
	(lbs)		*(Psig)*				*(Psig)*		*(Psig)*		*(Min)*		*(Psig)*		*(Psig)*	
	Min	***Max***	***Min***	***Max***	***Close***	***Open***	***Min***	***Max***	***Min***	***Max***	***Min***	***Max***	***Cut-Out***	***Cut-In***	***Cut-Out***	***Cut-In***
HFO5- 1	136	148	15	17	42	35	130	155	130	145	2.0	3.0	5	20	200	175
HFO5-1 1/4	146	158	10	12	42	35	130	155	130	145	2.0	3.0	5	20	200	175
HFO5-1 1/2	148	158	7	9	42	35	130	155	130	145	2.0	3.0	5	20	200	175

Table 24: HFO5 Spare Parts List

	Item	Vogt Part No.	Description	Qty.
Cutter Tank Parts	Water Pump	12A4020G01	Water pump, 1 1/2HP, 3-phase	1
	Cutter motor	12A2900M0508	Cutter motor, 1/2 hp, 3-phase	1
	Gear Reducer	12A4030R12	Grove, 10:1 gear reducer	1
	Makeup water float valve	12A4200H0402	Float valve, 1/2-in. (13 mm) MPT locknut & gasket, lead free brass	2
	Water distributor set	12B2185N31	Water distributor, 1 1/2-in. (38 mm) tubes	72
		12B2185N21	Water distributor, 1 1/4-in. (32 mm) tubes	102
		12B2185N11	Water distributor, 1-in. (25 mm) tubes	156
	Freezer cover gasket	12A2600G15	Gasket, gum rubber, freezer cover	1
	Cutter housing gasket (freezer flange to cutter tank)	12A2600G05	Gasket, cutter housing	1
	Water tank gasket (cutter assembled to tank)	12A2600G17	Gasket, gum rubber, water tank	1
	Water tank ice discharge splash curtain	12A4078C04	Splash curtain	1
Refrigeration Parts	Refrigerant float switch (electrical switch only)	12A7500E24	Refrigerant float switch, electrical switch only	1
	Suction gauge (150 psi) (10 bar)	12D2590G14	Gauge, 2.5-in. (64 mm), Liquid filled, 30-in. (76.2 cm) - 150 psi	1
	Discharge gauge (300 psi) (20 bar)	12D2590G15	Gauge, 2.5-in. (64 mm), Liquid filled, 30-in. (76.2 cm) - 150 psi	1
	Liquid line solenoid valve (A)	12A4200A0604RS	Valve, with 230V coil	1
	Thaw gas valve	12A4200A1204	Valve. Less coil	1
	Thaw gas valve coil	126229	Coil, 208-240V	1
	Condenser Water regulating valve	12A4200E1001	Valve, condenser water regulating 1-1/4”	1
	Condenser Fan Motor Contactor	12A7516E25	Contactor, 16A, 3 Pole, 1 N.O. Aux, 208/240 V Coil	1
	Condenser Fan Motor Starter	12A7530E58UL	Manual Motor Starter, 10-16.0 A	1
Compressor Parts	Oil Pressure Safety	12A2117A09	Oil Pressure Safety Control, P545, Single Point Diff.	1
		12A2117A09S	Oil Pressure Switch Sensor, P400	1
	Unloader coil	12A2110P0503	Coil, Unloader, 230V, 17W	1
	Crankcase Heater - 230V	12A7509E22	Crankcase Heater, 220V, 140W	1
	Unloader Stem	12A2110P0513	Unloader Stem Bitzer #347691	
	Compressor	12A2110Z07	Compressor, Reciprocating, 18 HP	1

Table 25: Temperature – Pressure Chart for R-513A

Deg (°F)	Sat Liq P (psig)	Sat Vap P (psig)		Deg (°F)	Sat Liq P (psig)	Sat Vap P (psig)		Deg (°F)	Sat Liq P	Sat Vap P		Deg (°F)	Sat Liq P	Sat Vap P
-40	-5.9	-6		**25**	26	26		**66**	71.3	71.3		**107**	147.1	147.1
-35	-4.6	-4.7		**26**	26.8	26.8		**67**	72.7	72.7		**108**	149.4	149.4
-30	-3.1	-3.2		**27**	27.6	27.6		**68**	74.2	74.2		**109**	151.8	151.8
-25	-1.5	-1.6		**28**	28.5	28.4		**69**	75.7	75.7		**110**	154.1	154.1
-20	0.2	0.1		**29**	29.3	29.3		**70**	77.2	77.2		**111**	156.5	156.5
-15	2.2	2.1		**30**	30.2	30.2		**71**	78.7	78.7		**112**	159	158.9
-10	4.3	4.3		**31**	31.1	31.1		**72**	80.2	80.2		**113**	161.4	161.4
-9	4.8	4.7		**32**	32	32		**73**	81.8	81.8		**114**	163.9	163.8
-8	5.2	5.2		**33**	32.9	32.9		**74**	83.4	83.4		**115**	166.4	166.3
-7	5.7	5.6		**34**	33.8	33.8		**75**	85	85		**116**	168.9	168.9
-6	6.2	6.1		**35**	34.8	34.7		**76**	86.6	86.6		**117**	171.4	171.4
-5	6.7	6.6		**36**	35.7	35.7		**77**	88.2	88.2		**118**	174	174
-4	7.2	7.1		**37**	36.7	36.6		**78**	89.9	89.9		**119**	176.6	176.6
-3	7.7	7.6		**38**	37.7	37.6		**79**	91.5	91.5		**120**	179.3	179.2
-2	8.2	8.1		**39**	38.6	38.6		**80**	93.2	93.2		**121**	181.9	181.9
-1	8.7	8.7		**40**	39.7	39.6		**81**	94.9	94.9		**122**	184.6	184.6
0	9.3	9.2		**41**	40.7	40.7		**82**	96.7	96.7		**123**	187.3	187.3
1	9.8	9.7		**42**	41.7	41.7		**83**	98.4	98.4		**124**	190	190
2	10.4	10.3		**43**	42.8	42.7		**84**	100.2	100.2		**125**	192.8	192.8
3	10.9	10.9		**44**	43.8	43.8		**85**	102	102		**126**	195.6	195.6
4	11.5	11.4		**45**	44.9	44.9		**86**	103.8	103.8		**127**	198.4	198.4
5	12.1	12		**46**	46	46		**87**	105.7	105.7		**128**	201.3	201.2
6	12.7	12.6		**47**	47.1	47.1		**88**	107.5	107.5		**129**	204.2	204.1
7	13.3	13.2		**48**	48.2	48.2		**89**	109.4	109.4		**130**	207.1	207
8	13.9	13.8		**49**	49.4	49.4		**90**	111.3	111.3		**131**	210	209.9
9	14.5	14.4		**50**	50.5	50.5		**91**	113.2	113.2		**132**	213	212.9
10	15.1	15.1		**51**	51.7	51.7		**92**	115.2	115.2		**133**	216	215.9
11	15.8	15.7		**52**	52.9	52.9		**93**	117.1	117.1		**134**	219	218.9
12	16.4	16.4		**53**	54.1	54.1		**94**	119.1	119.1		**135**	222.1	222
13	17.1	17.1		**54**	55.3	55.3		**95**	121.1	121.1		**140**	237.8	237.7
14	17.8	17.7		**55**	56.6	56.5		**96**	123.2	123.2		**145**	254.3	254.2
15	18.5	18.4		**56**	57.8	57.8		**97**	125.2	125.2		**150**	271.6	271.5
16	19.2	19.1		**57**	59.1	59.1		**98**	127.3	127.3				
17	19.9	19.8		**58**	60.4	60.4		**99**	129.4	129.4				
18	20.6	20.6		**59**	61.7	61.7		**100**	131.5	131.5				
19	21.3	21.3		**60**	63	63		**101**	133.7	133.7				
20	22.1	22		**61**	64.3	64.3		**102**	135.9	135.9				
21	22.8	22.8		**62**	65.7	65.7		**103**	138.1	138.1				
22	23.6	23.6		**63**	67.1	67.1		**104**	140.3	140.3				
23	24.4	24.4		**64**	68.5	68.5		**105**	142.5	142.5				
24	25.2	25.1		**65**	69.9	69.9		**106**	144.8	144.8				

Table 26: Constants

Specific Heat of Water	1 BTU/(lbm °F) 1 calorie/gram °C
Specific Heat of Air	4.19 Kj/(kg °C) 0.24 BTU/(lbm °F)
Tube-Ice Density	32-35 lb/ft^3 0.51-0.56 gm/cm3
Ice Latent Heat	144 BTU/hr (42 watts/hr)
Water Sensible Heat	1 BTU/(lb °F) (4,182 Joules/kg °C)
Ice Melting Effect **1 Ton Refrigeration**	12,000 BTU/hr (3.5 kw/hr)
Atmospheric Pressure	14.7 psia (760 mmHg)
Weight of Water	62.4 lb/ft^3 1,000 kg/m^3 8.33 lb/gal
1 gpm Water **3.79 L/min**	12,013 lb/day 5,449 kg/day
Weight of Air	0.0749 lb/ft^3 (0.0100 lb/gal)
1 Horsepower	2,545.6 BTU/hr (46 watts)
1 Kilowatt	1.34 horsepower 3,411 BTU/hr
Gravitational Acceleration	9.81 m/sec^2

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Since 1880