Vogt®

P34FXL

TUBE-ICE® MACHINE

Service Manual

50^{00}

09/2017

NOTICE

This manual is the property of the owner of this particular Tube-Ice® machine.

Model #_____ Serial #_____.

It is to be left on the premises with this machine at all times. After start-up, it should be stored in a safe place where it can be readily available when needed for future reference in maintaining troubleshooting or servicing.

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

This manual is intended as an informational tool for the installation, operation, maintenance, troubleshooting, and servicing of this equipment. If an existing situation calls for additional information not found herein, we suggest that you contact your distributor first. If further assistance or information is needed, please feel free to contact the factory at 502-635-3000 or FAX at 502-635-3024 or 502-634-0479.

IMPORTANT: The Warranty Registration/Start-Up Report found in the front of this manual is to be completed and returned to the factory promptly after the official start-up.

Please return to: Vogt Ice, LLC
1000 W. Ormsby, Suite 19
Louisville, KY 40210
Attn. SuperCare Department

Vogt Ice, LLC Tube-Ice® Machine

MID & LARGE MACHINE WARRANTY REGISTRATION/START-UP REPORT

MUST COMPLETE AND RETURN TO INITIATE WARRANTY

Machine Model No. _____ Serial No. _____

Installed at: _____( )_____
Company Name Phone

_____
Address City State Zip

_____

Installed by: _____( )_____/____/_____
Company Name Phone Date

_____
Address City State Zip

Describe any damage to machine/repairs made: _____

_____

_____

Start up by: _____( )_____/____/_____
Company Name Phone Date

_____
Address

Name of person starting up machine: _____

PRE START-UP CHECK

CHECK

- ☐ Service Manual on hand
- ☐ Machine room suitable 50°F minimum, 110°F maximum
- ☐ Proper power supply, actual voltage _____, _____, _____ (machine not running)
- ☐ Compressor crankcase heater on 12 hour minimum
- ☐ Necessary hand valves opened as required
- ☐ Solenoid valve stems in auto position
- ☐ System leak checked/tight
- ☐ Auxiliary equipment overloads wired into control circuit
- ☐ Compressor oil level _____ (1/4 glass min.)
- ☐ All water distributors in place (visually inspected)
- ☐ Water supply and drain lines installed and connected properly
- ☐ Compressor, pump, cutter and other motor direction of rotation correct
- ☐ Make-up water float valve adjusted properly
- ☐ Hour meter in control panel connected

OPERATION CHECK

Machine charged with refrigerant lbs._____ Actual voltage _____ , _____, _____(machine running)
Ambient temp. _____ °F Fan cycles On _____ Off _____ Tower water in _____°F out _____ °F
Comp motor RLA _____, _____, _____, Actual _____, _____, _____,
Pump RLA _____, _____, _____, Actual _____, _____, _____
Cutter motor RLA _____, _____, _____, Actual _____, _____, _____
Suction pressure end of freezing _____, end of harvest _____ Discharge pressure end of freezing _____, end of harvest _____
Evaporator/suction line frost _____ Receiver liquid level operating _____

Test Cycle	Water Temp	Freeze Time Min/Sec	Harvest Time Min/Sec	First Ice Out Min/Sec	All Ice Out Min/Sec	Avg. Hole Size	Ice Lb. Per Harvest	Ice Lb. Per Day
#1								
#2								
#3								
#4								

Note: Ice lb. per day can be found by: ___ice lb. per harvest____ x 1440
(freeze time + harvest time)

The machine operated satisfactorily for ___ continuous hours. Date _____

Comments_____

_____

Installer signature _____ End user signature _____

Please return to: Vogt Ice LLC, 1000 W. Ormsby, Suite #19, Louisville, KY 40210

VOGT®
TUBE-ICE® MACHINES
P34FXL Model

Installation, Service Manual, and Parts Catalog #12A-4171L21

Vogt Ice, LLC
1000 W. Ormsby Avenue, Suite 19
Louisville, Kentucky, 40210
800-853-8648 • 502-635-3000
Fax: 502-634-0479

09/2017

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Model P34FXL

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1. Introduction

Vogt Ice, LLC

A Brief History of Our Company. Henry Vogt Machine Co. was founded as a small machine shop in Louisville, Kentucky in 1880. Today, Vogt Ice, LLC is one of the world's leading producers of ice-making equipment.

In 1938, Vogt built the first Tube-Ice® machine and revolutionized the ice-making industry. Our first "sized-ice" machine quickly replaced the old can-ice plants, which required hard labor and large amounts of floor space for freezing, cutting, and crushing ice by hand.

Vogt Energy-Saving Tube-Ice Machines Are Cost Effective. Today, Vogt Tube-Ice® machines enjoy a well-earned reputation as the most energy efficient, dependable ice-making equipment in the world.

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

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

Preview. All the skill in engineering and fabrication that we've learned in over a century of experience is reflected in every Tube-Ice® machine. 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 production. The machine's economic and reliable operation has been proven over and over again, in a network of varied types of installations throughout the world.

This manual is designed to assist you in the installation, start-up, and maintenance of your unit. Your Tube-Ice® machine will give you a lifetime of service provided you install, maintain, and service it properly. It is evidence of our desire to deliver to you "the finest ice-making unit ever made."

Please read your manual carefully before attempting installation, operation, or servicing of this professionally-designed piece of equipment. Also, make sure the Warranty Registration/Start-up Report is completed and returned.

If you have additional questions, please call your distributor. Also, feel free to phone the factory direct at **(502) 635-3000**.

Important Safety Notice. This information is intended for use by individuals possessing adequate backgrounds in electrical, refrigeration and mechanical experience. Any attempt to repair major equipment may result in personal injury and/or property damage. The manufacturer or seller cannot be responsible for the interpretation of this information, nor can it assume any liability in connection with its use. It is important that personnel understand the properties of this refrigerant and that they be thoroughly trained in safe practices for its use and handling. Refer to the enclosed Safety Data Sheet in Appendix A.

Safety Symbols & What They Mean. Prior to installation or operation of the Tube-Ice® machine, please read this manual. Are you familiar with the installation, start-up, and operation of a Tube-Ice® machine? Before you operate, adjust or service this machine, you should read this manual, understand the operation of this machine, and be aware of possible dangers.

These safety symbols will alert you

when special care is needed.

Please heed them.

! DANGER !
Indicates an immediate hazard and that special precautions are necessary to avoid severe personal injury or death.
! DANGER !

! WARNING !
Indicates a strong possibility of a hazard and that an unsafe practice could result in severe personal injury.
! WARNING !

! CAUTION !
Means hazards or unsafe practices could result in personal injury or product or property damage.
! CAUTION !

Special Precautions to Be Observed When Charging Refrigeration Systems. Only technically-qualified persons, experienced and knowledgeable in the handling of R-404A 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 R-404A refrigerant. See "Material Safety Data Sheet", MSDS Code No. DU005612 in Appendix A.

If a refrigeration system is being charged from refrigerant cylinders, disconnect each cylinder when empty or when the system is fully charged. A gage 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 pounds 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, excessive or illegal release of refrigerant into the atmosphere.

! CAUTION !
Immediately close system charging valve at commencement of defrost or thawing cycle if refrigerant cylinder is connected. Never leave a refrigerant cylinder connected to 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 brought on by an increase in temperature.
! CAUTION !

Always store cylinders containing refrigerant in a cool place. They should never be exposed to temperatures higher than 120°F and should be stored in a manner to prevent abnormal mechanical shocks.

Also, transferring refrigerant from a refrigeration system into a cylinder can be very dangerous and is not recommended.

! CAUTION !
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--free of any contaminants or foreign materials--and must be weighed continuously to assure contents do not exceed net weight specified by cylinder manufacturer or any applicable code requirements.
! CAUTION !

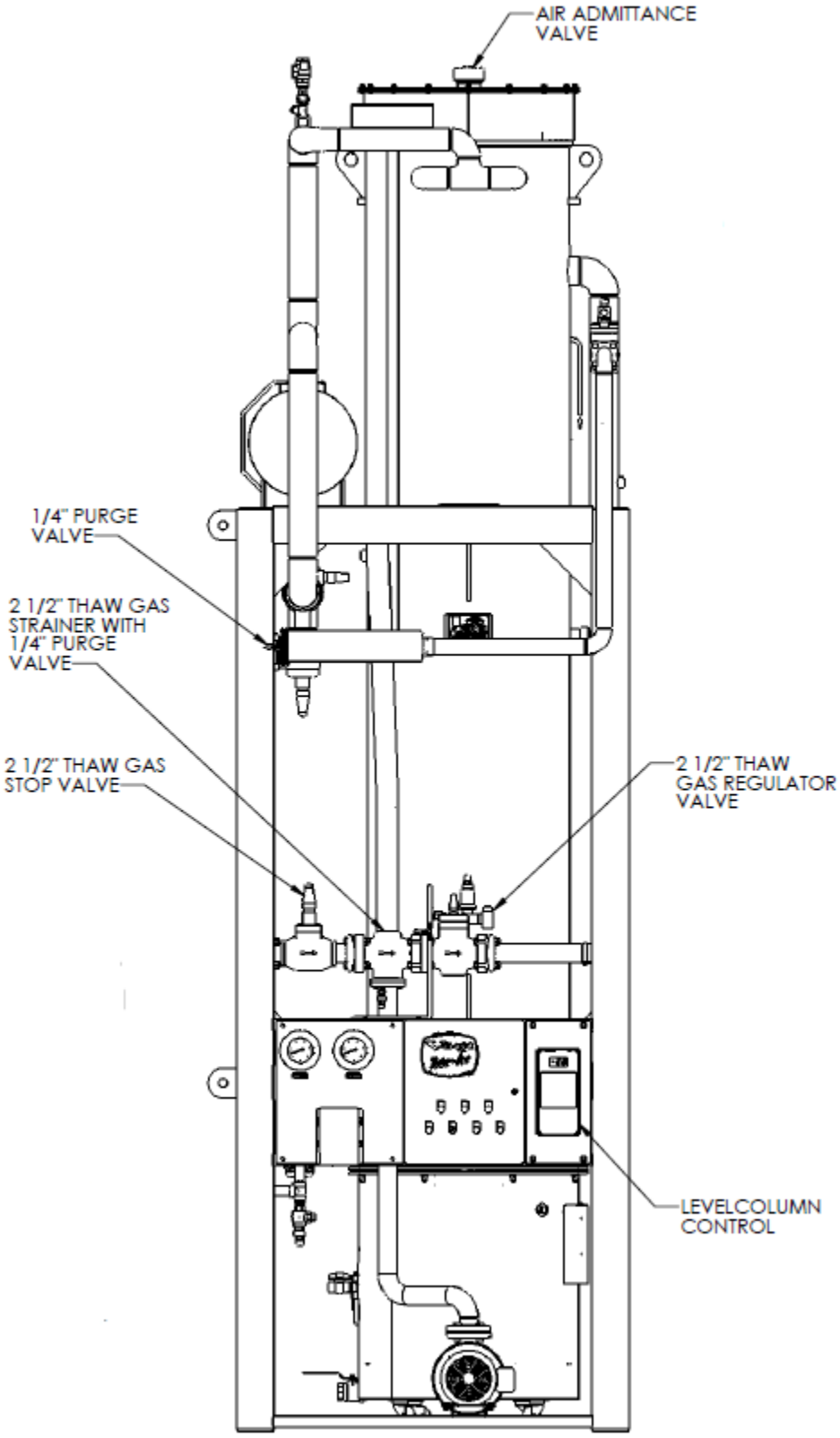


Figure 1-1
P34FXL Front Side (Control Panel)

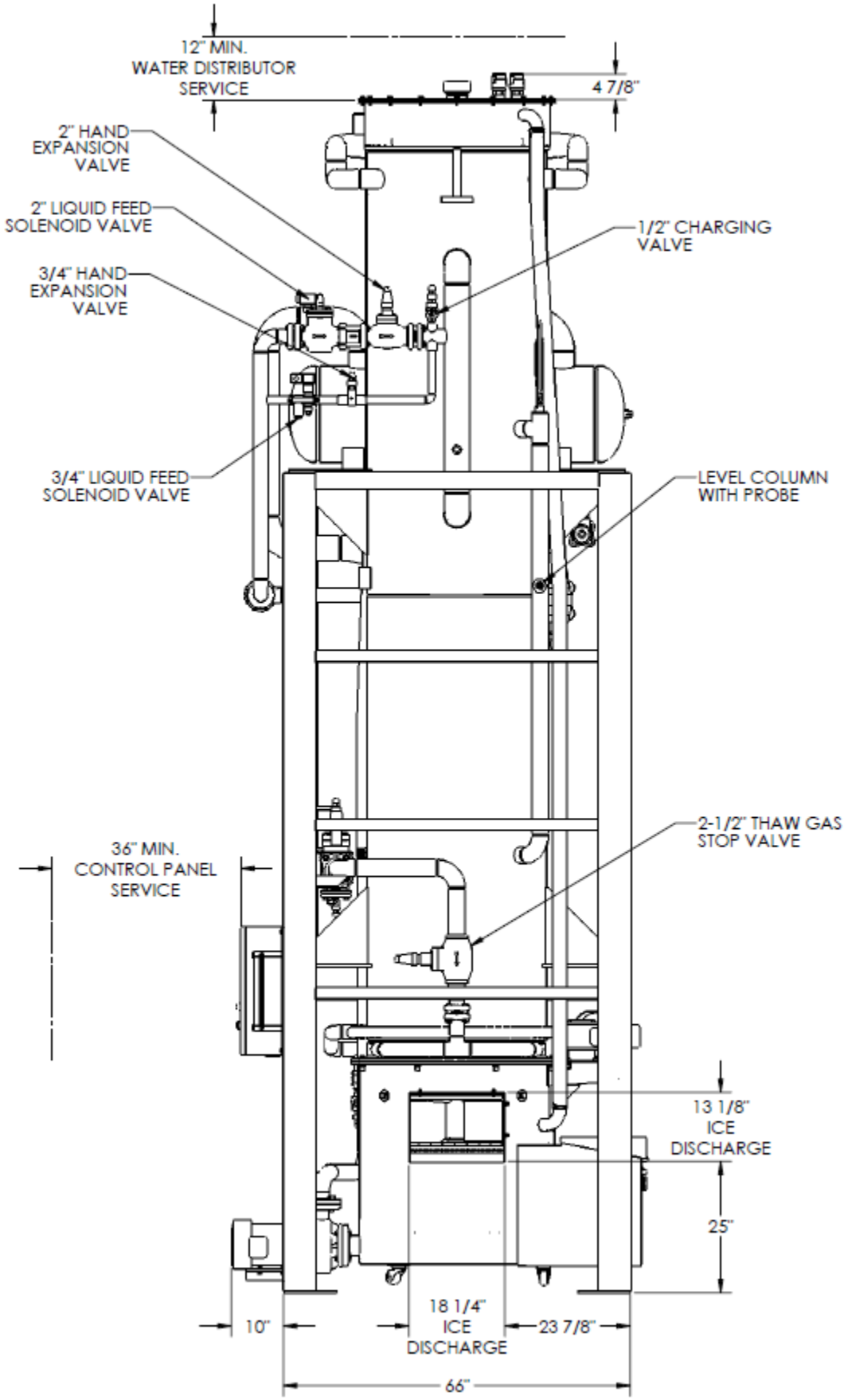


Figure 1-2
P34FXL Right Side

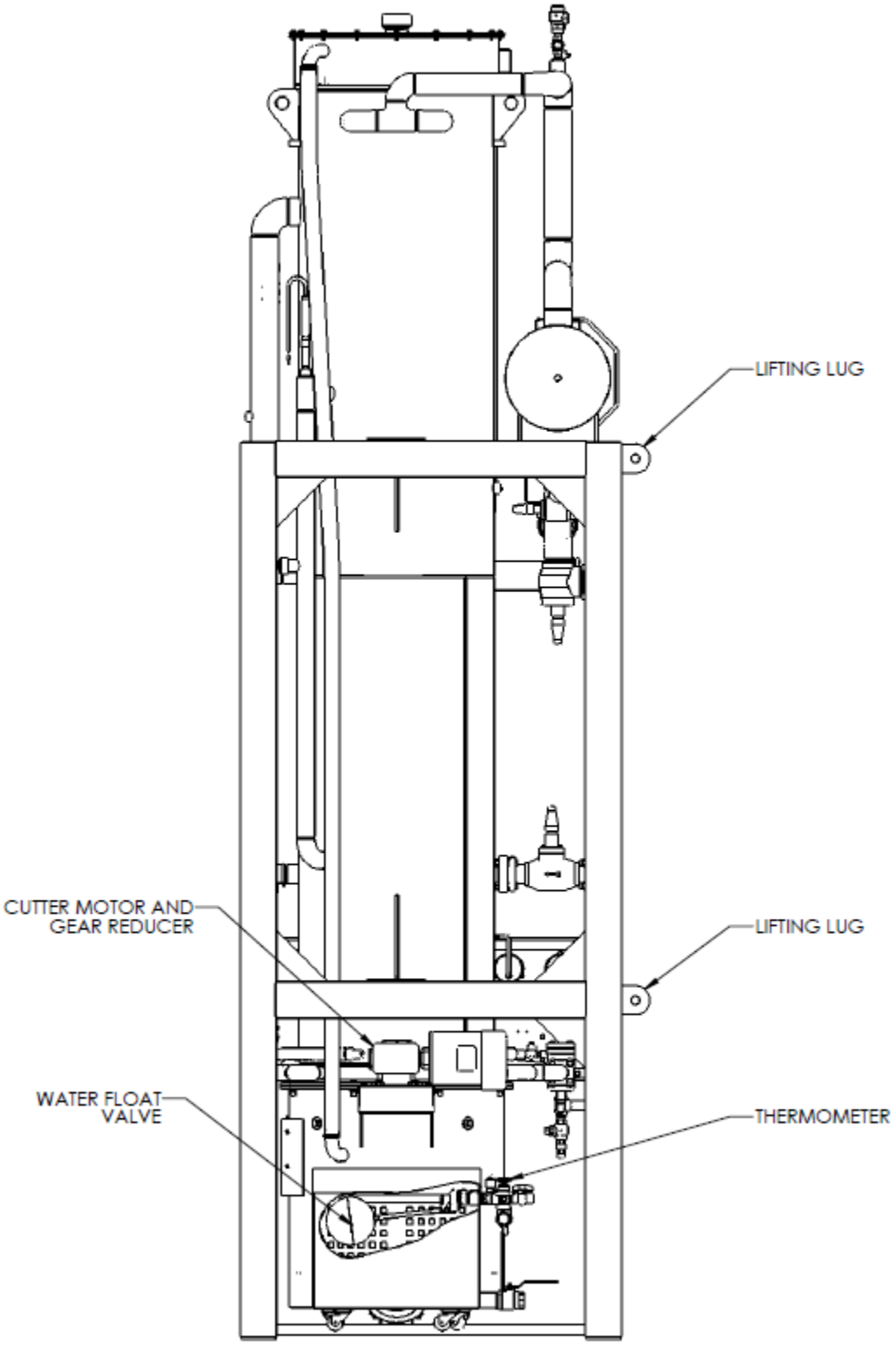


Figure 1-3
P34FXL Back Side

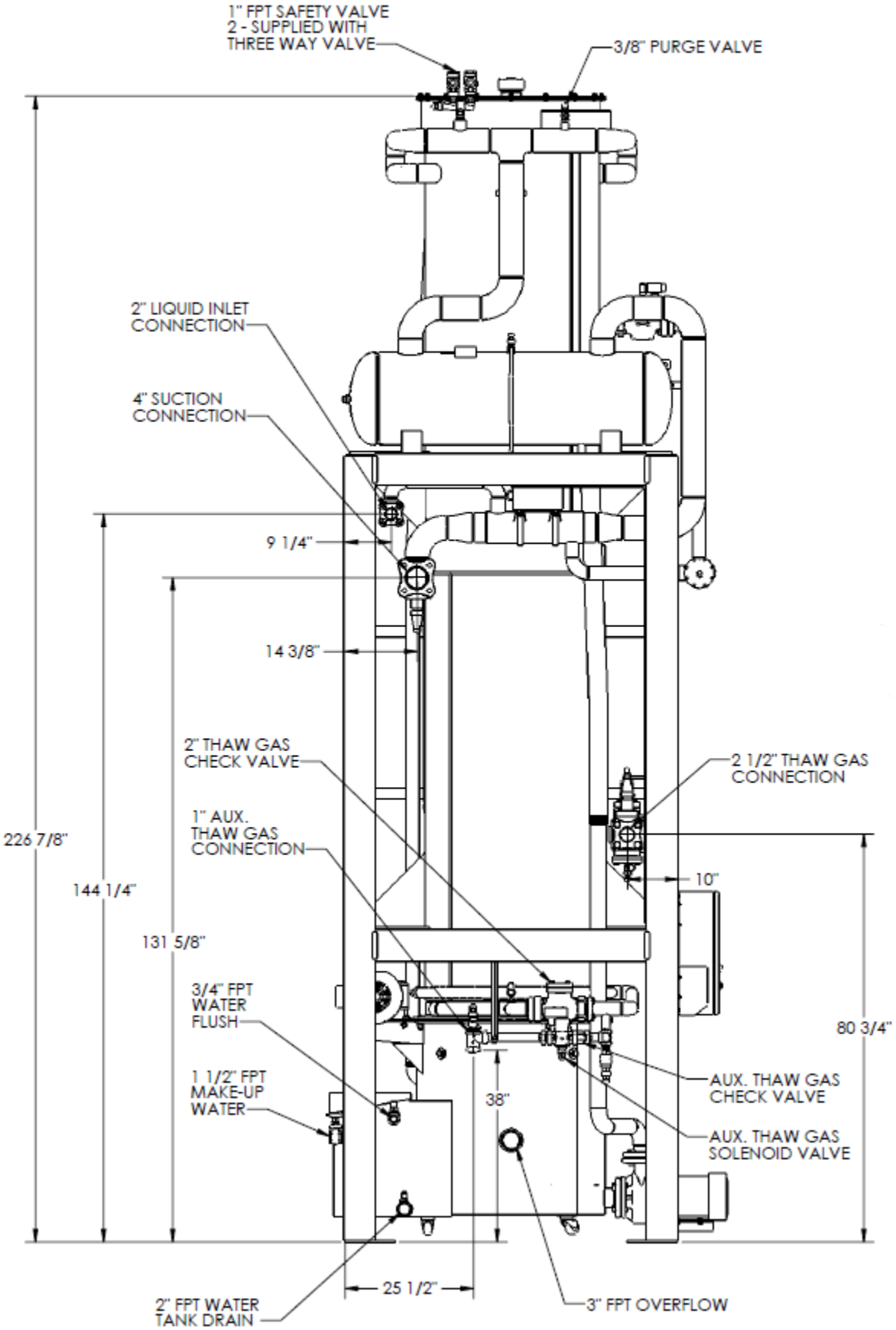


Figure 1-4
P34FXL Left Side

2. Receipt of Your Tube-Ice Machine

! CAUTION !
Only service personnel experienced in refrigeration and qualified to work on high amperage electrical equipment should be allowed to install or service this Tube-Ice® machine. **Eye protection should be worn by all personnel working on or around the Tube-Ice® machine.** **It is very important that you are familiar with and adhere to all local, state, and federal, etc. ordinances and laws regarding the handling, storing, and use of refrigerants.**
! CAUTION !

Inspection. As soon as you receive your machine, inspect it for any damage. If damage is suspected, note it on the shipper's papers (i.e., the trucker's Bill of Lading). **Immediately** make a separate written request for inspection by the freight line's agent. Any repair work or alteration to the machine without the permission of the Vogt Ice, LLC can void the machine's warranty. You should also notify your Vogt distributor or the factory.

Description of Machine. A low side Tube-Ice® machine is a remote ice producing plant requiring refrigerant suction connection, refrigerant liquid connection, thaw gas connection, make-up water supply, electrical connection, and the proper refrigerant charge.

The machine has been partially factory tested prior to shipment and will require adjustment to meet the high side (condensing unit) operating conditions. See "Start-up and Operation" for the correct setting of the controls.

After factory pressure testing of the machine, the machine is evacuated and charged with nitrogen gas pressure for shipment. This prevents air or moisture from entering the system during transit. There should be a positive pressure (20-25 psig) indicated on the control panel gages when the machine is received. The machine has been cleaned with ice machine cleaner and flushed so that the machine is ready for ice production.

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 machine is available in two different tube sizes for producing ice: 1 1/8" OD x 1" long, or 1 3/8" OD x 1" long. The ice is cut to length by a rotating breaker type cutter. Ice can be produced up to 1 1/2" long by modifying the spacers under the adapter plates (see Chapter 10, "Ice Length" for modifying instructions). Crushed ice is also available by modifying the cutter and making minor adjustments to the machine (see Chapter 10, "Crushed Ice").

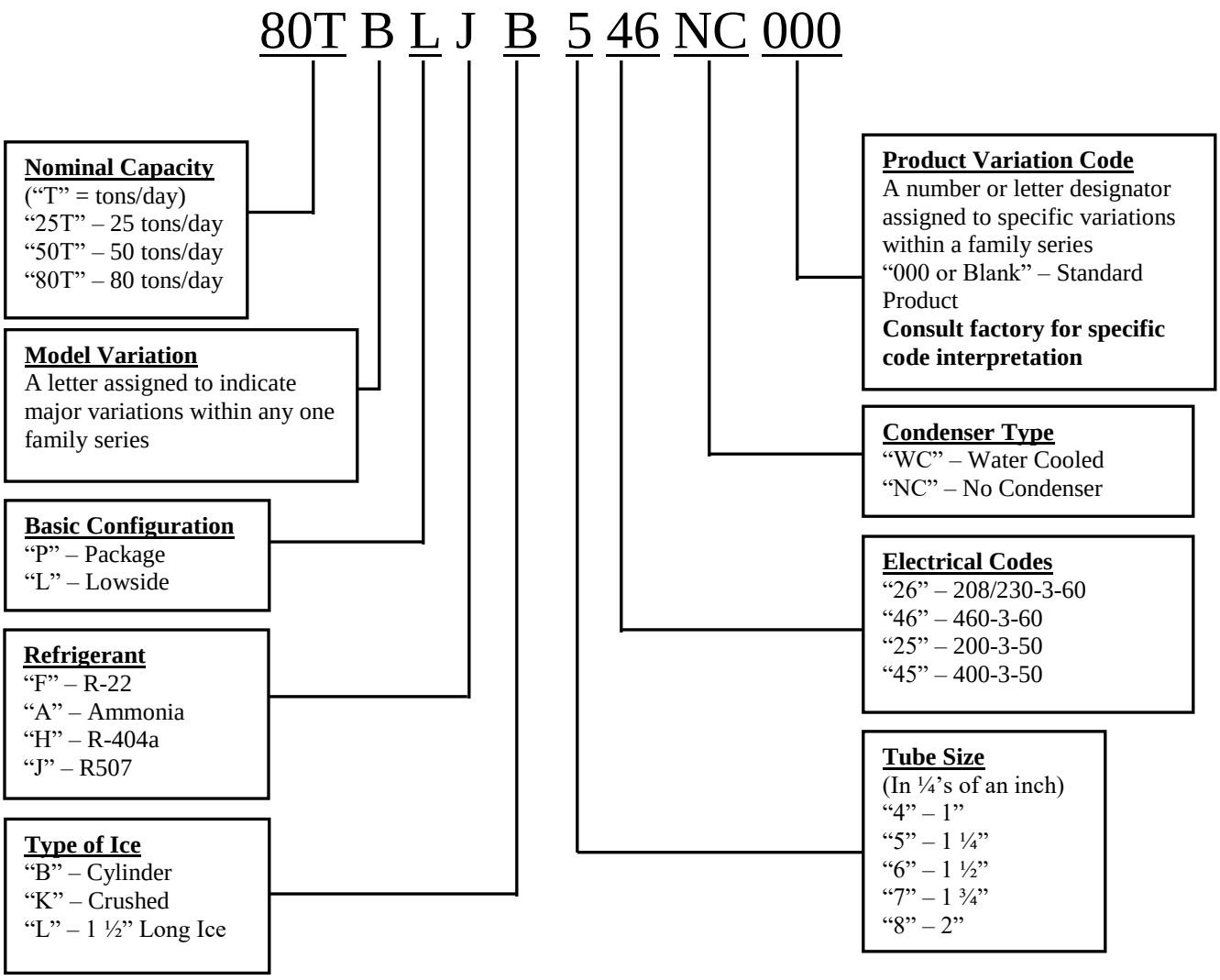


Figure 2-1
Model Designation for P-Series Ice

Rated Capacity. Tube-Ice® machines are rated to produce a given amount of ice when operating under the proper conditions as specified in this manual (see Chapter 11 for the operating specifications). You should be prepared to handle the ice produced as it is discharged from the machine and move it to your storage or bagging area promptly.

Storage (prior to installation or start-up). The machine must not be stored or installed in an area that is subject to reach temperatures at or above 110°F (43.3°C).

3. Installing Your Tube-Ice Machine

Your machine will be shipped to you as one package. You will need to arrange for the handling of the package as soon as it arrives, see Chapter 11 for shipping and operating weights. Before you remove the unit from the truck, be certain that any sign of damage, however slight, is noted on the carrier's papers.

Note: See "Lifting Procedure" drawing included with this manual, Figures 3-4A through 3-4C.

Machine Room. 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 (43.3°C). Heat radiation from other sources (sunlight, furnaces, condenser, etc.) and unusual air current may affect the operation of the machine and should be avoided. **The electrical components of the Tube-Ice® machine are rated NEMA 1. Therefore, the machine should not be located in a hazardous area or sprayed with water.** The machine should be installed in an area where water will not stand, but will readily drain away from the machine.

Space Requirements. Refer to the space diagrams, Figures 3-1 and 3-2, for recommended minimum clearance around the machine for ease of servicing and observation. Pay particular attention to the additional space required. If it ever becomes necessary to mechanically clean the condenser tubes, extra space will be required on one end (preferably on the opposite end from the water inlet and outlet) for the cleaning tools.

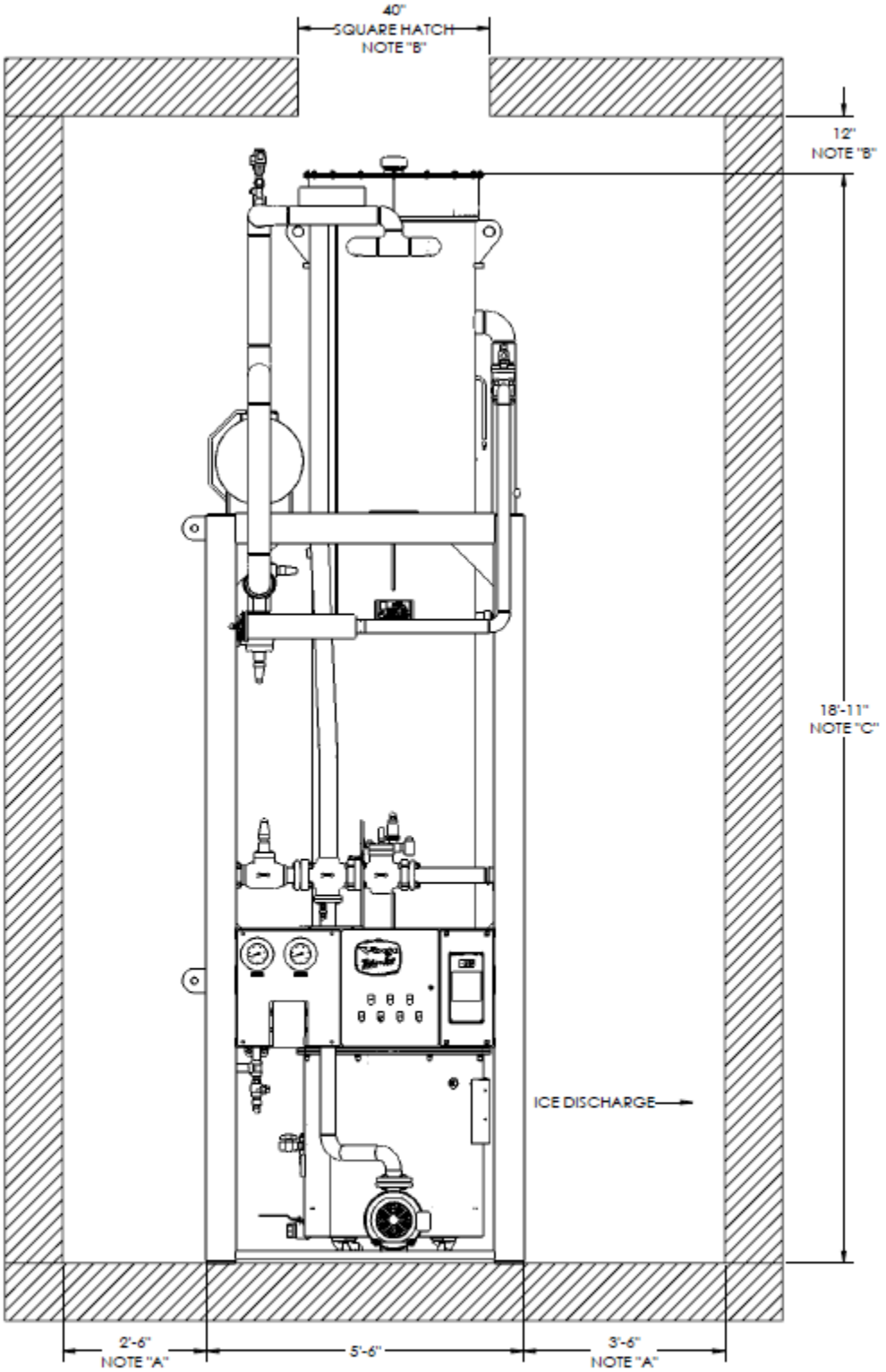
Foundation. Refer to the foundation layout, Figure 3-3, for recommended minimum foundation requirements. The figures show anchor bolt details and machine anchor hole details. Contact your local distributor for seismic anchoring requirements in your area.

! WARNING !
Lifting or moving heavy equipment should only be attempted by competent rigging and hoisting contractors. Never allow personnel near or under heavy equipment when it is being moved or lifted. Failure to comply could result in personal injury or loss of life.
! WARNING !

Lifting Procedures. Your Tube-Ice® machine is provided with lifting lugs for the purpose of unloading and moving the machine to its operation location. Refer to the enclosed drawings for instructions and illustrations of their use.

P34FXL - Figures 3-4A through 3-4C. Machine weight 12,500 lbs.

These figures are intended as a guide to unloading and lifting the P34FXL Tube-Ice® machine. **Vogt Ice, LLC is not responsible for product damage or personnel injury or loss of life during the loading or lifting process.**



NOTES -
A. REQUIRED TO SERVICE ELECTRICAL CONTROLS AND CUTTER ASSEMBLY.
B. REQUIRED ABOVE FREEZER TO SERVICE FREEZER TUBES.
C. MACHINE SHOWN WITH STD. SUPPORT, INCREASE AS REQUIRED TO ACCOMODATE EXTENDED BASE, IF USED.

CUSTOMER NOTES -
THIS DRAWING IS INTENDED TO BE USED AS A GUIDE ONLY FOR MINIMUM SPACE REQUIREMENTS. OTHER EQUIPMENT SUCH AS CONVEYORS, AUGERS, ETC. MUST BE CONSIDERED.

Figure 3-1
P34FXL Space Diagram (Front View)

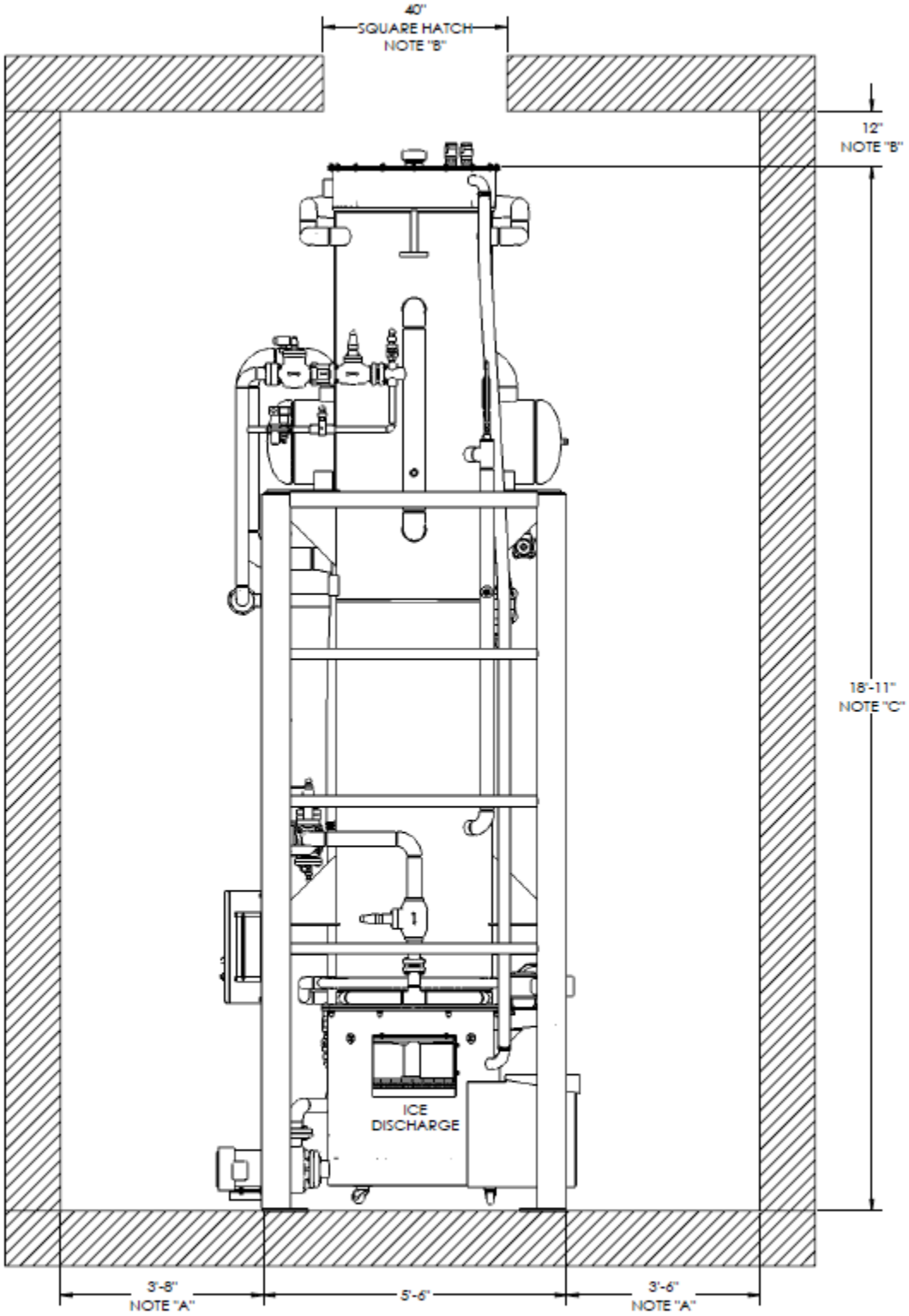


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Figure 3-2
P34FXL Space Diagram (Side View)

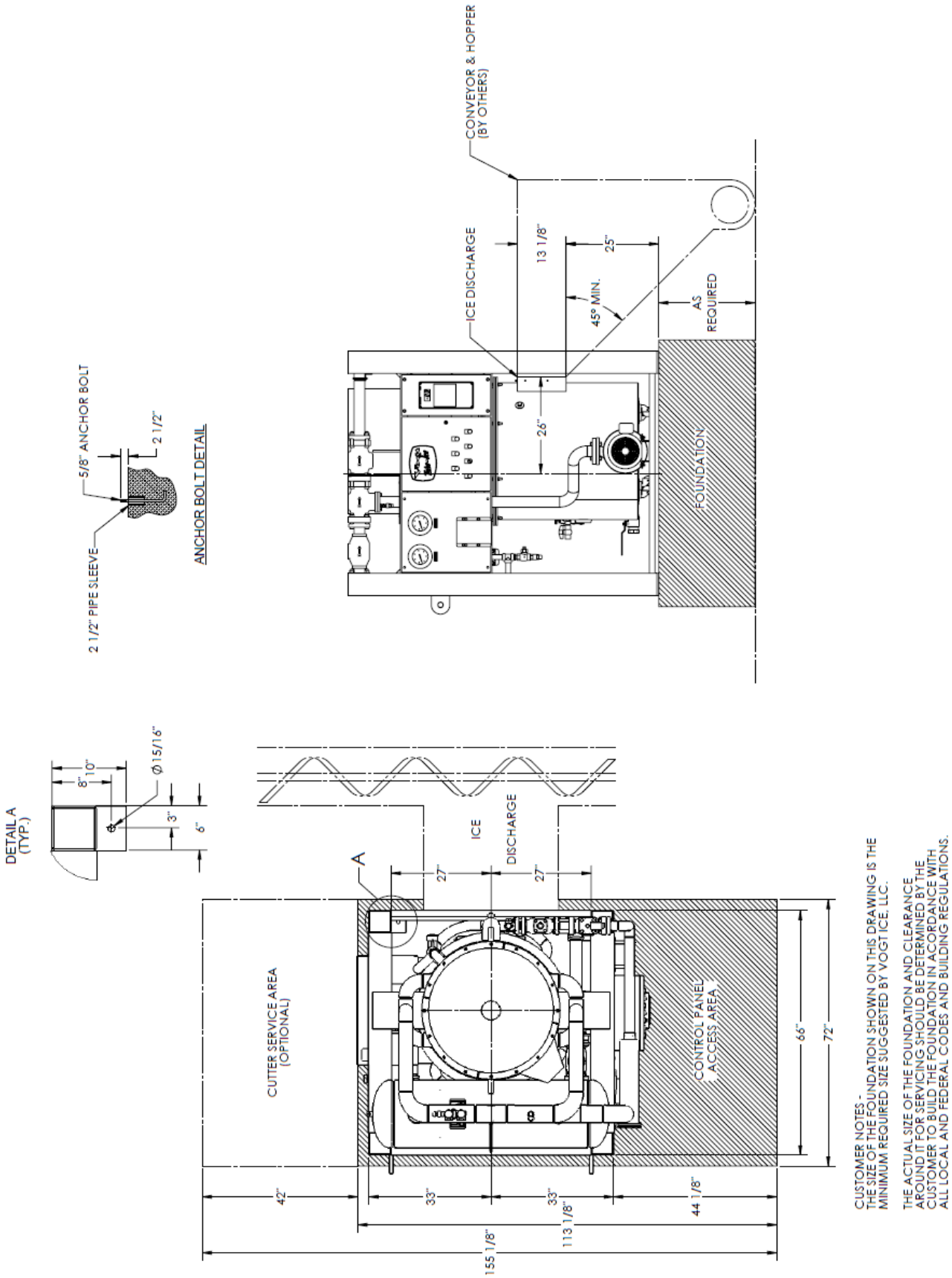


Figure 3-3
P34FXL Foundation Layout

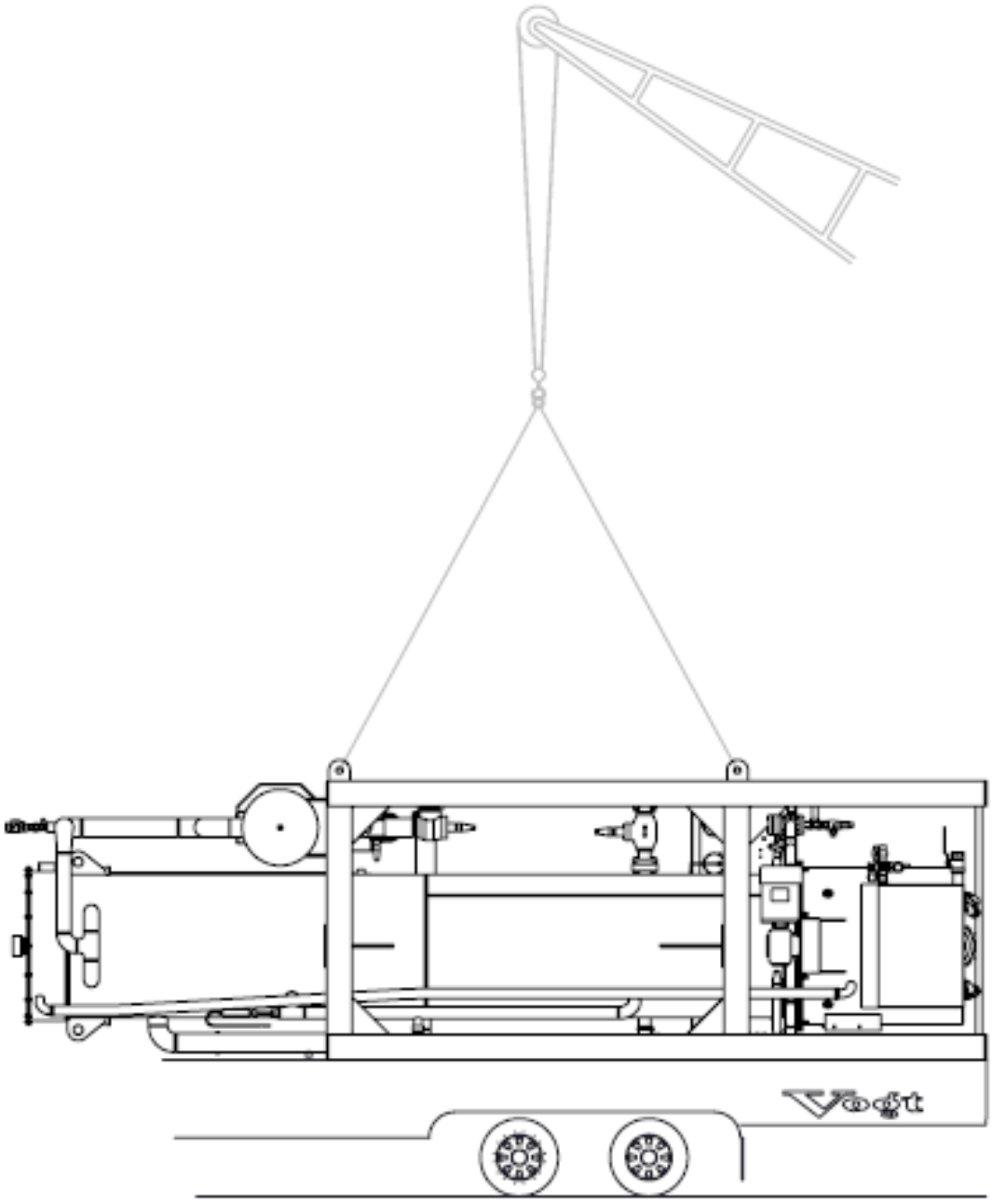


Figure 3-4A
Lifting Procedure for P34FXL, Step 1

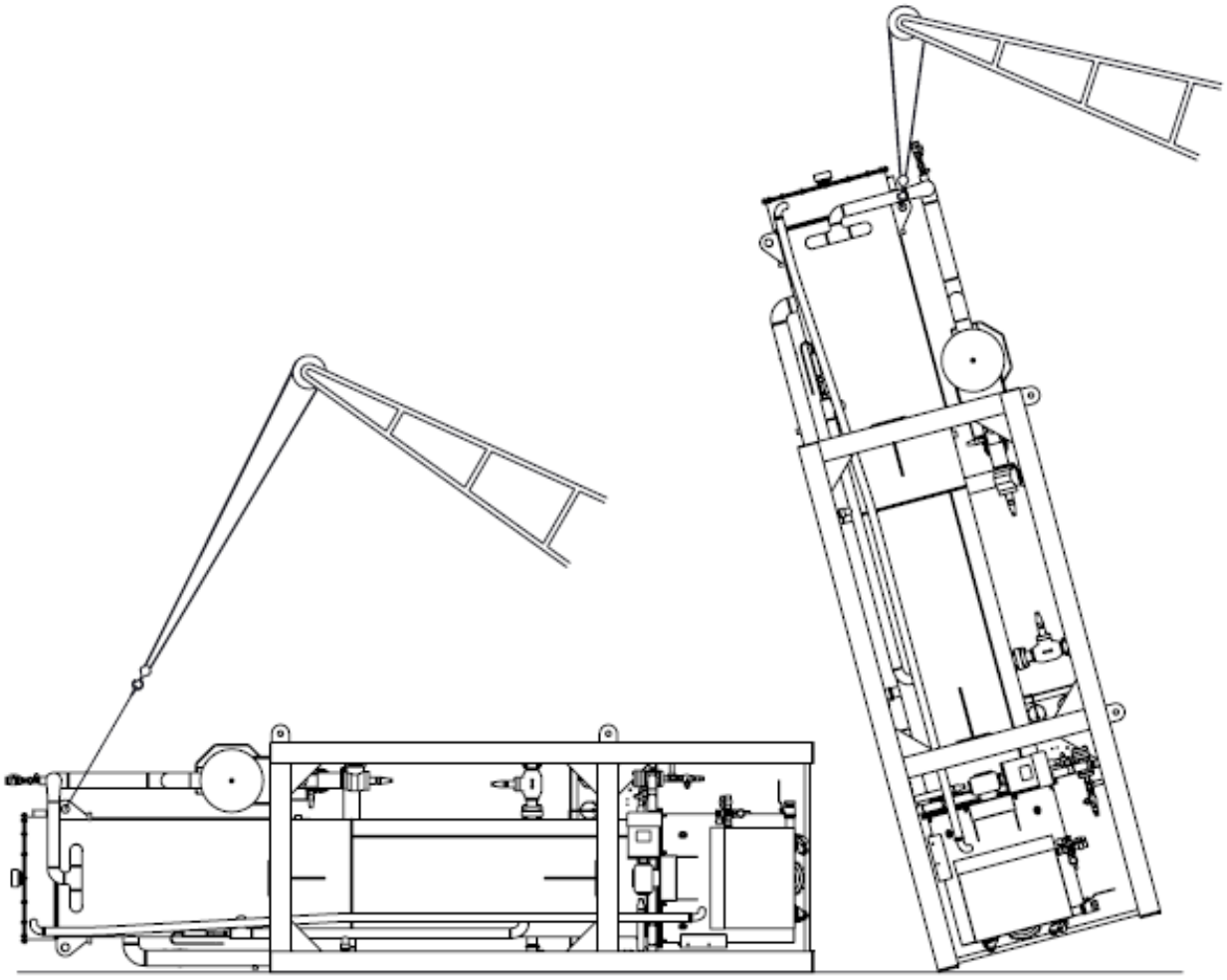
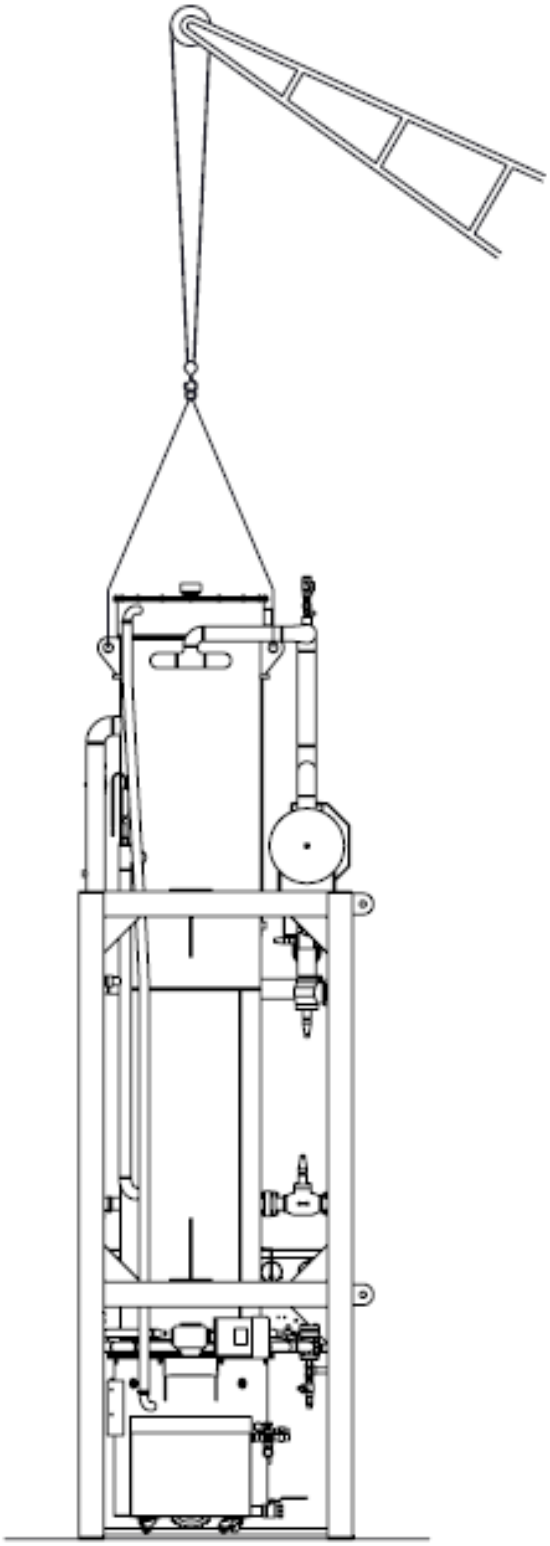


Figure 3-4B
Lifting Procedure for P34FXL, Step 2



POSITIONING MACHINE -
LOWER MACHING TO OPERATING POSITION
USING ALL FREEZER LIFINTG LUGS.

KEEP CHAINS AND CABLES AWAY FROM
FREEZER COVER.

Figure 3-4C
Lifting Procedure for P34FXL, Step 3

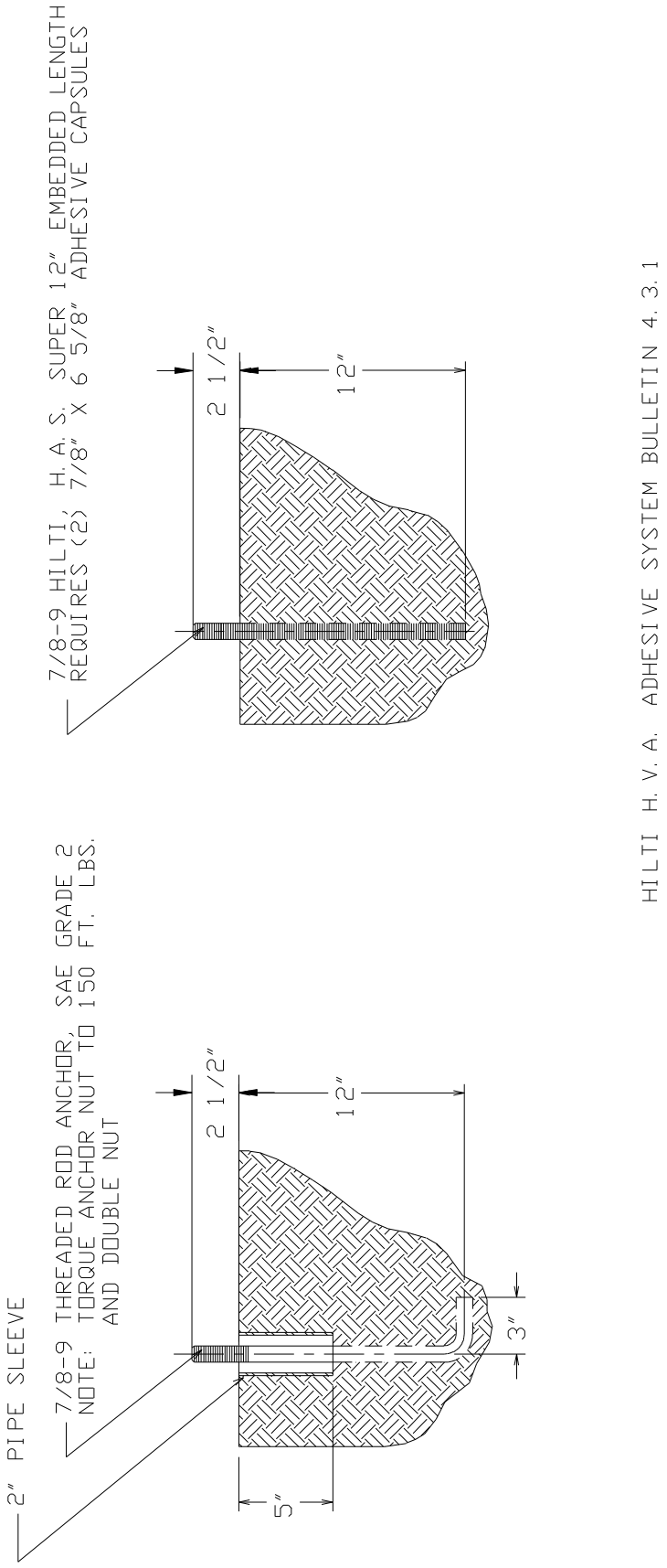


Figure 3-5
Seismic Anchoring Detail for P34FXL Tube-Ice Machines

Piping and Drain Connections. See Figures 1-1 to 1-4 for connection locations.

When connecting refrigeration piping, you must follow and adhere to all piping codes required in the jurisdiction of installation. Vogt recommends ASHRAE 15 "Safety Standard for Refrigeration Systems," and ASME B31.5 "Refrigeration Piping and Heat Transfer Components," which are required in many locations throughout the world. Make sure all piping is kept clean, dry and contaminate free. All piping should be supported properly.

! CAUTION !
Exterior shut-off valves must be provided in the water inlet lines. The minimum inlet water pressure for satisfactory operation of the machine is 30 psig. The maximum allowable pressure is 100 psig.
! CAUTION !

Model	Make-up Water In	Flushing Water In	Water Tank Drain	Water Tank Overflow	Low Side Suction Connection*	Low Side Liquid Connection**	Low Side Thaw Gas Connection
P34FXL	1 1/2" FPT	3/4" FPT 104 gal/3 min.	2" FPT	3" FPT	4" Flange	2" Flange	2 1/2" Flange

* Mating 4 bolt flange supplied with machine.
** Liquid connection is all purpose coupling.

Table 3-1
Water Supply, Drain and Refrigeration Connections
(See Figure 1-1 through 1-4 for locations)

Make-Up Water In. The water required for ice making must be potable water, safe for human consumption, and should be of the highest quality available. The best way to determine water quality is to have a complete water quality analysis by a qualified laboratory.

It is advisable to install a particle filter in the make-up and flushing water lines to trap dirt, sand, rust, or other solid particles prior to entering the water tank and contaminating the ice. Be sure to size the filter large enough to meet the water demands of 16 GPM (peak flow), allowing for a restriction through the filter as it traps these particles. The inlet water pressure should be a minimum of 30 psi. Refer to Table 3-1 for line size and Chapter 11 for average flow rate at various water temperatures.

Flushing Water In. Flushing water (blowdown) is necessary to melt ice fines and to flush dissolved solids from the water tank during the thawing (harvest) cycle. This function is important and helps to maintain good ice quality. If water quality is superior, this blowdown can be reduced by installing a smaller orifice in the flushing outlet elbow. Make sure there is enough flushing water to prevent the accumulation of excessive ice fines and dissolved solids in the tank.

If make-up and flushing water are from the same source, they can be connected by a common line to the machine.

Water Tank Drain. This valve and connection is for the purpose of flushing and draining the water tank of impurities, foreign material and cleaning chemicals used during servicing. It should be piped to an open drain or sump for visible discharge. It can be tied in with the overflow line but no others.

Water Tank Overflow. A 3" FPT connection on the side of the water tank is provided to carry away overflow water during the thawing (harvest cycle). This water contains ice fines accumulated during harvesting and dissolved solids accumulated during the freezing cycle. **Do not reduce the size of this line**. Three inches is needed to provide sufficient area for ice fines to be flushed out, especially if the incoming flushing water is 55°F (13°C) or below. This overflow line should not tie in with any other drain line except the water tank drain.

Unless water quality is superior, do not discharge the overflow water to the cooling tower system. This water contains additional dissolved solids left from the ice making process and can lead to excessive condenser fouling or cooling tower chemical usage. It is recommended that a heat exchanger be used in place of direct contact with condenser water.

Receiver. The receiver used to supply hot thaw gas must be sized adequately to provide a sufficient amount of thawing gas to the freezer. Table 3-2 shows the volume required to hold the refrigeration charge of the freezer and the hot gas required for the thaw cycle. It is recommended that a heating coil be installed in the receiver to assure that the liquid refrigerant is at saturation at the start of each thawing period.

Note: Additional storage volume may be required for the interconnecting piping. Add volume of interconnecting piping to the values shown in Table 3-2

RECEIVER VOLUME (Cubic Feet)		
MODEL	With Heating Coil	With out Heating Coil
P34FXL	60	80

Table 3-2
Receiver Volume Requirements

Thaw Gas Pressure Regulator. The thaw gas pressure regulator is a 2-1/2" solenoid operated pressure combination regulator and shut-off valve (see Figures 1-1 through 1-4 for locations). **Do not reduce the size of this line**. This valve is designed to carry the proper amount of thaw gas to the evaporator during the harvest cycle. See Page 5-7 for operating instructions.

Suction Pressure Regulator. When a P34FXL is attached to a central system, a pressure regulator will be required. This regulator (usually furnished by the purchaser) must be a combination back pressure regulating and stop-type valve. The usual minimum pressure drop across this type valve is 2 psig; therefore, the valve must be set to maintain a freezer pressure that is at least 2 psi above the maximum general suction pressure.

Compressor Unloading. When a P34FXL is attached to a dedicated compressor system, unloading of the compressor will be required. A minimum compressor unloading during the harvest cycle is 50%. If the compressor cannot be unloaded, then a hot gas bypass to the suction line must be installed.

Cooling Tower (optional). When selecting a cooling tower, careful attention must be given to operating wet bulb conditions. It is advisable to check with your local cooling tower distributor for their recommendations based on actual operating conditions in your area. An average wet bulb of 78°F is typical in the U.S., but many localities have designed wet bulbs as low as 72°F or as high as 82°F.

The cooling tower water pump must be capable of delivering the required volume of water through the condenser. Due to cooling tower location and pressure drop through water lines and regulating valves, the water pump must be sized for each installation. Refer to Table 3-3 for condenser water requirements. The water piping for the cooling tower and the installation of the pump must be in accordance with the manufacturer's instructions. Caution must be used to prevent the condenser water pump from losing prime during off cycles.

Proper water treatment for the prevention of mineral and foreign matter accumulation in the condenser or cooling tower is recommended. A water analysis should be obtained to determine the proper chemicals to use. The use of a 40-mesh strainer in the condenser water supply line is also recommended.

	P34FXL – Cylinder		P34FXL – Crushed	
Suction Temperature °F / °C	1 1/4" Tube	1 1/2" Tube	1 1/4" Tube	1 1/2" Tube
20 / -6.7	1,183	925	1,523	1,488
15 / -9.4	1,601	1,267	1,994	1,881
10 / -12	2,003	1,602	2,423	2,221
5 / -15	2,391	1,933	2,818	2,522
0 / -18	2,767	2,258	3,187	2,795

Total Heat of Rejection is at pulldown with 100°F SCT, 70°F make-up water, and 20% blowdown.
Values are nominal and based on an open drive reciprocating compressor.
Suction Temperatures are average during the freezing period.
Consult factory for condenser sizing if desired.

Table 3-3
Total Heat Rejection (MBH)

The condenser water pump should be sized on GPM required for condenser at 80 ft. total discharge head for a typical installation. However, due to cooling tower location and pressure drop through water lines, the water pump should be sized for each installation.

If the condenser inlet water temperature is expected to be below 75°F / 24°C, a water regulating valve should be installed in the condenser water inlet line and adjusted to maintain a head pressure of not less than 235 psig.

See Figures 3-6 through 3-8 for possible cold climate installations with indoor sump.

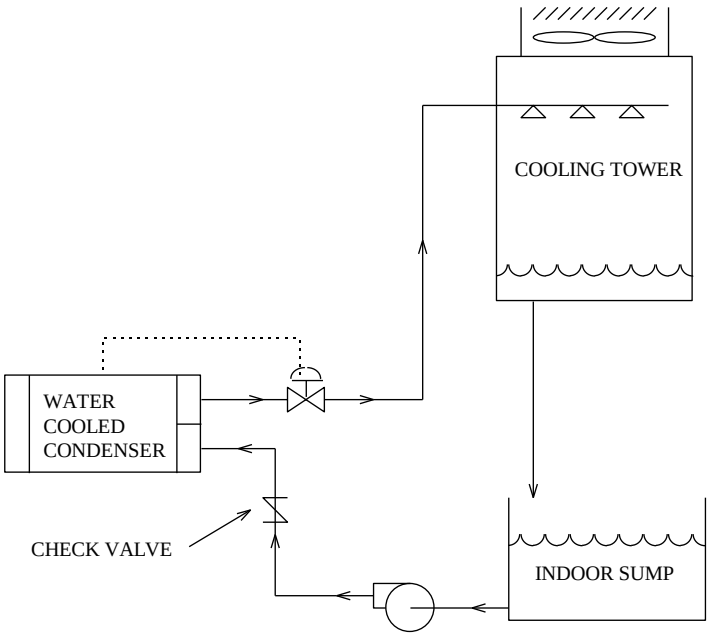


Figure 3-6
1 Pump / 2-Way Valve
*** Poor Freeze Protection**
Because low flow rate = high freeze chance

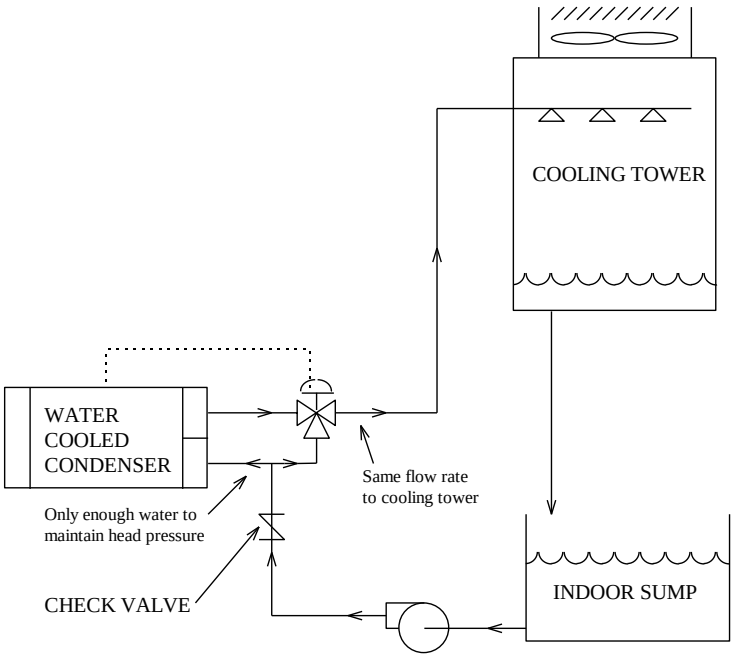


Figure 3-7
1 Pump / 3-Way Valve
*** Better Freeze Protection**

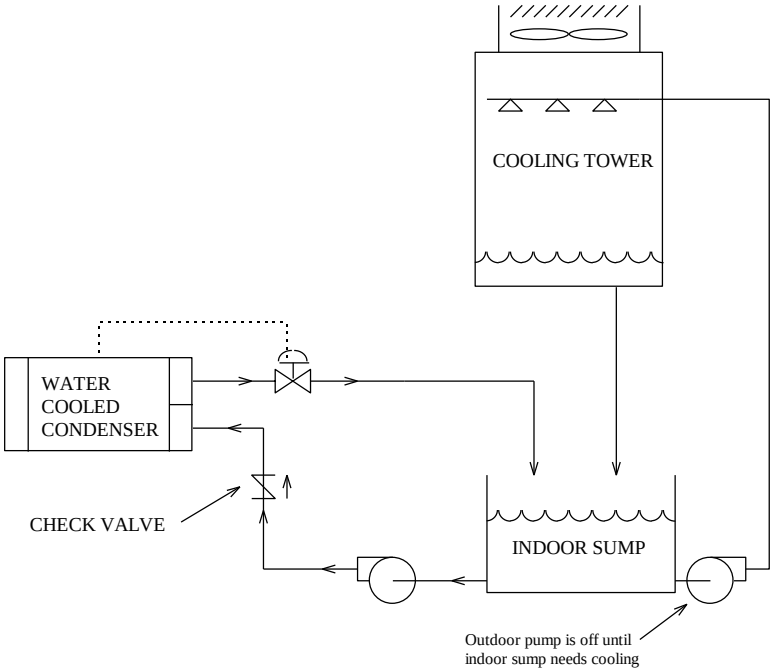


Figure 3-8
2 Pump / 2-Way Valve
*** Best Freeze Protection**

Safety Valves. Two safety pressure relief valves are an integral part of the packaged Tube-Ice® machine. They are located on the suction piping near the top of the freezer. Vent each of the pressure relief valves to the atmosphere in such a manner as to comply with local and national codes. Specific requirements can be found in standards published by ASHRAE.

Wiring and Electrical Connections

! WARNING !
Only service personnel experienced in refrigeration and qualified to work with high voltage electrical equipment should be allowed to install or work with the Tube-Ice® machine.
! WARNING !

A fused disconnect must be provided near the Tube-Ice® machine. The control panel and transformer (if required) are attached to the structural frame on the front of the machine (see Figure 3-9). Rotation checking of the cutter motor, water pump and auxiliary equipment is required (see Rotation Check). If one leg of the 3 phase power is higher or lower ("wild"), then it should be connected to terminal L3. Connect the ground wire to the "ground" terminal provided.

Make sure wires #22 and #27 are connected to the elapse time (ET) indicator in the control panel.

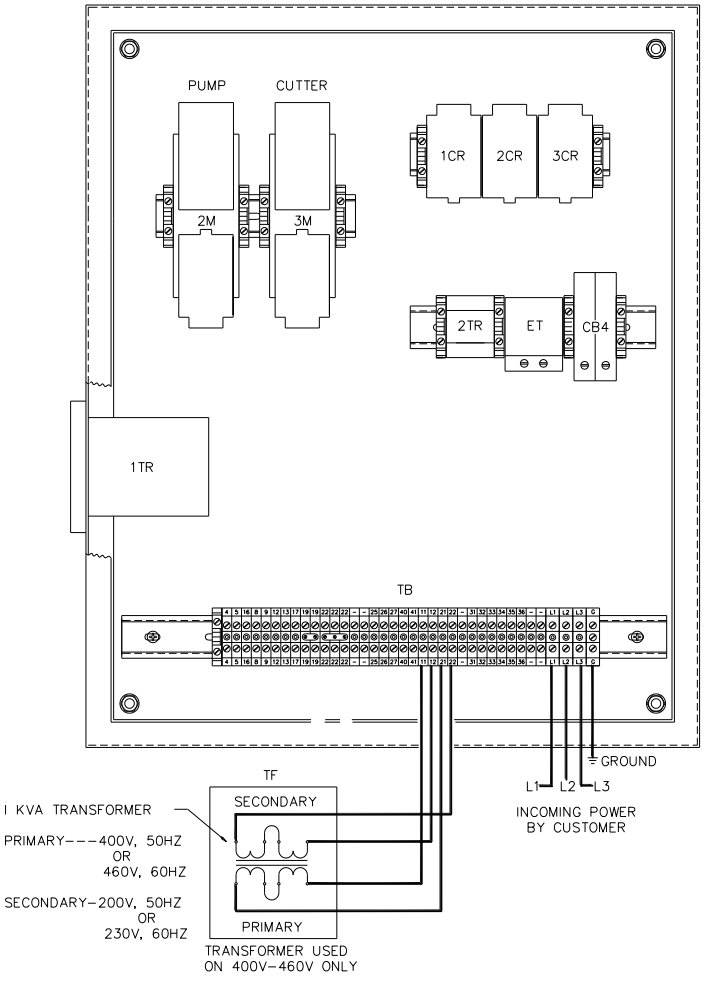


Figure 3-9
Power Supply Connections

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

Example: Supply voltage = 230-3-60

Voltage Readings: AB = 220 Volts
BC = 225 Volts Average = (220 + 225 + 227)/3 = 224 Volts
AC = 227 Volts

(AB) 224-220 = 4 Volts (Highest Deviation)
(BC) 225-224 = 1 Volts
(AC) 227-224 = 3 Volts

% Voltage Unbalance = 100 x (4/224) = 1.78% "Acceptable"

Important: If the supply voltage phase unbalance is more the 2%, contact your local electric utility company.

Current Unbalance. Voltage unbalance will cause a current unbalance, but a current unbalance does not necessarily mean that a voltage unbalance 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 connection 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 unbalance is 10%.

Example:

Current Readings: L1 = 96 Amps
L2 = 91 Amps Average = (96 + 91 + 98)/3 = 95Amps
L3 = 98 Amps

(L1) 96-95 = 1 Amps
(L2) 95-91 = 4 Amps (Highest Deviation)
(L3) 98-95 = 3 Amps

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

Rotation Check. The cutter and pump motor rotation are factory synchronized, but must be checked at installation. For cylinder ice production, the cutter disc as viewed at the ice discharge opening should turn from left to right.

Check rotation by the following procedure:

1. Turn the power to the machine on and check voltages.
2. Make sure the water tank is full of clean water.
3. Turn the HAND/AUTO switch (ISS) to HAND position. The water pump will start and the FREEZING (1LT) and the LIQUID FEED (2LT) pilot lights will illuminate. Check pump rotation.
4. Push the MANUAL HARVEST button. The water pump will stop, the FREEZING and LIQUID FEED lights will go out, and after 20-30 seconds, the cutter motor will start. The thawing gas solenoid valve will open and the THAWING pilot light (3LT) will illuminate.
5. Check the cutter disc rotation. It should be turning from left to right (CCW looking from the top).
6. Turn the HAND/AUTO switch to AUTO to stop the cutter.

To change rotation, follow this procedure:

1. Disconnect power to the machine and lock it out to make sure it can't be turned back on.
2. Check for power at L1, L2, L3 with a volt meter to make sure it is off.
3. At the cutter motor circuit breaker (CB3) or at the power disconnect, reverse wires L1 and L2.
4. Make sure these terminals are tight and restore power to the machine.
5. Perform rotation check again to confirm that it is correct.

! CAUTION !
Do not attempt to start the machine until first making sure all conditions listed in the Installation Review Checklist and all necessary valves have been opened for operation.
! CAUTION !

Auxiliary Controls or Equipment. When connecting other equipment such as high/low pressure switch, conveyor motors, bin level control, etc., refer to the control panel wiring drawing for the proper connecting terminals and instructions. See Figure 6-3.

! IMPORTANT !
Be sure to follow the wiring schematic when incorporating overloads of conveyor (5 MOL). Also remove jumpers as instructed. This is necessary to provide proper protection for the Tube-Ice® machine and its component parts.
! IMPORTANT !

Installation Review: A Checklist. Make a visual check to be sure these steps have been taken BEFORE continuing.

CHECK: _____ PRIOR TO OPENING VALVES, check all joints for leaks which may have developed during shipment. (NOTE: the machine was shipped with a positive pressure of 20-25 psig, which should be indicated on the suction and discharge gages.)

CHECK: _____ The system is properly evacuated to 500 microns.

CHECK: _____ All refrigerant piping, water supply and drain connections for conformity to requirements stipulated in this manual and properly connected to inlets and outlets.

CHECK: _____ Electrical supply for proper size of fuses and for compliance to local and national codes. See the machine nameplate for minimum circuit ampacity and maximum fuse size.

CHECK: _____ All field installed equipment (augers, conveyors, cooling towers, bin level controls, etc.) for proper installation.

CHECK: _____ The applicable portion of the warranty registration/start-up report for proper completion.

CHECK: _____ Cutter gear reducer oil level oil should run out of side pipe plug when removed.

CHECK: _____ The water distributors at top of freezer to make sure they are all in position (one seated firmly in each tube with a vent tube in each distributor).

INSTALLING YOUR TUBE-ICE MACHINE

4. How Your Tube-Ice Machine Works

Operating Features. Your low side Tube-Ice® machine is an efficient ice producing plant. If installed and maintained properly, it will give many years of operation with a minimum amount of repairs. Refer to piping schematic, Figure 4-1, to identify component parts while following the information and instructions in this manual.

The machine is manually started and stopped by the START and STOP push buttons. The machine features automatic stop safeties, including cutter and pump motor overloads, as well as other auxiliary motor overloads. It will also stop automatically due to high head pressure and low suction pressure conditions (if field wired to the high side). The circulating water pump can be operated independently for chemically cleaning the freezer tubes and water tank by use of the HAND/AUTO selector switch. The machine can be manually forced into a harvest cycle with the MANUAL HARVEST push button.

Principle of Operation. The freezer (2) is a shell-and-tube type vessel. During the freezing period (cycle), water is constantly recirculated through the vertical tubes of the freezer by a centrifugal pump (6). Make-up water is maintained by a float valve (12) in the water tank (7). The refrigerant float switch (10) opens and closes the liquid feed "A" solenoid valve (20) and maintains the desired refrigerant level in the freezer (2) (evaporator).

Refrigerant gas from the top of the freezer (2) passes through the suction accumulator (88) to the suction header and back to the compressor. The cool gas from the evaporator is compressed to a high temperature, high pressure gas which discharges through the oil separator (then through the heat coil of the receiver, when installed) and to the condenser. In the condenser, heat is removed and the gas is condensed to a high temperature, high-pressure liquid. The high-pressure liquid passes through the liquid line through a strainer (43), liquid "A" solenoid valve (20) check valve (101), and hand expansion valve (17). At the hand expansion valve (17), the refrigerant expands from a saturated high pressure liquid state to a low pressure, low temperature liquid. This cold liquid enters the freezer (2) where it absorbs heat from the circulating water in the freezer tubes. Cool gas is again pulled out of the freezer through the suction outlet, completing the circuit.

The freezing period is completed by action of the freezer pressure switch (2PS) in the control panel. The water pump (6) stops and the "A" solenoid valve (20) closes. After a delay of 20-30 seconds, the cutter motor starts, the thawing gas "D" solenoid valve (18) opens, and the harvest (thawing) timer (2TR) is activated. Warm gas from the receiver is discharged through the thawing chamber (16), check valve (101), and into the freezer. There it warms the refrigerant and the outer surface of the freezer tubes, allowing the ice to release on the inside of the tubes and drop down onto the rotating cutter for sizing. After sizing, the ice drops on the tines cutter disc and is discharged through the ice discharge opening.

See "Freeze Period" and "Harvest Period" for additional details.

Freeze Period. Water is frozen inside the stainless steel tubes of the freezer (2) by the direct application of refrigerant to the shell side of the tubes. Ice is produced from constantly circulating water down each tube. As the ice thickness increases, the freezer suction pressure decreases. At a set time, the freeze timer (1TR) energizes the relay (1CR), which stops the water pump, closes the "A" liquid feed solenoid valve (20), de-energizes the suction regulator (when installed) and turns out the two pilot lights, LIQUID FEED and FREEZING.

Harvest Period. About 20-30 seconds after the 1CR relay is energized, the thaw gas valve (18) opens, the "H" water flush solenoid valve (63) opens, the compressor unloads (when required), the cutter motor starts, the thaw timer (2TR) is energized, the red thawing gas light illuminates and auxiliary equipment starts (conveyors, etc.). When the refrigerant in the freezer is warmed sufficiently, approximately 40°F / 5°C to allow the ice in the tubes to release and be sized, the ice is then discharged into the customer's ice handling equipment. See "Ice Handling" for more information on this subject. The thaw timer (2TR) is adjustable and should be set for the time required for all the ice to clear the freezer plus 30 seconds more.

! CAUTION !
Make sure all the ice clears the freezer with at least 30 seconds to spare before the next freezer period begins. This is to prevent refreezing and to allow the ice moving augers etc. to clear.
! CAUTION !

1PG	Suction Pressure Gauge
2PG	Discharge Pressure Gauge
6	Water Pump
9	Water Tank Overflow (3" FPT)
12	Make-Up Water Float Valve
13	Suction Line Heat Exchanger
17	Hand Expansion Valve
18	Thawing Gas Regulator/Solenoid Valve "D"
18A	Aux. Thaw Gas Solenoid "D2"
19	Liquid Feed Solenoid Valve "A"
20	Bypass Liquid Feed Solenoid Valve "A2"
21	Bypass Hand Expansion Valve
28	Refrigerant Charging Valve
29	Liquid Line Stop Valve
39	Water Tank Drain Valve
43	Strainer
46	Filter Drier
49	Freezer Suction Stop Valve
51	Pressure Relief Valve
52	3-Way Valve
61	Aux. Thaw Gas Purge Valve
62	Make-up Water Inlet Valve
63	Water Flush Solenoid Valve
65	Liquid Level Probe
67	Sight Glass
69	Low Suction Pressure Stop Valve
70	Suction Accumulator Purge Valve
75	Filter Drier Purge Valve
76	Freezer Purge Valve
88	Accumulator
90	Thawing Gas Stop Valve
91	Aux. Thaw Gas Stop Valve
101	Check Valve

Piping Nomenclature

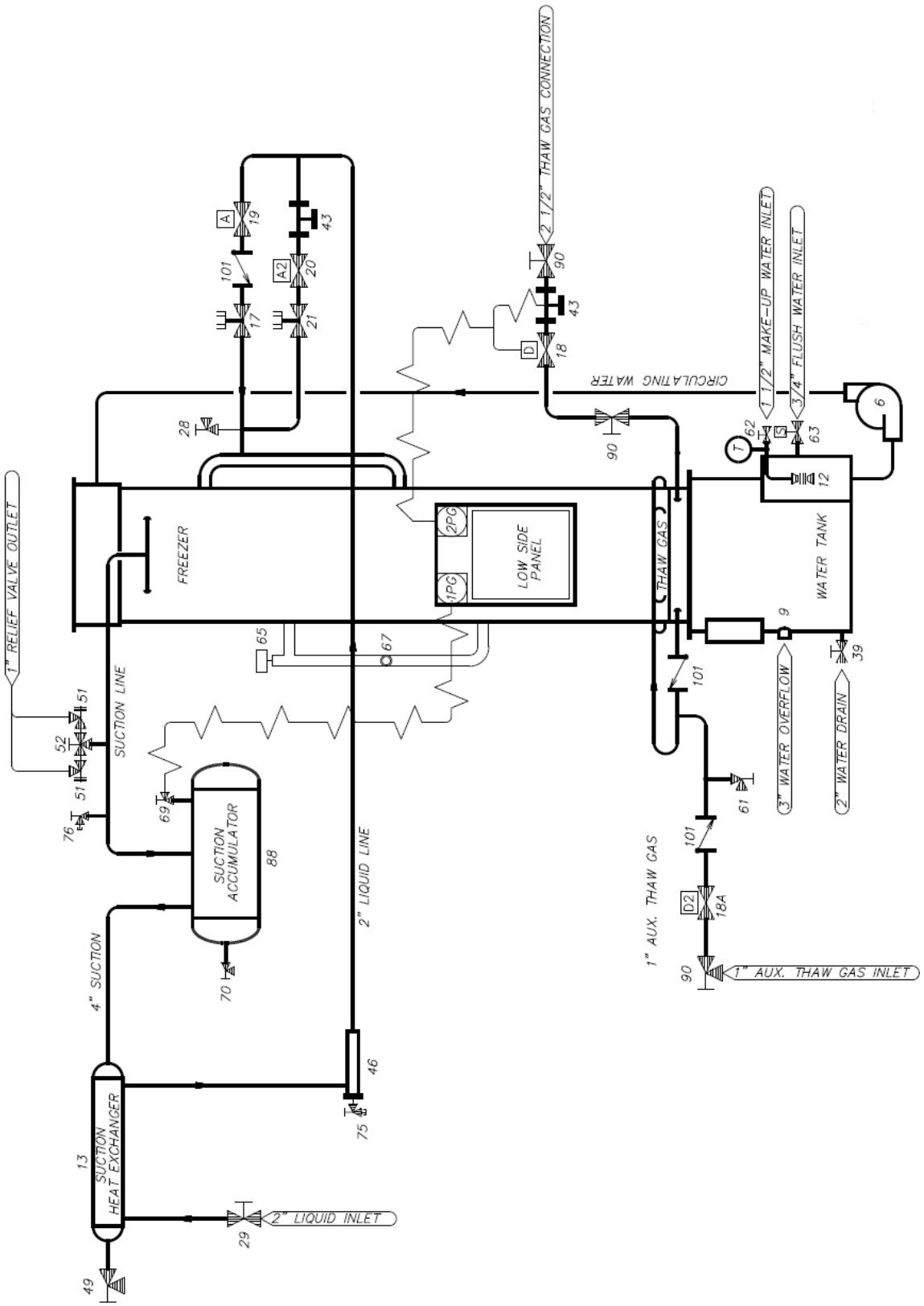


Figure 4-1
Piping Schematic for P34FXL

HOW YOUR TUBE-ICE MACHINE WORKS

5. Start-Up & Operation

Refrigeration System Review. The refrigeration system uses R-404A refrigerant. Following the piping schematic (Figure 4-1), you will see that during the machine's freeze cycle, the compressor discharge gas goes through the oil separator to remove any oil present in the discharge gas and return the oil to the compressor crankcase. It is then discharged into the condenser and condensed into a liquid by the removal of heat by water passing through the condenser tubes. A reservoir of liquid refrigerant is accumulated in the receiver and is required for thawing purposes (see Table 3-2). Liquid from the receiver flows through the filter drier (46), and the heat exchanger (13), to the "A" solenoid valve (20A), which opens and closes by action of the capacitive level probe (65). The liquid is then expanded through the hand expansion valve (17) and into the evaporator (2) (freezer). The cold, wet refrigerant floods the evaporator and is in contact with the outside of the ice making tubes through which water is being circulated. The heat contained in the water passes through the wall 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 freezer tubes. Since the purest water freezes first, the circulating water continues to wash the dissolved solids down into the sump area of the water tank. The flushing valve (63) helps to rid the water tank of increased dissolved solids by flushing them out the overflow during the harvest (thawing) period.

The wet suction gas leaves the freezer (2) and passes through the suction accumulator (88) and heat exchanger, where liquid droplets are removed, allowing superheated dry gas to enter the suction side of the compressor (3). The suction gas is then compressed and discharged once again, completing the cycle. As ice continues to form in the freezer tubes, the suction pressure steadily decreases, until the freezer pressure switch is satisfied and the contact closes, initiating the thaw (harvest) cycle.

Note: Freezing time will vary, depending on make-up water temperature and thickness of ice produced.

During the harvest period, the "D" thawing gas valve (18) opens and the compressor unloads (when required), allowing the warm high-pressure gas from the receiver to enter the freezer. As the tubes warm up to slightly above freezing (approximately 40°F / 5°C), the ice inside the tubes releases and falls down onto the rotating cutter for sizing and discharging. Harvesting requires about three minutes, but can vary depending on ice thickness, suction pressure, discharge pressure (thawing gas temperature) and distance from the receiver to the freezer.

! IMPORTANT !
It is a good idea and will be profitable for you to observe and become familiar with the proper operating characteristics of your Tube-Ice® machine. It will help you to recognize and correct minor irregularities as they occur in order to help prevent major problems. **"An ounce of prevention is worth a pound of cure."**
! IMPORTANT !

Start-up Checklist. Be sure to complete and return the "Warranty Registration/Start-up Report" located in the front of the manual.

1. See that the water-inlet connections are attached properly. The water inlet shutoff valve (62) for the water tank should be open. The water level in the water tank should be at a height where the make-up float valve will be closed when the machine is idle and water is not running out of the overflow (9).
2. Fill the cooling tower sump and check the tower manufacturer's installation and operation instructions to make sure it is ready to run.
3. Check condenser cooling water pump rotation.
4. Check rotation of augers or ice handling equipment to make sure they are rotating the proper direction.
5. Check all tagged valves and make sure they are in their correct operational position (opened, closed, or automatic). Sight glass valves on the freezer must be closed prior to operation.
6. See that the electrical disconnect is closed and the proper power is supplied to the machine.
7. See that the compressor oil temperature is 100-110°F and there is no liquid ammonia in the crankcase. The oil level should be 1/2-3/4 of the sight glass.
8. Check the elapsed time indicator (ET) and make sure wire #22 and #27 are attached.
9. Reconfirm "Rotation Check" for cutter and water pump (See Section 3).

Refrigerant Charge. Prior to charging the machine with R-404A refrigerant, make sure the system is leak tight and free of non-condensables or other contaminants. All valves tagged prior to shipment must be opened before starting the machine

Low Side Refrigerant Charge (lbs)		
Model	**Tube Size**	
	1-1/4"	1-1/2"
P34FXL	2,480	2,320

Table 5-1
Low Side Total Refrigerant Charge

Special precautions to be observed when charging refrigeration systems. Only technically qualified persons, experienced and knowledgeable in the handling of R-404A 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 R-404A refrigerant. See "Material Safety Data Sheet", MSDS Code 5B81-83, located in the Appendix A.

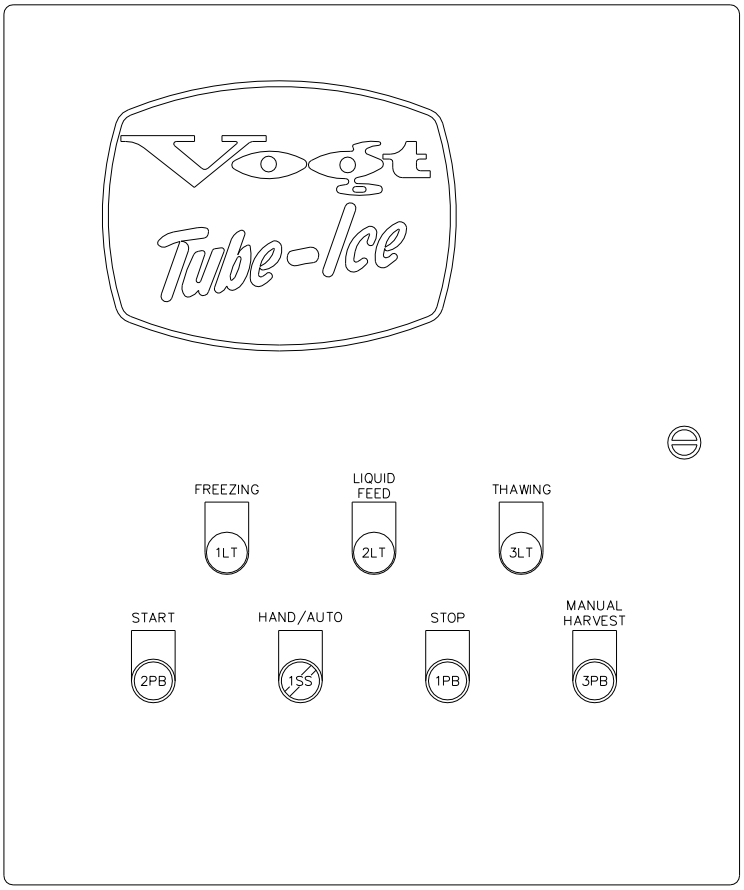


Figure 5-1
Control Panel

Start-Up. Starting the machine in a freezing cycle can be accomplished as follows:

1. Make sure the crankcase oil temperature is approximately 100°F and there is no liquid refrigerant in the compressor crankcase.
2. Turn the HAND/AUTO switch (1SS) to the HAND position and allow the water tank to refill. MAKE SURE THE DRAIN VALVE IS CLOSED.
3. If the compressor motor starter is wired to the control relay (3CR) then push the green START push button to start the compressor and immediately observe the oil pressure, the oil level, the discharge pressure, and listen for any unusual sounds. The compressor should start unloaded and will load automatically after several seconds of operation.
4. Turn the HAND/AUTO switch to the AUTO position.
5. When the discharge pressure increases to about 235 psig (R-404A), push the MANUAL HARVEST button to initiate the harvest cycle. See “Harvest Period”.
6. Set the thaw gas pressure regulator (18R) and the suction regulator (if used). See “Thaw Gas Regulator” and “Suction Regulator” for instructions.
7. When the suction pressure raises to 85-90 psig (R-404A), any ice made should release and discharge. After all of the ice clears the cutter and auger, turn the HAND/AUTO switch to HAND and back to AUTO. This will interrupt the harvest cycle and start another freeze cycle. See “Freeze Cycle”.

As the machine continues its freezing cycle, the liquid refrigerant will feed into the freezer until the level float switch (10) is satisfied. The float switch will open and close the liquid line solenoid valve (20) to maintain that level of refrigerant in the freezer during the freeze cycle. When the suction pressure pulls down to the setting of the freezer pressure switch (2PS), the switch will close and initiate the harvest cycle. See "Harvest Period."

Be sure to observe several complete cycles of ice production to confirm the satisfactory operation of the machine.

! IMPORTANT !
Complete the remaining part of the "Warranty/Registration Start-Up Report" and return it to Vogt Ice, LLC.
! IMPORTANT !

Check the refrigerant level at the receiver liquid gage glass to make sure it is near the operating level mark.

Adding Refrigerant. Add refrigerant while the machine is running by the following procedure:

1. With a cylinder of refrigerant laying on its side, cylinder valve outlet pointing up and bottom end raised two inches higher than the valve end, connect an "approved for R-404A" charging hose between the freezer charging valve (28) and the cylinder valve.
2. Purge all air from the charging hose and open the cylinder valve gradually to check for possible leaks around the packing nut or hose fittings. Then open the cylinder valve fully.
3. While the "refrigerant feed" light is not illuminated, open the charging valve (28) and refrigerant will flow from the cylinder to the freezer.
4. Close the cylinder valve immediately when the "refrigerant feed" light comes on and reopen it when the light goes out. Repeat until properly charged.

! CAUTION !
Do not leave a refrigerant cylinder attached to the machine unattended. Disconnect it immediately when the machine is charged or the cylinder is empty.
! CAUTION !

Operating Tips.

- Make sure the machine is left running in the AUTO position. This will assure a complete shutdown if a safety or overload is tripped.
- To initiate a harvest cycle, simply push the MANUAL HARVEST push button (3PB).
- To interrupt the harvest cycle and revert to a freeze cycle, turn the HAND/AUTO switch to HAND and back to AUTO.
- The circulating water overflow tubing will show that water is being slightly lifted up the tubing near the end of the freezing cycle. If this action ceases and water begins overflowing from the top water box, it is an indication that the tubes are freezing solid and the machine should begin a harvest cycle. It is best not to freeze the ice solid with no hole.
- To cease ice production manually, allow the machine to complete the harvest period and start the freeze period. When the LIQUID FEED light comes on at the beginning of the freeze period, push the STOP button to cease ice production.

Thaw Gas Regulating and Suction Regulating Valve Adjustment. The following is the procedure for regulating valve adjustment. On dedicated compressor systems, the suction regulating valve is not required. However, the compressor must unload by 50% or greater during the harvest or a hot gas bypass must be installed.

1. Install gauge and gauge valve in gauge port of regulator.
2. Turn high pressure stem (down stream pressure) on suction regulator into the milled flats, do not turn milled flats into packing nut.
3. Start the machine and initiate a harvest.
4. Adjust the thaw gas regulator to build pressure to 85-90 psig (R-404A).
5. Adjust (downstream) high-pressure stem on suction regulator to begin regulating at 84-89 psig. (Slightly below the thaw gas regulator, R-404A)
6. After the machine has completed the harvest cycle and returned to the freeze cycle, adjust the low pressure (upstream pressure) on the suction regulator to maintain the required freezer pressure.

6. Electrical Controls

Your low side Tube-Ice® machine is equipped with a dry contact (3CR) for a compressor motor starter and a transformer (if required) for the control circuit power. The control panel and transformer are mounted on the machine front side (see Figure 1-1).

The control panel wiring schematic, Figure 6-3, illustrates these components as well as provisions for auxiliary equipment that may be incorporated by the customer such as:

(FU1) Main power disconnect
(5M) Conveyor motor starter and overload (5MOL)
(6M) Tower fan starter and overload (6MOL)
(7M) Condenser pump starter and overload (7MOL)

When adding motor starters for auxiliary equipment, be sure to incorporate the overload protection as indicated between terminals #12 - #13 and remove the jumper wire. This will assure that the machine will shutdown when any auxiliary equipment fails.

Bin Level Control. Included in the wiring schematic is provision for a bin level control (BLC). The NC contract of your control should be wired between terminals #8 – #9 and the jumper wire removed as indicated. Installation in this manner will allow the machine to finish the harvest period before shutdown. However, the machine will still need to be manually started to resume production.

Safety Switches. The machine is not equipped with the following safeties and control switches; however, they can be wired into the control circuit. Refer to the wiring schematic Figure 6-3 for their circuitry.

- High/Low dual pressure switch (1PS) to stop the machine if the compressor suction pressure goes too low (15-20 psig) or the compressor discharge pressure goes too high (350 psig for R404A). See “High/Low Pressure Switch”.

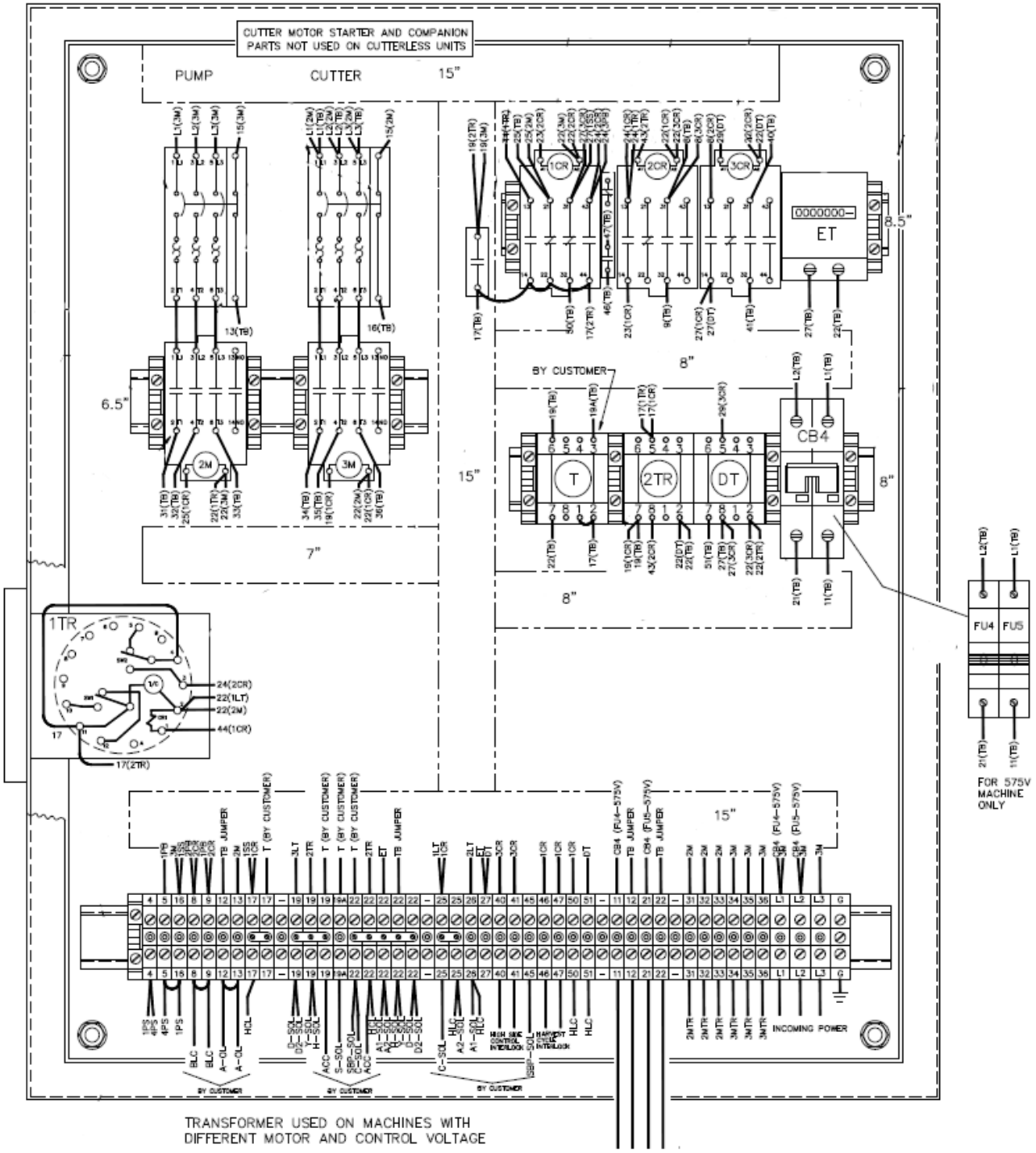


Figure 6-1
Control Panel (Door Opened)

2M	Pump Motor Starter	Provides power to the circulating water pump during the freezer period or when the HAND/AUTO switch is in the HAND position to circulate water or ice machine cleaner, etc. Provides motor overload and short circuit protection.
3M	Cutter Motor Starter	Provides power to the cutter during the harvest period. Provides motor overload and short circuit protection.
1CR	Control Relay With Pneumatic Timer	For making and breaking various circuits during freezing and thawing period with pneumatic timer to delay the actual thawing process. Energized during thawing.
2CR	Control Relay	For making and breaking circuits during freezing and thawing. Energized during freezing, thawing, and hand. Momentarily de-energized at the end of the harvest.
3CR	Compressor Motor Starter contact and holding relay	Holding relay for safety and bin level control. Auxiliary contact provides control power to the compressor motor starter. Continuously energized during freezing and thawing.
1TR	Freeze Timer	Used to control the freeze time.
2TR	Thawing Timer	Controls the time of the harvest (thawing) period. Energized during the harvest period.
DT	Delay Timer	Allows the compressor to start unloading by delaying the energizing of the "UR-SOL" (unloader solenoid) valve. This gives lower in rush amps and helps prevent belt slippage at start-up.
ET	Elapsed Time Indicator	Indicates total hours of machine operation. Is powered when the compressor is running.
CB4	Circuit Breaker	Overload and short circuit protection for crankcase heater and the control circuit.
T	Suction Valve Timer	Customer Supplied suction valve timer. Used to control customer supplied main suction valve.
TB	Terminal Block	Numbered for multiple wire connections and ease of troubleshooting.

Table 6-1
Description of Control Panel Parts (Inside)

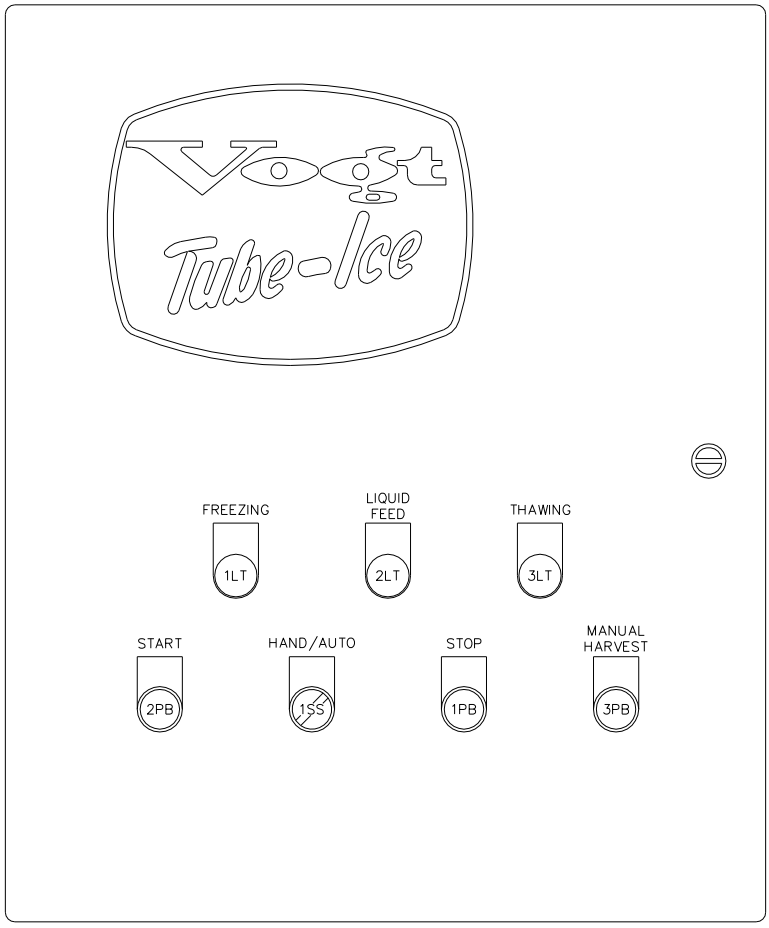


Figure 6-2
Control Panel (Hinged Door)

1LT	Amber Pilot Light – FREEZING	Illuminated during the freeze period or whenever the circulating water pump is running.
2LT	Clear Pilot Light – LIQUID FEED	Illuminated when the circulating water pump is running and the float switch (10) is closed. Indicates that the liquid line solenoid valve (20) is opened.
3LT	Red Pilot Light – THAWING	Illuminated when the machine is in a harvest period.
2PB	Green Push Button – START	For starting the compressor motor and ice production. (NO)
1PB	Red Push Button – STOP	For stopping the compressor motor and ice production. (NC)
3PB	White Push Button – MANUAL HARVEST	For manually initiating a harvest cycle. (NO)
1SS	Selector Switch – HAND/AUTO	HAND position for running the circulating water pump independently at start-up or for cleaning the freezer tubes and water tank. AUTO position for provision of automatic system shutdown if there is a control circuit power interruption.

Table 6-2
Description of Control Panel Parts (Outer Door)

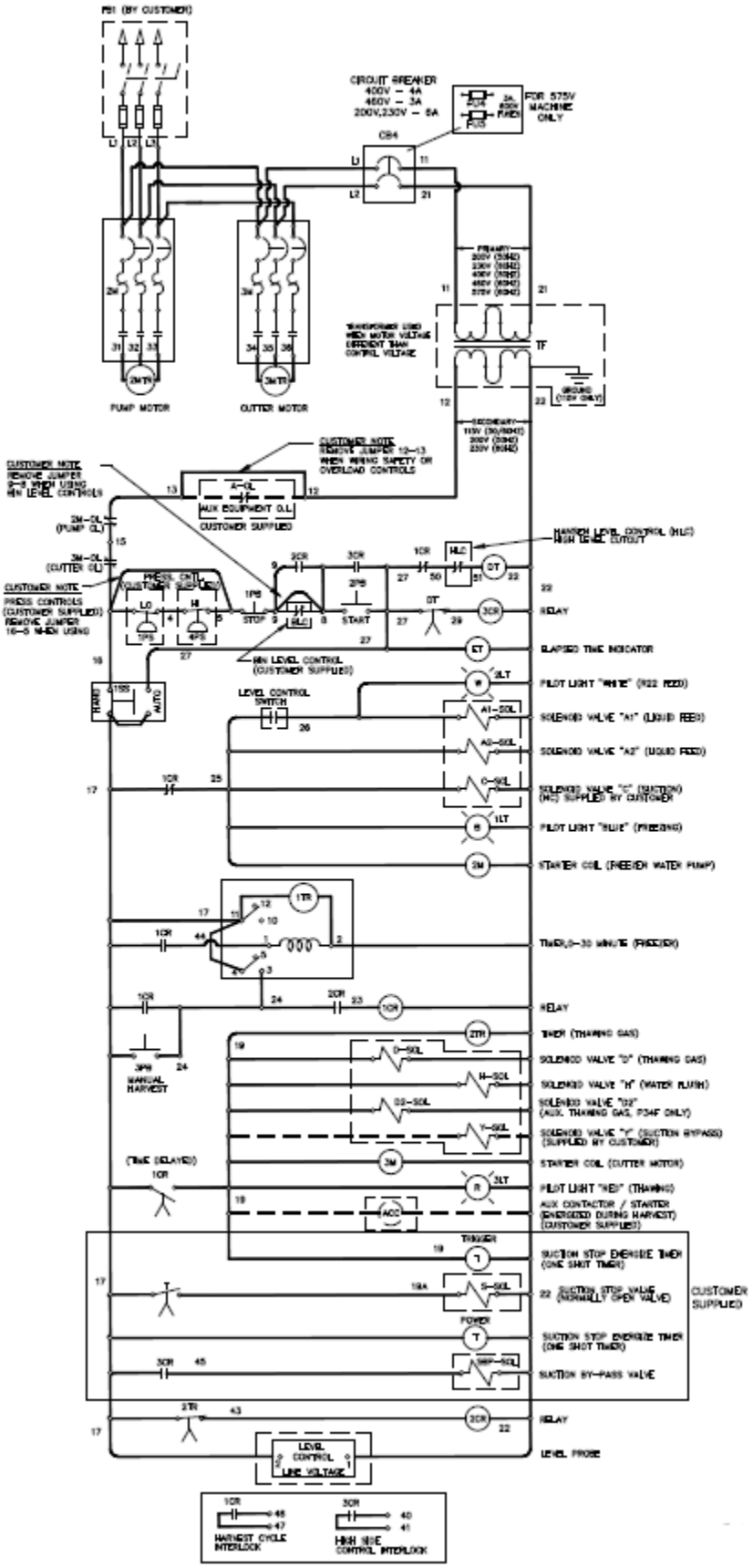


Figure 6-3
Electrical Schematic for P34FXL all Voltages, 50-60 Hz.

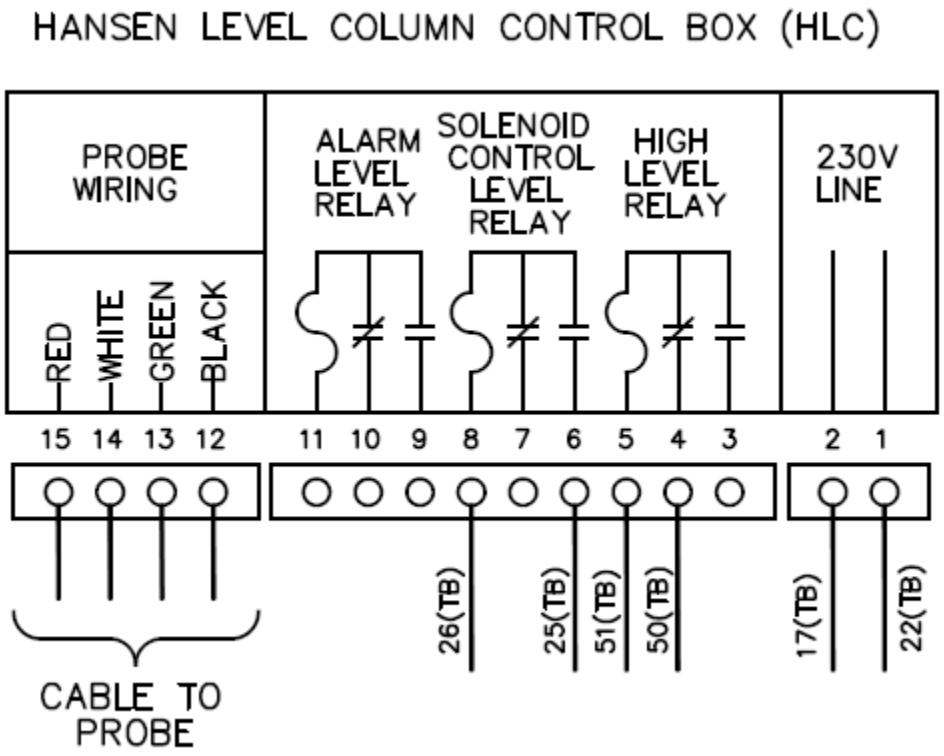


Figure 6-4
Level Column Wiring for P34FXL, all Voltages, 50-60 Hz

7. Maintenance

Preventative Maintenance. A careful inspection of your Tube-Ice® machine for leaks and correct operational functions at the time of installation and start-up will begin a long, satisfactory life of service. In order to insure this degree of dependability, a systematic maintenance program is necessary. Therefore, the following schedule is suggested as a minimum.

A. Daily
   1) Check operating pressures (suction, discharge, oil).
   2) Check ice quality.
   3) Check "ice out" time (maintain 30 seconds of continued harvest after last ice is out).
   4) Check compressor oil level.
   5) Check refrigerant operation level.
   6) Check frost pattern on freezer shell and oil trap.
   7) Check make-up water float valve adjustment.

B. Weekly (in addition to daily checks)
   1) Check for leaks after 400 hours or four weeks of operation

C. Monthly (in addition to weekly checks)
   1) Check calibration and operation of all high side controls (high and low pressure switches, oil pressure switch, etc.)
   2) Check cooling tower spray nozzles and pump suction screen for scaling and algae (consult water treatment suppliers for corrective measures).
   3) Check water distributors in freezer for scale accumulation.
   4) Check water tank for solids to be removed.
   5) Check all motor drive units (compressor, cutter and pump motors, cooling tower fan, and pump, etc) for abnormal noise and/or vibrations.
   6) Check oil level in gear reducer.
   7) Check one complete freeze/thaw cycle, record data and compare with production check of Registration/Start-up Report.

D. Yearly (in addition to weekly and monthly)
   1) Check entire system for leaks.
   2) Drain water from condenser and cooling tower and check condenser tubes. Check closely for damage by corrosion or scale.
   3) Remove all rust from all equipment, clean, and paint.
   4) Check all motors for shaft wear and end play.
   5) Check operation and general condition of all electrical controls, relays, motor starters, and solenoid valves.
   6) Check freezing time, ice release time, and ice out time.
   7) Change oil in gear reducer box once a year.
   8) Lubricate compressor motor bearings.

PREVENTATIVE MAINTENANCE FORM

This form can be removed and duplicated for record keeping.

Date: _____ Model #: _____ Serial #: _____

The following service performed and checked:

- ☐ Hour meter reading _____, Ambient temperature (inside)_____ °F
- ☐ Make-Up water float valve adjusted properly
- ☐ Water distributors clean and in place
- ☐ All drains freely draining
- ☐ Cleaned and flushed water tank
- ☐ Compressor oil changed
- ☐ Cleaned and inspected inside compressor crankcase
- ☐ Changed compressor oil filter
- ☐ Checked/adjusted compressor belt tension or alignment
- ☐ Lubricate compressor motor bearings
- ☐ Check/change cutter gear reducer oil
- ☐ Check/adjust cutter drive gear meshing
- ☐ Leak check entire system
- ☐ Check liquid refrigerant level in receiver
- ☐ Drained oil from oil trap
- ☐ Compressor crankcase heater working
- ☐ Compressor net oil pressure (gage reading less suction)

Motor amps: Compressor _____ Cutter _____ Pump _____
Suction psig (end of freeze) _____ Discharge psig (end of freeze) _____
Suction psig (end of thaw) _____ Discharge psig (end of thaw) _____
Compressor water out ____°F Tower fan cycles ___ On ___ Off

Production Check

Test Cycle	Make-up Water Temp	Freezing Time Min/Sec	Harvest Time Min/Sec	First Ice Out Min/Sec	All Ice Out Min/Sec	Avg. Hole Size	Ice lb. Per Harvest (est)	Ice lb. Per Day (est)
#1								
#2								
#3								
#4								

Comments: _____
_____
_____

Name: _____

Ice Making Section. 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 water pump is used to circulate the cleaner through the system. For complete instructions, follow the "Cleaning Procedure" below.

Cleaning Procedure

1. Stop the machine at the end of harvest.
2. Shut off make-up water supply.
3. Drain the water tank, flushing out any loose sediment.
4. Close the drain valve and fill the tank with warm water. Warm water promotes faster cleaning.
5. Cover the ice discharge opening to prevent water from splashing out and contaminating any stored ice.
6. Add sufficient ice machine cleaner to the water tank.
   P34 tank = 4.7 gallons of water per inch of water height in tank, 13" = 60.6 gallons
   Mix cleaning solution according to manufacturer's recommendations.
7. Remove top water box cover, inspect distributors, remove any hard particles from orifices, and make sure all distributors are in place. Replace cover.
8. Turn HAND/AUTO switch to HAND position and circulate the cleaning solution until deposits are dissolved or the solution is neutralized. After draining, the pump may have to be stopped and restarted to dispel air.
9. Turn switch to AUTO position to stop the pump. Drain and flush the water tank. Repeat cleaning as necessary.
10. After cleaning, fill the tank with fresh water, start the pump again, and circulate for 15 minutes.
11. Stop the pump, drain and flush the tank and again refill with fresh water.
12. Remove the cover from the ice discharge opening, and clean any area that may have been splashed with solution during cleaning.
13. Make sure the make-up water float valve is adjusted properly and the drain valve is closed.
14. Start and stop the pump again to make sure it is circulating water and it is not air bound.

The machine is now ready to produce ice.

Water Distributors. The water distributors are located under the top freezer cover. These distributors are similar in design to those used in mid-size and small machines (i.e. P18F, P118, etc.) except they have a small vent tube. It is important that this plastic vent tube remain in place in each distributor. The distributors may require occasional or periodic cleaning to remove solids, foreign particles, or mineral deposit accumulated from the circulating make-up (ice making) water. The frequency of cleaning operation will depend on the characteristics of the water supply. The distributors need inspection when the inside diameter of a large portion of the ice becomes irregular (due to channeling of water), if some of the ice is opaque or if there is a noticeable decrease in ice capacity and quality.

Tube Size	1 1/2"	1 1/4"	1"
Model	Number of Distributors		
P34FXL	306	420	564

Table 7-1
Water Distributors

You may look through the plastic freezer cover to inspect the water distributors if the view is clear. For a closer inspection, you should stop the unit, remove the nuts and retaining ring sections and lift off the top cover. Make sure the two orifices in the side of each distributor are open, the vent tubes are in place, and a distributor and vent tube assembly is installed firmly in each tube.

To remove the water distributors for cleaning:

1. Grip the top of the distributor body (not at the vent tube) with adjustable pliers.
2. Hold and twist the distributor while pulling upward.
3. Lift the distributor out of the hole.

To install the distributors:

1. Insert one in each tube hole and seat firmly by using a short piece of pipe or conduit.
2. Slide the pipe or conduit down over the vent tube and gently tap the distributor in place.
3. Do not allow the distributor to be recessed below the top of the tube sheet.

To replace the cover:

1. Replace water distributor box cover gasket.
2. Install the cover over the bolt studs.
3. Install the four (4) cover retaining rings sections and nuts.
4. Tighten the wing nuts firmly to prevent foreign materials from entering the water box.

Note: The freezer cover and gasket are not intended to hold the pressure of the circulating water in the event of a freeze up. Therefore, every effort should be made to prevent the Tube-Ice® from freezing solid (with no hole).

Tube Size	1 1/2”	1 1/4”	1”
Hole Size	1/4”-3/8” Avg.	1/8”-3/16” Avg.	1/16”-1/8” Avg.

Table 7-2
Average Hole Size in Tube-Ice®

Water Tank. The production of opaque ice can indicate that the water in the water tank contains a concentrated amount of solids or salts. See Troubleshooting, “Poor Ice Quality”.

To clean the water tank:

1. Stop the machine at the end of harvest.
2. Shut off the make-up water supply.
3. Open the drain valve and drain the tank.
4. Remove the water box cover and flush out any loose sediment from the tank. The wire mesh screen can be removed if necessary.
5. If further cleaning is needed, follow “Cleaning Procedure”.
6. If further cleaning is not needed, close the drain valve and refill the tank with fresh water.
7. Make sure the float valve is adjusted properly and install the water box cover.
8. Start and stop the pump again to make sure it is circulating water and is not air bound.

Compressor (optional). This section is only a guide, please consult the compressor manual for manufacturers recommended maintenance.

In starting and charging the unit, the oil sight glass should be continually checked to make sure an adequate oil level is maintained. The oil level should be 1/4-3/4 of the sight glass. If the oil level drops below 1/4 of the glass, add refrigeration oil as per the compressor manufacturer recommendations. Never allow the oil level to be out of sight, above or below the sight glass when the compressor is operating.

! CAUTION !
The crankcase heater should be energized for a minimum of four hours and the oil temperature should be 100°-110°F before attempting to start the compressor.
! CAUTION !

During operation, the specified net oil pressure should be maintained for proper lubrication and operation of the cylinder unloader mechanism.

Note: Net oil pressure is calculated by subtracting the compressor suction pressure from the oil pressure gage reading while the compressor is running.

Example:
Oil pressure gage reading: 65 psig
Suction pressure gage reading: 40 psig
Net oil pressure: 25 psig

The compressor oil should be changed at close intervals during initial break-in operation and up to the first 1000 hours (see Table 7-3 below).

Note: It is the owner's responsibility to make sure normal maintenance is initiated to insure that the compressor is not subjected to premature wear or failure due to neglect or lack of sufficient maintenance and care.

	Frequency				
	1st	2nd	3rd	4th	Thereafter
Change oil	200 hr.	500 hr.	1500 hr.	4000 hr.	every 4000 hrs.
Clean suction strainer cloth	200 hr.	500 hr.	Remove if clogging is minimal		

Table 7-3
Compressor Maintenance

The above maintenance is only a guide. The compressor should be inspected anytime there is unusual noise, damage is suspected or the oil becomes discolored. The oil should be changed any time the compressor is opened. For specific recommendations and instructions, refer to the particular compressor manufacturer's manual. See "Compressor Oil Changing and Inspection"

Cutter Gear Reducer. The oil level of the gear reducer should be checked monthly or when there is any evidence of leakage. The correct level is indicated by the pipe plug in the side of the gear housing. The oil should run out of the hole when the plug is taken out. If low, add oil through one of the top plugged holes. A USDA high food grade lubricant such as Chevron FM Lubricating Oil 460X should be used. The oil should be changed annually. Drain the oil and flush the gear case with mineral spirits. Drain the mineral spirits completely and refill with the proper oil.

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

8. Troubleshooting

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

When the machine stops, it must be manually restarted by pushing the START button. If it stopped while in a freeze cycle, it should be manually harvested to remove all ice from the freezer. This is done by pushing the white MANUAL HARVEST button.

Always check the machine operation thoroughly after remedying the problem. Be sure to correct the source or cause of the problem to prevent the problem from occurring again.

Contact your distributor first for technical service assistance about operation problems not covered in this manual.

Also feel free to contact the factory for additional service (502) 635-3510

Symptom: Machine Stopped

Possible Cause	Possible Remedy
Power failure or interruption	Check fused disconnect or circuit breaker supplying power to the machine. If power has been off, make sure the crankcase heater is energized and there is no liquid refrigerant in the compressor crankcase prior to restarting the compressor. If ice is in the freezer, initiate a manual harvest.
Circuit breaker (CB4) for control circuit tripped	Check coils of relays, contactors, starters, solenoid valves, and thawing timer for a ground. Repair or replace any defective part and reset circuit breaker. Make sure there is no liquid refrigerant in the compressor crankcase prior to restarting the machine.
Compressor motor starter overload (1MOL) tripped	Check for a loose connection on all motor starter and motor terminals that could cause excessive amp draw. Reset overload and restart the machine, check amperage, power supply, and head pressure.
Water pump, cutter motor, conveyor motor, overload tripped	Check for loose connection on all terminals, which could cause excessive amp draw. Reset the overload and manually run that particular motor to check actual voltage and amperage against motor rating.
Freezer water pump motor overload (2MOL) tripped	Check for loose terminal connections and reset the overload and start the pump by turning the selector switch (1SS) to HAND. Check voltage and amperage against motor rating. Confirm proper rotation.
Cutter motor overload (3MOL) tripped	Check for loose terminal connections and reset the overload. Clear all ice that may have jammed cutter. Turn the selector switch (1SS) to HAND and push the MANUAL HARVEST button. Check voltage and amps against motor rating. If tripping repeats but ice is not jammed, check the gear reducer for resistance, cutter bearings for wear, drive gear and ring gear for proper engagement, and reducer motor for defect or single phasing.
Bin level control (optional) open	Adjust or replace control as required. If bin level control is not used, make sure jumper wire #8 and #9 is installed at of the terminal block.

Symptom: Machine Stopped (con't)

Possible Cause	Possible Remedy
High/Low pressure safety switch (1PS or 4PS) tripped (optional)	If the machine stops by low pressure cutout, the switch will reset automatically when the pressure raises to the "cut-in" setting. Check thaw gas valve (18) to make sure it opens during harvest time. Check Liquid feed valve (20) to make sure it is feeding during a freeze. If the machine stops by high pressure cutout, the switch will have to be manually reset after the pressure drops below the "cut-in" setting. Check the head pressure during the next freeze cycle.
Low oil pressure tripped (OPS) located on compressor (optional)	Manually reset the switch after the switch heater cools. Check the crankcase oil level (1/4-3/4 full). Add oil if below 1/4 glass before attempting to restart the machine. Restart the machine and check net oil pressure (net oil pressure = oil pump line pressure minus crankcase suction pressure). Net oil pressure range: Mycom = 17-28 psig Vilter = 35-50 psig
Defective control panel component such as 1PB, 1SS, 1M contact, 2TR	See Figure 6-3, Wiring Schematic, and check for open circuit. Refer to Figures 6-1 and 6-2, Control Panel to identify parts. Check for loose wires. Replace defective part, restart machine, check power supply, and current draw.
Motor Starter (2M or 3M) for pump or cutter motor tripped.	Check for loose connection on all terminals, reset overload and check amp draw against breaker rating. Check voltage and current unbalance, Chapter 3. Replace motor starter if defective.

Symptom: Freeze-up due to extended freeze period

Possible Cause	Possible Remedy
High refrigerant level in evaporator due to liquid feed valve "A1" leaking through	Check the manual opening stem to make sure it is in the automatic position (stem fully out). Check for leakage by sound, temperature difference, and frost during the freeze cycle. Leakage should stop by closing the hand stop valve downstream of the thaw gas valve. Isolate and repair or replace the valve as needed.
High refrigerant level in evaporator due to level controller failure	Check liquid level control on Hansen Level Control (HLC) for proper operation and set point. Replace defective part.
Freeze timer (1TR) malfunction or improper adjustment.	Adjust freeze time or replace if defective.
Freezer pressure switch (2PS) set too low or defective (optional)	Adjust switch or replace if defective.
Water tank drain valve, make-up water float valve or flushing valve stuck or opened (if 2PS is used)	Close, repair, or replace valve as needed. The float valve should be adjusted low enough that water should not run out the tank overflow during the freeze cycle.
Level control set too high	Check liquid level control on HLC for proper operation and set point. Replace if defective.
Thaw gas solenoid valve (18) leaking through during freeze (if 2PS is used)	Check the manual opening stem to make sure it is in the automatic position (stem screwed in). Check for leakage by sound, temperature difference and frost during the freeze cycle. Leakage should stop by closing the hand stop valve downstream of thaw gas valve. Isolate and repair or replace the valve as needed.
Compressor running unloaded	If the compressor is running unloaded, the motor amp draw will only be 60%-70% of the normal amp draw of a loaded compressor. Check the load delay timer electrical circuit to make sure the "UR-SOL" coil is not energized. Refer to the compressor manual for normal oil pressure needed to load the compressor cylinders and any further procedures to check the mechanical function of the unloader mechanism.

Symptom: Freeze-up due to ice failing to discharge

Possible Cause	Possible Remedy
Extended freeze period (if 2PS is used)	Check freeze timer setting (1TR) or optional freezer pressure switch (2PS) adjustment. See Figures 9-2 or 9-3 for adjustment, and Table 7-2 for average hole size. Make sure all water distributors are in place (one in each tube).
Thaw time too short (2TR)	Adjust thaw timer (2TR) to allow all ice to clear the cutter and ice discharge opening with at least 30 seconds to spare. Replace defective timer. See pressure regulating valve adj.
Thaw pressure too low	The thaw gas regulator should be adjusted to increase the pressure in the freezer to 85-90 psig during a harvest. Isolate and repair or replace the valve as needed.
Insufficient heat for thawing due to low condensing pressure	The head pressure should be maintained from 235-250 psig usually by a water regulating valve or fan cycling switch. Check to make sure these controls are working properly. Cold prevailing wind can also be a factor.
Insufficient heat due to non-condensables (usually air) in the system	If non-condensables are present with the refrigerant, the saturated temperature will not relate to the pressure reading at the receiver and the refrigerant will be cooler, although pressure will be high.
Insufficient heat due to water in the refrigeration system	If water is present in the refrigeration system, the ice will release, but discharge very slowly. Check the refrigerant for water content (purchased kit or freezer pump-down).
Insufficient heat due to low refrigerant charge	The refrigerant level in the receiver should be near the operating mark at the end of a freezing cycle to provide enough volume of warm gas for harvesting. DO NOT OVERFILL RECEIVER. See Table 3-2
Cutter or cutter disc does not turn	Check cutter gear reducer and drive gear for proper operation and alignment. Check for broken gear teeth or sheared shaft key. Replace defective parts.
Compressor not running unloaded during thaw cycle. (for dedicated high side only)	Check compressor motor Amp draw. During the thaw cycle, the compressor motor Amp draw should be 60 - 70% of normal amp draw during the freeze cycle. Check compressor unloader solenoid coil (UR) to make sure it is energized and the valve opening during the thaw cycle.

Symptom: Low ice capacity.

Suspicions of low ice capacity should be confirmed by accurate calculations of actual ice product. Much weight can be lost by melting and off fall through augers and other ice handling equipment.

1. Time the total freeze and thaw cycle for the cycle which is to be caught and weighed.
2. Catch all the ice at the ice discharge opening of the machine.
3. Weight the total amount of ice caught.

Lbs. ice per cycle
Cycle time minutes X 1440 = _____ lbs. production per 24 hours

More than one cycle should be caught and weighed to get an accurate average.

Possible Cause	Possible Remedy
Inadequate water for ice making	Water pressure of 30 psig minimum is required to assure proper water supply. Check water pressure. Check for a restriction in the incoming line or at the make-up water float valve.
Water distributors may be stopped up	Check distributors and clean orifices as needed.
Freezer pressure switch or thaw timer out of adjustment	Check hole size in Tube-Ice (See Table 7-2). Crushed ice should be 3/16”-1/4” thick. Check and adjust thawing time. Thawing should be 30 seconds longer than it takes for all the ice to clear the freezer.
Excessive ice chips in the water tank, causing short cycling	Check incoming water temperature (45°F minimum). Check flushing valve to make sure ice chips are being melted and flowing out the tank overflow during the harvest cycle.
Compressor running unloaded or not pumping full volume	Check compressor motor amp draw. Check for belt slippage and tighten as needed. Check for leaking compressor suction or discharge valves. Refer to your compressor manual. See other related symptoms.
Restriction in the refrigerant liquid line or float switch not operating properly	Check for a partially closed valve or an obstruction at the strainer, solenoid valve, or hand expansion valve. The liquid line will normally have frost on the downstream side of a restriction, especially as the suction pressure decreases.
Low refrigerant charge, causing re-freeze	Check the receiver gage glass mark for the proper level. Check for and repair leaks. Add refrigerant.
Warm make-up water for ice making	Capacity of the machine is proportional to ice making water temperature. Warmer water will reduce the ice making capacity. Check float adjustment and water tank drain valve.

Symptom: Low ice capacity (cont.)

Possible Cause	Possible Remedy
Excessively high head pressure	Check cooling tower or evaporative condenser to make sure sufficient water is provided for cooling and the equipment is operational to cool the water. Also, see "Symptom High Head Pressure".
Suction regulator out of adjustment or defective (optional)	Check the freezer pressure and compare to the main suction pressure. The suction regulator should regulate the freezer pressure and create a 2 psig pressure drop across the valve. Adjust pressure regulator. Repair or replace defective valve.
Thawing gas solenoid valve (18) leaking through during freeze cycle	Check the manual opening stem to make sure it is in the automatic position (stem screwed in). Check for leak by sound, temperature difference and frost during a freeze cycle. Close the stop valve (90) to confirm suspicion of leakage. Repair or replace the valve.

Symptom: Poor ice quality

Possible Cause	Possible Remedy
Excessive concentration of solids in the water tank usually indicated by a build-up of mineral deposit on the sides and bottom of the tank and opaque ice production. Also, water distributors restricted.	Perform a cleaning procedure as well as removing the freezer cover and cleaning the water distributors. Make sure the flushing valve (63) is functioning and the tank overflow piping is not restricted.
Insufficient water supply indicated by a low level in the tank	Check water pressure, 30 psig is recommended minimum. Check for a water line restriction, partially closed valve, or defective make-up water float valve. Make sure the water tank drain is closed.
Water pump rotation wrong direction	Check rotation in relation with arrow on pump housing and reverse two wires at the motor if necessary.
Low refrigerant charge, causing an ice out problem and re-freeze	Check refrigerant level mark on the receiver and on the painted portion of the gage glass guard. Be sure to keep the gage glass cocks closed when finished checking the level.
Suction Pressure too low	Adjust suction regulator valve
Restriction in liquid line, causing short freeze cycle	Check for closed valve, defective solenoid valve (20), float switch defective or strainer restricted. The liquid line will normally have frost on the down-stream side of a restriction, especially as the suction pressure decreases.

Symptom: High discharge pressure (check gage accuracy)

Possible Cause	Possible Remedy
Insufficient water flow through the cooling tower or condenser	Check the condenser water pump to make sure it is pumping enough water. Check sump strainer screen and clean. Check condenser pump direction of rotation.
Fan control out of adjustment	Check adjustment. Replace if defective.
Non-condensables in system	If non-condensables are present with the refrigerant, the saturated temperature will not relate to the pressure reading at the receiver. The refrigerant will be cooler, although the pressure will be high.
Cooling tower or evaporative condenser in need of maintenance	Check fan motor and fan belts for proper operation and tension. Check spray nozzles, tubes, sump, and sump screen, for accumulation of mineral deposit and clean as required. Check tower blowdown and chemical treatment if applicable.
Dirty condenser tubes	Visually inspect the condenser tubes to see if there is any build-up of mineral deposit, which would reduce the cooling effect of the tubes and water. Clean chemically or mechanically as applicable.
Too much liquid in condenser covering tubes causing inefficiency	Remove refrigerant to avoid logging liquid in the condenser.

Symptom: Low discharge pressure (check gage accuracy)

Possible Cause	Possible Remedy
Fan cycling switch out of adjustment or defective	Check adjustment. Replace if defective.
Compressor running unloaded or not pumping efficiently	Check compressor motor amp. If the compressor is running unloaded, the amperage will only be approximately 60% of normal amp draw (FLA). Refer to the compressor manual.
Ambient temperature low and prevailing winds blowing through tower	Shield tower from prevailing winds to prevent excessive cooling. Install an indoor sump.
Too much cold water circulating through condenser	Install a water-regulating valve in the water line form the condenser and control flow by receiver pressure.
Thaw gas valve #18 leaking through	Make sure manual opening stem is in the automatic (screwed in) position. Repair or replace defective parts.

Symptom: High suction pressure (check gage accuracy)

Possible Cause	Possible Remedy
Compressor running unloaded or not pumping efficiently	Check compressor motor amp. If the compressor is running unloaded, the amperage will only be approximately 60% of normal amp draw. Refer to the compressor manual.
Thaw gas valve #18 leaking through	Make sure manual opening stem is in the automatic (screwed in) position. Repair or replace defective parts.
Defective gage	Check pressure with accurate gage and replace as necessary.

Symptom: Compressor running unloaded during freeze (dedicated compressor only)

Possible Cause	Possible Remedy
Low oil pressure	Check compressor net oil pressure. Net oil pressure = oil pressure gage reading less suction pressure. Refer to the compressor manual for “Oil Pressure Adjustment”.
Unloader solenoid valve open	Check solenoid coil to make sure it is not energized. If valve is stuck open, replace valve.
Unloader mechanism not working properly	Refer to compressor manual.

Symptom: Compressor oil pressure low (check gages)

See Section 7, for compressor oil pressure requirements.

Possible Cause	Possible Remedy
Oil diluted with refrigerant	Oil will be very foamy. Check liquid feed control for overfeed problem.
Oil pressure regulating valve out of adjustment	Adjust valve to increase oil pressure. Turn stem in to increase, out to decrease.
Compressor rotation incorrect	Check rotation direction by arrow indication. Reverse rotation, if necessary.
Restriction strainer, oil filter, pick-up tube or oil passage	Clean strainer or restriction in passage or replace filter.
Compressor thrust bearing installed upside down	The Mycom compressor thrust bearing on the shaft seal end has an oil passage hole, which has to be in the proper position when installing the thrust bearing. Hole up for “WA” and “WB” series Mycom compressor. Refer to your compressor manual.

Symptom: Compressor loosing oil excessively

Possible Cause	Possible Remedy
Non-effective oil separator or float	The oil separator will normally return a good portion of oil leaving the compressor, if it is working properly. Check the oil float and return line to see it is not restricted.
Liquid refrigerant in crankcase	Check liquid feed to make sure it is not overfeeding and that the solenoid valve #20 is not leaking through when the machine is stopped.
Compressor piston rings seized or broken	Check compressor efficiency. If rings are seized or broken, replace defective parts.
Leaking shaft seal	A few drops per minute is okay. If ammonia is leaking, replace the seal.

Symptom: Machine short cycles (using freeze pressure switch (2PS) only)

Possible Cause	Possible Remedy
Freezer pressure switch (2PS) set too low or defective	Adjust switch or replace if defective. See Figure 9-3.
Freeze-up	See "Freeze-up due to extended freezer period" and "Freeze-up due to ice failing to discharge".
Clogged water distributors	Clean water distributors.
Lack of water for making ice	Check water tank for sufficient water level. Check for restrictions in water line, defective float valve, and open drain valve, excessive ice chips or low water pressure and correct.
Lack of sufficient liquid refrigerant feed	Check float and float switch, solenoid valve and coil #20 in liquid line, strainer, and refrigerant level in receiver.
Water pump rotation incorrect or pump defective	Check pump motor rotation. Check for leaking pump seal or defective motor and repair or replace as needed.

Symptom: High compressor discharge temperature

Possible Cause	Possible Remedy
High head pressure	Check gage accuracy and "High discharge pressure".
Defective suction or discharge valves	Feel the compressor heads for hot spots or one head running hot. Replace worn or leaking valves.
Restriction in the discharge gas line	Check all hand and check valves to make sure they are fully opened and not stuck. Repair or replace as needed.
Internal relief valve leaking	Check the compressor manual to see if your compressor is so equipped. Replace accordingly.

Symptom: Suction line frosting to compressor

Possible Cause	Possible Remedy
Liquid refrigerant overfeed	Check liquid level controller to make sure it is functioning properly. Replace if defective. Check solenoid valve #20 to make sure it is not leaking through. Repair or replace if defective.
Refrigerant contaminated with water	Test refrigerant or oil for water contamination. Completely pump the freezer out (pumpdown) and pull vacuum on freezer. Refer to Chapter 9 "Removing Excess Water".

9. Servicing Operations

Automatic Blowdown (harvest cycle). A feature of this machine is a solenoid activated flushing valve (63) which is provided to eliminate or reduce the necessity for frequent flushing or cleaning of the water tank. This flushing during the harvest cycle helps to remove salts or solids accumulated in the water as a result of the freezing action. It also helps melt ice chips that fall into the water tank during harvest. The flushing valve is opened (energized) during each thaw cycle when the water pump stops and the water in the freezer tubes returns to the water tank. If water quality is superior, this blowdown can be reduced by installing a smaller reducer bushing in the outlet elbow.

The flushing action carries accumulated salts, solids, and ice chips (fines) out through the water tank overflow pipe. This overflow should be kept open at all times to allow the water to drain freely and keep the water level below the cutter disc and ice discharge opening. If the flushing solenoid valve leaks through during the freeze cycle, it can be disassembled and cleaned, then reassembled.

Cleaning Ice Making Section. Refer to Chapter 7, Maintenance for instructions for cleaning the circulating water tubes, water distributors, and water tank.

Float valve (make-up water). The make-up water float valve (12) maintains the proper pumping level in the water tank for ice making. The valve should be set to maintain a water level in the water tank during the freezing period, so that there will be a quantity of blow down only during the thaw mode. The water level during the freeze mode should always be below the overflow piping to prevent excessive waste of cold water, resulting in loss of ice capacity.

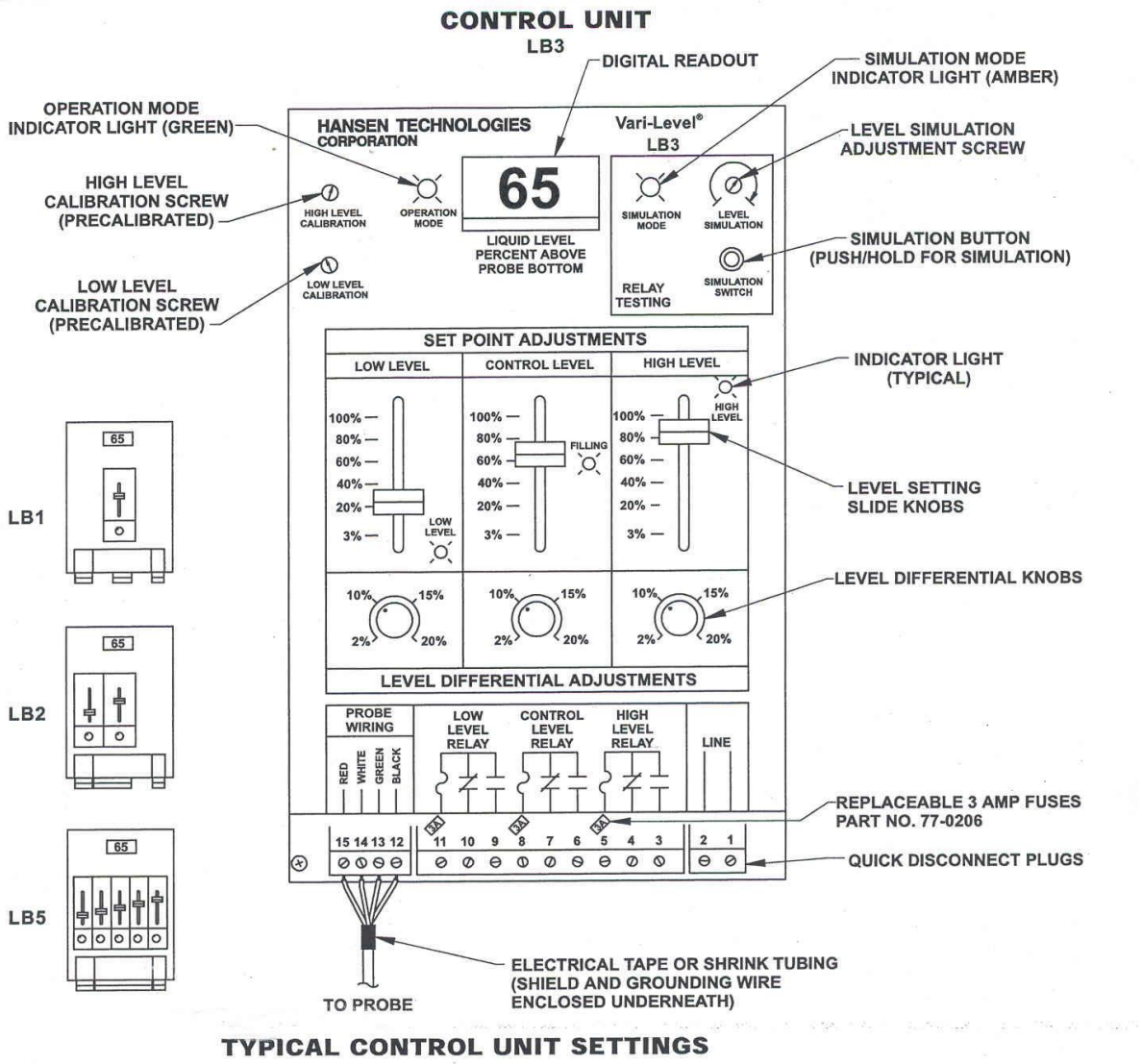
If it should become necessary to clean the float valve, close the stop valve in the make-up water line to the machine and remove the float valve. After the valve has been cleaned and reinstalled, check to ascertain if the proper water level is being maintained. After the machine is stopped and the water in the tank seeks its normal level, there should be no water flow through the float valve or out the overflow.

It is advisable to install a large area strainer in the water supply line to protect the float valve from dirt or solids in the water which would necessitate frequent cleaning. A strainer of 40-mesh screen is usually satisfactory.

Capacitive Level Control. The control unit houses the "brains" of the Vari-Level®, its digital readout, knobs for adjusting set points and differentials, and the relays themselves. Because the signal from the probe is unique, it requires the control unit to interpret and convert it to an understandable signal and display.

The control unit, which has a watertight enclosure, is mounted in an accessible area away from the movement of material and equipment.

CAUTION: Do not install conduit connections into top of control unit; water can condenser in conduit and drop down on control unit electronics, causing failure.



TYPICAL CONTROL UNIT SETTINGS

Set Point Adjustments		
	Differential	**Set Point**
High Level	2%	70%
Control Level	2%	20% - 40%
Low Level	Not Used	Not Used

Figure 9-1
Hansen Level Control

See Chapter 6, Figure 6-4 of this manual for control unit electrical wiring diagram. Before connecting electrical power, check the voltage on the control unit nameplate and the power supply at the wire leads to be sure that they are the same. Supply voltage must be within +10% or -15% of listed voltage. Connect power supply leads to the quick disconnect plug (Terminals 1 & 2) and secure into the appropriate marked socket.

The probe is the device that actually measures the liquid level. It accomplishes this by sending a small, specialized signal out into the refrigerant liquid and vapor. The signal returns via the level column back to electronics inside the probe housing. The strength of the returning signal is measured to determine level. This information is continuously sent to the control unit through the control cable.

When installing the probe, match its serial number with the control unit. Remove the probe from the packing crate, being careful not to bend or whip the probe. Use nonelectrically isolating pipe thread sealant (**DO NOT use Teflon® tape**) on the ¾" MPT fitting on the probe and insert in top of the level column. Tighten probe on hex; do not grip probe housing flats or electrical box. Pressure test for leaks.

Probes are supplied from the factory with 50 feet of shielded control cable. If the control unit is located less than 50 feet from the probe, trim the control unit end of the cable as necessary. Securely place the control cable quick disconnect plug into the appropriate marked socket inside the control unit.

Setpoint and Operation. The level set point adjustment control cable is a slide knob with a scale in percentage of active probe length. The percentage related to the liquid level in the column between the 3% level point and the 100% level point, as measure from the probe bottom end.

The level set point has a level differential adjustment control which is a rotating knob scaled in percentage of active probe length from 2% to 20%. These percentages relate to the number of percentage points above or below the set point at which the particular relay position will change, as detailed in the following paragraphs.

Low Level Adjustment. Not used on the P34FXL.

Control Level Adjustment. This set point is intended to maintain the level inside the vessel via a liquid refrigerant supply solenoid valve, "A1." The control level set point is the level at which make-up liquid will start to feed into the vessel. The level in the freezer should be between 20% and 40% and is dependent on make-up water and ambient temperatures. The differential adjustment control should be set at 2%. The filling indicator light (green) will be on when the relay is energized.

High Level Adjustment. This set point is intended to signal that the liquid level is becoming too high. The high level set point is the highest level that the liquid should ever reach before a compressor cutout occurs. The level in the freezer should be 70%. The differential adjustment should be set at 2%. The high level indicator light (red) will be on when the relay is de-energized.

Simulation. The purpose of the built-in level simulator is to enable the level set pints and differentials to be very accurately set and to be checked for proper system operation. Before entering the simulation mode, be aware of the following:

! IMPORTANT !
Control devised (solenoid valves, contactors, etc.) can operate while in the simulation mode. For calibration and electrical checkout, disconnect the main circuits of the compressor motor, pump motor, etc., where necessary to prevent damage, or remove the relay quick disconnect plug in control unit.
! IMPORTANT !

To enter simulation mode, depress and hold the simulation button; the amber simulation mode light will be on. When in simulation mode, the digital readout displays the simulated (pretend) liquid level. While continuing to depress the simulation button, use a small screwdriver in the other hand to rotate the level simulation adjustment screw to change the simulated liquid level and display. Observe the operation of the indicator lights. If necessary, make adjustments to the level set point and differential knobs.

When the relay level set points and differentials are properly set, return the simulated level to a percentage value between the control and high level settings. This prevents the unexpected operation of relays during the next simulation. Simply release the simulation button to return to normal operation' the operation mode light (green) will come on. The value displayed on the readout will now become that of the actual liquid level in the level column and the relay positions will respond to this level.

Recalibration. Control units are accurately factory calibrated to a 3" level column for the specified refrigerant and the supplied probe. Recalibration may be necessary when a replacement probe or control unit is installed, especially if not "factory matched" by serial number. However, the zero point and at least one other point should be checked at the operating refrigerant temperature for the highest level of accuracy. It is ultimately the responsibility of the installer to ensure proper calibration for the specific application. If the control unit appears to be out of calibration, check for possible causes in the trouble-shooting guide before attempting to change the calibration.

If recalibration is ever required, only two points need to be checked, typically the 0% and sight glass at 50% level point. Recalibration must be done in the order specified below:

1. To check the proper calibration at 0% level, the level column should be free of liquid to below the probe bottom end. This can be accomplished by pumping down the freezer. With the probe end free of liquid, the control unit digital readout should display -00%. If not, remove the seal on the low level calibration screw and adjust with a small screwdriver until the readout indicates -00%; replace seal.
2. The level column standard sight glass location is at 50%. Raise or lower the liquid level so that it is centered in the sight glass. The digital readout on the control unit should display 50%. If not, remove the seal on the high level calibration screw and adjust until the digital readout displays 50%; replace seal. For greatest accuracy, recheck 0% calibration and readjust if necessary.

Problem	Cause	Action
Digital readout and indicator lights do not display	No power to control unit or wrong voltage	Check voltage at terminals 1 and 2 in the control unit
	Moisture in control unit or probe housing	See Note 1 below
Digital readout does not indicate level changes	Fault in control cable	See Note 2 below
	No continuity between probe and level column	Check for Teflon® tape or other non-conductive pipe sealant at probe to column connection; replace sealant
	Moisture in control unit or probe housing	See Note 1 below
	Probe wire loose	Open probe housing cover and check connection of probe wire (single wire lead) from probe center to terminal connection
Solenoid valve (#20A) does not respond	Blown fuse in control unit; fuses located just above quick disconnect terminal strip	Find reason for electrical fault and correct; replace blown fuses
Digital readout indicates too low of a level compared to sight glass	Control unit and probe serial numbers do not match	Contact factory if mate is not available
	Fault in control cable	See Note 2 below
	Moisture in control unit or probe housing	See Note 1 below
	Calibration not correct	See recalibration instructions
	Calibrated for different refrigerant	Contact factory for replacement
	Insulating resistance of Teflon® enclosed probe rod is too low	See Note 3 below
Digital readout indicates too high of a level compared to sight glass	Control unit and probe serial numbers do not match	Contact factory if mate is not available
	Fault in control cable	See Note 2 below
	Moisture in control unit or probe housing	See Note 1 below
	Calibration not correct	See recalibration instructions
	Calibrated for different refrigerant	Contact factory for replacement
	Oil rich mixture in level column	Check for excessive oil carryover from compressor
Intermittent high level	Rapid suction pressure pull down results in excessive boiling and liquid surging	Check time delay timer “DT” for proper operation
	High level alarm point has been positioned too close to operating set point	Lower operating set point or raise high level set point
	Moisture in control unit or probe housing	See Note 1 below
Occasional erratic level displayed on digital readout without actual changes in level.	Moisture in control unit or probe housing	See Note 1 below
	Radio Frequency Interference (RFI)	Find source of interference, such as mobile radios or transmitters, and disable. If unable, contact factory for arrestor device.

Note 1.
MOISTURE IN CONTROL UNIT OR PROBE HOUSING. Dry out control unit or probe housing. If appearance is dry, look for signs of moisture damage, such as white residue. Check cover gaskets, watertight cable connectors, and other water sealing joints; replace if worn. If a conduit connection is on top of the probe, carefully seal the inside to prevent condensation migration into the housing. Relocate any conduit connections on top of the control unit to the bottom, or seal the connections.

Note 2.
FAULT IN CONTROL CABLE. A symptom can be the digital readout display above 100% or below 0%. Check wires and matching color dots on quick disconnect plugs at the probe and control unit for proper connection. See probe wiring diagram. Wires should be securely fastened and not frayed. Check for continuity in the wiring.

Note 3.
INSULATION VALUE OF PROBE. The following procedure is only required if probe integrity is questioned. With the probe wire removed from its socket, check the insulating resistance of the Teflon®-enclosed probe rod using a 500V “Megger.” Connect the positive side to the probe wire, the negative side to the probe housing. The result should be over 1000 Mega Ohms; halocarbon probes should be over 50 Mega Ohms. If not, contact factory.

Table 9-1
Troubleshooting Guide for Level Controller

Hand Expansion Valve. The hand expansion valve is located directly after the "A1" solenoid valve. This valve should be set at a point where the float switch is open for a length of time approximately equal to the time that it is closed.

Freeze Timer. The freezing time period for producing ice of a desired thickness is controlled by the freeze timer (1TR), Figure 9-2, located inside the control panel. This timer is a microprocessor based timer housed in a standard 15 terminal CYCL-FLEX® plug-in case. Time set points are entered into the unit using a sealed membrane keypad on the front of the unit. Each digit in the setpoint is individually increased or decreased by pressing the appropriate keypad switch. There is a mode annunciator in the display area on the front of the unit. The mode annunciator will flash when the unit is timing. Table 9-2 shows the miniature rocker switch settings for the unit. This enables the unit to pulse output, reverse start, minute/second display and battery back-up set points and timing.

Switch	#1	#2	#3	#4	#5	#6	#7
ON	X	X	X			X	X
OFF				X	X		

Table 9-2
Miniature Rocker Switch Settings for Freeze Timer

Entering and Displaying Set Points. Whenever the freeze timer unit is powered up and the previous setpoint has been lost, the digit display indicates four hyphens. The unit will not operate until it has been provided with a setpoint, clearing the display of hyphens.

To create or change a setpoint, press the SET key. The setpoint if any, is displayed and the panel key pads become active. The operation of the timing or counting function and the output loads are not affected. For setpoint changes, the SET indicator appears on the graphics panel. The setpoint is changed by pressing appropriate Δ or ∇ key pads. Pressing a Δ key increments the setpoint digit located above the key; the ∇ key decrements the digit located above the key. If the pad is continually depressed, the digit will change every .5 second until the pad is released. The display will carry to the digit on the left on the 9 to 0 transitions when using the Δ pads. The display will borrow from the digits on the left on the 0 to 9 transitions when using the ∇ pads. On ranges 6 and 7, the display will carry on the 59 to 00 transition and borrow on the 00 to 59 transition of the two least significant digits.

When the desired setpoint is displayed, touch the ENT key. The new setpoint is entered, all Δ and ∇ keys become inoperable and "SET" disappears from the graphics panel. New set points can be entered while the unit is timing or counting, but they will not take effect until the next reset.

The setpoint may be displayed at any time without disturbing the timing or counting cycle by pressing SET. The actual value is returned by pressing ENT. If the unit is set at 0000, the load is always ON if programmed for OOX, and always OFF if programmed OXO.

A keypad "lock" is provided on the freeze timer to prevent unauthorized tampering. To initiate the keypad lock, press the word "SIGNAL" in the Eagle Signal logo for 8 seconds. To disable the lock to change set points, remove power from the unit and turn the battery off (miniature rocker switch #6) and then on. The unit will lose all set points and they must be re-entered for further operation.

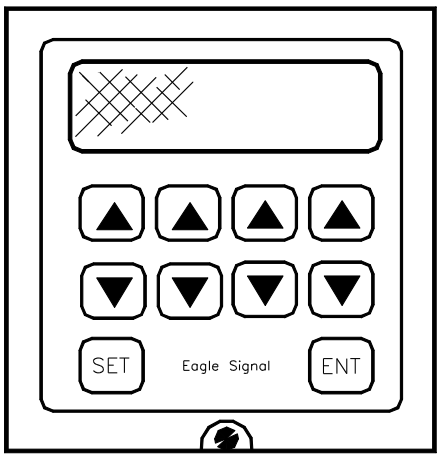


Figure 9-2
Freeze Timer (1TR)

Freezer Pressure Switch (optional). The freezing time period for producing ice of a desired thickness is controlled by the freezer pressure switch (2PS), Figure 9-3, located inside the control panel.

The original switch will not be factory set. It must be when the machine is initially started up. See Tables 11-5 or 11-6, Operating Vitals for typical settings. When making adjustments, allow two ice discharging cycles between adjustments. Switch adjustment is as follows: See Figure 9-3.

1. Turn the low signal adjustment nut CCW until low signal setting indicator is fully down. Turn the high signal adjustment nut until high signal setting indicator is slightly beyond the actuation setting of 55 psig.
2. Starting with the pressure above the actuation pressure, reduce the pressure to desired actuation pressure of 55 psig, contact opens.
3. Advance the low signal adjusting nut until the switch actuates and contact closes.

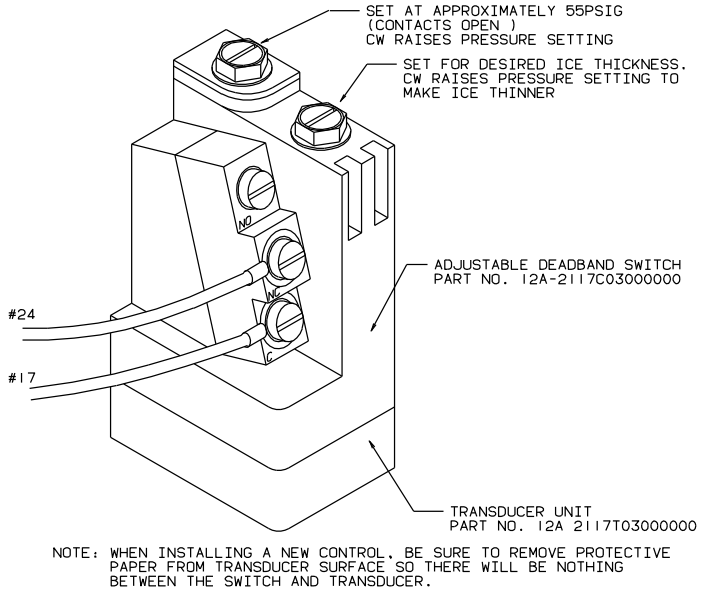


Figure 9-3
ASCO Freezer Pressure Switch (2PS)

It is preferable that the freezing cycle be such that a small diameter hole remains in the center of the ice cylinder (1/16" diameter for 7/8" diameter ice, 1/8" diameter for 1 1/8" diameter ice, 1/4" diameter for 1 3/8" diameter ice). This insures that the freezing cycle is not extended unnecessarily and eliminates a possible opaque core in the center of the ice, as well as a loss of production.

Control Circuit Protection. The electrical control circuit of the machine is protected by a 6 amp, 4 amp or 3 amp circuit breaker (CB4) based on the machine voltage. If this breaker should open, the machine will immediately stop. Before resetting the circuit breaker, open the disconnect switch and lock-out all power to the control panel. Reset CB4 and restore power. Check circuitry with a voltmeter. If the machine was off for an extended time, the crankcase heater must be energized for a minimum of four (4) hours and no liquid refrigerant in the crankcase before restarting the machine. When ready to restart the machine, depress the "Start" button. As usual, initiate a harvest cycle if there is ice remaining in the freezer. Check Amp draw through the breaker for excessive load or unbalance.

Thawing Timer. The thawing timer (2TR), Figure 9-4, governs the ice thawing period. It is located inside the control panel (Figure 6-1). It is started by action of the freeze timer (2TR) or freezer pressure switch (2PS), which energized the "1CR" relay. This timer is set prior to shipment for approximately a three-minute period. To replace the timer, simply pull the timer from its base and plug in another, set to "X1" and "Min" and set the thawing period for at least 30 seconds longer than the time required to harvest the entire discharge of ice. If it should be necessary to change the setting of the timer, turn the adjustment dial clockwise to increase the time or counter-clockwise to decrease the time. Check thaw time after each adjustment.

Note: Thicker ice may require a longer thaw period, due to slower ice release time.

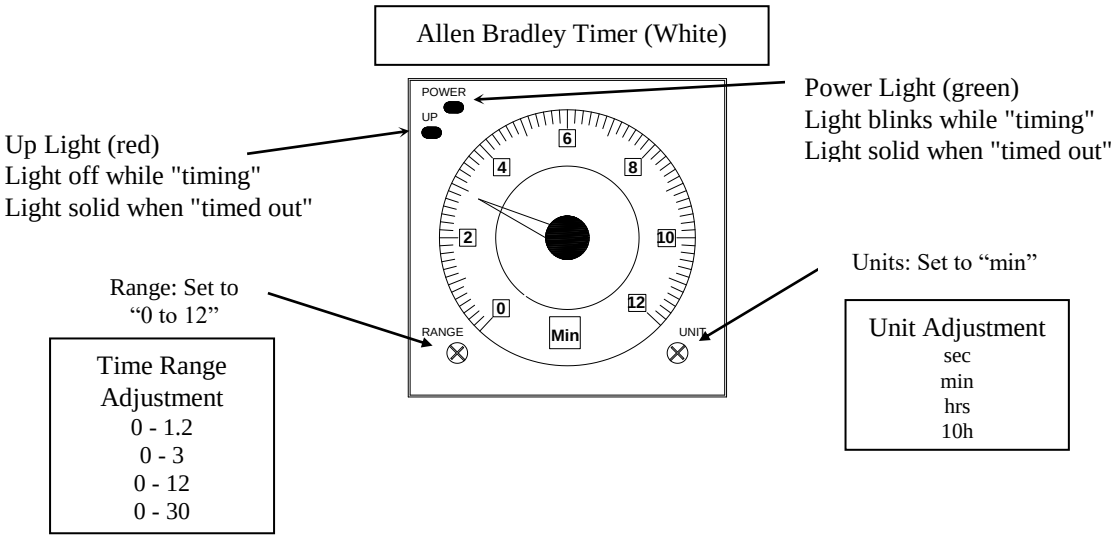


Figure 9-4
Thawing Timer (2TR)

Suggested Condenser Cleaning. Any brush or cleaning tool should be sized accordingly so as not to damage the tubes during cleaning. The cleaning tools should be rotated at the specified speed for the particular tool used. The tubes should be kept wet during cleaning. After cleaning the tubes should be flushed thoroughly and all foreign material removed. Contact your distributor or Vogt's Service Department to obtain the proper cleaning tools.

The following is the condenser cleaning procedure:

1. Make sure ample room is provided for removing the condenser heads and using the mechanical cleaning equipment.
2. Order replacement cover gaskets for use at the time of reassembly.
3. Disconnect and lock-out power to the ice machine, compressor and auxiliary equipment.
4. Disconnect water piping and drain the condenser. Generally additional water can be drained by loosening the cover (heads) and separating the covers from the condenser end.
5. Remove the heads bolts and gasket completely.
6. Inspect the tubes for excessive corrosion and possible ammonia leaks to determine whether or not further cleaning is feasible.
7. Clean the inside of each tube as well as possible, being careful not to damage the tube. Follow the instructions for the particular tool being used.
8. Flush each tube with water to remove all loose material to prevent contamination of the cooling tower and sump.
9. Clean the ends of the tube sheets, so the new gasket will seal properly.
10. Install the replacement gasket. Make sure the gasket does not cover the tube ends.
11. Install the end covers (heads) and fasten securely in place with the head bolts. It is recommended that a anti-seize compound be applied to the bolt and nut threads to prevent rusting and ensure ease of removal at the next cleaning.
12. Reconnect the water piping, turn on the power. Check for leaks by turning the power on to the condenser pump allowing it to run.
13. Turn the power ON to the compressor and wait for the crankcase heater to warm-up the compressor before starting the machine.

Cutter Gear Reducer. The cutter motor and gear reducer (54), Figure 9-5A, drive the ring gear of the cutter assembly. It is important that the teeth of the drive gear and the ring gear mesh properly both vertically and horizontally. The drive gear and hub can be raised or lowered on the gear reducer shaft to obtain maximum vertical tooth engagement and the reducer assembly can be moved in or out horizontally to obtain the proper tooth depth for maximum gear life.

Note: The motor and gear reducer are an integral unit. Only qualified personnel should attempt to disassemble and repair this unit.

Drive Gear Replacement.

1. Disconnect and lock-out all power to the machine.
2. Remove the top and side bolts holding the mounting plate to the support bracket. Lift the plate and gear reducer from the bracket and rest the assembly on a stable worktable sitting next to the tank. Leave the electrical conduit connected to the gear reducer motor.
3. Inspect the drive gear teeth for proper vertical alignment and wear pattern.
4. If the wear pattern indicates less than a full width of tooth engagement, measure the difference and make a note to correct at the time of reassembly.
5. Measure and record the dimension from the drive gear to the bottom side of the mounting plate.
6. Remove the three or four cap screws holding the drive gear to the split taper bushing.
7. Using two of the same cap screws in the threaded holes of the bushing, jack the gear off the bushing and remove both from the gear reducer shaft.
8. Clean the split bushing and tapered hole of the new drive gear and insert the bushing into the drive gear making sure the tapers match.
9. Slide the split hub and gear onto the keyed shaft with the key in place, positioning the hub (by measurement previously recorded) so the full width of the gear teeth will engage when assembled and tightened.
10. Tighten the cap screws (three or four) progressively and uniformly around the hub and recheck the location measurement. If it is not correct, loosen the cap screws, hub and gear assembly and make correction. Then retighten the cap screws.
11. Install the reducer and mounting plate assembly on the water tank bracket and fasten in place with the side and top cap screws.
12. Rotate the cutter and disc assembly by hand and stop at the point where you feel the least amount of backlash between the gear teeth.

    NOTE: There should be only a slight amount of backlash (more specifically “tooth tip clearance”). Too much clearance will cause premature wear and possible tooth damage. When the cutter runs under a no load condition, it should have a smooth uniform sound. For lubrication, see Chapter 7, Maintenance.

13. If the tooth tip clearance needs adjusting, loosen the four hex nuts holding the reducer to the mounting plate and move the reducer as required for proper tooth engagement. Tighten the hex nuts securely and recheck backlash.

Gear Reducer Replacement.

1. Disconnect and lock out all power to the machine.
2. Disconnect electrical wires and conduit from the motor.
3. Remove the top and side bolts holding the mounting plate to the support bracket and lift the plate and gear reducer assembly from the tank bracket.
4. Inspect the drive gear teeth for proper vertical alignment and wear pattern. If the wear pattern indicates less than a full width of tooth engagement, measure the distance so correction can be made at the time of reassembly.
5. Measure and record either the distance of the drive gear from the mounting plate or the split hub from the shaft end for future reference when reassembling.
6. Remove the three or four cap screws from the split taper bushing.
7. Use two of the cap screws in the threaded holes of the busing as jacking screws for pushing the drive gear from the hub.
8. Drive a wedge in the split of the hub (bushing) and slide both the hub and gear from the shaft.
9. Remove the four hex nuts and lock washers from the carriage bolts around the reducer base and mounting plate and separate the plate and reducer.
10. Install the replacement gear reducer and motor onto the mounting plate using the carriage bolts, lock washers, and hex nuts. Tighten the nuts snug only for later adjustment.
11. Clean the split hub and drive gear, insert the hub into the gear, making sure the tapers of the two match and slide the hub and gear onto the shaft.
12. Position the hub on the shaft (note measurements previously taken) so the full width of the gear teeth will engage when assembled and tightened.
13. Tighten the cap screws (three or four) progressively and uniformly around the hub, checking the measurements and adjusting as necessary.
14. Install the reducer and mounting plate assembly on the water tank bracket and fasten in place with the side and top cap screws.
15. Rotate the cutter and disc assembly by hand and stop at the point where you feel the least amount of backlash between the gear teeth.
16. If the gear tooth tip clearance needs adjusting, loosen the four hex nuts around the reducer base and move the reducer as required for proper tooth clearance. Tighten the hex nuts securely and recheck for backlash.
17. Reconnect the electrical wires and conduit to the motor.
18. Check cutter rotation and correct as necessary.

    NOTE: When the cutter runs under a “no-load” condition, it should have a smooth uniform sound.

The weights listed in Table 9-2 will give you an idea of manpower or equipment needed when servicing and handling the various parts of the water tank and cutter. Be sure to use safe lifting and handling practices to prevent bodily injury and/or damage to parts. If additional information is needed, you should contact your distributor or the factory.

To inspect the cutter assembly and make repairs or replace parts, it will be necessary to lower and remove the water tank from its mounting to the bottom of the freezer. The water tank has metal casters allowing it to be rolled out from under the freezer for inspection and servicing.

Description	Weight (lbs.) P34
Water tank (bare)	428
Bearing bracket assembly and cutter disc	150
Cutter assembly and ring gear	164
Water tank and cutter assembly	742
Cutter disc	97
Cutter drive gear	14
Gear reducer and motor	96
Water pump	85

Table 9-2
Water Tank and Cutter Parts Weights

Water Tank Removal

1. Disconnect and lock-out all power to the machine.
2. There should be ample space to roll the water tank from under the machine. It may be necessary to provide a flat level surface such as a sheet of plywood sufficiently supported to hold the weight of the tank and cutter assembly. See Table 9-2.
3. Turn off water supply, drain water, and disconnect water and drain lines from the tank.
4. Remove the overflow tubing from the water tank and remove the circulating water tubing from the pump.
5. The water pump is mounted to the structural frame of the machine and will have to be disconnected from the tank at the pump inlet bolted flange before moving the water tank.
6. Disconnect the ice discharge chute or hopper from the ice discharge opening of the water tank, making sure the tank is free to be moved.
7. Remove the mounting bolts from around the flange of the tank, allowing the tank to be lowered to rest on its casters.
8. The channel support at the right side base of the machine (opposite from the pump side) will have to be removed for the tank to be rolled out from under the freezer.
9. Roll the water tank from under the freezer, turning it as you go to clear the gear reducer and motor. It is now accessible for inspecting and/or repair of the cutter assembly.

Cutter Assembly Removal and Installation.

1. Follow water tank removal instructions, Steps 1-9. See Figure 9-5A.
2. Remove the socket head cap screw from the center of the cutter shaft and lift out the retainer and gasket.
3. Lift the cutter straight up and off the shaft, taking care to catch the shaft key as it is removed.
4. To install the cutter, lower it down onto the shaft, allowing the ring gear to mesh with the drive gear.
5. Rotate the cutter, aligning the shaft and hub key way and inserting the key to its full depth.
6. Install the gasket, the retainer, and the socket head cap screw and tighten to approximately 15 ft. lb. torque.
7. Check and adjust the cutter height per "Cutter Height Adjustment" instructions.

Bearing Bracket and Cutter Disc Removal.

1. Remove the cutter assembly per instructions.
2. Match mark the bearing bracket support arms with the water tank for reassembly reference.
3. Remove the splash shield and ice deflector plate from the ice discharge opening.
4. Support the bearing bracket to keep it from falling in the tank. Loosen and remove the four cap screws and lock washers from the ends of the bearing bracket support arms.
5. Lift the bracket and cutter disc from the tank. Be sure the support arms are match marked for reassembly. You may have to gently drive the support arms up or down to release them from the tank walls.
6. With the bracket and disc assembly turned upside down, remove the cotter pin from the shaft.
7. Loosen and remove the slotted hex nut, spring washer, and spacer.
8. Lift the cutter disc from the keyed shaft, being careful not to loose the shaft key.

The cutter shaft and bearings are sealed in the bearing bracket assembly. The cavity between the bearings has been filled with a food-grade grease to prevent the presence of moisture and prolong the life of the unit. If there is any vertical or side movement of the shaft or if the bearings feel rough or tight when turning the shaft, the assembly should be dismantled and rebuilt. Refer to the cutter tank assembly drawing, Figure 9-5A, for parts location and identification.

Cutter Shaft and Bearing Removal.

Note: Use only a soft mallet or other soft tool for fitting all parts into place.

1. With the bearing bracket assembly removed from the tank, press the shaft out of the housing from the bottom up.

   Note: The two top bearings may come out with the shaft along with the upper seal and excluder.

2. Turn the bracket over and press the bottom bearing out the bottom, along with the lower seal.
3. There are three spacers on the shaft that should be removed and labeled as to their location. Remove them as they are made accessible.
4. Clean and inspect all parts for wear or damage. Discard all parts showing any indication of damage.

Cutter Shaft and Bearing Installation.

1. Clean the inside of the bearing housing of grease or foreign matter. Further clean the top bearing housing with pro-lock cleaner and primer (or a suitable substitute) and remove the pipe plugs from the side of the housing
2. Apply a thin coat of Loctite® RC/609 retainer (or a suitable substitute) to the inner surface and bearing shoulder of the top of the bearing bracket.
3. Insert a bearing in the top housing and set it in place.
4. Clean the cutter shaft and press the top bearing onto the shaft.
5. Slide the upper bearing spacer on the shaft and begin driving the shaft down through the middle bearing of the housing. Do not start the top shaft bearing in the housing.
6. Partially fill the housing with grease (MPG-2 or a USDA approved grease). Use enough to fill the area between the two upper bearings, forcing some out the pipe plughole when the shaft and top bearing are seated.
7. Finish driving the shaft and bearing into the housing until it is firmly seated.
8. Turn the bracket and shaft upside down and fill the housing around the shaft with MPG-2 (or suitable equivalent) grease.
9. Slide the lower bearing spacer over the shaft and into the housing.
10. With the top end of the shaft supported, install the lower bearing on the shaft driving it down into the housing firmly against the housing shoulder.
11. Slide the seal spacer (ridged end in, flat end out) and seal (open face out) onto the shaft together.
12. Uniformly tap the seal into the housing against its shoulder.

NOTE: The purpose of the seals and excluders are to prevent moisture from entering the housing area not to hold the grease in.

13. Wipe off excess grease and install the two pipe plugs.
14. Install the largest excluder on the bracket as illustrated by the assembly drawing.
15. Install the tines disc, the 1/4 x 1/4 key, spacer, spring washer, castle nut, and cotter pin.
16. Turn the assembly right side up and install it in the water tank, locating the support arms as they were match marked when removed and secure in place using the 5/8” stainless steel cap screw and lock washer maximum torque should be 90 ft. lbs.
17. Install the top seal (open side facing out*), tapping it uniformly into the housing until it seats.
18. Install the top water excluder.
19. Install the splash shield and ice deflector plate in the ice discharge opening.
20. Install the cutter assembly, using the 1/4” X 1/4” X 3 3/16” lg. stainless steel key to align the key ways and lock the cutter and shaft together.
21. Install the red rubber gasket, retainer, and 3/8” stainless steel socket head cap screw. Tighten to approximately 15 ft. lbs.
22. Check and adjust the cutter height per “Cutter Height Adjustment” instructions.

Cutter Height Adjustment. The height of the cutter can be adjusted by the four bolts holding the bearing bracket assembly in place. These bolts are threaded into holes in the end of each arm through holes in the water tank. The current design has these washers welded in place after the cutter height is properly adjusted. This helps to insure proper adjustment during servicing. Using a true straight edge long enough to reach across the top flange of the water tank (40" for P34), the top of the cutter rim and blade should be 1/8" ± 1/16" below the top of the water tank flange.

Keep one end of the straight edge at the same point and swing the other end across the tank at various points to check the clearance.

Also, rotate the cutter to check all points. If adjustment is necessary, loosen the four side bolts and raise or lower each arm as needed. Tighten the bolts securely to approximately 90 ft. lb.

Water Tank Installation.

1. Place the 3/16" thick gum rubber gasket on the top of the tank flange. It can be held in place with narrow strips of tape through the bolt holes.
2. Push the water tank in and under the freezer aligning the boltholes and installing the mounting bolts around the flange and tightening the nuts securely.
3. Reconnect the discharge chute or hopper to the ice discharge opening.
4. Mount the water pump and attach the circulating water tubing and overflow tubing.
5. Reconnect all water piping such as drain, overflow, and make-up water lines. Turn water on and check for leaks.
6. Fill the water tank with water and make sure the drain valve is closed.

When ready, turn the power "On" to the machine, but don't operate the compressor until the oil is warm and there is no liquid refrigerant in the crankcase.

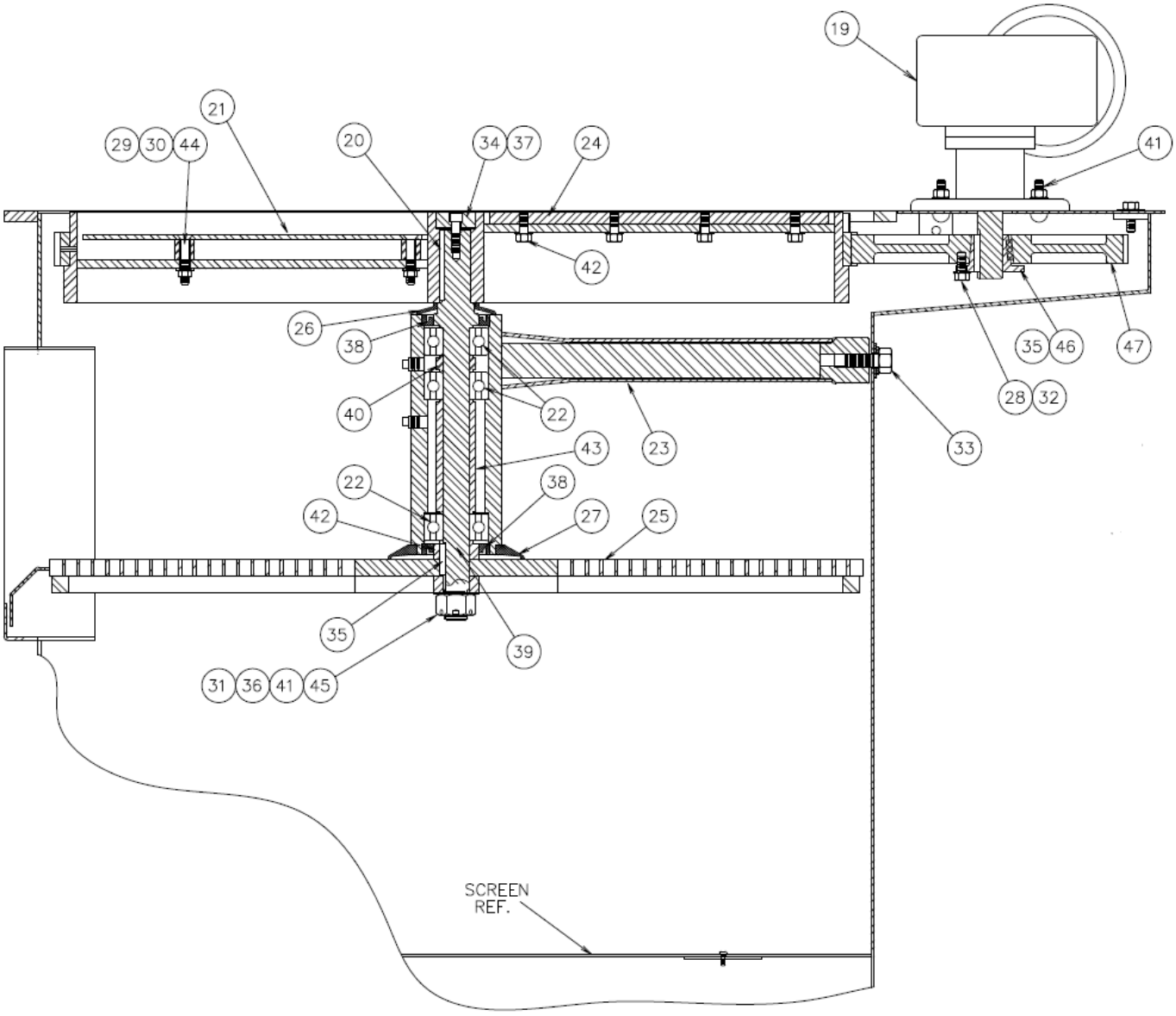


Figure 9-5A
P34FXL Cutter Assembly

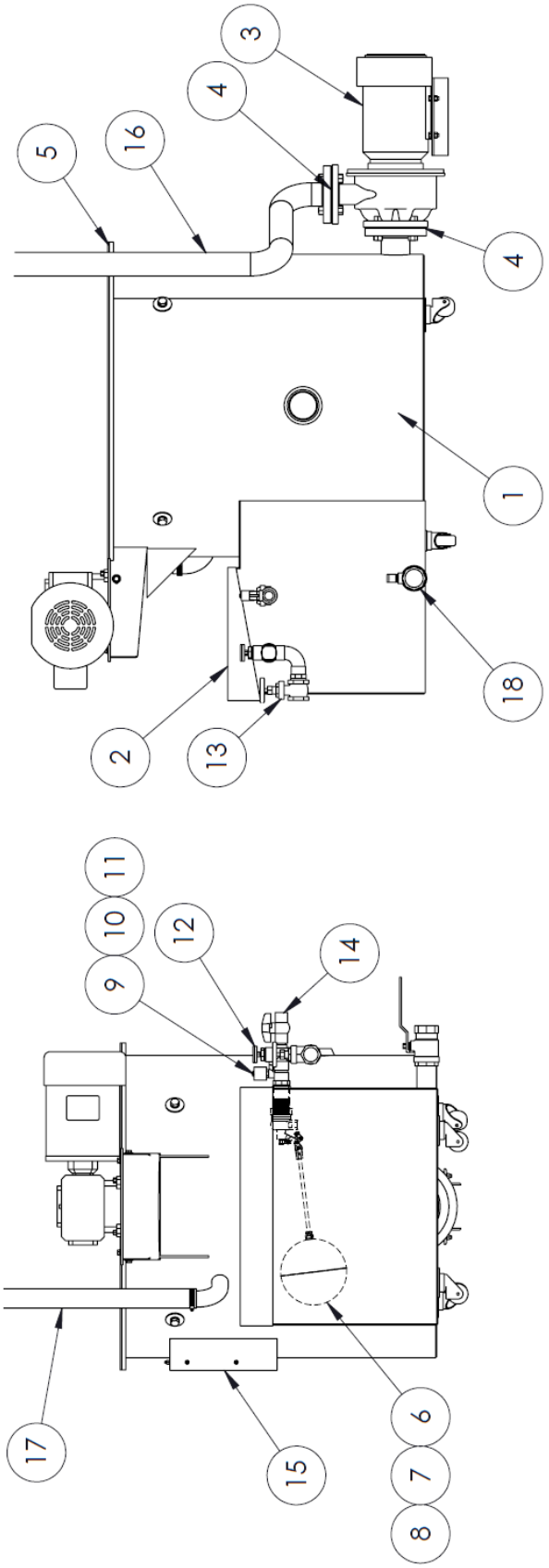


Figure 9-5B
P34FXL Water Tank Assembly

Item #	Description	P34FXL Part Number
1	Water Tank Assembly	19T4500S34X
2	Water Tank Cover	19T2150C02X
3	Water Pump	12A4020G12
4	Water Pump Gasket (2)	12A2600R03
5	Water Tank Gasket	12A4200G11
6	Make-Up Water Float Valve (Valve Body)	12A4200H0603
7	Make-Up Water Float Valve (Stem)	12A4200HP05
8	Make-Up Water Float Valve (Float + Stem Adapter)	12A4200HP04, 12A4200HP05A
9	3/4” Water Tank Flush Valve Solenoid	12A4200A0607LF
10	Water Tank Flush Valve Solenoid Coil (230V)	12A2105C42K
11	Water Tank Flush Valve Solenoid Coil (120V)	12A2105C41K
12	Make-Up Water Thermometer	12A4170T01
13	1-1/2” Make-Up Water Shut Off Valve	12A4205G0603LF
14	3/4” Flush Water Shut Off Valve	12A2450V04
15	Ice Discharge Curtain	12A4078C02
16	Circulating Water Tubing (Clear)	12A4181T15
17	Overflow Water Tubing (Clear)	12A4181T09
18	2” Water Tank Drain Valve	12A4200G1401LF
19	Gear Motor & Reducer	12A2900M0806A
20	Upper Cutter Shaft Keyway	19T2785S0200
21	Cutter Adapter Plate (2)	19T2010A13
22	Cutter Shaft Bearing (3)	12A2020M02
23	Cutter Bearing Bracket Assembly	19T2025B0162
24	Cutter Blade (2)	19T2035B02
25	Tines Disc Assembly	19T2163D0403
26	Upper Excluder Seal	12A2210E01
27	Lower Excluder Seal	12A2210E04
28	5/16” Cap Screw for Drive Gear (3)	12A2215G111
29	3/8” Machine Screw for Adapter Plate (8)	12A2226H1117
30	3/8” Hex Nut (8)	12A2240A1309
31	Tines Disc Slotted Nut	12A2240E1216
32	5/16” Lock Washer (3)	12A2250B108
33	5/8” Lock Washer (4)	12A2250B113
34	Retaining Gasket	12A2600R02
35	Lower Cutter Shaft Key	19T2785S0100
36	Cotter Pin	12A3040S06
37	Cutter Retaining Spacer	19T4065R01
38	Cutter Shaft Seal (2)	19T4080S02
39	Cutter Shaft	19T4090S03
40	Upper Bearing Spacer	19T4130C01
41	Tines Disc Hub Spacer	19T4130C02
42	Seal Spacer	19T4130C03
43	Lower Bearing Spacer	19T4130C04
44	Cutter Adapter Plate Spacers (8)	19T4130T09
45	Disc Spring	12A4138S01
46	Drive Motor Split Taper Bushing	12B2060B02
47	Cutter Drive Gear	12B2615D05

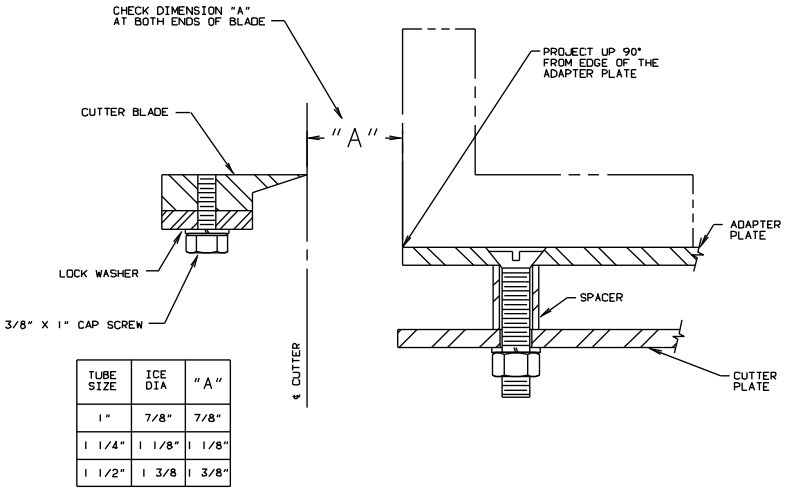
Table 9-3
P34FXL Cutter & Water Tank Part Numbers

Cutter Ring Gear Replacement.

1. Remove the water tank assembly (see water tank removal).
2. Remove the cutter assembly from the cutter shaft.
3. Remove the 1/4” drive pins which hold the ring gear to the cutter bank (8 pins).
4. The ring gear is a shrink fit onto the cutter band and therefore will have to be driven off. It should be driven off progressively and uniformly around its circumference to avoid binding.
5. Inspect and clean the cutter bank, removing any burrs, scale, or dirt.
6. Attempt to put the new gear onto the cutter and check for fit. If it will not fit, it will have to be expanded by heat.
7. Move the ring gear away from the cutter and heat the gear uniformly to 300-400°F (150-205°C). This can be done by passing a hand/held oxy/acetylene torch uniformly over the entire ring gear. DO NOT HEAT THE CUTTER.
8. Align the valley of the ring gear teeth with the existing drive pin holes and carefully set the ring gear onto the cutter. Make sure it is fully seated all the way against the machined shoulder of the cutter bank.
9. After the gear has cooled, drill 1/4” holes in the valley (between the teeth) of the ring gear and install the drive pins. Make sure the drive pins do not protrude and interfere with the engagement of the drive gear.
10. Install the cutter assembly onto the shaft.
11. Check and adjust cutter height and meshing of the gear teeth.
12. Install the water tank assembly.

Cutter Blade Replacement. The cutter blades are designed to give many years of satisfactory service and rarely need to be replaced. If they become damaged, they can be replaced by the following procedure:

1. Disconnect and lock-out all power and remove the water tank assembly so the cutter assembly is accessible. (See water tank removal).
2. Remove the 3/8” cap screws holding the blades to the cutter plate and remove the blades.
3. Set the new blades in place and install the cap screws and washers but do not tighten.
4. Refer to Figure 9-6; adjust each blade to dimension “A” and lock the blade in position by tightening the 3/8” cap screws. Note: Use a 90° square (as illustrated) to obtain the proper blade clearance required for satisfactory ice discharge. Dimension “A” is critical and should be measured at both ends of the blade. Note: 3/8” x 1” cap screw must be flush with cutter blade.
5. Make sure all bolts and nuts are tightened securely then reinstall the tank assembly.



TUBE SIZE	ICE DIA	"A"
1"	7/8"	7/8"
1 1/4"	1 1/8"	1 1/8"
1 1/2"	1 3/8	1 3/8"

Figure 9-6
Cutter Blade and Adapter Plate Adjustment

Cutter Adapter Plate Installation.

1. Disconnect and lock-out all power to the machine and remove the water tank assembly so the cutter is accessible (see water tank removal).
2. Locate the new adapter plate, holding the correct dimension “A” from the edge of the plate to the edge of the blade. See Figure 9-6.
3. Using two C-clamps to hold the adapter plate securely in place, drill four 7/16” diameter holes through the adapter plate and through the cutter plate at the same time so they will adjoin properly.
4. Countersink the holes in the adapter plate to make the bolt heads flush with the plate.
5. Install bolts and spacers as illustrated and tighten securely. Note: the length of ice is determined by the spacer length. Refer to “Ice Length” for details.
6. Install the water tank assembly to the machine.

Note: Length of cylinder ice can be changed. See Chapter 10.

Refrigerant Leaks. Refrigerant leaks can be detected by an electronic leak detector. Apply a solution of soap and water with a narrow brush or spray bottle to all joints, welds, or areas of suspicion. The solution will form bubbles if there is a leak.

Non-condensable Gasses. Satisfactory operation of the machine is not possible if non-condensable gases (usually air) are present in the system. Excessive condensing pressure is an indication of such gases. Excessive condensing pressure in water-cooled condensers may also be due to the accumulation of scale in the cooling coil or due to insufficient cooling water or excessive water temperature. See Chapter 7 “Water-Cooled Condensers”, and Chapter 9 “Condenser Cleaning”.

Air and other non-condensable gases in a refrigeration system are not desirable. Removing air from your Tube-Ice machine will greatly improve system performance and save money. This should be performed by a Certified Refrigeration Technician.

Non-condensable gas effects are:

1. Higher condensing pressure than what should match the condensed liquid temperature.
2. Greater electrical power consumption.
3. Reduced refrigeration capacity.
4. Longer than normal compressor running time.
5. Slow ice release and long thaw cycle.

Water Contamination of HFC Refrigerants

Water in the refrigerant can cause a slow ice discharge, erratic operation, and dilution of the oil. This can result in freeze-up, refrigerant carry-over, and compressor failure. This condition should not go uncorrected, and the water should be immediately removed. There are two options for water removal from the refrigeration system. The first and best alternative is removal of all refrigerant and oil from the system, followed by vacuuming and recharging according to the procedure outlined in Chapter 5. The second is reclaiming and reconditioning the refrigerant and the oil.

Note: whenever excessive water is present in the system, the source should be identified and corrections made prior to further operation.

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 is equipped with a mechanical seal which is self-adjusting and requires no lubrication. However, the pump should not be operated unless 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.

Solenoid Valves. The P34 is equipped with several solenoid valves to perform various functions for proper operation and good ice production.

The Thaw Gas Solenoid Valve (18), Figure 9-7, is opened during the thaw cycle to allow warm gas to pass from the receiver to the freezer.

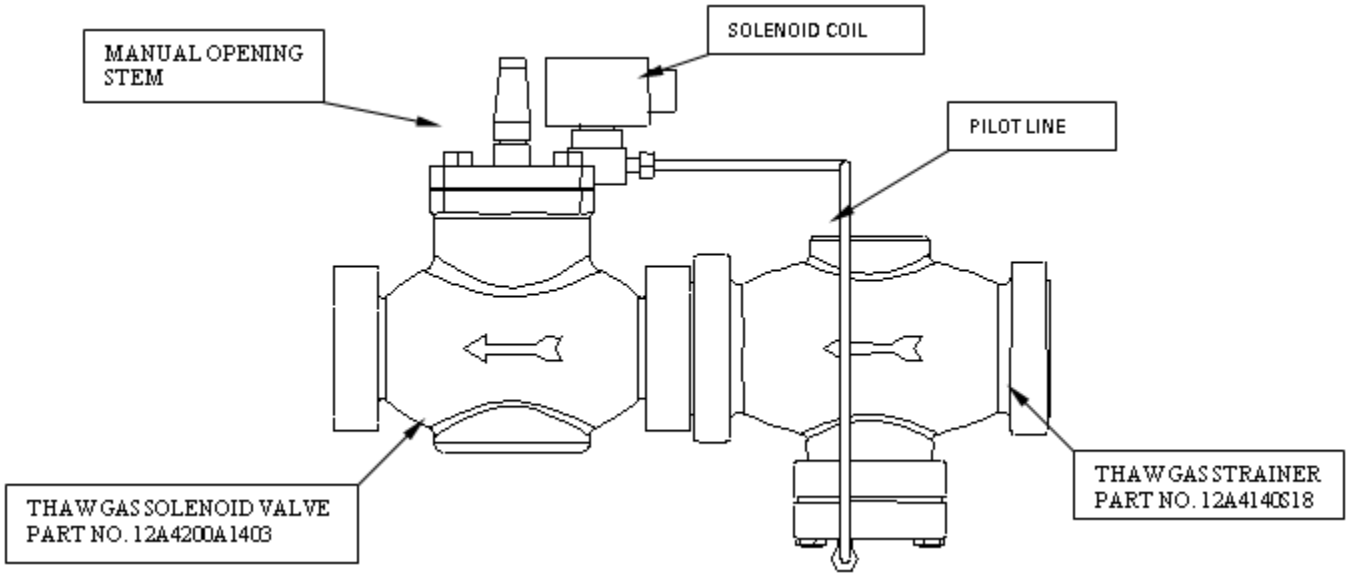


Figure 9-7
Thaw Gas Solenoid Valve Assembly

The Liquid Feed Solenoid Valve (20), Figure 9-8, is opened and closed during the freezer cycle by the liquid level controller in order to maintain the proper freezer refrigerant level. It is closed when the machine is off to prevent liquid flow from the receiver to the freezer.

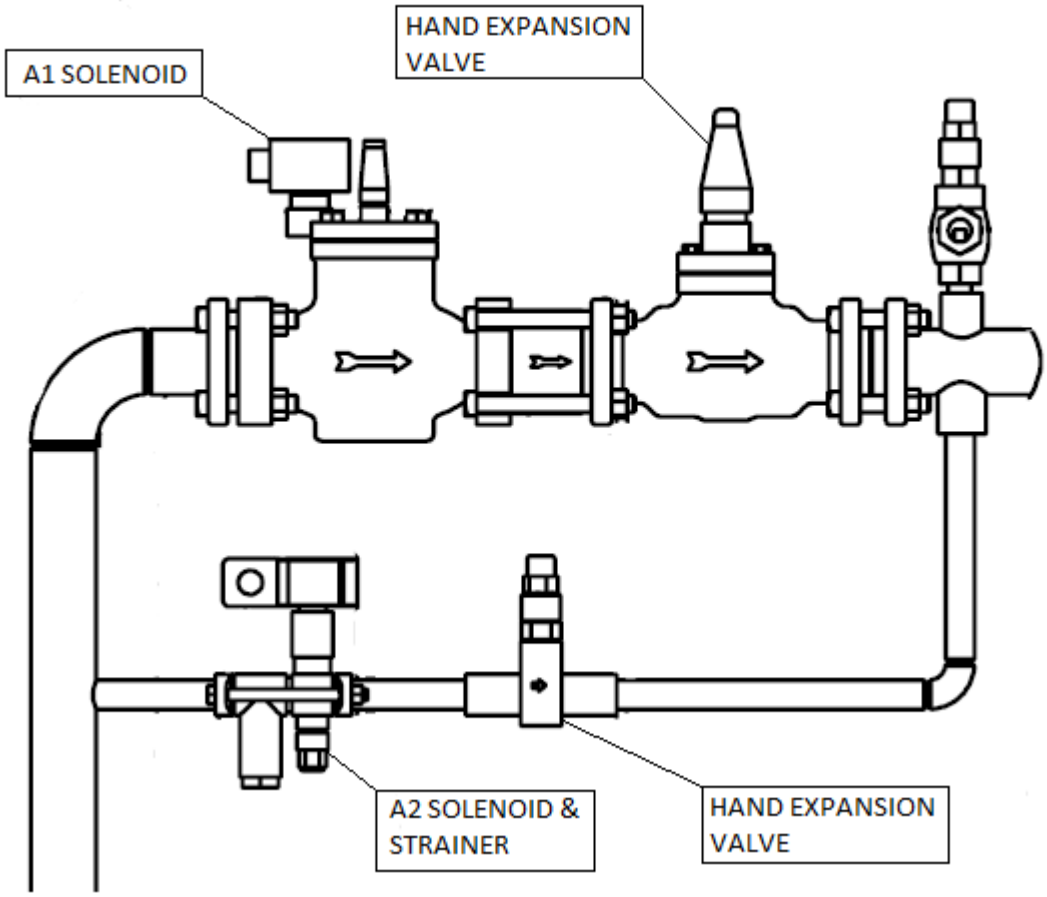


Figure 9-8
Liquid Line Solenoid Valve

Thaw Chamber Check Valve (101) Fig. 9-9. This valve is closed during the freeze cycle to keep the thaw chamber from filling with liquid ammonia. To manually open simply turn the manually opening stem inward.

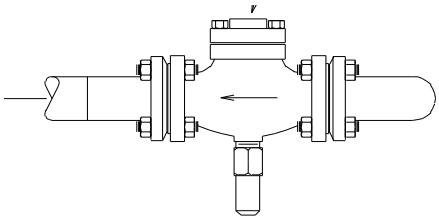


Figure 9-9
Thaw Gas Check Valve

Water Flush Solenoid Valve (63) is opened during the thaw (harvest) cycle, to flush out some of the impurities form the water in the tank, thereby improving the ice quality.

10. Options and Accessories

Crushed Ice Production. Your P34FXL Tube-Ice machine is capable of producing crushed ice with no loss of capacity; however, there are certain changes to be made in order to convert to crushed ice production. The following modifications are required:

1. Remove the existing cutter adapter plate and install new adapter plates for crushed ice.
2. Remove the existing tines disc assembly and install new crushed ice disc assembly.
3. Remove the existing ice shield and scraper and install new shield and scraper.
4. Readjust the freezer pressure switch to produce ice 3/16”-1/4” thick for crushed ice.

To remove and install cutter parts, it will be necessary to first remove the water tank assembly for unrestricted access. The result is that the ice is approximately 1/2” long and frozen only 3/16 – 1/4” thick. A modification of this type is not one you would want to make every time a temporary change to crushed ice was wanted. Contact your distributor for more information and complete details.

Length of Ice. Ice length can be changed by increasing or decreasing the length of the spacer under the adapter plates. The water tank assembly must be removed for making this modification. When installing the adapter plates, make sure the horizontal dimension from the cutter blade edge to the edge of the adapter plate is as follows:

7/8” space for 1” tubes
1 1/8” space for 1 1/4” tubes
1 3/8” space for 1 1/2” tubes

See Figure 9-6 for illustration of this critical adjustment.

! CAUTION !
Always witness several ice making cycles after making conversions or modifications to make sure all ice clearing during the set thawing time and adjust timer accordingly.
! CAUTION !

PLC (Programmable Logic Controller). Tube-Ice® machines are available with a Mitsubishi Fx1N 24MR programmable controller, FX2N-8ER expansion module and a Mitsubishi E1012 Operator interface. The E1012 interface contains a real-time clock and 6 programmable function keys that allow for easy screen navigation and enhanced machine operation over the standard Tube-Ice® machine mechanical controls.

NOTE: The E1012 interface replaces the E150 and requires a 24VDC power supply to power the unit, where the E150 was powered by the PLC itself.

The PLC/Interface adds features such as selectable “Automatic Restart” after a power failure, choice of timed or pressure switch controlled freeze cycles and Freezer “Pumpdown”. For package units, the machine will automatically “Pumpdown” before cycling off. The PLC/Interface provides the following programmable functions:

- Cutter delay (amount of time at start of harvest before cutter comes on).
- Conveyor control contacts (delay at start of harvest before conveyor comes on and run time).
- Automatic Restart after a Power Failure (enable/disable)
- Auto-restart time (delay time before restarting – recommended 2 hours for package machines)

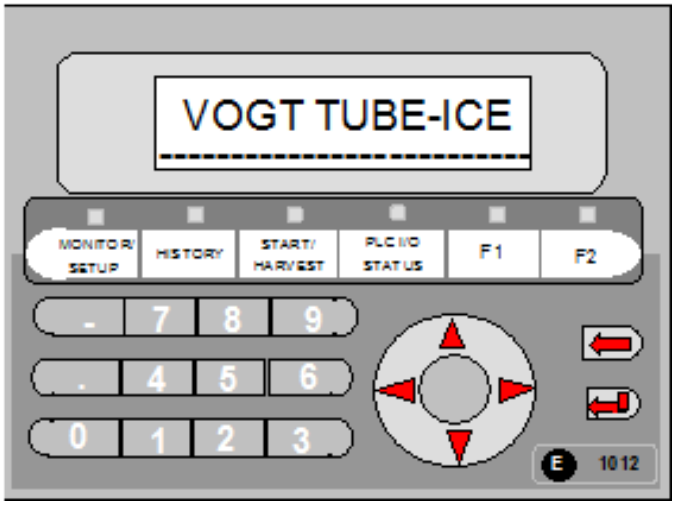


Figure 10-1
Mitsubishi E1012 Operator Interface

The PLC provides a MACHINE FAULT indication with an alarm relay. The PLC will log when the fault occurred (time and date) and where in the cycle the machine was when the fault occurred. It will store the last 5 faults in history, which can be accessed by pressing the HISTORY button on the interface until the FAULT HISTORY title appears. Press the down arrow on the pad to scroll down t through the information. Machine faults are listed below:

- Compressor high discharge pressure
- Compressor low suction pressure
- Compressor oil pressure
- Compressor motor fault
- Cutter motor overload
- Water pump motor overload
- Long cycle – a freeze cycle lasting more than 60 minutes
- Short cycle – 3 consecutive freeze cycles that are 5 minutes or less in duration
- Power failure / Power return

The Mitsubishi unit also records the last 10 machine cycles. This data can be viewed by pressing the HISTORY button on the interface until the CYCLE HISTORY title appears. Press the down arrow to scroll through the information. To exit HISTORY, press the MONITOR/SETUP key twice. This will take you back to the current mode screen.

The PLC I/O Status screen can be used to view PLC Inputs and Outputs without opening the control panel door.

Mitsubishi PLC. The Mitsubishi PLC contains 14 inputs and 10 outputs on the base unit with an additional 4 input and 4 outputs on an expansion module. The power supply for the unit can be 100-240VAC, 50/60 Hz and is internally fused for 3A. The inputs are 24VDC internally fused for 5-7mA and supplied by the PLC. All 24VDC control wiring is blue in color and is distinguished from the red 240VAC or 120VAC control wiring. The outputs are externally fused for 2A. Outputs 1 and 2 are dry contacts used for high side control interlock and conveyor control. Outputs 0, 3-11 & 20-23 are relay type with 120V or 200/240 V connections.

The LED indicators on the right hand side of the Mitsubishi PLC indicate the power, run and error status of the PLC. When power is on to the PLC and the run/stop switch is in the run position the power and run indicators will be illuminated. A solid or flashing error light indicates a processor or program error. The LED indicators on the upper right hand side of the PLC, indicates the input status and LED indicators on the lower right hand side of the PLC indicate the output status. If the input (X#) indicator is illuminated, then the PLC is receiving the input. If the output (Y#) indicator is illuminated, then the PLC is sending the output. Use of these LED's will be helpful in troubleshooting the machine.

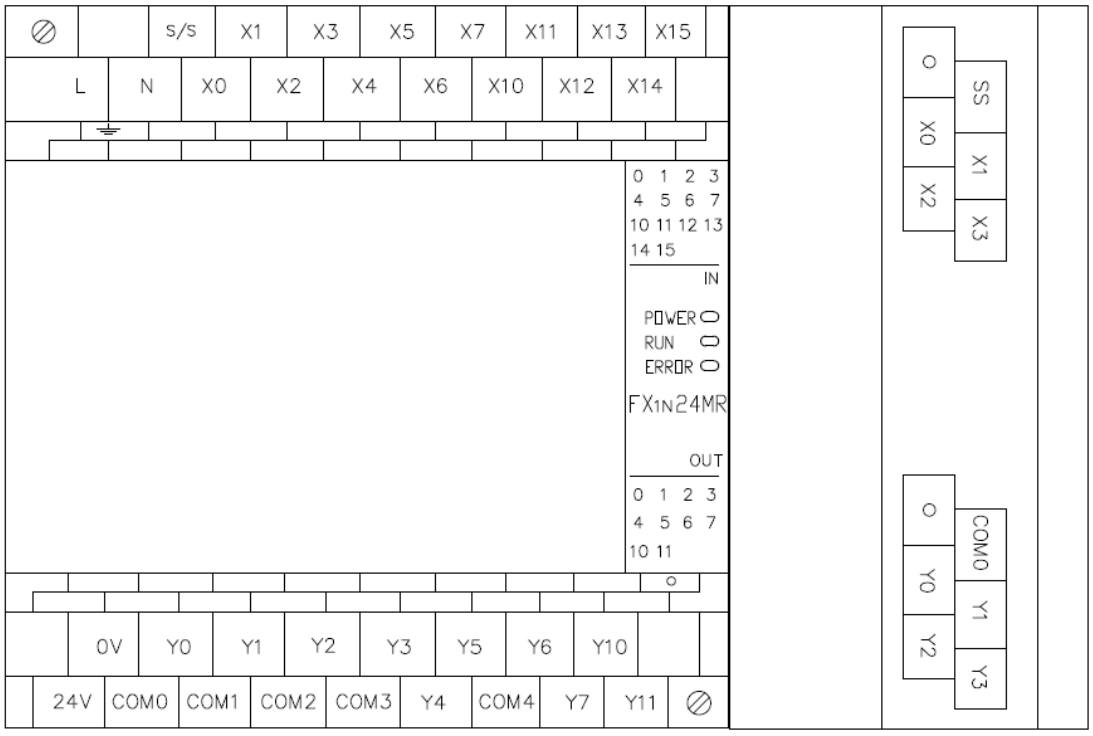


Figure 10-2
Mitsubishi FX_{1N}-24MR PLC and FX_{2N}-8ER-ES/UL (Used before 2016)

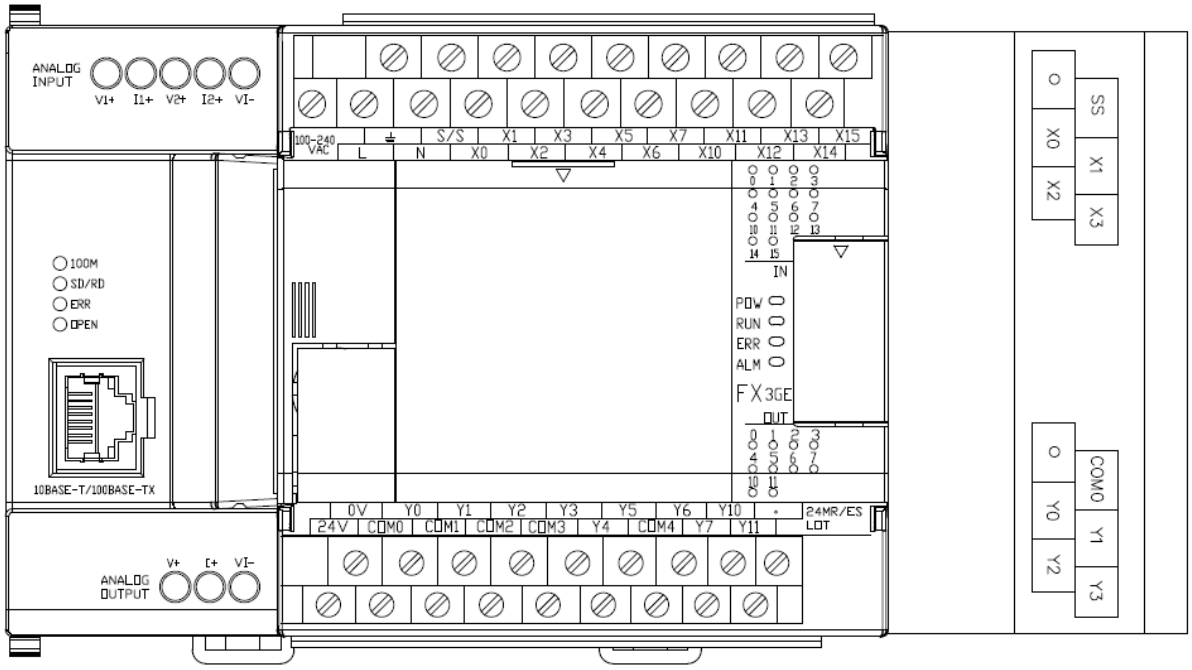


Figure 10-3
Mitsubishi FX3GE-24MR PLC and FX_{2N}-8ER-ES/UL (Used after 2015)

Inputs	Description	Outputs	Description
0	Not used	0	Not used
1	Not used	1	High Side Control Interlock
2	Start / Manual Harvest Button	2	Conveyor Control Contact
3	Selector Switch (Clean position)	3	ET - Elapsed Timer
4	Selector Switch (Ice position)	4	Water Pump motor starter
5	Freezer Pressure switch	5	Alarm
6	Compressor Motor fault	6	D-sol (defrost solenoid valve)
7	Cutter Motor overload	7	Not used
10	Pump Motor overload	10	Float switch / A-sol (liquid feed valve)
11	Oil press safety	11	Cutter motor starter
12	High / Low pressure safety		
13	Not used		
14	High Refrigerant Level (HLC) Freon Machine only		
15	Not used		
Expansion Module			
20	Not used	20	UN-sol (compressor unloader)
21	Not used	21	Not used
22	Not used	22	Not used
23	Not used	23	Not used

Table 10-1
Mitsubishi PLC Input / Outputs

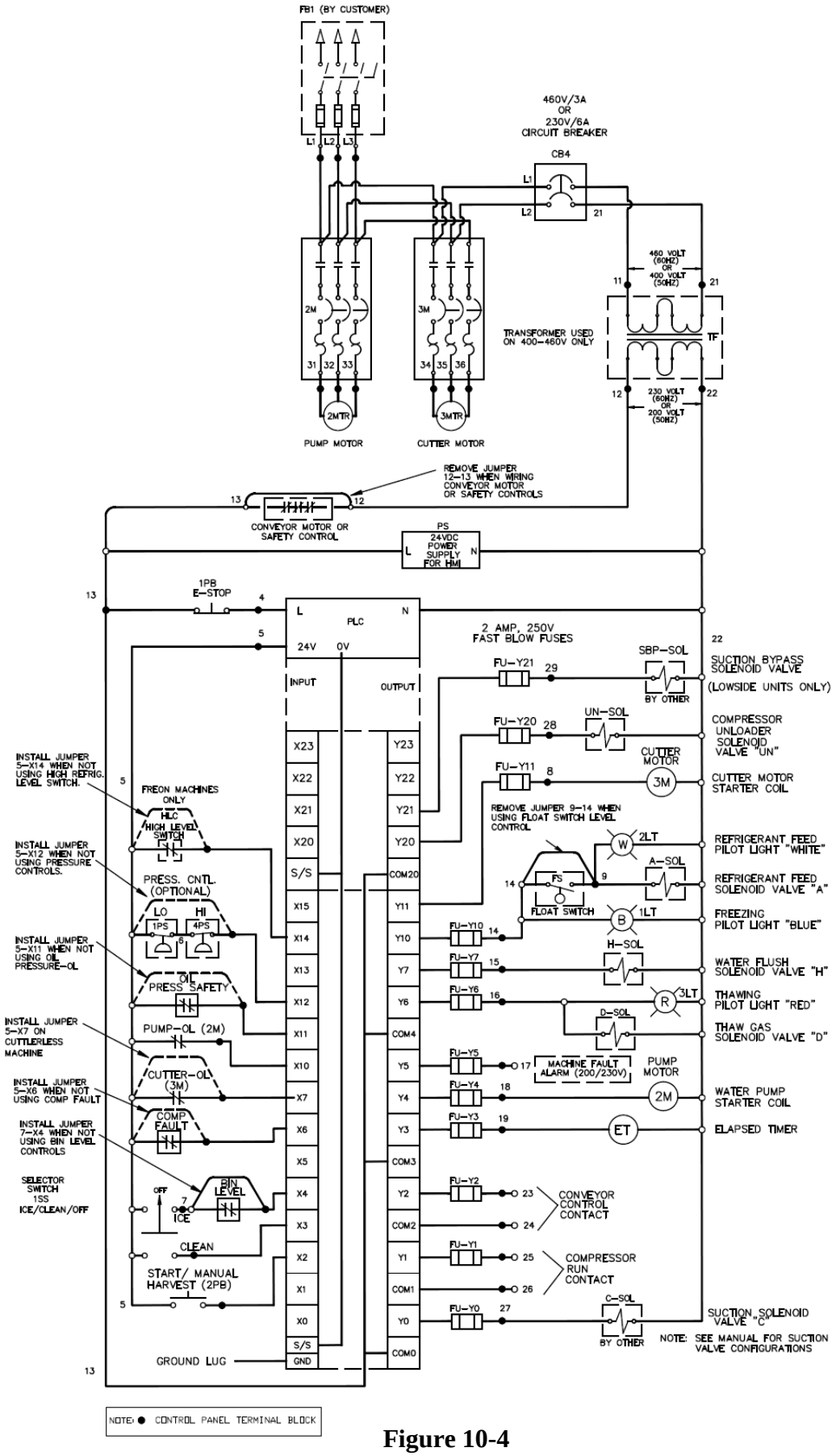


Figure 10-4
Wiring Schematic – P34FXL with Mitsubishi PLC

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 with LCD display. The units are also available for after market 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 automatic system shutdown and restart based on current line conditions, a voltmeter, and a non-volatile system memory so settings are retained even if power is lost. If 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.

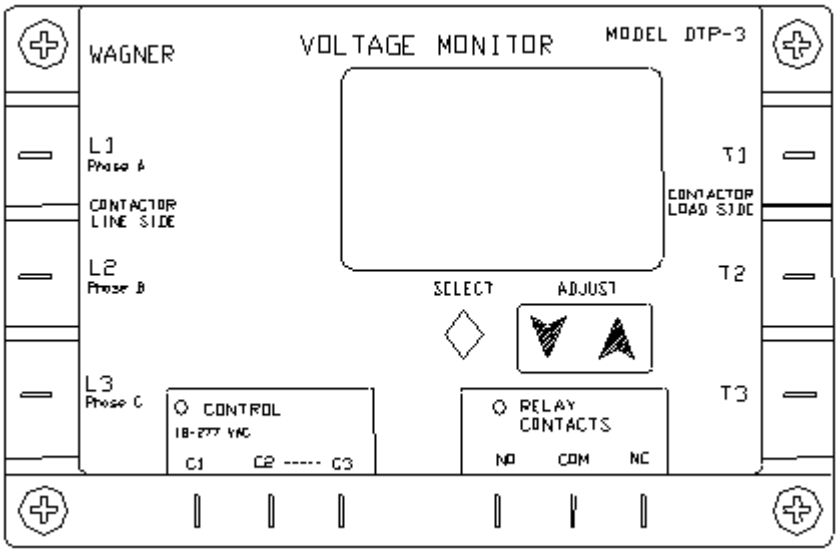


Figure 10-5
Power Monitor

The Display. The display normally shows the AB BC CA line voltages. If the unit is waiting 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 AB BC CA line voltage pairs.

Pressing the SELECT button 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 the SELECT button to step through the parameters. As you step through the parameters, the selected parameter will flash. Use the up and down arrow keys to adjust to the desired operating value.

Parameter	Minimum	Maximum	Default	Recommended Settings	Unit
Line Side Voltage (Nominal Voltage)	90	650	208	**Supply voltage**	Volts
Under /Over Voltage (tolerance)	6	18	12	**10**	%
Phase Unbalance	2	25	6	**5**	%
Lockout Time (Delay on Break)	0	720	30	**120**	Seconds
Delay Time (Delay on Make)	0	30	0	**0**	Seconds
Response Time (Delay on Fault)	0.1	20	2	**2**	Seconds
Control	Off / Auto / On		Auto	**On**	N/A
Contactor Test	OFF	5	OFF	**OFF**	Volt Diff

Table 10-2
Power Monitor Parameter Limits

Parameter Adjustments

Active display of **Line Voltage** (this is the default normal display).

Active display of **Load Side Voltage** (if connected).

Voltage Set Point (VAC Flashes). The value may be adjusted by pressing the up and down arrows. This may be set to the normal operating voltage of the device being protected in one volt increments.

Under/over Voltage Tolerance in % (UNDERVOLTAGE/OVERVOLTAGE flashes). The value may be adjusted by pressing the up and down arrows.

Imbalance Voltage Tolerance in % (% IMBALANCE flashes). The value may be adjusted by pressing the up and down arrows.

Lockout Time in seconds (SECONDS flashes). The value may be adjusted by pressing the up and down arrows. (This is the delay on break timer value)

Delay time in seconds and tenths of seconds (RESP. SECONDS flashes). The 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). The value may be adjusted to OFF (load will not turn on), ON (load will turn on whenever there are not faults and timers are finished) and AUTO (Load will turn on when there is a control input).

Contactor fault monitor mode (CONTACTOR FAULT flashes). This option allows you to monitor the contactor and lock it out if the line voltage and load side varies by more than 5 volts. Pressing the up and down arrows selects off (default) or on. The load side of the contactor must be connected to the load terminals of the DTP-3 to use this option.

Display of fault memories (MEM flashes). Pressing up or down displays the last fault conditions that took the unit off line. 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 the up and down keys until the display is cleared.

NOTE: If you press SELECT and do not change a parameter by pressing the up or down arrow keys, the DTP-3 automatically returns to displaying the line voltage in a few seconds.

The new settings are saved in permanent memory when the display returns to displaying the line voltage. The new settings may be verified by pressing the select button to sequence through the various parameters.

To prevent tripping on a 1-volt change, the DTP-3 automatically calculates cut-in voltages for the return from undervoltage conditions. The cut-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 sometimes referred to as hysteresis. This is to help reduce oscillation that may occur on weak power distribution system. When the load is switched off due to undervoltage, the line voltage will increase. Without the hysteresis, the monitor would switch the load back on, the line voltage would again drop, and cause a continuous on-off-on cycling.

11. Tables & Charts

P34FXL SPECIFICATIONS, 400/460 Volt-3 Phase- 50/60Hz

Tube Size	**inches** (cm)	**1 1/4** (3.17)	**1 1/2** (3.18)
Nominal Capacity (1)	**Tons/day** (M Tons/day)	54.6 (49.5)	43.7 (39.6)
Overall Dimensions (LxWxH)	**Feet** (meters)	6.6x6.3x18.9 (2.0x1.9x5.8)	6.6x6.3x18.9 (2.0x1.9x5.8)
Shipping Weight	**lbs** (Kg)	12,500 (5,670)	12,200 (5,540)
Operating Weight	**lbs** (Kg)	16,400 (7,440)	16,100 (7,300)
Refrigerant Charge (R-404A) (2)	**lbs** (Kg)	2,480 (1,125)	2,320 (1,050)
Total FLA (3)		**27**	**27**
Maximum Fuse		**50**	**50**
Minimum Ampacity		**32.5**	**32.5**
System Requirements			
-Dedicated Compressor (4)	**Tons** (kW)	96 (338)	72 (253)
-Average Refrigeration (4)	**Tons** (kW)	79 (278)	62 (218)
-Peak Refrigeration (4)	**Tons** (kW)	103 (360)	81 (285)
-Makeup (5)	**gpm** (m^3/ Hr)	16 (3.6)	13 (3.0)
-Blowdown per Harvest	**gal** (L)	50 (189)	50 (189)
Connection Sizes			
-Makeup Water	**FPT**	**1 1/2”**	**1 1/2”**
-Tank Drain	**FPT**	**2”**	**2”**
-Tank Overflow	**FPT**	**3”**	**3”**
-Flush Water	**FPT**	**3/4”**	**3/4”**
Water Pump - HP-KW-FLA		**7.5 – 5.7 – 10.8**	**7.5 – 5.7 – 10.8**
Cutter Motor - HP-KW-FLA		**3 – 2.2 – 3.9**	**3 – 2.2 – 3.9**
THR @ Pulldown	**Btu/hr** (kW)	1,601,400 (469)	1,266,600 (371)

(1) Nominal capacity is based on 70°F makeup water, 100°F condensing temperature, 70°F ambient, and 20% blowdown.

(2) For evaporator only. Dedicated system charge is 4,100 lb. (1,860 kg).

(3) FLA for 460 volt models is approximately 1/2 that of 230 volt models. Total FLA does not include cooling tower or auxiliary equipment.

(4) Compressor requirements are based on 15°F suction, 100°F condensing, 70°F ambient, and 20% blowdown.

(5) Makeup water is maximum value and includes 20% blowdown.

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

Table 11-1
P34FXL Specifications

Make-Up Water Temp. °F	Cylinder Ice		Crushed Ice	
	Tube Size		Tube Size	
	1 1/4”	1 1/2”	1 1/4”	1 1/2”
40	11.5	8.8	13.8	13.1
50	10.9	8.3	13.3	12.6
60	10.4	7.9	12.7	12.2
70	9.9	7.5	12.3	11.8
80	9.5	7.2	11.8	11.4
90	9.1	6.9	11.4	11.1

Includes 25% blowdown per cycle

Table 11-2
P34FXL Make-Up Water Usage (gpm)

			Suction Pressure (psig) R404A		Discharge Pressure (psig) R404A		Harvest Times (secs)			Ice per cycle Average (lbs)	Freeze Time (minutes)				
			End of Freeze	End of Thaw	End of Freeze	End of Thaw	First Ice	All Ice Out	Total Harvest		Water Temperature (deg. F)				
											90	80	70	60	50
60 HZ	C	1"	37	87	228	100	70	200	230	1094	13.0	12.5	11.5	10.8	10.0
	Y	1 1/4"	31	82	235	114	95	210	240	1300	18.7	17.3	16.5	15.5	14.5
	L	1 1/2"	28	87	235	106	105	225	255	1236	25.0	23	22.3	22.0	21.0
	C	1"	48	87	228	100	40	270	300	1020	12.3	11.6	10.8	10.1	9.3
	R	1 1/4"	45	82	235	100	50	285	315	953	10.7	10.0	9.3	8.7	8.0
	U	1 1/2"	41	87	235	106	35	280	210	708	8.2	7.6	7.1	6.5	6.0
50 HZ	C	1"	37	87	228	100	70	200	230	1094	13.0	12.5	11.5	10.8	10.0
	Y	1 1/4"	31	82	235	114	95	210	240	1300	18.7	17.3	16.5	15.5	14.5
	L	1 1/2"	28	87	235	106	105	225	255	1236	25.0	23	22.3	22.0	21.0
	C	1"	48	87	228	100	40	270	300	1020	12.3	11.6	10.8	10.1	9.3
	R	1 1/4"	45	82	235	100	50	285	315	953	10.7	10.0	9.3	8.7	8.0
	U	1 1/2"	41	87	235	106	35	280	210	708	8.2	7.6	7.1	6.5	6.0

Table 11-3
P34FXL Normal Operating Vitals

TEMPERATURE - PRESSURE CHART
FOR COMMON REFRIGERANTS (°F-psig)

DegF	R-12	R-22	R-502	R-134a	R-404A	R-717	MP-39
-50	-7.6	-3.0	0.2	-9.0	0.0	-7.0	-2.16
-48	-7.2	-2.4	0.7	-8.7	0.8	-6.5	-0.87
-46	-6.8	-1.7	1.5	-8.3	1.6	-6.0	0.54
-44	-6.3	-1.0	2.3	-8.0	2.5	-5.4	2.1
-42	-5.8	-0.2	3.2	-7.6	3.4	-4.9	3.7
-40	-5.4	0.5	4.1	-7.1	5.5	-4.3	5.4
-38	-4.9	1.3	5.0	-6.7	6.5	-3.6	7.3
-36	-4.4	2.2	6.0	-6.3	7.5	-3.0	9.3
-34	-3.8	3.0	7.0	-5.8	8.6	-2.3	11.5
-32	-3.3	4.0	8.1	-5.3	9.7	-1.6	13.7
-30	-2.7	4.9	9.2	-4.8	10.8	-0.8	16.2
-28	-2.1	5.9	10.3	-4.2	12.0	0.0	18.8
-26	-1.5	6.9	11.5	-3.8	13.2	0.8	21.6
-24	-0.8	7.9	12.7	-3.0	14.5	1.7	24.5
-22	-0.1	9.0	14.0	-2.4	15.8	2.6	27.6
-20	0.6	10.1	15.3	-1.8	17.1	3.5	30.9
-18	1.3	11.3	16.7	-1.1	18.5	4.5	34.4
-16	2.1	12.5	18.1	-0.4	20.0	5.6	38.1
-14	2.8	13.8	19.5	0.3	21.5	6.7	42.0
-12	3.7	15.1	21.0	1.1	23.0	7.8	46.2
-10	4.5	16.5	22.6	1.9	24.6	8.9	50.5
-8	5.4	17.9	24.2	2.8	26.3	10.2	55.1
-6	6.3	19.3	25.8	3.6	28.0	11.4	59.9
-4	7.2	20.8	27.5	4.5	29.8	12.8	65.0
-2	8.2	22.4	29.3	5.5	31.6	14.2	5.7
0	9.2	24.0	31.1	6.5	33.5	15.6	6.7
2	10.2	25.6	32.9	7.5	35.6	17.1	7.7
4	11.2	27.3	34.9	8.5	37.4	18.6	8.8
6	12.3	29.1	36.9	9.6	39.4	20.3	9.9
8	13.5	30.9	38.9	10.8	41.6	21.9	11.0
10	14.6	32.8	41.0	12.0	43.9	23.7	12.2
12	15.8	34.7	43.2	13.1	46.0	25.4	13.4
14	17.1	36.7	45.4	14.4	48.3	27.4	14.6
16	18.4	38.7	47.7	15.7	50.7	29.3	15.9
18	19.7	40.9	50.0	17.0	53.1	31.3	17.2
20	21.0	43.0	52.5	18.4	55.6	33.3	18.6
22	22.4	45.3	54.9	19.9	58.2	35.5	20.0
24	23.9	47.6	57.5	21.4	59.9	37.7	21.5
26	25.4	49.9	60.1	22.9	63.6	40.0	23.0
28	26.9	52.4	62.8	24.5	66.5	42.4	24.6
30	28.5	54.9	65.6	26.1	69.4	44.8	26.2
32	30.1	57.5	68.4	27.8	72.3	47.4	27.9
34	31.7	60.1	71.3	29.5	75.4	50.0	29.6
36	33.4	62.8	74.3	31.3	78.5	52.7	31.3
38	35.2	65.6	77.4	33.2	81.8	55.5	33.2
40	36.9	68.5	80.5	35.1	85.1	58.4	35.0
42	38.8	71.5	83.8	37.0	88.5	61.3	37.0
44	40.7	74.5	87.0	39.1	91.9	64.4	39.0
46	42.7	77.6	90.4	42.0	95.5	67.6	41.0
48	44.7	80.7	93.9	43.3	99.2	70.8	43.1
50	46.7	84.0	97.4	45.5	102.9	74.2	45.3

DegF	R-12	R-22	R-502	R-134a	R-404A	R-717	MP-39
50	46.7	84.0	97.4	45.5	102.9	74.2	45.3
52	48.8	87.3	101.0	47.7	109.0	77.7	60.0
54	51.0	90.8	104.8	50.1	113.0	81.3	62.0
56	53.2	94.3	108.6	52.3	117.0	84.9	65.0
58	55.4	97.9	112.4	55.0	121.0	88.7	68.0
60	57.7	101.6	116.4	57.5	125.0	92.6	70.0
62	60.1	105.4	120.4	60.1	130.0	96.6	73.0
64	62.5	109.3	124.6	62.7	134.0	100.7	76.0
66	65.0	113.2	128.8	65.5	139.0	104.9	79.0
68	67.6	117.3	133.2	68.3	144.0	109.3	82.0
70	70.2	121.4	137.6	71.2	148.0	113.7	85.0
72	72.9	125.7	142.2	74.2	153.0	118.3	89.0
74	75.6	130.0	146.8	77.2	158.0	123.1	92.0
76	78.4	134.5	151.5	80.3	164.0	127.9	95.0
78	81.3	139.0	156.3	83.5	169.0	132.8	99.0
80	84.2	143.6	161.2	86.8	174.0	137.9	102.0
82	87.2	148.4	166.2	90.2	180.0	143.2	106.0
84	90.2	153.2	171.4	93.6	185.0	148.5	109.0
86	93.3	158.2	176.6	97.1	191.0	154.1	113.0
88	96.5	163.2	181.9	100.7	197.0	159.7	117.0
90	99.8	168.4	187.4	104.4	203.0	165.5	121.0
92	103.1	173.7	192.9	108.2	209.9	171.4	125.0
94	106.5	179.1	198.6	112.1	215.0	177.5	129.0
96	110.0	184.6	204.3	116.1	222.0	183.7	133.0
98	113.5	190.2	210.2	120.1	229.0	190.1	138.0
100	117.2	195.9	216.2	124.3	235.0	196.1	142.0
102	120.9	201.8	222.3	128.5	242.0	203.3	146.0
104	124.7	207.7	228.5	132.9	249.0	210.2	151.0
106	128.5	213.8	234.9	137.3	256.0	217.2	156.0
108	132.4	220.0	241.3	142.8	264.0	224.4	160.0
110	136.4	226.4	247.9	146.5	271.0	231.7	165.0
112	140.5	232.8	254.6	151.3	279.0	239.2	170.0
114	144.7	239.4	261.5	156.1	286.0	246.9	175.0
116	148.9	246.1	268.4	161.1	294.0	254.8	180.0
118	153.2	252.9	275.5	166.1	302.0	262.8	185.0
120	157.7	259.9	282.7	171.3	311.0	271.0	191.0
122	162.2	267.0	290.1	176.6	319.0	279.4	196.0
124	166.7	274.3	297.6	182.0	328.0	288.0	202.0
126	171.4	281.6	305.2	187.5	336.0	296.7	207.0
128	176.2	289.1	312.9	193.1	345.0	305.7	213.0
130	181.0	296.8	320.8	198.9	354.0	314.8	219.0
132	185.9	304.6	328.9	204.7	364.0	324.2	225.0
134	191.0	312.5	337.1	210.7	373.0	333.7	231.0
136	196.2	320.6	345.4	216.8	383.0	343.4	237.0
138	201.3	328.9	353.9	223.0	392.0	353.4	243.0
140	206.6	337.3	362.6	229.4	402.0	363.5	250.0
142	212.0	345.8	371.4	235.8	412.0	373.8	256.0
144	217.5	354.5	380.4	242.4	423.0	384.4	263.0
146	223.1	363.4	389.5	249.2	434.0	395.2	269.0
148	228.8	372.3	398.9	256.0	444.0	406.1	277.0
150	234.6	381.5	408.4	263.0	449.0	432.0	283.0

TABLE 11-4

All pressures are in lbs/in^2 gage (psig).

REFERENCE INFORMATION

CONVERSION FACTORS: English to Metric

To Convert	From	To	Multiply by
Area	ft^2 in^2	m^2 m^2	9.2903e-2 6.416 e-4
Energy	BTU hp kW	Joule (J) BTU/Hr hp	1054.48 2546.2 1.34
Length	ft. in.	m. m.	0.3048 0.0254
Pressure	lbf/ft^2 lbf/in^2 (psi) in. Hg in H_2O	Paschals Paschals psi psi	47.88 6894.76 0.491 0.03612
Temperature	°F °C	°C °F	$T_C=5/9*(T_F - 32)$ $T_F=(9/5*T_C) + 32$
Volume	ft^3 gal(U.S.) ft^3	m^3 m^3 gal(U.S.)	2.8317e-2 3.7854e-3 7.48

TABLE 11-5

CONSTANTS

Specific heat of Water	1 BTU/(lbm °F)
Specific heat of Air	4.19 kJ/(kg °C) 0.24 BTU/(lbm °F)
Tube-Ice Density	32-35 lbs/ft^3
Ice Latent Heat	144 BTU/hr
Water Sensible Heat	1 BTU/(lb °F)
Ice Melting Effect (IME) 1 Ton Refrigeration	12,000 BTU/hr
Atmospheric pressure	14.7 psia
Weight of Water	62.4 lbs/ft^3 8.33 lbs/gal
1 gpm water	12013 lb/day
Weight of air	0.0749 lbs/ft^3 0.0100 lbs/gal
1 Horsepower	2545.6 BTU/hr
1 Kilowatt	1.34 horsepower
Gravitational accel.	9.81 m^2/sec

TABLE 11-6

TABLES & CHARTS

Appendix A

The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

"SUVA" HP62 (R404A)
6002FR Revised 29-AUG-2001

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

"SUVA" is a registered trademark of DuPont.

Corporate MSDS Number : DU005612

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont Fluoroproducts
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
Product Information : 1-800-441-7515 (outside the U.S. 302-774-1000)
Transport Emergency : CHEMTREC 1-800-424-9300(outside U.S. 703-527-3887)
Medical Emergency : 1-800-441-3637 (outside the U.S. 302-774-1000)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
PENTAFLUOROETHANE (HFC-125)	354-33-6	44
ETHANE, 1,1,1-TRIFLUORO- (HFC-143a)	420-46-2	52
ETHANE, 1,1,1,2-TETRAFLUORO- (HFC-134a)	811-97-2	4

HAZARDS IDENTIFICATION

Potential Health Effects

Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness, or death. Intentional misuse or deliberate inhalation may cause death without warning. Vapor reduces oxygen available for breathing and is heavier than air. Liquid contact can cause frostbite.

HUMAN HEALTH EFFECTS:

Overexposure to the vapors by inhalation may include temporary nervous system depression with anesthetic effects

(HAZARDS IDENTIFICATION - Continued)

such as dizziness, headache, confusion, incoordination, and loss of consciousness. Higher exposures to the vapors may cause temporary alteration of the heart's electrical activity with irregular pulse, palpitations, or inadequate circulation; or fatality from gross overexposure. Contact with the liquid may cause frostbite.

Individuals with preexisting diseases of the central nervous or cardiovascular system may have increased susceptibility to the toxicity of increased exposures.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

INHALATION

If inhaled, immediately remove to fresh air. Keep person calm. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

Flush area with lukewarm water. Do not use hot water. If frostbite has occurred, call a physician.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

Not a probable route. However, in case of accidental ingestion, call a physician.

Notes to Physicians

THIS MATERIAL MAY MAKE THE HEART MORE SUSCEPTIBLE TO ARRHYTHMIAS. Catecholamines such as adrenaline, and other compounds having similar effects, should be reserved for emergencies and then used only with special caution.

FIRE FIGHTING MEASURES

\# Flammable Properties

Flash Point : No flash point

Flammable Limits in Air, % by Volume:
LEL : None per ASTM E681
UEL : None per ASTM E681
Autoignition: Not determined

Fire and Explosion Hazards:

Cylinders may rupture under fire conditions. Decomposition may occur.

Contact of welding or soldering torch flame with high concentrations of refrigerant can result in visible changes in the size and color of torch flames. This flame effect will only occur in concentrations of product well above the recommended exposure limit, therefore stop all work and ventilate to disperse refrigerant vapors from the work area before using any open flames.

R-404A is not flammable in air at temperatures up to 100 deg C (212 deg F) at atmospheric pressure. However, mixtures of R-404A with high concentrations of air at elevated pressure and/or temperature can become combustible in the presence of an ignition source. R-404A can also become combustible in an oxygen enriched environment (oxygen concentrations greater than that in air). Whether a mixture containing R-404A and air, or R-404A in an oxygen enriched atmosphere becomes combustible depends on the inter-relationship of 1) the temperature 2) the pressure, and 3) the proportion of oxygen in the mixture. In general, R-404A should not be allowed to exist with air above atmospheric pressure or at high temperatures; or in an oxygen enriched environment. For example: R-404A should NOT be mixed with air under pressure for leak testing or other purposes.

Experimental data have also been reported which indicate combustibility of HFC-134a, a component in this blend, in the presence of chlorine.

Extinguishing Media

As appropriate for combustibles in area.

Fire Fighting Instructions

Cool cylinder with water spray or fog. Self-contained breathing apparatus (SCBA) is required if cylinders rupture and contents are released under fire conditions. Water runoff should be contained and neutralized prior to release.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures

Ventilate area using forced ventilation, especially in low or enclosed places where heavy vapors might collect. Remove open flames. Use self-contained breathing apparatus (SCBA) for large spills or releases.

HANDLING AND STORAGE

Handling (Personnel)

Avoid breathing vapor. Avoid liquid contact with eyes and skin. Use with sufficient ventilation to keep employee exposure below recommended limits. Contact with chlorine or other strong oxidizing agents should also be avoided. See Fire and Explosion Data section.

Storage

Clean, dry area. Do not heat above 52 deg C (125 deg F).

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Avoid breathing vapors. Avoid contact with skin or eyes. Use with sufficient ventilation to keep employee exposure below the recommended exposure limit. Local exhaust should be used if large amounts are released. Mechanical ventilation should be used in low or enclosed places.

Refrigerant concentration monitors may be necessary to determine vapor concentrations in work areas prior to use of torches or other open flames, or if employees are entering enclosed areas.

Personal Protective Equipment

Impervious gloves should be used to avoid prolonged or repeated exposure. Chemical splash goggles should be available for use as needed to prevent eye contact. Under normal manufacturing conditions, no respiratory protection is required when using this product. Self-contained breathing apparatus (SCBA) is required if a large release occurs.

(EXPOSURE CONTROLS/PERSONAL PROTECTION - Continued)

Exposure Guidelines

Applicable Exposure Limits

PENTAFLUOROETHANE (HFC-125)

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	(DuPont)	: 1000 ppm, 8 & 12 Hr. TWA
WEEL	(AIHA)	: 1000 ppm, 4900 mg/m3, 8 Hr. TWA

ETHANE, 1,1,1-TRIFLUORO- (HFC-143a)

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	(DuPont)	: 1000 ppm, 8 & 12 Hr. TWA
WEEL	(AIHA)	: 1000 ppm, 8 Hr. TWA

ETHANE, 1,1,1,2-TETRAFLUORO- (HFC-134a)

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	(DuPont)	: 1000 ppm, 8 & 12 Hr. TWA
WEEL	(AIHA)	: 1000 ppm, 8 Hr. TWA

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Boiling Point	: -46.7 C (-52.1 F) Average
Vapor Pressure	: 182.1 psia at 25 deg C (77 deg F)
% Volatiles	: 100 WT%
Evaporation Rate	: (CL4 = 1) Greater than 1
Solubility in Water	: Not determined
Odor	: Slight ethereal
Form	: Liquefied gas
Color	: Clear, colorless
Specific Gravity	: 1.05 @ 25C (77F)

STABILITY AND REACTIVITY

Chemical Stability

Material is stable. However, avoid open flames and high temperatures.

Incompatibility with Other Materials

Incompatible with active metals, alkali or alkaline earth metals--powdered Al, Zn, Be, etc.

(STABILITY AND REACTIVITY - Continued)

Decomposition

Decomposition products are hazardous. This material can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrofluoric acid and possibly carbonyl fluoride.

These materials are toxic and irritating. Contact should be avoided.

Polymerization

Polymerization will not occur.

TOXICOLOGICAL INFORMATION

Animal Data

The blend is untested.

HFC-125

Inhalation 4 hour ALC: > 709,000 ppm in rats

Single, high inhalation exposures caused lethargy, decreased activity, labored breathing and weight loss. Weak cardiac sensitization effect, a potentially fatal disturbance of heart rhythm caused by a heightened sensitivity to the action of epinephrine. Lowest-Observed-Adverse-Effect-Level for cardiac sensitization: 100,000 ppm.
Repeated exposure caused: No significant toxicological effects. No-Observed-Adverse-Effect-Level(NOAEL): 50,000 ppm

No animal data are available to define carcinogenic, developmental or reproductive hazards. In animal testing this material has not caused developmental toxicity. HFC-125 does not produce genetic damage in bacterial or mammalian cell cultures or when tested in animals (not tested for heritable genetic damage).

HFC-134a

Inhalation 4-hour LC50: 567,000 ppm in rats

Single exposure caused: Cardiac sensitization, a potentially fatal disturbance of heart rhythm associated with a heightened sensitivity to the action of epinephrine. Lowest-Observed-Adverse-Effect-Level for cardiac sensitization: 75,000 ppm. Single exposure caused: Lethargy. Narcosis. Increased respiratory rates. These effects were temporary. Single exposure to near lethal doses caused: Pulmonary edema. Repeated exposure caused: Increased adrenals, liver, spleen weight. Decreased uterine, prostate

(TOXICOLOGICAL INFORMATION - Continued)

weight. Repeated dosing of higher concentrations caused: the following temporary effects - Tremors. Incoordination.

CARCINOGENIC, DEVELOPMENTAL, REPRODUCTIVE,MUTAGENIC EFFECTS:

In a two-year inhalation study, HFC-134a, at a concentration of 50,000 ppm, produced an increase in late-occurring benign testicular tumors, testicular hyperplasia and testicular weight. The no-effect-level for this study was 10,000 ppm. Animal data show slight fetotoxicity but only at exposure levels producing other toxic effects in the adult animal. Reproductive data on male mice show: No change in reproductive performance. Tests have shown that this material does not cause genetic damage in bacterial or mammalian cell cultures, or in animals. In animal testing, this material has not caused permanent genetic damage in reproductive cells of mammals (has not produced heritable genetic damage).

HFC-143a

Inhalation 4-hour LC50: >540,000 ppm in rats

Single exposures by inhalation to 500,000 ppm caused anesthesia but no mortality at 540,000 ppm. Cardiac sensitization occurred in dogs at 300,000 ppm following an intravenous challenge with epinephrine. Two, 4-week inhalation have been conducted. In the first study, pathological changes in the testes were observed at all exposure concentrations; no effects were observed in females. The testicular effect was considered related to the method used to expose the rats to HFC-143a. In the second study using the same exposure concentrations, no effects were noted in males at any concentration. Data from a 90-day study revealed no effects in male or female rats at exposures up to 40,000 ppm. Long-term exposure caused significantly decreased body weights in male rats fed 300 mg/kg for 52 weeks, but there was no effect on mortality. Tests in rats demonstrated no carcinogenic activity when administered orally 300 mg/kg/day for 52 weeks and observed for an additional 73 weeks. Tests in bacterial cell cultures demonstrated mutagenic activity, but the compound did not induce transformation of mammalian cells in culture or in the whole animal. Tests in animals demonstrate no developmental toxicity.

ECOLOGICAL INFORMATION

Ecotoxicological Information

Aquatic Toxicity

HFC 143a
96-hour LC50, Rainbow trout: >40 mg/L

HFC-134a
48-hour EC50, Daphnia magna: 980 mg/L
96-hour LC50, Rainbow trout: 450 mg/L

DISPOSAL CONSIDERATIONS

Waste Disposal

Comply with Federal, State, and local regulations. Reclaim by distillation or remove to a permitted waste disposal facility.

TRANSPORTATION INFORMATION

Shipping Information

DOT/IMO/IATA

Proper Shipping Name	: Refrigerant Gas R-404A
Hazard Class	: 2.2
UN No.	: 3337
Label(s)	: Nonflammable Gas

Shipping Containers

Tank Cars.

Cylinders
Ton Tanks

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Reported/Included.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute	: No
Chronic	: No
Fire	: No
Reactivity	: No
Pressure	: Yes

(REGULATORY INFORMATION - Continued)

LISTS:

SARA Extremely Hazardous Substance	-No
CERCLA Hazardous Material	-No
SARA Toxic Chemicals	-No

OTHER INFORMATION

NFPA, NPCA-HMIS

NPCA-HMIS Rating

Health	: 1
Flammability	: 0
Reactivity	: 1

Personal Protection rating to be supplied by user depending on use conditions.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS	: MSDS Coordinator
>	: DuPont Fluoroproducts
Address	: Wilmington, DE 19898
Telephone	: (800) 441-7515

# Indicates updated section.

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

12. Index

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U

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