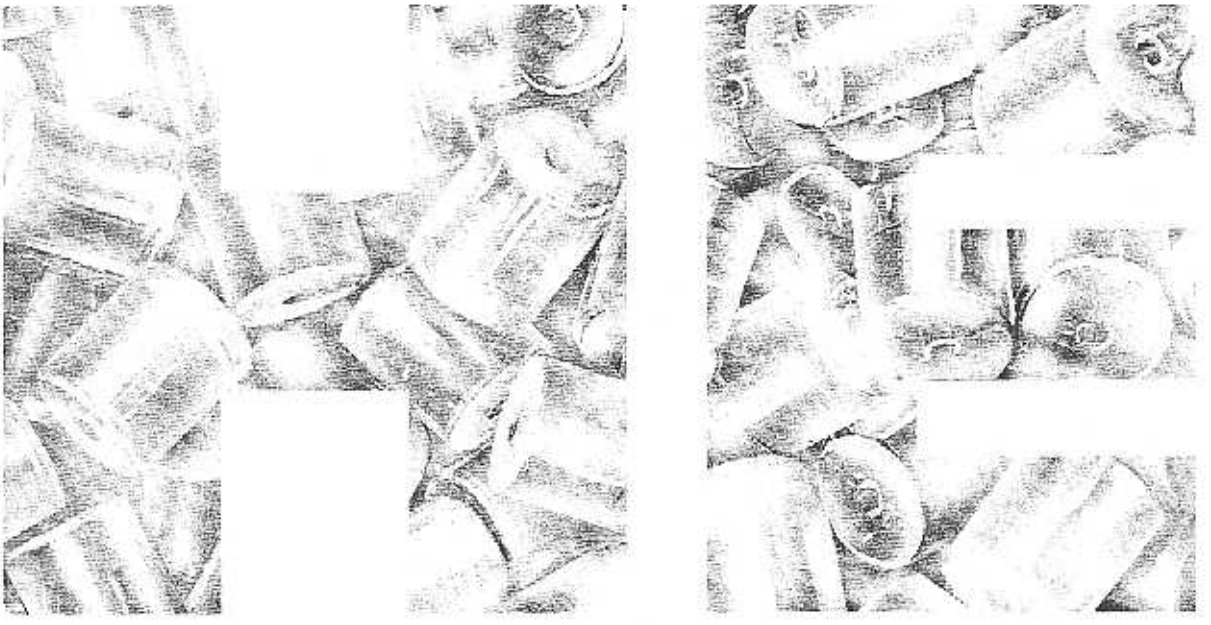
Vogt®



SERIES

Tube-Ice® machines

Service Manual

$50⁰⁰

Vogt®

TUBE-ICE® MACHINES
Models HE10, HE20, HE30 & HE40

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1. Introduction
Henry Vogt Machine Co.

A Brief History of Our Company

Henry Vogt Machine Co. was founded as a small machine shop in Louisville, Kentucky in 1880. Today it 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 much 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 the HE model Tube-Ice® machines. 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 have been proven over and over again, in a network of varied types of installations throughout the world.

Furnished with your machine is the CERTIFICATE OF TEST—the report of operating data which is a record of the unit's satisfactory operation at our factory test floor. It is evidence of our desire to deliver to you "the finest ice-making unit ever made."

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 when you install it, maintain it, and service it properly.

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

If you have additional questions, please call your distributor.

Important Safety Notice

This information is intended for use by individuals possessing adequate backgrounds of electrical, refrigeration and mechanical experience. Any attempt to repair major equipment may result in personal injury and 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.

Special Precautions To Be Observed When Charging Refrigeration Systems

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

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 R-22 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 and slowly—to relieve refrigerant pressure between the cylinder valve and the charging valve.

! 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.
! CAUTION !

Always store cylinders containing refrigerant in a cool place. They should never be exposed to temperatures higher than 125°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 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 !

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.

! 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 !

Vogt®
Tube-Ice® machine

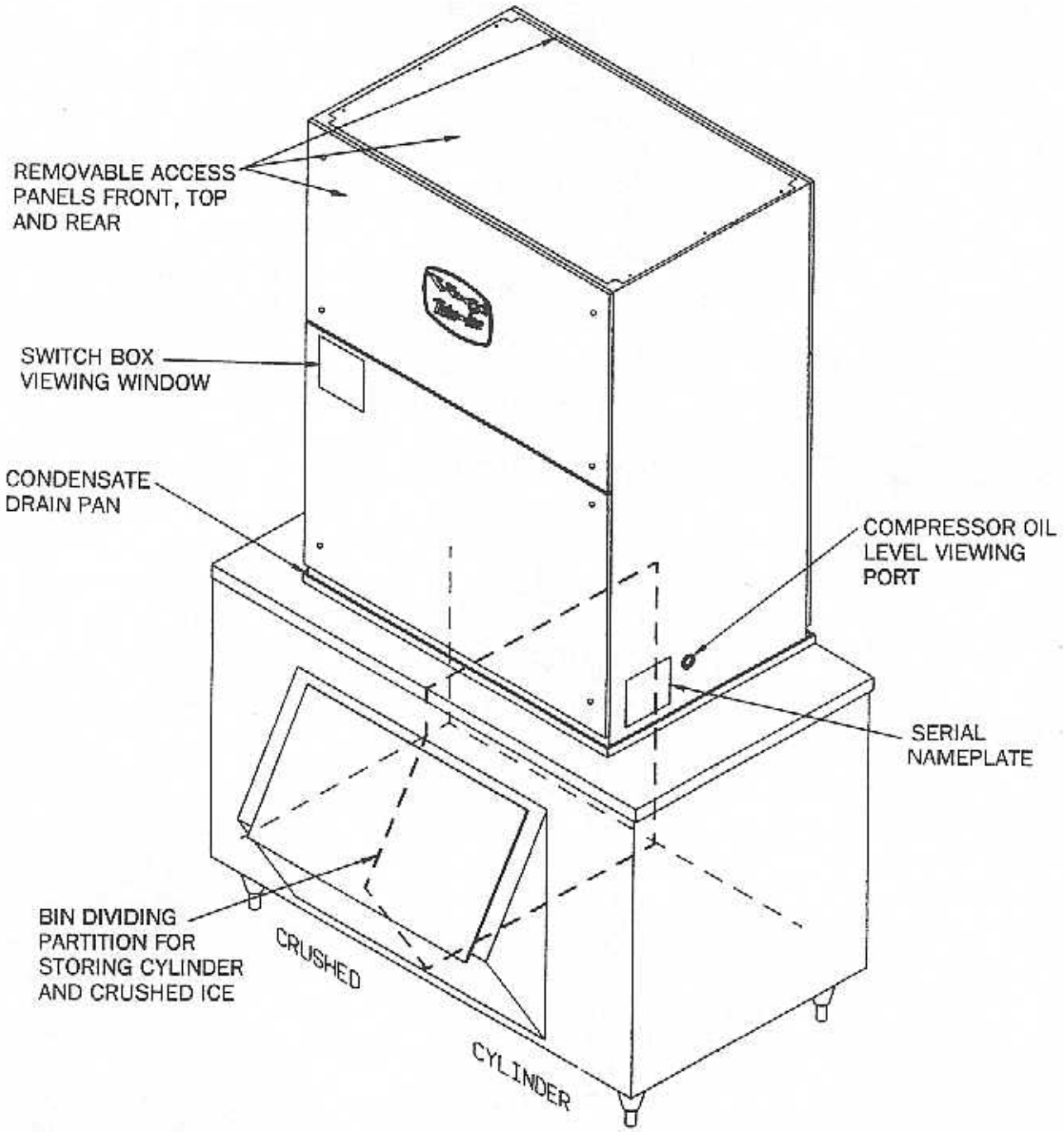


Figure 1. Tube-Ice® machine shown atop a typical ice storage bin. The bin is optional equipment.

NOTICE! The ice storage bin is shown for illustration purposes only. The Henry Vogt Machine Co. accepts no responsibility for the selection or use of any ice bin in conjunction with the Tube-Ice® machine.

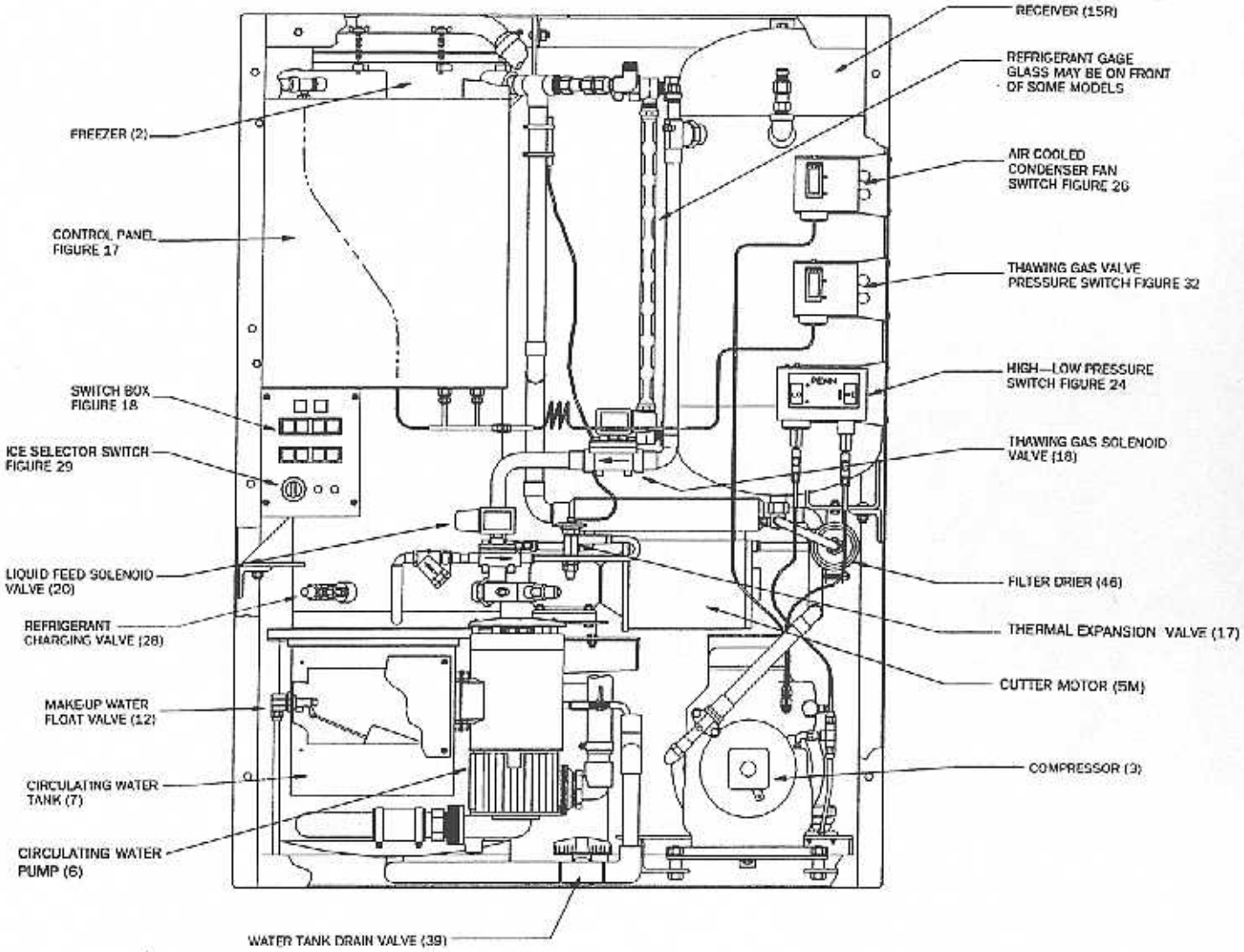


Figure 2. Assembly Model HE30

Air Cooled

Front View

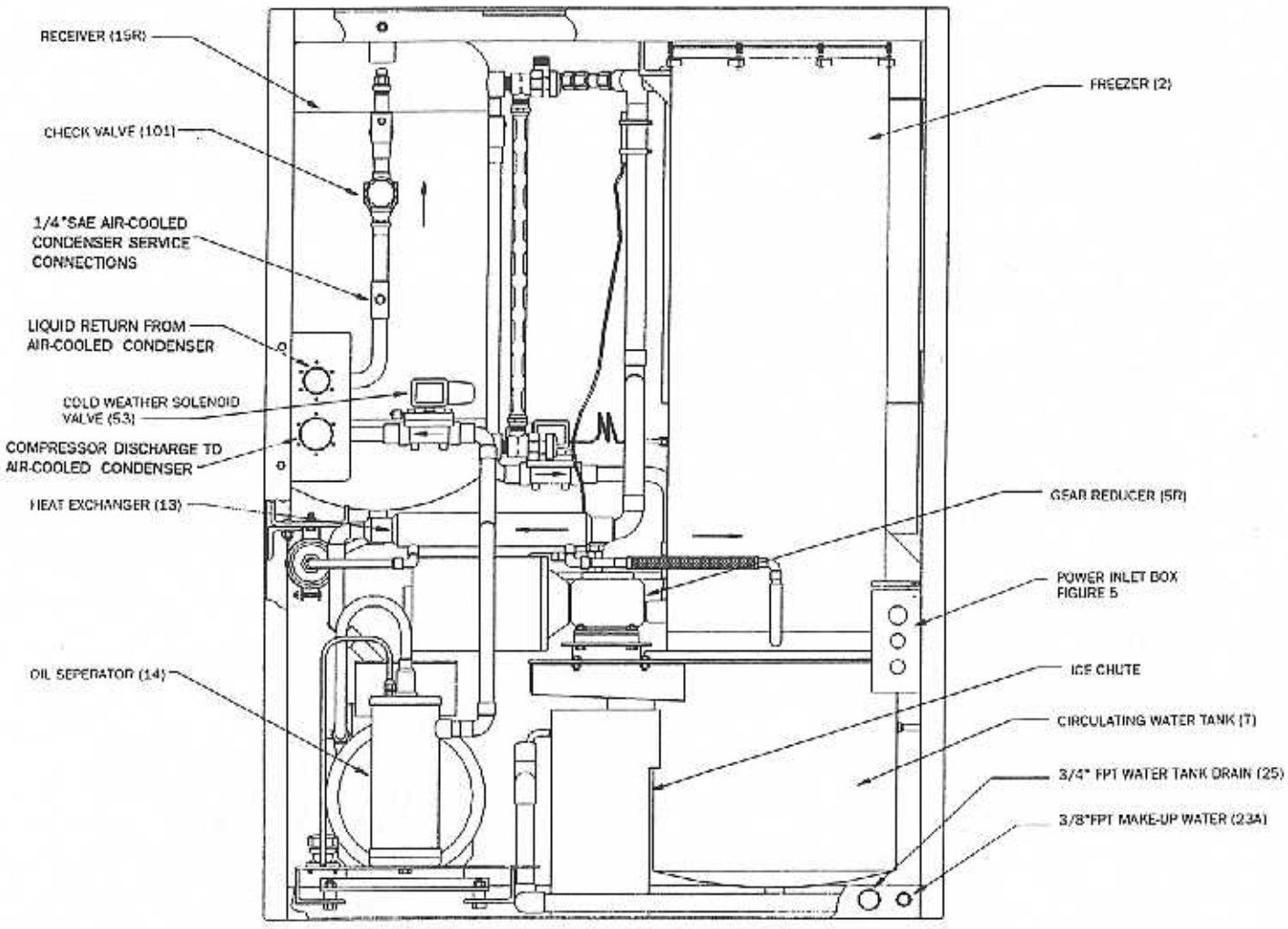


Figure 2A. Assembly Model HE30

Air Cooled

Rear View

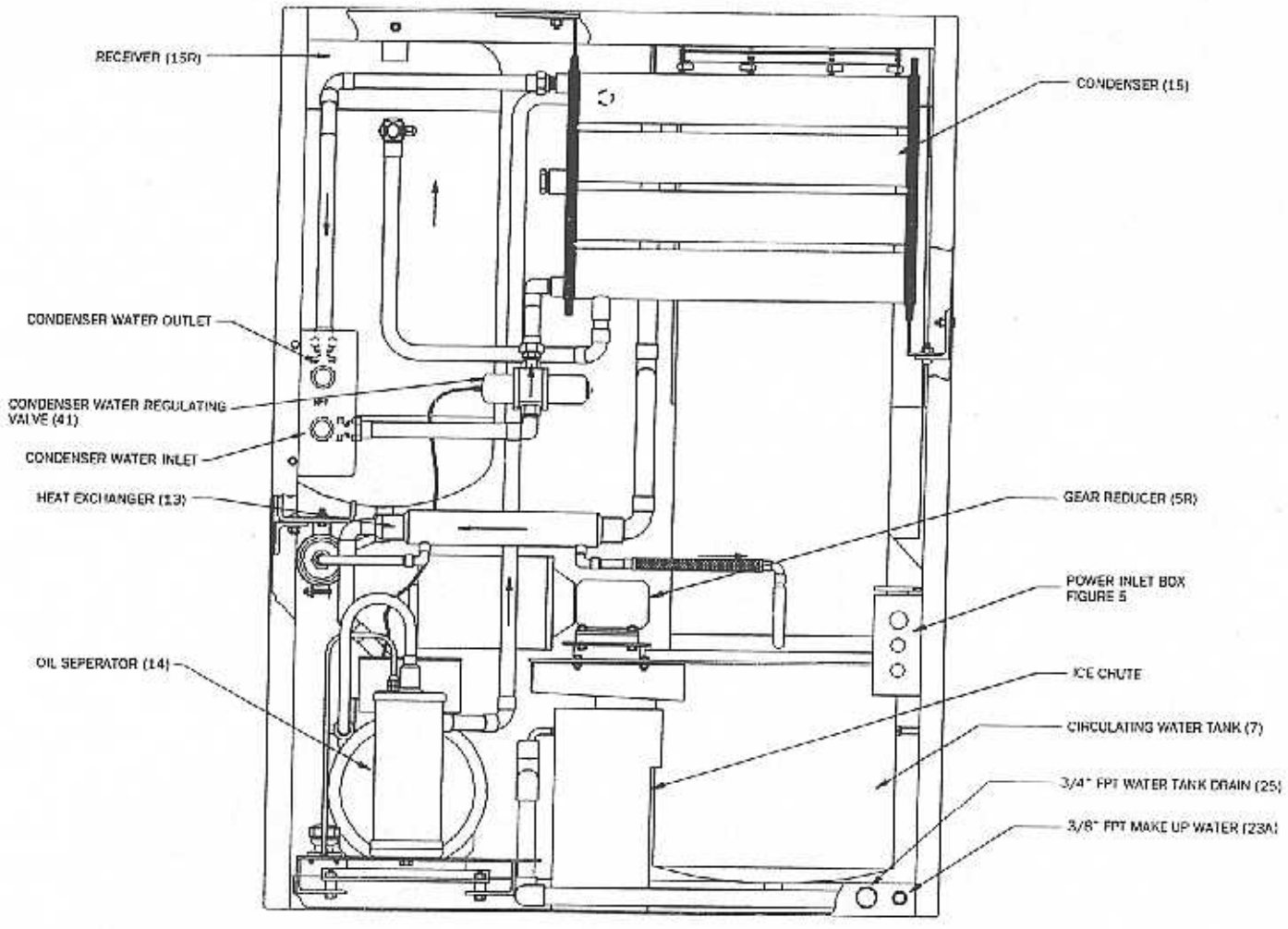


Figure 2C. Assembly Model HE30

Water Cooled

Rear View

2. Receipt of Your Tube-Ice® machine

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

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 Henry Vogt Machine Co. can void the machine's warranty.

The machine was shipped with a full charge of R-22 stored in the receiver. Visually check all lines for mechanical damage. If a leak is suspected, check all the joints with a Halogen Leak Detector. All leaks should be reported to the Henry Vogt Machine Co. to obtain authorization for repair.

Safety Valves. Two safety pressure relief valves are an integral part of the packaged Tube-Ice® machine. One is located in the low-side of the system, on the freezer, and one is in the high side of the system on the receiver. You must vent each of the pressure relief valves to the atmosphere in such a manner as to comply with local and national codes.

Machine Room. The machine must be located inside a suitable building and must not be subjected to ambient temperatures below 50°F. 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.**

3. Installing Your Machine

Installation Without Bin. Machine must be installed on a drainable condensate drip pan.

Bin Installation. Set the bin on a solid, level footing. Inside the bin you will find the four legs. Screw these legs to the bottom of the bin. You can make MINOR leveling adjustments by using these legs as leveling screws, as outlined in the manufacturer's instructions.

Once the ice storage bin is level, the Tube-Ice® machine can be elevated and placed inside the condensate drip pan on the top of the bin.

FIGURES 3, and 4. Illustrate two methods of lifting & setting Tube-Ice® machine on a level ice storage bin.

! CAUTION !
The approximate weight of the machine is 1360 pounds. Always use equipment with adequate load-carrying capacity.
! CAUTION !

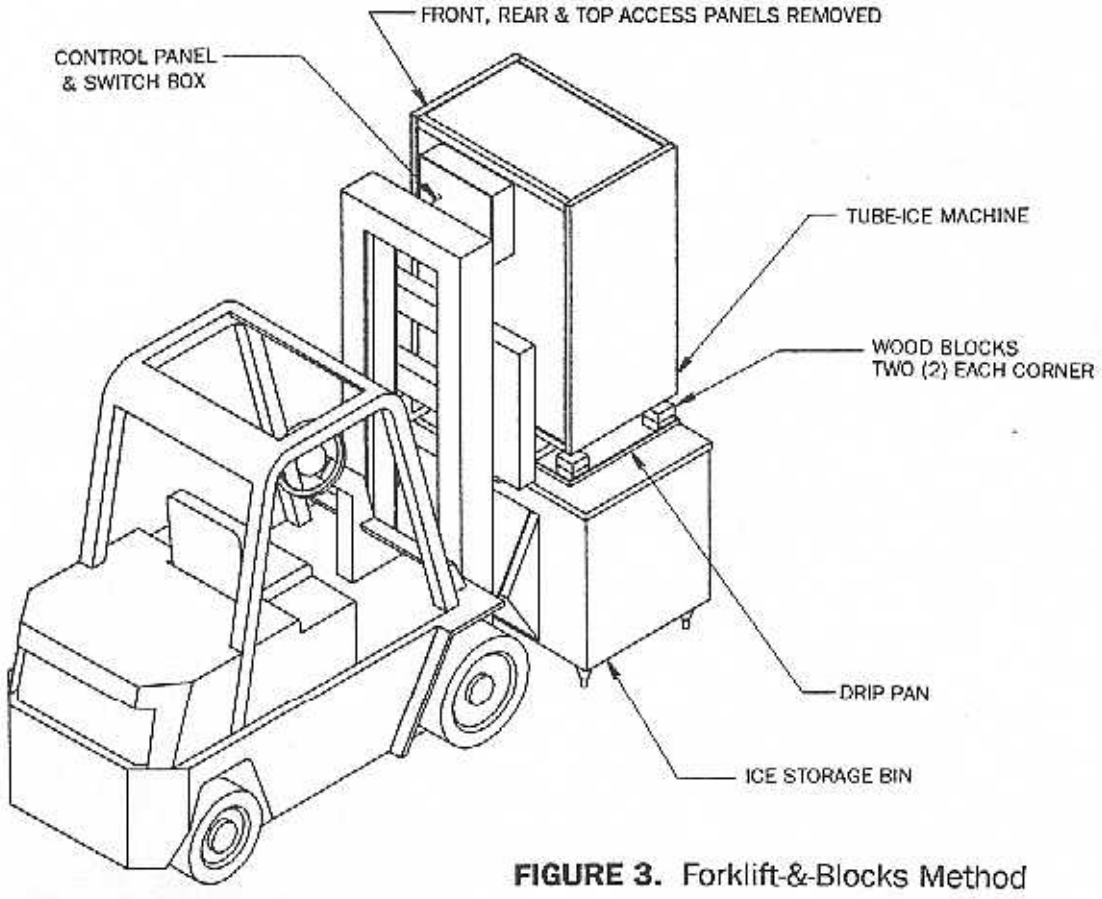


FIGURE 3. Forklift-&-Blocks Method

Forklift and Blocks Method

You need:
- \+ forklift truck with adequate load and height capacities
- \+ 8 2x4 wood blocks 8 in. long
- \+ two (2) wooden 2x4's measuring 3-ft. long
- \+ pry bar

Step 1. Position Tube-Ice® machine on forks.

! CAUTION !
The Tube-Ice® machine may be somewhat top heavy to the rear.
! CAUTION !

Step 2. Stack wood blocks in each corner of the drip pan on top of the ice storage bin.

Step 3. Lift and set Tube-Ice® machine on wood blocks.

Step 4. Remove forklift.

Step 5. Stack 3-ft. long 2x4's beside drip pan, overlapping front and back of bin.

Step 6. Using a pry bar with fulcrum on 2x4's, raise side of machine enough to remove the TOP wood blocks.

! CAUTION !
Do not remove top AND bottom blocks at the same time.
! CAUTION !

Step 7. Repeat steps 5 and 6 on other side.

Step 8. With machine sitting on one (1) block under each corner, repeat steps 5, 6 and 7and remove remaining blocks. Drip pan flanges may bend slightly.

Step 9. Straighten bent drip pan flanges.

Step 10. Check alignment of ice chute to bin opening.

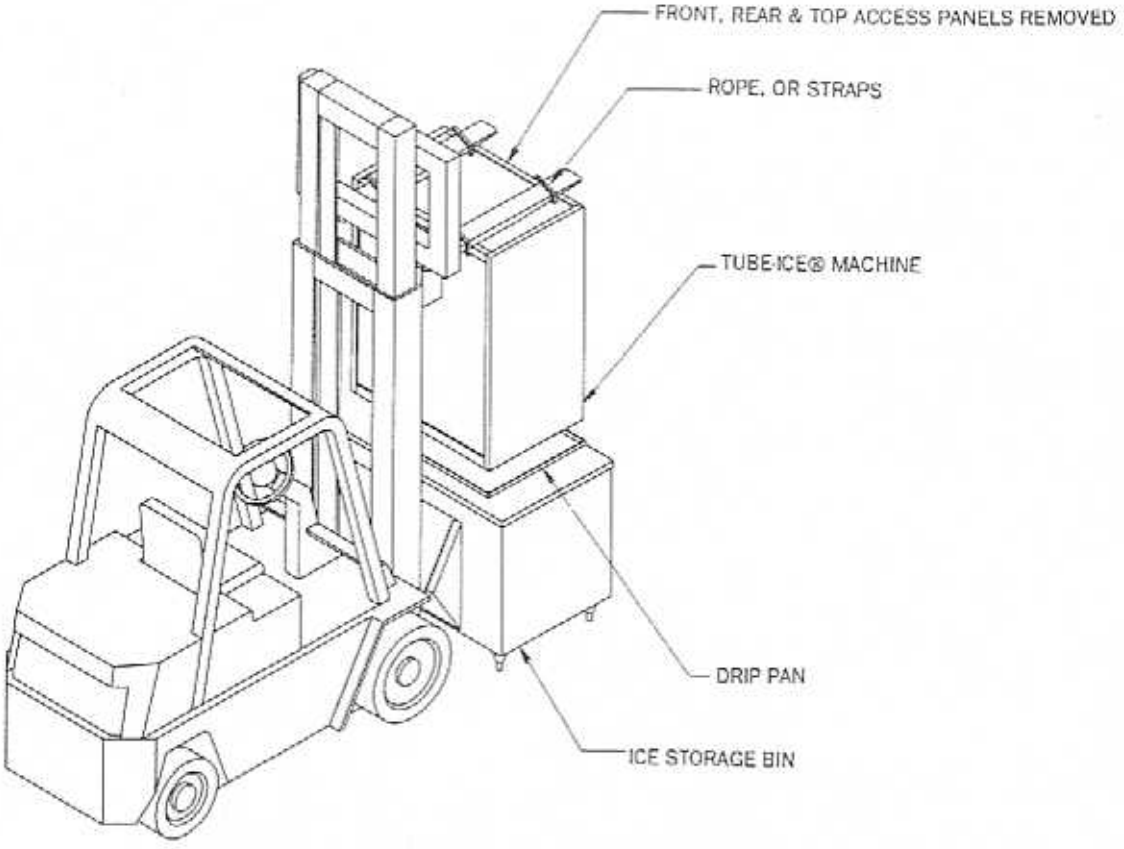


FIGURE 4. Forklift-& Rope or Lifting Straps Method

Forklift and Rope or Lifting Straps Method

You need:
+ extra head room
+ forklift with adequate load and height capacities
+ 1/2" rope or 4 lifting straps to bind forks to top angles.

Step 1. Remove front, rear and top access panels.

Step 2. Position fork truck so that forks are resting flat on top angles of Tube-Ice® machine.

Step 3. Use the rope or straps to securely bind forks to the top angles.

! CAUTION !
Be sure the bin is level and is set in its proper location. See the space diagrams, FIGURES 7 and 8.
! CAUTION !

Step 4. Lift Tube-Ice® machine and set into drip pan of bin.

Step 5. Remove rope or straps and fork truck.

Step 6. Install front, rear and top access panels.

Step 7. Check alignment of ice chute to bin opening

Water-Cooled Machine Installation

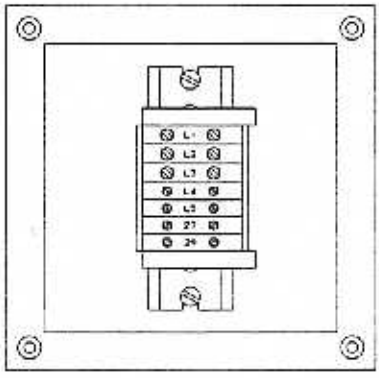
Wiring & electrical connection.

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

After removing the lower rear access panel locate the power inlet box on the back of the machine. Make sure the wiring and electrical supply are proper for this machine. Verify the requirements with the machine nameplate.

FIGURE 5. Power Inlet Box.

LOCATED AT REAR OF MACHINE.



A fused disconnect must be provided near the Tube-Ice® machine. Connect 3 phase power to terminals L1, L2, L3 for operation of the Tube-Ice® machine and its controls. Rotation checking of compressor is not required, however, if one leg of the 3 Phase Power is higher or lower ("Wild"), then it should be connected to terminal #L2. Connect the "Ground" wire to the "Ground" terminal provided.

Terminals L4 and L5 are for connection of single phase 208/230 electrical supply for split voltage applications such as 460 volt 3 phase for compressor.

! CAUTION !
Do not attempt to start machine prior to connecting water lines and making the following NECESSARY provisions. Refer to FIGURE 6 (space diagram) for correct installation.
! CAUTION !

Piping and drain connections. All connections are located at the rear of the machine. Look for four (4) water connections on the freezing unit of each water-cooled machine. See FIGURE 6(space diagram) for correct utility connections.

! 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 !

Water Supply and Drains

MODEL	HE10	HE20	HE30	HE40
Make Up Water In	3/8" FPT	3/8" FPT	3/8" FPT	3/8" FPT
Water Tank Drain	3/4" FPT	3/4" FPT	3/4" FPT	3/4" FPT
Condenser Water In	3/4" FPT	3/4" FPT	3/4" FPT	1" FPT
Condenser Water Out	3/4" FPT	3/4" FPT	3/4" FPT	1" FPT

TABLE 1

When the ice machine sits on a storage bin, the bin must be provided with a drip pan for catching the condensate from the ice machine. Separate drains for the condensate and for the bin are necessary. See FIGURE 6 (space diagram drawing for typical water and drain connections).

Condensate drain **must not** run through the ice compartment of the bin.

The condenser water outlet, water pan drain, condensate drain and ice storage bin drain connection must be extended to an open drain or sump and arranged for visible discharge.

! CAUTION !
These lines must NOT be connected into a pressure tight common header due to the possibility that warm condenser water may back up into the water pan, drip pan or the ice storage bin. The condenser water outlet MUST be piped separately to the drain.
! CAUTION !

CONDENSER WATER CONNECTIONS

	HE10	HE20	HE30	HE40
A	3/4"FPT	3/4"FPT	3/4"FPT	1"FPT
B	3/4"FPT	3/4"FPT	3/4"FPT	1"FPT

NOTES:

A FUSED DISCONNECT FOR THE ICE MACHINE MUST BE PROVIDED NEAR THE MACHINE.
INDIVIDUAL PLUMBING LINES TO OPEN SEWER OR COOLING TOWER ARE REQUIRED FOR CONDENSER WATER OUTLET & DRAINS.
ICE BIN SHOWN FOR ILLUSTRATION PUROSES ONLY.

BIN DIMENSIONS MAY VARY.

SERVICE MANUAL IS SHIPPED IN CONTROL PANEL

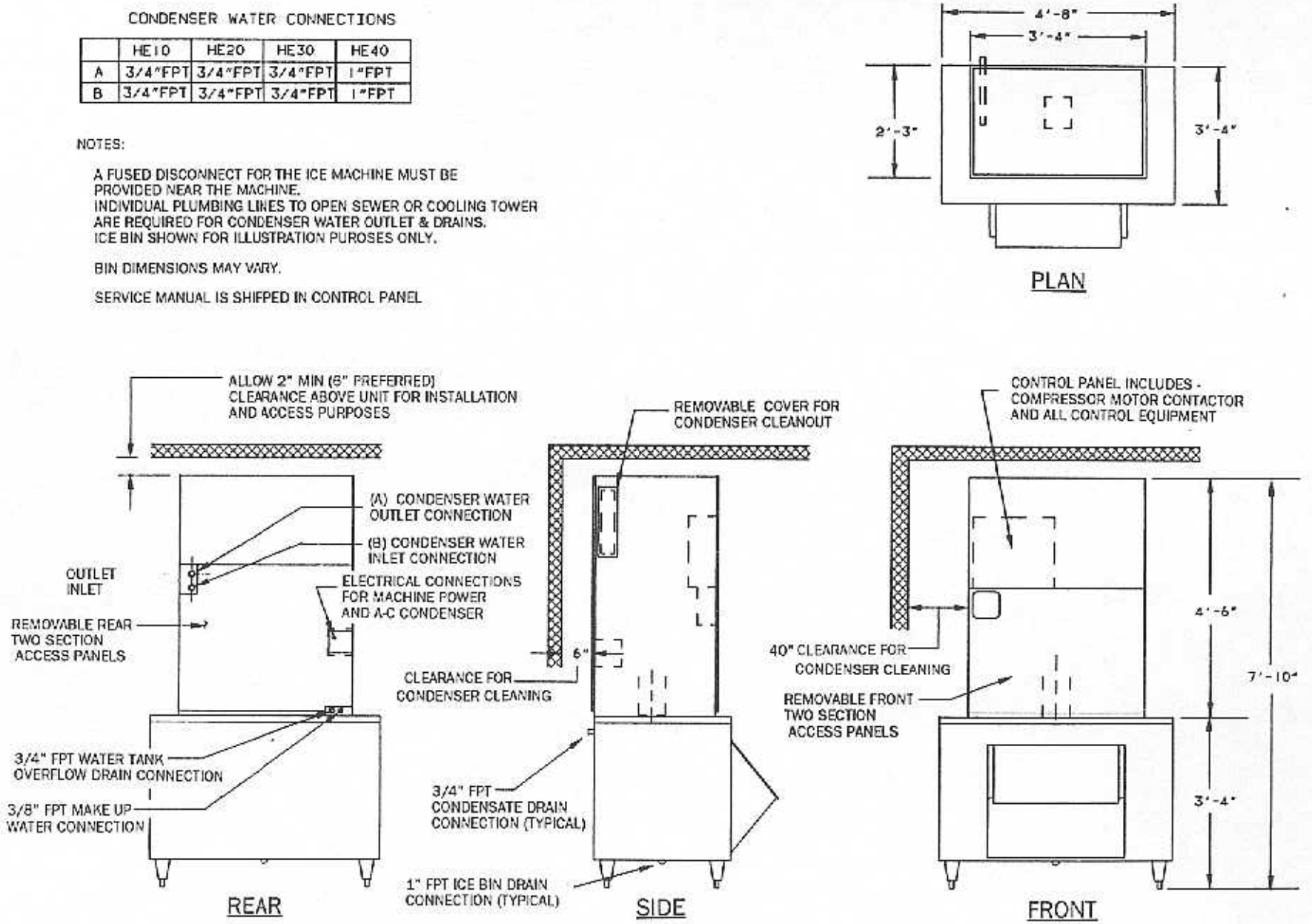


Figure 6. Space Diagram Water-Cooled Machine

Air-Cooled Machine Installation

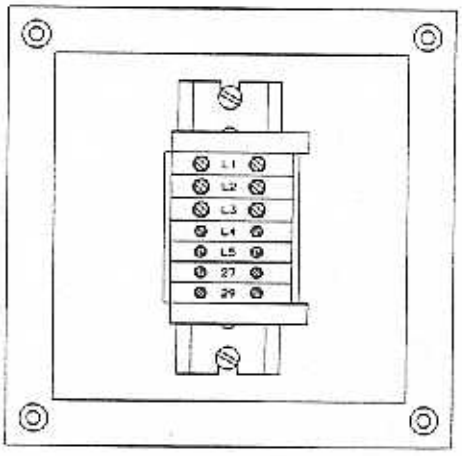
Wiring & electrical connection.

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

After removing the lower rear access panel locate the power inlet box on the back of the machine. Make sure the wiring and electrical supply are proper for this machine. Verify the requirements with machine nameplate.

FIGURE 5. Power Inlet Box.

LOCATED AT REAR OF MACHINE.



A fused disconnect must be provided near the Tube-Ice® machine. Connect 3 phase power to terminals L1, L2, L3 for operation of the Tube-Ice® machine and its controls. Rotation checking of compressor is not required, however, if one leg of the 3 Phase Power is higher or lower ("Wild"), then it should be connected to terminal L2.

Terminals L4 and L5 are for connection of single phase 208/230 electrical supply for split voltage applications such as 460 volts 3 phase for compressor.

Use terminals 27 and 29 for the single phase connection to the fan motor(s) of remote air-cooled condenser.

! CAUTION !
Do not attempt to start machine prior to connecting water lines and making the following NECESSARY provisions. Refer to FIGURE 8 (space diagram) for correct installation.
! CAUTION !

Piping and drain connections. All connections are located at the rear of the machine. Look for two (2) water connections on the freezing unit of each air-cooled machine. See FIGURE 8 (space diagram) for correct utility connections.

! 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 !

Water supply and drains. As follows:

1. 3/8" FPT Supply (makeup water IN)
2. 3/4" FPT Drain (water tank OUT)

When the ice machine sits on a storage bin, the bin must be provided with a drip pan for catching the condenstate from the ice machine. Separate drains for the condensate and for the bin are necessary. See FIGURE 8 (space diagram drawing for typical water and drain connections).

Condensate drain **must not** run through the ice compartment of the bin.

The water pan drain, condensate drain and ice storage bin drain connection must be extended to an open drain or sump and arranged for visible discharge.

Installation Of Air-Cooled Condensers

For MODELS HE10, HE20, HE30 and HE40 Tube-Ice® Machines

The following criteria should be followed when installing air-cooled condensers:

1. Condenser should be installed with vertical air flow.
2. For ideal operation, condenser should be mounted with liquid outlet above liquid return connection on Tube-Ice® machine.
3. All piping should be done in accordance with "The Safety Code for Mechanical Refrigeration" (ANSI B9.1) and "The Code for Pressure Piping (ANSI B31.1) as well as all applicable local and national codes.
4. Piping to and from condenser should be sized as follows:

MODEL	Discharge Line (Machine to Cond.)	Liquid Line (Condenser to Receiver)	Recommended KRAMER TRENTON Cond. Model••	Condenser Heat Rejection 60HZ.	Condenser Heat Rejection 50HZ.
HE10M	5/8" o.d.	1/2" o.d.	DD - 40	13,690	11,360
HE 10S	5/8" o.d.	1/2" o.d.	DD - 40	16,200	13,450
HE 20M	5/8" o.d.	1/2" o.d.	DD - 60	21,600	17,950
HE 20S	5/8" o.d.	1/2" o.d.	DD - 60	25,800	21,450
HE 30M	7/8" o.d.	5/8" o.d.	DD - 100	35,160	29,200
HE 30S	7/8" o.d.	5/8" o.d.	DD - 100	42,120	35,000
HE 40M	1 1/8" o.d.	7/8" o.d.	DD - 130	66,960	55,600
HE 40S	1 1/8" o.d.	7/8" o.d.	DD - 130	80,400	66,750

TABLE 2

NOTE: Each above line size is based on use of Type "L" copper tubing at maximum equivalent distance of 100 feet.* The above line sizes are based on ambient air temperatures of 95°F. If machine is installed in a location with warmer conditions, use next larger tubing size for liquid lines.

•• Above condenser selection based on 30°F suction temperature and 105°F condensing temperature with 10° F T.D.
See FIGURE 9, for field connection air-cooled condsenser refrigerant tubing.
* See TABLE 3 for equivalent feet of fittings.

Equivalent Feet of Fittings Due To Friction				
Copper Tube O.D. Tyle "L"	1/2"	5/8"	7/8"	1 1/8
Globe Valve (open)	14	16	22	28
Angle Valve (open)	7	9	12	15
Close Return Bend	2	4	5	6
90° Turn Through Tee	3	4	5	6
Tee (Straight Through or Sweep Elbow)	.75	1	1.5	2
90° Elbow or Reducing Tee (Straight Through)	1	2	2	3

TABLE 3

5. Horizontal runs in discharge line should slope away from the Tube-Ice® machine at the rate of 1/4" per foot.
6. A trap should be installed in vertical discharge lines every 15 feet. The width of these traps should be kept to a minimum required by standard wrot copper fittings.
7. After all refrigerant lines are installed they must be pressurized and leak tested.
8. After proven tight, evacuate lines and condenser with vacuum pump to 500 microns.

! CAUTION !

Head pressure controls (such as Alco's Headmaster) are NOT to be utilized with Tube-Ice® machines. Unauthorized installations will void all warranties!

! CAUTION !

9. Break vacuum with R-22, pressurizing lines and condenser to minimum of 25 pounds.
10. After machine is operating, it may be necessary to add enough R-22 to obtain a proper operating level in receiver. The approximate additional amount of refrigerant required for the condenser and piping is shown in TABLE 4.

Pounds Refrigerant Required for Various Line Sizes

LINE SIZE	Liquid Refrigerant Line Length (Feet)								
	20	30	40	50	60	70	80	90	100
1/2" O.D.	.8	1.0	1.2	1.7	2.1	2.5	2.8	3.2	3.6
5/8" O.D.	1.2	1.7	2.3	2.9	3.5	4.1	4.6	5.2	5.7
7/8" O.D.	2.6	3.9	5.3	6.6	8.0	9.2	10.5	12.8	13.2
1 1/8" O.D.	4.5	6.7	9.0	11.2	13.5	15.7	17.8	20.1	22.4

TABLE 4

11. Insulate discharge and liquid lines with 1/2"-thick Armaflex® insulation or equal.

12. Condensers should be protected from the effects of prevailing winds by an enclosure (open top and bottom) extending one (1) foot above condenser and having six (6) inches air space between the enclosure and mounting surface. When condenser is exposed to sub-zero temperature, the enclosure should be extended to the mounting surface, and have open area between condenser and enclosure equal to 150% of the condenser face surface.

    Additional drawings will be furnished upon request.

13. The installer must provide a lockable disconnect switch adjacent to the condenser.

14. Electrical connections between the condenser disconnect switch, and terminals 27 and 29 in the power inlet box of the Tube-Ice® machine, require minimum #12 ga. wire size.

    Local electrical code must be checked for wiring method.

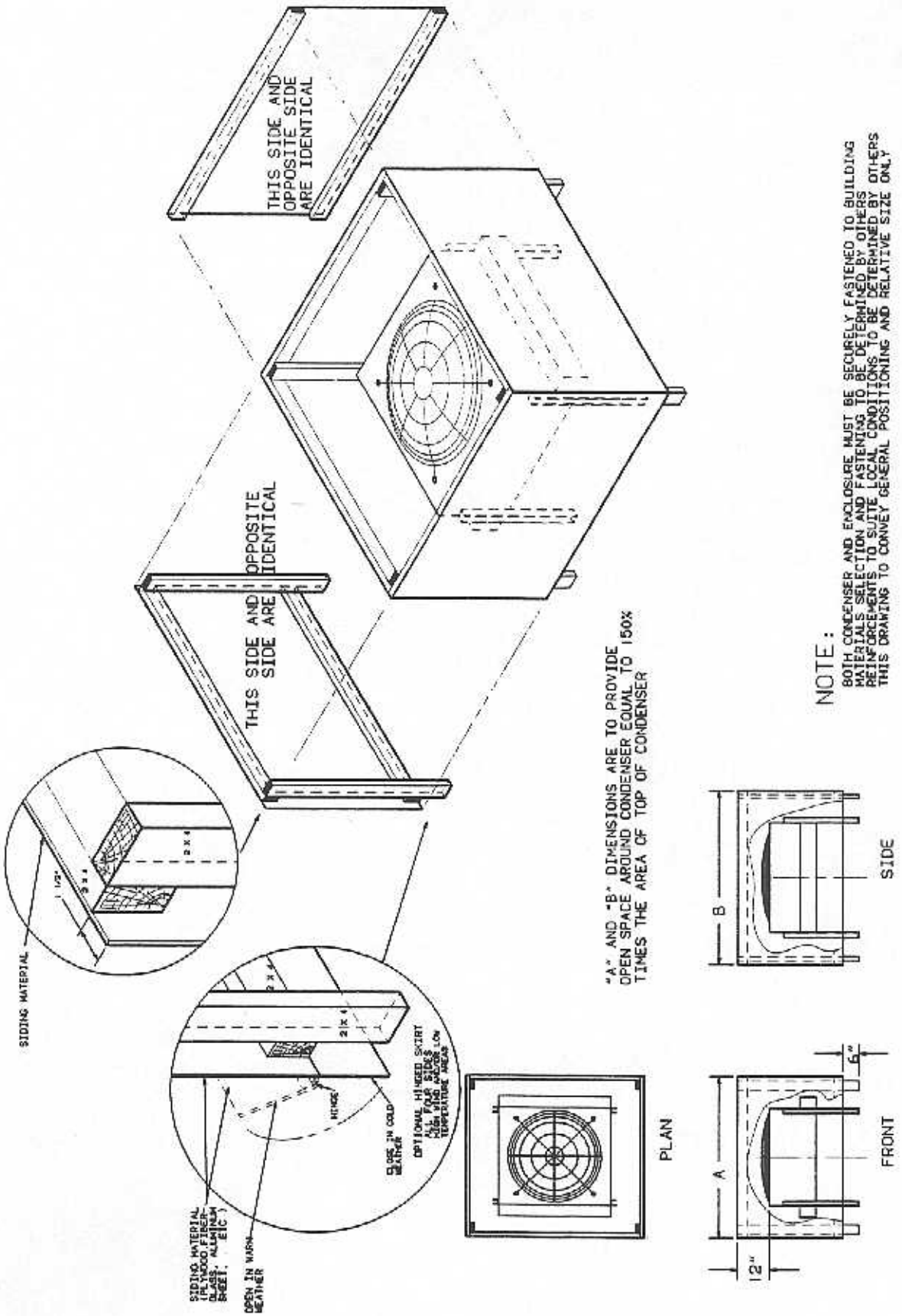


FIGURE 7. Air Cooled Condenser Enclosure

CONDENSER REFRIGERANT LINES

	HE10	HE20	HE30	HE40
A	5/8"OD	5/8"OD	7/8"OD	1 1/8"OD
B	1/2"OD	1/2"OD	5/8"OD	7/8"OD

LINE SIZES MAY VARY DEPENDING ON LOCATION OF CONDENSER

NOTES:

A FUSED DISCONNECT FOR THE ICE MACHINE MUST BE PROVIDED NEAR THE MACHINE.
A SEPARATE DISCONNECT SWITCH FOR THE CONDENSER MUST BE PROVIDED NEAR THE CONDENSER

ICE BIN SHOWN FOR ILLUSTRATION PUROSES ONLY.

BIN DIMENSIONS MAY VARY.

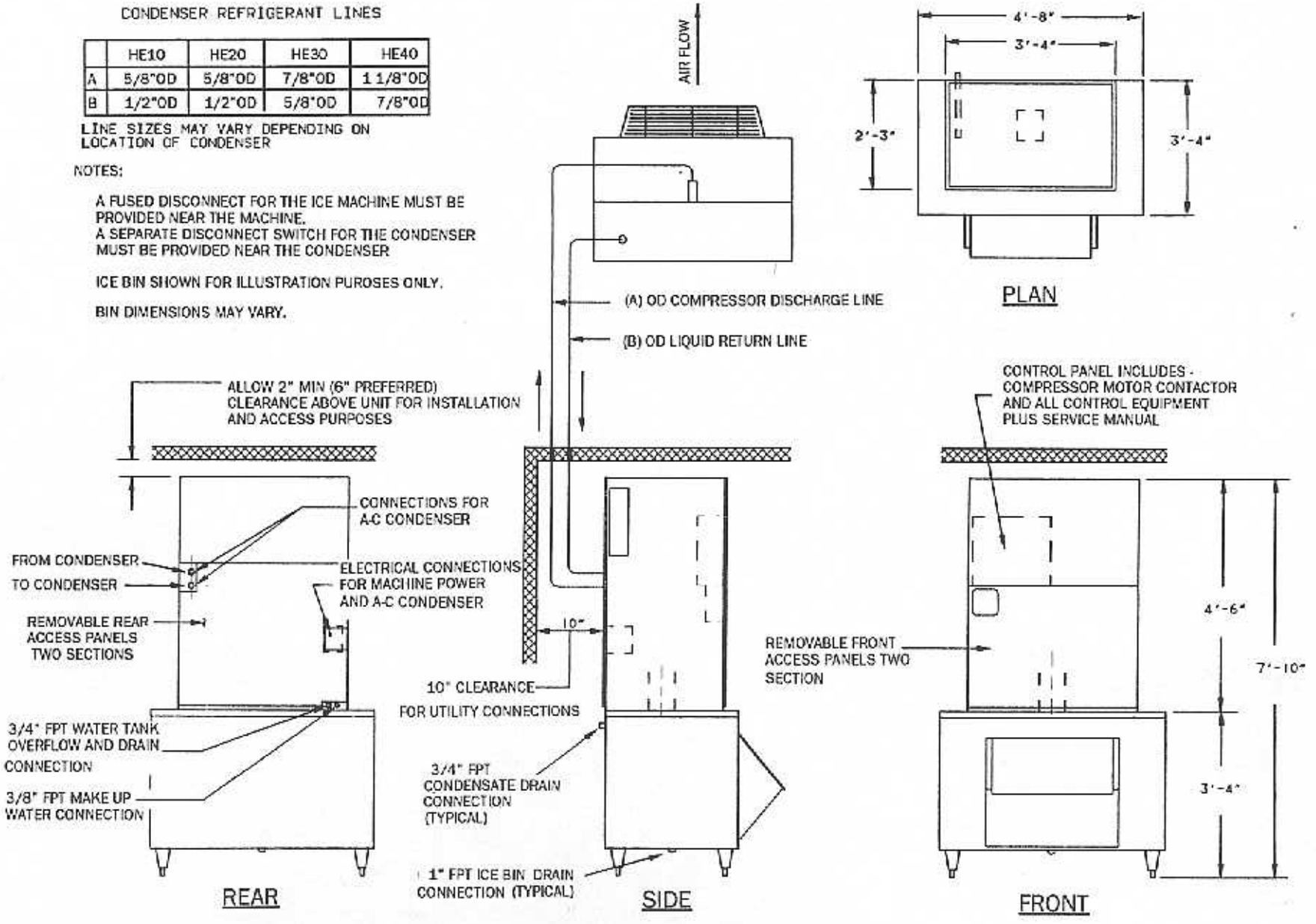


FIGURE 8. Space Diagram Air-Cooled Machine

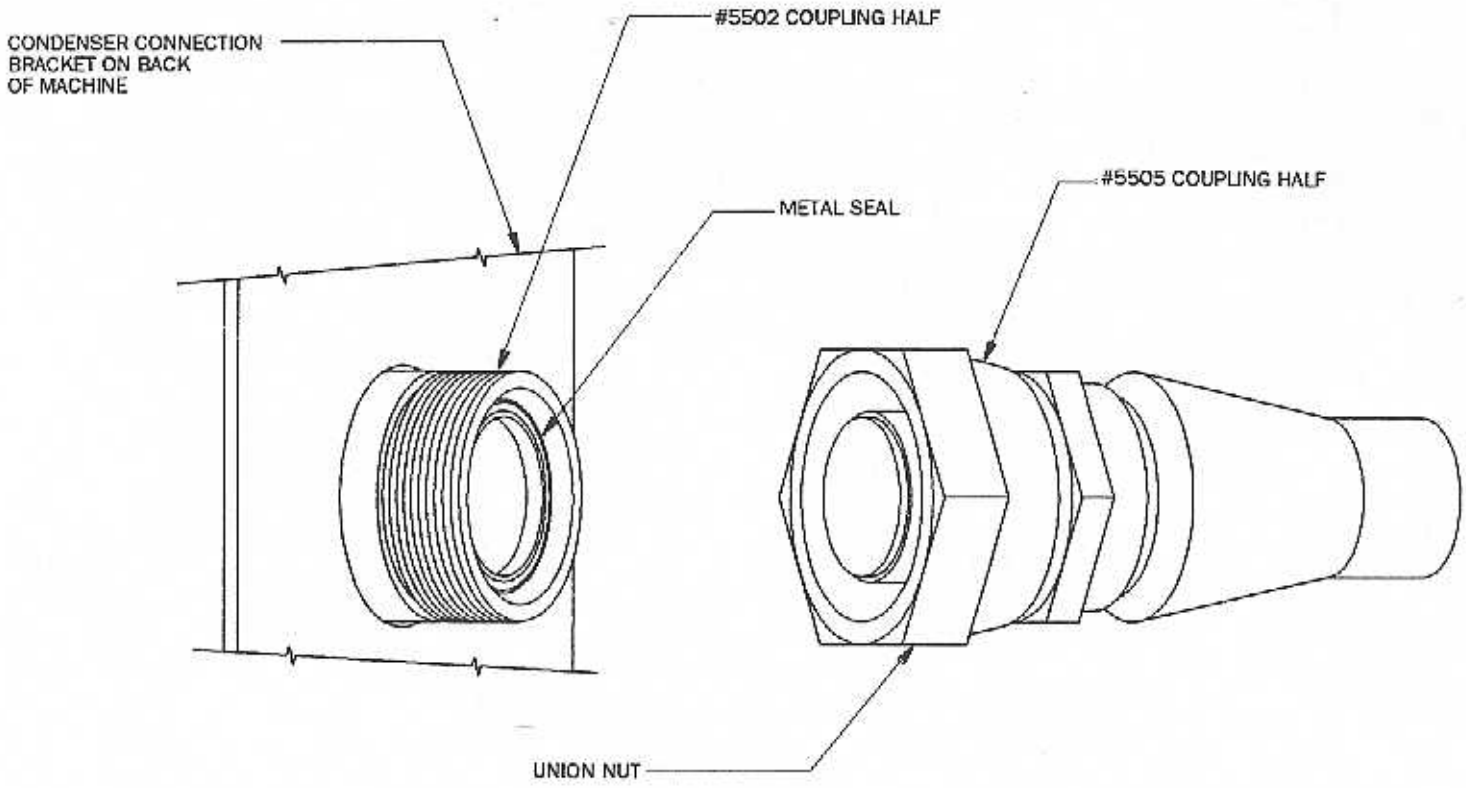


FIGURE 9

Field Attachment of Air-Cooled Condenser Refrigerant Tubing to Tube-Ice® machine

Coupling Halves - #5505 - are shipped with each air-cooled machine.

STEP 1 - BRAZE TUBING ENDS USING CHILL BLOCKS OR WET RAGS ON COUPLING BODIES TO PREVENT SEAL DAMAGE.

STEP 2 - REMOVE DUST CAPS AND PLUGS IF USED, MAKING SURE THAT COMPONET SYNTHETIC SEALS ARE INTACT.

STEP 3 - WIPE OFF COUPLING SEALS AND THREADED SURFACES WITH A CLEAN CLOTH TO PREVENT THE INCLUSION OF DIRT OR ANY FOREIGN MATERIAL IN THE SYSTEM.

STEP 4 - LUBRICATE RUBBER SEAL IN MALE HALF WITH REFRIGERATION OIL. THREAD COUPLING HALVES TOGETHER BY HAND TO INSURE PROPER MATING OF THREADS. USE PROPER SIZE WRENCHES (ON COUPLING BODY HEX AND ON UNION NUT) AND TIGHTEN UNTIL COUPLING BODIES "BOTTOM" OR A DEFINITE RESISTANCE IS FELT. USING A MARKER OR INK PEN, MARK A LINE LENGTHWISE FROM THE COUPLING HEX TO THE BULKHEAD. THEN TIGHTEN AN ADDITIONAL 1/6 TO 1/4 TURN. THE MISALIGNMENT OF THE LINE WILL SHOW THE DEGREE OF TIGHTENING. THIS FINAL TURN IS NECESSARY TO INSURE THAT THE KNIFE EDGE METAL SEAL BITES INTO THE BRASS SEAT OF THE COUPLING HALVES. FORMING THE LEAKPROOF JOINT. IF TORQUE WRENCH IS USED, THE FOLLOWING TORQUE VALES ARE RECOMMENDED.

COUPLING SIZE	FT. LBS.
1/2" OD, -8	35
5/8" - 3/4" OD -12	50
7/8" - 1 1/8" OD -16	65

Ice Bin Thermostat Bulb Installation

Each machine is equipped with 2 ice bin thermostats. To assure proper protection for the machine, the control bulb of each ice bin thermostat must be located so that ice will contact it when the bin is full. For a divided bin locate the control bulbs as illustrated in FIGURE 10. This allows space for the machine to make an additional discharge of ice AFTER the ice contacts the bulb WITHOUT the ice building up into the discharge opening of the chute.

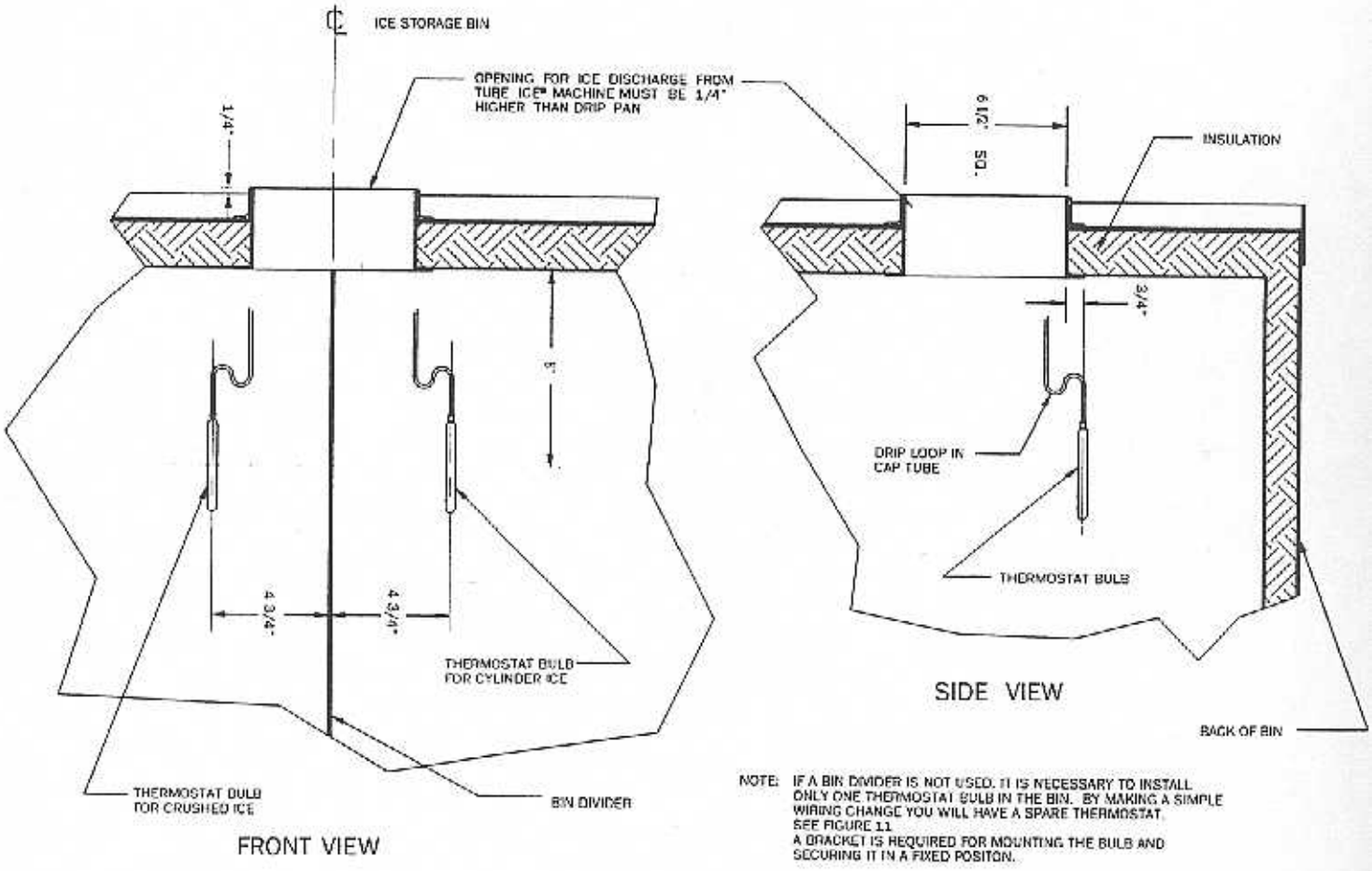


FIGURE 10. Location of Thermostat Bulbs in Ice Storage Bin

The control panel is electrically connected so that the bin thermostat will stop the machine only upon the completion of a harvest period.

When both cylinder and crushed ice are produced and separately stored in a divided bin, the control bulb of thermostat BT1 is placed in the crushed ice section of the storage bin (left side) and the control bulb of thermostat BT2 is placed in the cylinder ice section (right side of bin).

When the bin does not have a divider, only one thermostat is necessary. The wiring may be modified to use only one thermostat and bulb (See "With No Divider In Bin," in SECTION 5 and FIGURE 11). Or, install both bulbs—so that the ice contacts both bulbs when the bin is full.

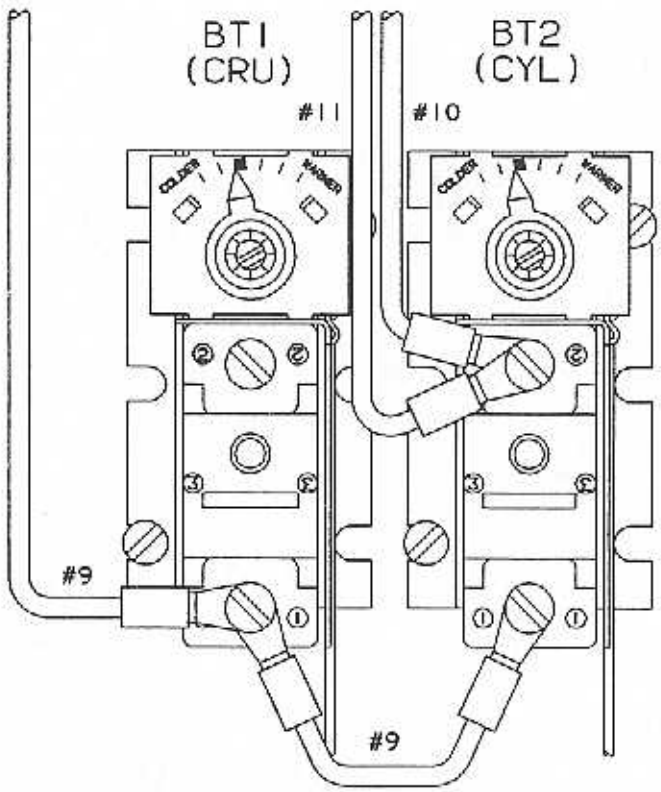


FIGURE 11. Wiring for Single Thermostat Operation (follow instructions below)

1. TURN POWER OFF TO THE MACHINE & CHECK WITH VOLT METER TO MAKE SURE PANEL IS DEAD.
2. SELECT THE THERMOSTAT WHICH WILL NOT BE USED (EITHER CRU OR CYL) AND DISCONNECT WIRE #10 OR #11 FROM THAT THERMOSTAT.
3. CONNECT WIRE #10 & #11 TO THE SAME TERMINAL OF THE THERMOSTAT TO BE USED, AND EXTEND THAT THERMOSTAT BULB INTO THE BIN, MOUNTING IT AS ILLUSTRATED IN FIGURE 10.
4. TURN POWER ON TO THE MACHINE

Installation Review: A CHECKLIST

Make a visual check to be sure these 4 steps have been taken BEFORE continuing.

CHECK: _____ PRIOR TO OPENING VALVES, check all joints for leaks which may have developed during shipment. [NOTE: The required charge of Refrigerant 22 has been isolated in the Receiver (15R).]

CHECK: _____ All water supply and drain connections for conformity to requirements stipulated in this manual. See Figures 6 and 8.

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 (air cooled condenser, ice storage bin, ice spreader, etc.) for proper installation.

THE SWITCH BOX

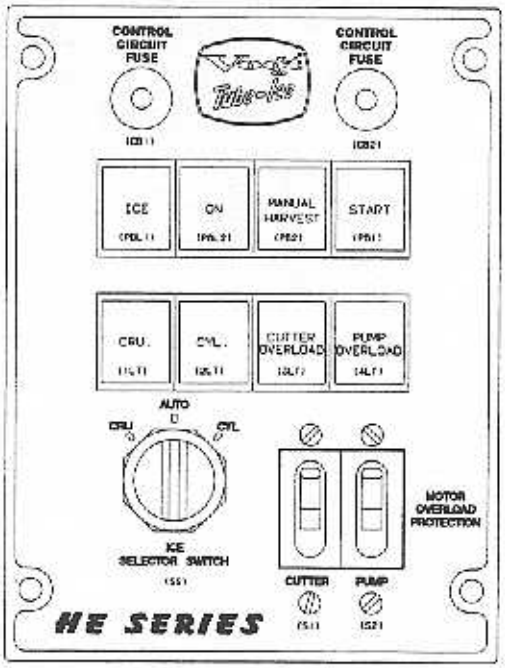


FIGURE 12. Switch Box. All the functions of the machine can be controlled at this switch box.

FU1 and **FU2, 2.5 AMP. Fuses.** Overload and short circuit protection for crankcase heater and the control circuit.

PB1, Start Push Button. For starting the machine in either the clean mode or the ice-making mode. (Momentary Contact)

PB2, Manual Harvest Push Button. Initiates a thaw period immediately when manually depressed. (Momentary Contact)

PBL1, Ice/Clean Lighted Push Button. "ICE" illuminated in the ice making position. Not illuminated in the clean position.

PBL2, On/Off Lighted Push Switch. "ON" illuminated in the On posiition. Not illuminated in the Off position.

1 LT, Crushed Light. "CRU" illuminated when set to produce crushed ice.

2 LT, Cylinder Light. "CYL" illuminated when set to produce cylinder ice.

Both 1 LT and 2LT are illuminated when selector switch set in "AUTO" position.

3 LT, Cutter Overload. Illuminated when cutter overload switch (SI) has tripped.

4 LT, Pump Overload. Illuminated when pump overload switch (S2) has tripped.

SS, Selector Switch. For the purpose of selecting the type of ice to be made, either crushed (CRU) or cylinder (CYL). NOTE: Use "AUTO" poisition only when using divided bin.

S1 Cutter Overload Switch. Stops machine operation in the event of a mechanical or electrical malfunction of the cutter motor, resulting in excessive motor amperes.

S2, Pump Overload Switch. Stops machine operation in the event of a mechanical or electrical malfunction of the pump motor, resulting in excessive motor amperes.

f machine is turned off by either S1 or S2 there is a five second delay before machine stops.

4. How Your Tube-Ice® machine Works

Principle of operation. The manual operation of the machine is controlled by the "ON-OFF" and "START" switches located in the switch box of the freezing unit. The **automatic** operation is controlled by the Ice Bin Thermostats which will automatically stop and start the Freezing Unit by the level of the ice in the Storage Bin (NOTE: See "Ice Bin Thermostat Bulb Installation" for instructions on installation of the Control Bulb of the Ice Bin Thermostats FIGURE 10). The type ice produced (cylinder or crushed) is determined by the position of the Ice Selector Switch located in the switch box. The control wiring is arranged so that the unit will stop only upon the completion of a thawing period whether by action of the "ON/OFF" Switch or the Ice Bin Thermostats.

The "ICE/CLEAN" Switch must always be set on the "ICE" position (Illuminated) during normal ice-making operation. It is set on the "CLEAN" (Not Illuminated) position only when the equipment is to be cleaned as outlined in the "Cleaning Procedure," Section 9, and instructions attached to the machine.

If it should become necessary to instantly stop the machine, either the external disconnect switch or both the "ICE" and "ON" switches in the switch box must be pushed "OFF".

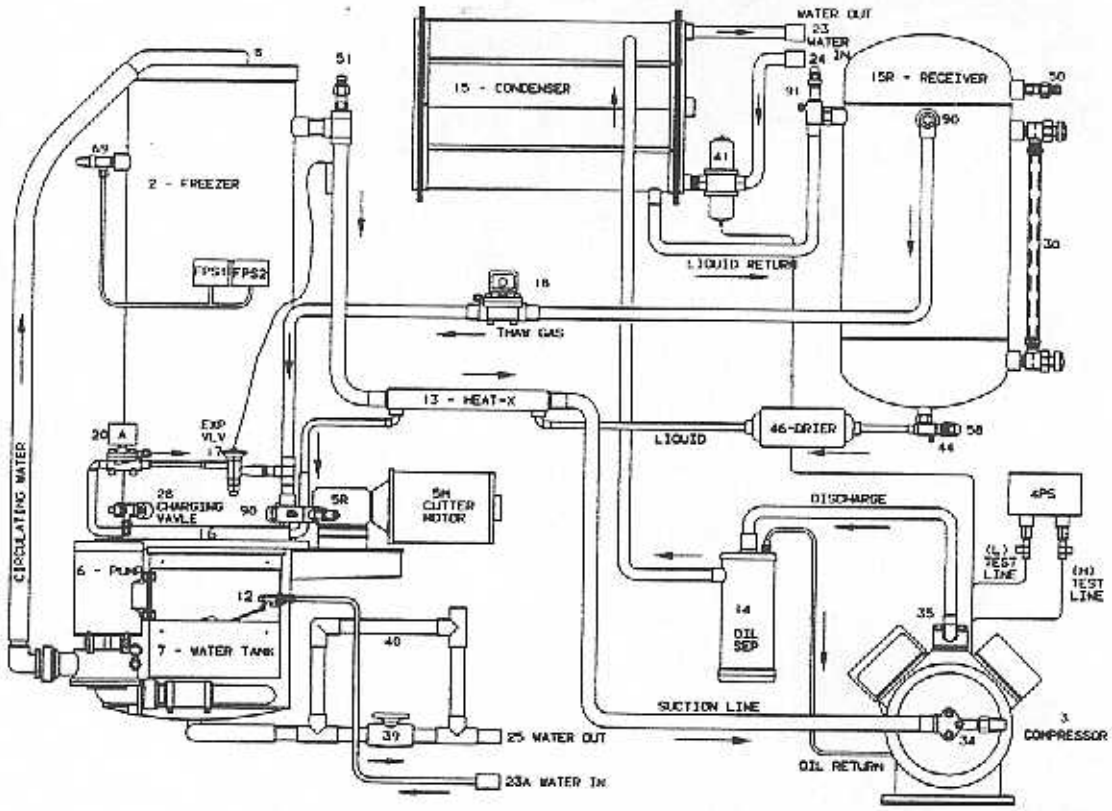
Figure 13 Illustrates the piping diagram of the refrigerant and water circuits of the Tube-Ice® machine, with numbers for easy reference. Throughout this manual, the numbers you see in parentheses refer to the numbers in this piping schematic.

The Freezer (2) is a shell and tube-type vessel. During the freezing period, water is constantly recirculated through the vertical tubes of the freezer by a Centrifugal Pump (6). Makeup water is maintained by a Float Valve (12) in the Water Tank (7). Solenoid Valve (20), sometimes referred to as the "A" valve, is open and Solenoid Valve (18), sometimes referred to as the "D" valve, is closed.

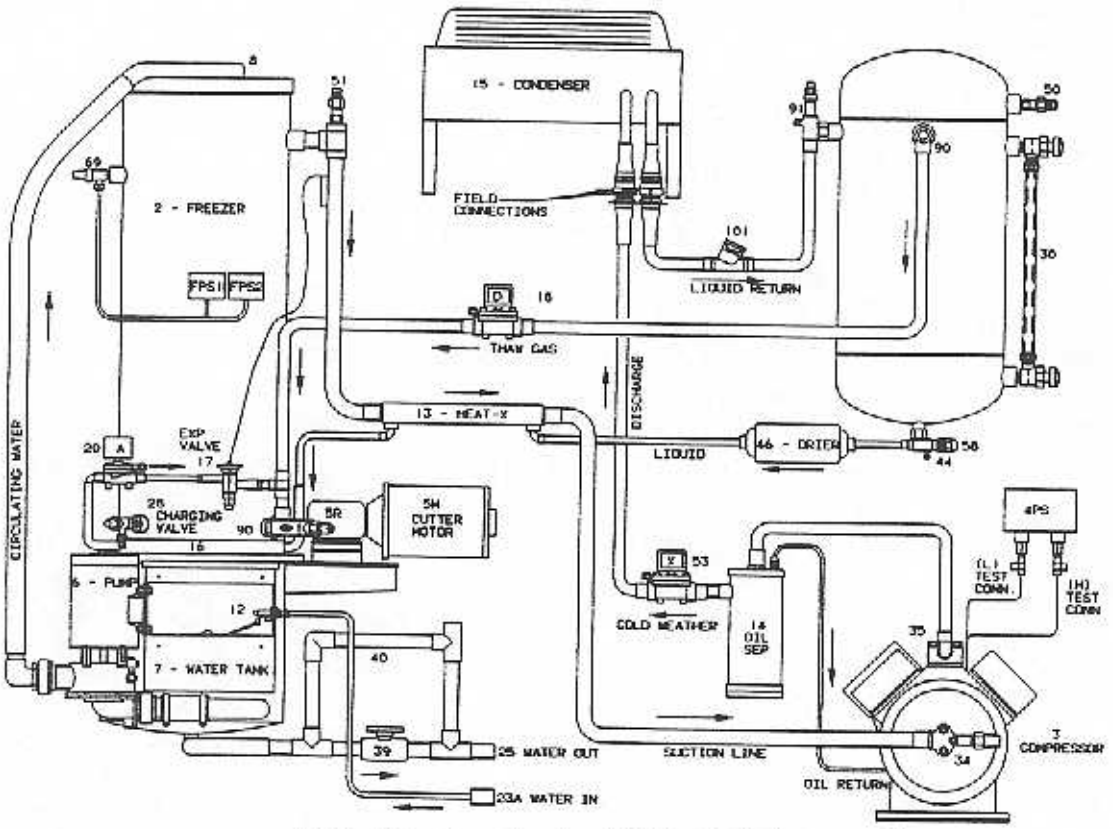
Refrigerant gas from the top of the freezer(2) passes through the Heat Exchanger (13) to the Compressor (3) which discharges it through the Oil Separator (14), into the Condenser (15). Condensed liquid refrigerant from the condenser flows into the receiver (15R). Liquid refrigerant from the Receiver flows through the Filter/Drier (46), the Heat Exchanger (13), Thawing Chamber (16) of the Freezer, the "A" Valve (20), the Expansion Valve (17) and into the Freezer, thereby completing the freezing circuit.

At the completion of the freezing period, thawing is started by action of the Freezer Pressure Switch in the Control Panel and Solenoid Valve "D" (18) is opened. The Water Pump (6) is stopped and the Cutter Motor (5M) is started. Warm gas from the receiver is discharged into the freezer through valve (18), thereby slightly thawing the ice which drops on the rotating cutter for sizing. Cylinder Ice will be discharged through the right half-section of the Ice Discharge Chute when viewing the Tube-Ice® machine from the front. Crushed Ice will be discharged through the left half-section of the Ice Discharge Chute.

Air Cooled machines have a Solenoid Valve (53), sometimes referred as the "X" valve, in the compressor discharge line, and a Check Valve (101) in the liquid return line to the receiver. These valves prevent the migration of refrigerant to the condenser when the machine is not operating.



HE, Water-Cooled—Piping Schematic



HE, Air-Cooled—Piping Schematic

FIGURE 13

5. How Ice Is Stored

With divider in bin (cylinder and crushed ice separately stored). With the selector switch on "AUTO," the machine will automatically produce cylinder ice until the cylinder-ice bin is filled. This action will open the cylinder ice thermostat switch in the cylinder ice bin and will, automatically, change the machine over to crushed ice production—PROVIDED THE CRUSHED ICE BIN IS NOT FULL. When the crushed ice bin is filled, its thermostat switch opens and stops the machine upon completion of the harvest cycle.

When cylinder ice is removed—at any time during the freeze cycle of the crushed ice operation—the cylinder ice bin thermostat switch closes and the machine reverts immediately to cylinder ice production.

If, when producing cylinder ice, the thermostat switch for the cylinder ice should open by bulb contact with ice in any manner, the machine will complete that cylinder ice production cycle before automatically changing to crushed ice production.

If the selector switch should be set to CRU (crushed ice production) during cylinder ice production, it will continue to make cylinder ice for that cycle then change to crushed ice production. Note that the "R" (Reversing) Relay is not energized while making crushed ice.

The machine will never stop by action of the bin thermostat during any freezing operation. It will always complete the evacuation and discharge of all the ice regardless of the causes which open either thermostat switch.

See FIGURE 10 . Illustration of the Bin Thermostat Bulb Installation.

With no divider in bin (producing only ONE type ice). When there is no partition in the bin for separating cylinder and crushed ice, you need use only one bin thermostat and bulb. By connecting wires #10 and #11 together on the same thermostat terminal and installing that thermostat bulb in the bin, you will have the other thermostat as a spare. You will still be able to produce cylinder or crushed ice, whichever is desired.

See FIGURE 11. Wiring for Single Thermostat Operation.

When the selector switch is set on either AUTO or CYL, the machine will produce cylinder ice until the bin is filled and the thermostat switch opens, shutting down production at the completion of the thaw mode.

If the selector switch is changed to CRU after the unit has started a cylinder ice freeze, it will complete the freeze and evacuation of the cylinder ice BEFORE changing to the production of crushed ice.

With the selector switch set on CRU, the machine will produce crushed ice until the bin is filled and the thermostat switch opens. It will then shut down at the completion of the thawing period. If the switch is changed to AUTO or CYL after the machine has started a crushed ice freeze, it will switch immediately to the production of cylinder ice.

When ice bin thermostats are NOT used. With the selector switch set on either AUTO or CYL, the machine will produce cylinder ice. If the switch is changed to CRU while the unit is producing cylinder ice, it will complete the freeze and evacuation of the cylinder ice before changing to the production of crushed ice.

With the switch set on CRU the machine will produce crushed ice. If the switch is changed to AUTO or CYL, the unit will revert immediately to the production of cylinder ice.

Starting and Stopping of the machine must be controlled by the "ON/OFF" switch.

Refrigeration System.

(Review Before Starting Machine)

The refrigeration system uses R-22 refrigerant, a compressor, a thermal expansion valve, a flooded evaporator (freezer), and warm gas defrost. Following the schematic, you see that during the freeze period of the machine's cycle, the compressor discharge gas leaves the compressor and goes to the condenser where it is condensed into a liquid by the removal of heat by either air or water passing through the condenser. A reservoir of liquid is accumulated in the receiver and flows as required, passing through the filter/drier, then the heat exchanger on its way to the thawing chamber, (a lower separate section of the freezer). The liquid solenoid valve (the "A" valve) being open during the operation allows the liquid to be metered by the thermal expansion valve that opens and closes as the temperature of the suction line dictates. The evaporator floods with wet refrigerant that is in contact with the outside of the tubes that the ice-making water is being circulated through. The heat contained in this water passes through the wall of the tubes, lowering the temperature of the water, causing it to freeze and form a long tube of ice that adheres to the inside of each of the freezer tubes. The flowing water keeps the accumulated ice clear by washing separated solids down into the sump area of the water tank.

The wet suction gas leaves the freezer and has any remaining liquid droplets removed by the heat contained in the high side liquid passing through the heat exchanger. The dry gas enters the compressor and is compressed then discharged to the condenser, completing the cycle.

As the ice is formed in the freezer, the suction pressure steadily reduces until it causes one of the freezer pressure switches to close and switch the machine to a harvest period.

During the harvest period the thawing gas solenoid valve, (the "D" valve), is open allowing the warm high pressure gas to enter the freezer. This heat melts a thin film from the outside of the ice, reducing the diameter and letting it fall free from the freezer tubes. The thawing gas valve is closed and opened during the thaw period by a pressure switch which is set to close the valve at 68 psig and open the valve at 62 psig. This maintains a maximum freezer pressure of 68 psig during the harvest period. See FIGURE 30 for adjustment. The cutter was started at the same time that the thawing gas valve was opened, and it cuts the long cylinders into uniform pieces and discharges the sized ice out of the chute.

The thawing timer setting will keep the machine in a harvest period for about 30 seconds after all the ice has been harvested and will then switch the machine into another freeze period, completing the machine's cycle.

6. Initial Start-Up & Operation

Start-Up Checklist

In order to prepare the machine for start-up, it will be necessary to remove the front panels for access to the various valves and for observation.

____ 1. See that water-inlet connections are attached to the proper couplings (water-cooled units) and to water for ice making. The inlet shutoff valves should be open. The water level in the water pan should be at a height where the makeup water float valve will be closed when the machine is idle.

____ 2. See that the cutter motor gear reducer is lubricated (see "Lubrication" for instructions).

____ 3. See that compressor crankcase oil level is at proper height of 1/4 to 1/2 of the sight glass.

____ 4. See that "CUTTER" and "PUMP" circuit breakers are in the "ON" position.

____ 5. See that the "ON" push button switch is in the "OFF" position (Button Out).

____ 6. See that the "ICE" push button switch is set to "ICE" position (Button In).

NOTE
All valves are tagged with instructions.

____ 7. Open compressor service valves (34 and 35), the two hand-stop valves (90) in the thawing gas line, (91) in the condenser return line, and the hand-stop valve (58) in the liquid line and hand-stop valve (69) to the freezer pressure switch. These valves are tagged to indicate that they were closed for shipping purposes.

____ 8. IMPORTANT! CHECK TO SEE that all stop valves in the various refrigerant lines are open except charging valve (28), according to the attached tags.

____ 9. Immediately after opening all valves, entire machine should be checked for refrigerant leaks with electronic leak detector.

____ 10. Close exterior disconnect switch to energize crankcase heater.

! CAUTION!
The crankcase heater should be energized for a MINIMUM of 2 HOURS before attempting to operate the compressor.
! CAUTION !

____ 11. After TWO HOURS, push "START" button, then "ON" button. The machine may not operate immediately until pressure raises sufficiently (to approximately 35 psig) to close the low-pressure switch (4PS).

It may be necessary to manually open the solenoid valve (20) (liquid line) to admit refrigerant to the "Low-Side" to close the low-pressure switch (4PS). Be sure to return the "MANUAL OPENING STEM" to the closed position (screwed IN) after the machine starts.

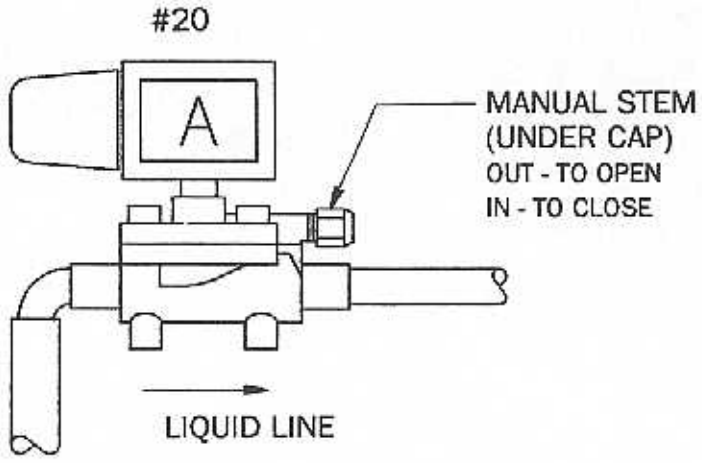


FIGURE 14. Solenoid Valve (Liquid Line)

12. When the machine starts, check water level in water pan (7) to determine whether or not water pump (6) is pumping water. It may be necessary to stop and start the machine several times to expel air from the water pump impeller housing.

Use one of the circuit breakers, CUTTER or PUMP to stop—for approximately 10 seconds—and start the machine, if necessary to prime the pump.

! CAUTION!
If it should ever become necessary to add refrigerant to the system, charging valve (28) is provided for this purpose.
! CAUTION !

Refrigerant charge. Check the refrigerant level after the machine has operated for a few cycles. It should be slightly above the operating level, as indicated on the receiver, a few minutes prior to start of a thawing period. If this level is low at this time, sufficient refrigerant should be added to the system to raise the level above this point. Add only a small quantity (5# or less) at a time, and operate the machine several cycles to check the level before adding additional refrigerant.

It is important that no air or other non-condensible gases enter the system when charging refrigerant into the unit. The charging line should be purged through the flare connection at charging valve (28), allowing a small amount of refrigerant from the refrigerant shipping cylinder to escape through the charging line. Tighten flare nut, open charging valve and charge unit as required. Refrigerant may be added as a liquid through the charging valve (28) only, while the machine is operating.

(Continued on page 37)

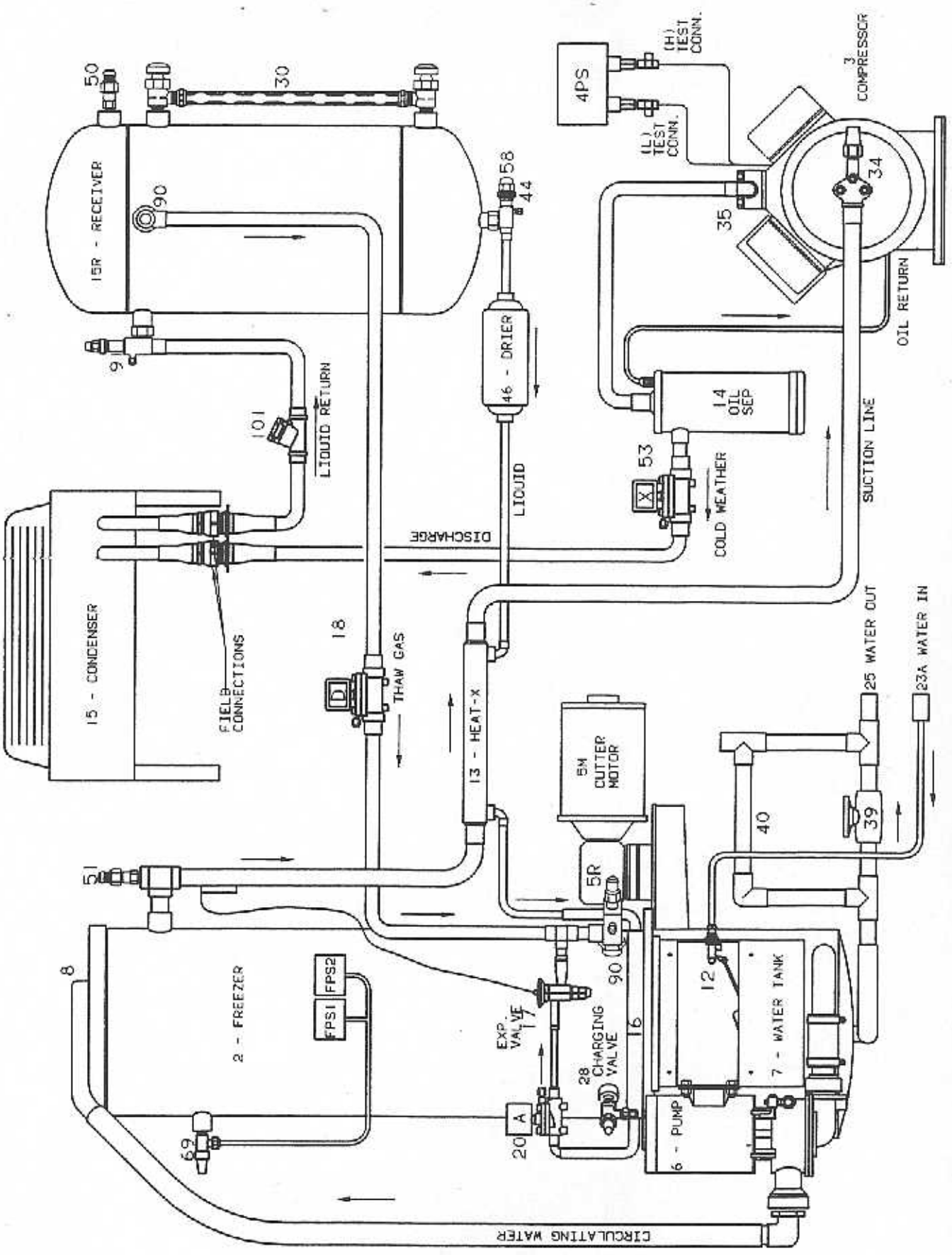


FIGURE 15. Piping Schematic, Air-Cooled

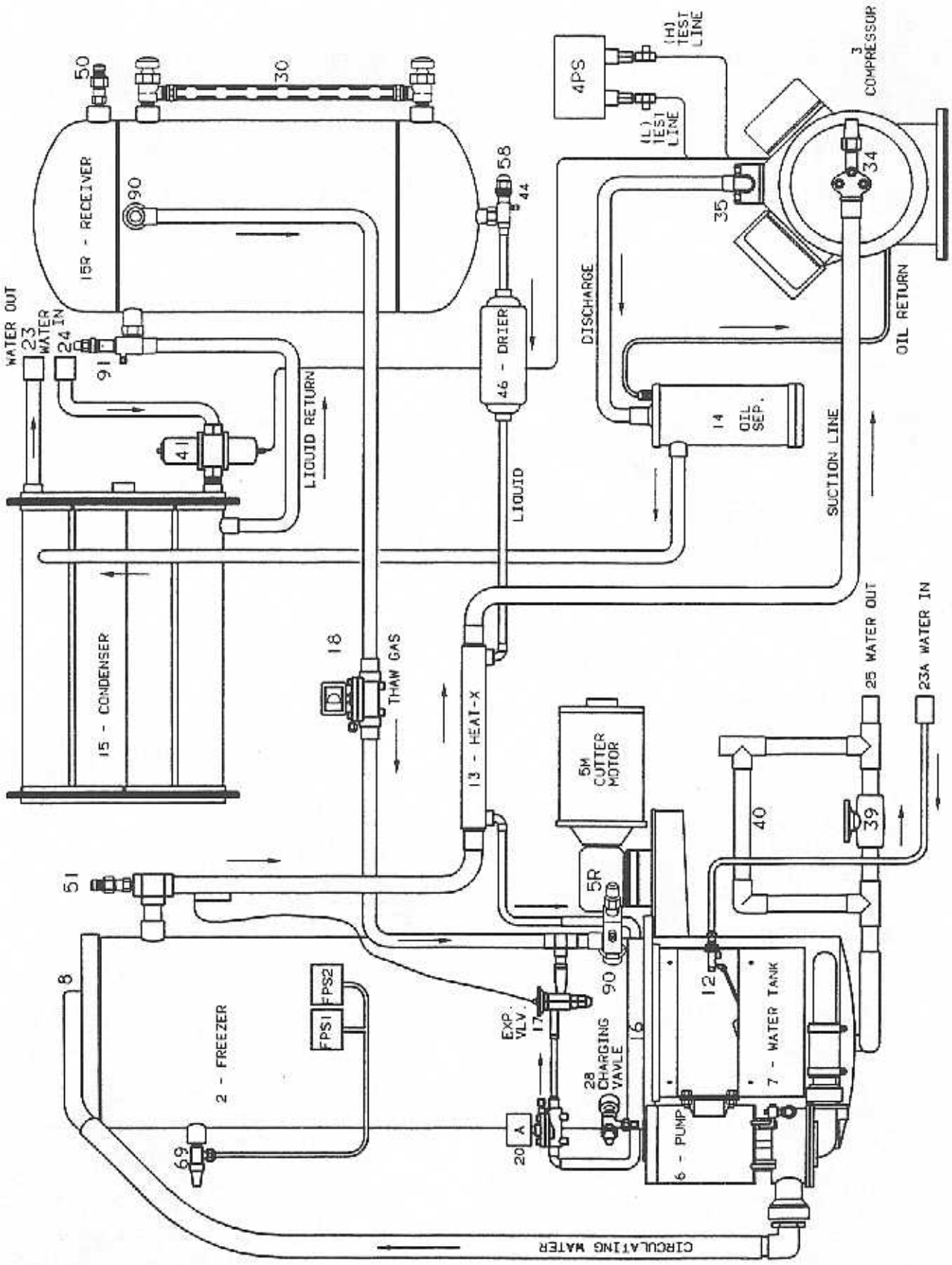


FIGURE 16. Piping Schematic, Water-Cooled

Refrigerant charge

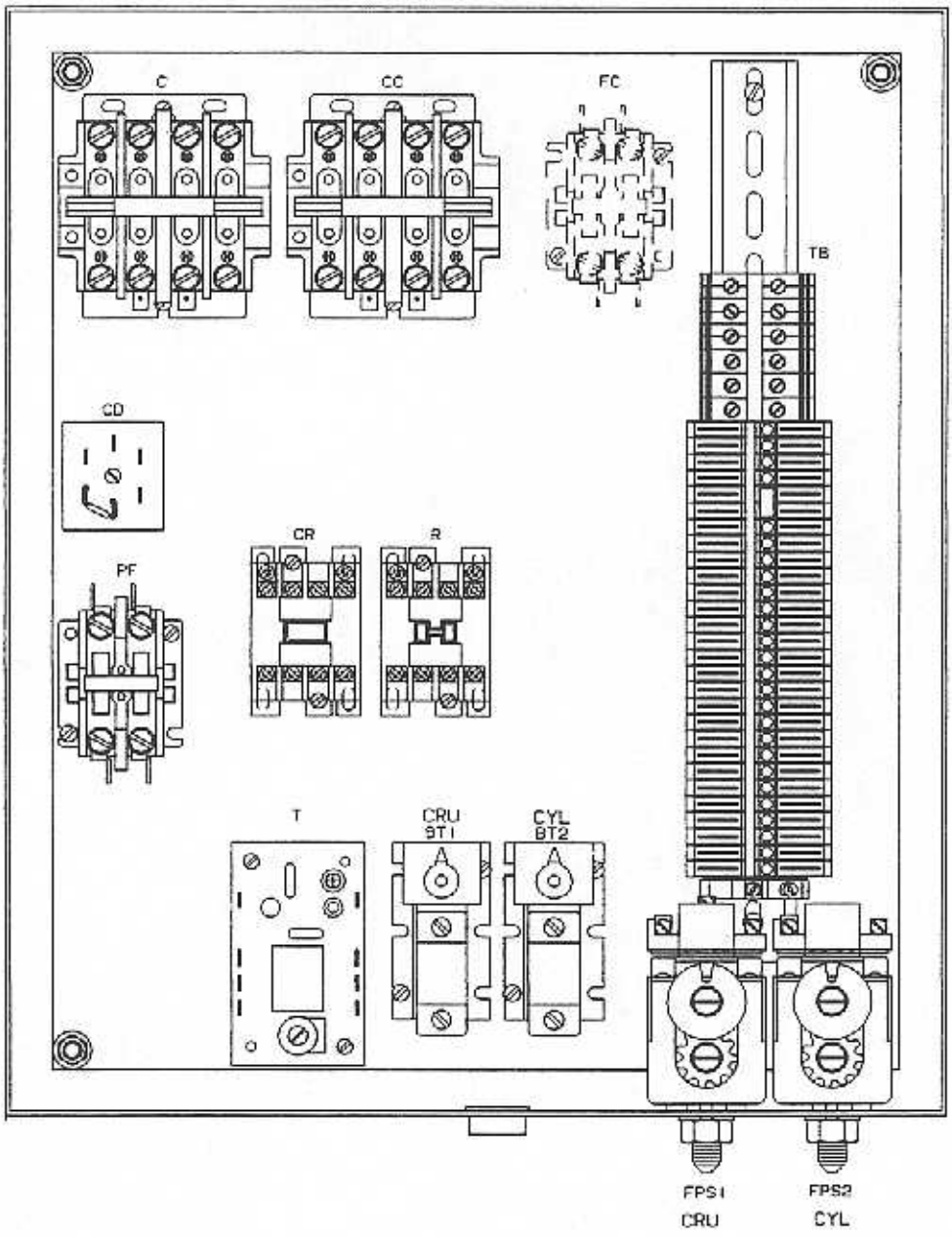
(Continued from page 34)

When adding refrigerant to the system, it may also be necessary to add lubricating oil. See "Lubrication Compressor," SECTION 9 "Maintenance."

In order to check the total charge in the system, it is necessary to transfer all of the refrigerant to the receiver. The following procedure should be followed for pump-down:

1. Stop the machine after all ice has been cleared from freezer.
2. Close the hand stop valve (69) in the line from the freezer to the freezer pressure switches (FPS1 and FPS2) while the freezer pressure is 50 psig or above. This will keep the machine from going into a harvest period during the pump-down.
3. Close the hand stop valve (58) in the liquid line.
4. Start the machine and let operate until high/low pressure switch (4PS) opens and stops the machine by low pressure. (Approximately 15 psig).
5. Note the refrigerant level in the receiver. If the level is low, add refrigerant to bring the level up to, or slightly above, the indicated point.
6. Open valves (69) and (58) before restarting the machine. The machine will not start until the pressure builds up and closes the low-pressure switch. It may be necessary to manually open the solenoid valve (20) in the liquid line to admit refrigerant to the low-side to close the low-pressure switch (4PS). Be sure to return the MANUAL OPENING STEM to the closed position (screwed IN) after the machine starts.
7. Push the manual harvest switch to clear the freezer of any ice made during pumpdown.

7. Electrical Controls & Their Functions



CONTROL PANEL PARTS

BT1- 12A 2117G02000000 - BIN THERMOSTAT CRUSHED ICE

BT2- 12A 2117G02000000 - BIN THERMOSTAT CYLINDER ICE

C - 12A 7516E05000000 - COMPRESSER CONTACTOR

CC - 12A 7516E05000000 - CONTROL CONTACTOR

CD - 12A 7503E12000000 - COMPRESSER CONTACTOR

CR - 12A 7517E16000000 - CONTROL RELAY

* USED ON AIR-COOLED MODELS ONLY

FPSI - 12A 2117E04000000 - FREEZER PRESSURE SWITCH CRUSHED ICE

FPS2- 12A 2117E04000000 - FREEZER PRESSURE SWITCH CYLINDER ICE

PF - 12A 7516E01000000 - POWER FAILURE CONTACTOR

R - 12A 7517E15000000 - REVERSING RELAY

T - 12A 7503E13000000 - THAWING TIMER

*FC- 12A 7 516E01000000 - FAN CONTACTOR

FIGURE 17. Control Panel (Cover Removed)

Description of Control Panel Parts

BT1 and BT2. Bin Thermostats. Ice Bin thermostats, for automatically stopping and starting the machine, based on the ice level in the storage bin. BT1 (Crushed Ice). BT 2 (Cylinder Ice).

C. Compressor Motor Contactor. Provides power to the compressor motor, liquid solenoid valve, and fan control (air-cooled units). Energized during freezing and thawing. Auxillary contact provides power to the compressor crankcase heater when the machine is off.

CC. Control Contactor. For making and breaking control circuit. Energized during freezing, thawing, and clean cycle.

CD. Compressor Delay. Delays the stopping of the compressor (5 seconds) when the machine cycles off. Also, prevents the compressor from being exposed to momentary loss of power between the thaw and freeze periods.

CR. Control Relay. For making and breaking various circuits concerning freezing and thawing. Energized during the thaw period.

FPS1 and FPS2. Freezer Pressure Switches. For regulating the ice thickness by sensing the freezer pressure and initiating the thaw period. FPS1 (Crushed Ice). FPS2 (Cylinder Ice).

PF. Power Failure Contactor. Stops the machine when there is a power failure or interruption by the high-low pressure switch, compressor overloads, compressor thermal switch, or the control circuit fuses. Machine must be manually restarted, by pushing the start button after a power failure or an interruption. De-energized if there has been a power interruption.

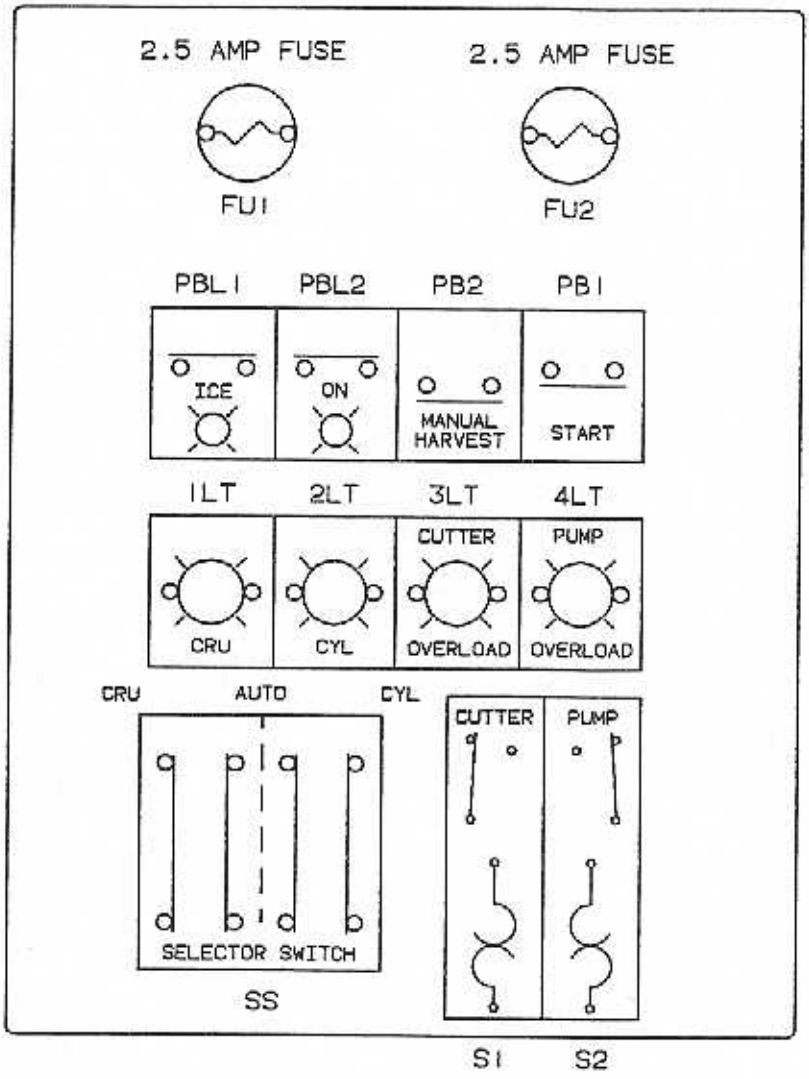
R. Reversing Relay. Switches machine to either cylinder or crushed ice by making or breaking various circuits concerning cylinder or crushed ice production. Energized during cylinder ice production only.

T. Thawing timer. For controlling the time of the thawing period.

FC. Fan Contactor. Cycles the fan motor(s) of air-cooled condenser "on" and "off." Activated by the Condenser Pressure Switch. (Air-cooled machines only)

CD-OL. Compressor Motor Overload. HE 30 and HE 40 only. Stops the machine in the event of a mechanical or electrical malfunction of the compressor motor, causing excessive amperage. Is automatically reset, but the machine must be manually restarted by the "start" push button.

CD-TS. Compressor Motor Thermal Overload. HE10, HE 30 and HE 40 only. Stops the machine in the event of excessive temperature in the compressor motor windings. HE10 will reset when motor cools sufficiently. HE30 and HE40 will not reset. Contact Vogt Service Department for instructions.



SWITCH BOX PARTS

FU1	- 12A 7504E10000000 - FUSE 2.5 AMP
FU2	- 12A 7504E10000000 - FUSE 2.5 AMP
PBL1	- 12A 7500E01000000 - ICE/CLEAN LIGHTED PUSH SWITCH
PBL2	- 12A 7500E01000000 - ON/OFF LIGHTED PUSH SWITCH
PB1	- 12A 7500E03000000 - START PUSH BUTTON
PB2	- 12A 7500E02000000 - MANUAL HARVEST PUSH SWITCH
SS	- 12A 7500E07000000 - SELECTOR SWITCH
S1	- 12A 7515E01000000 - CUTTER OVERLOAD SWITCH
S2	- 12A 7515E02000000 - PUMP OVERLOAD SWITCH
1LT	- 12A 7520E10000000 - CYLINDER LIGHT
2LT	- 12A 7520E10000000 - CRUSHED LIGHT
3LT	- 12A 7520E09000000 - CUTTER OVERLOAD LIGHT
4LT	- 12A7520E09000000 - PUMP OVERLOAD LIGHT

FIGURE 18. Switch Box. All the functions of the machine can be controlled from the switchbox.

Description of Switch Box Parts

FU1 and FU2, 2.5 Amp Fuses. Overload and short circuit protection for crankcase heater and the control circuit.

PB1, Start Push Button. For starting the machine in either the clean mode or the ice-making mode. (Momentary contact)

PB2, Manual Harvest Push Button. Initiates a thaw period immediately when manually depressed. (Momentary contact)

PBL1, Ice/Clean Lighted Push Button. "ICE" illuminated in the ice making position (button in). Not illuminated in the clean position (button out).

PBL2, On/Off Lighted Push Switch. "ON" illuminated in the On position (button in). Not illuminated in the Off position (button out).

1 LT, Crushed Light. "CRU" illuminated when set to produce crushed ice.

2 LT, Cylinder Light. "CYL" illuminated when set to produce cylinder ice.

Both 1LT and 2LT are illuminated when selector switch set in "Auto" position.

3 LT, Cutter Overload. Illuminated when cutter overload switch (SI) has tripped.

4 LT, Pump Overload. Illuminated when pump overload switch (S2) has tripped.

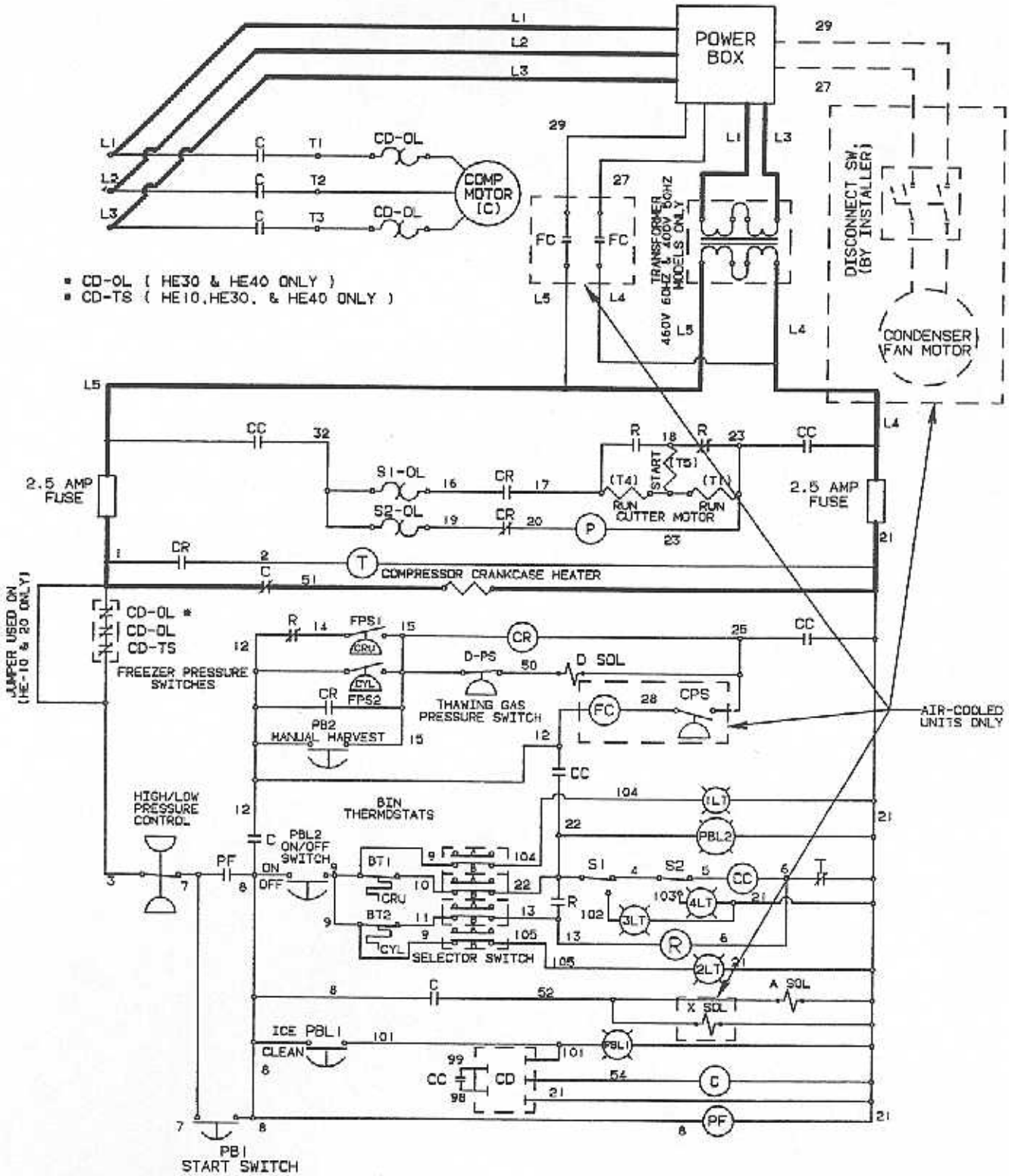
SS, Selector Switch. For the purpose of selecting the type of ice to be made, either crushed (CRU) or cylinder (CYL). **NOTE:** Use "AUTO" position only when using divided bin.

S1 Cutter Overload Switch. Stops machine operation in the event of a mechanical or electrical malfunction of the cutter motor, resulting in excessive motor amperes.

S2, Pump Overload Switch. Stops machine operation in the event of a mechanical or electrical malfunction of the pump motor, resulting in excessive motor amperes.

If machine is turned off by either S1 or S2 there is a five second delay before machine stops.

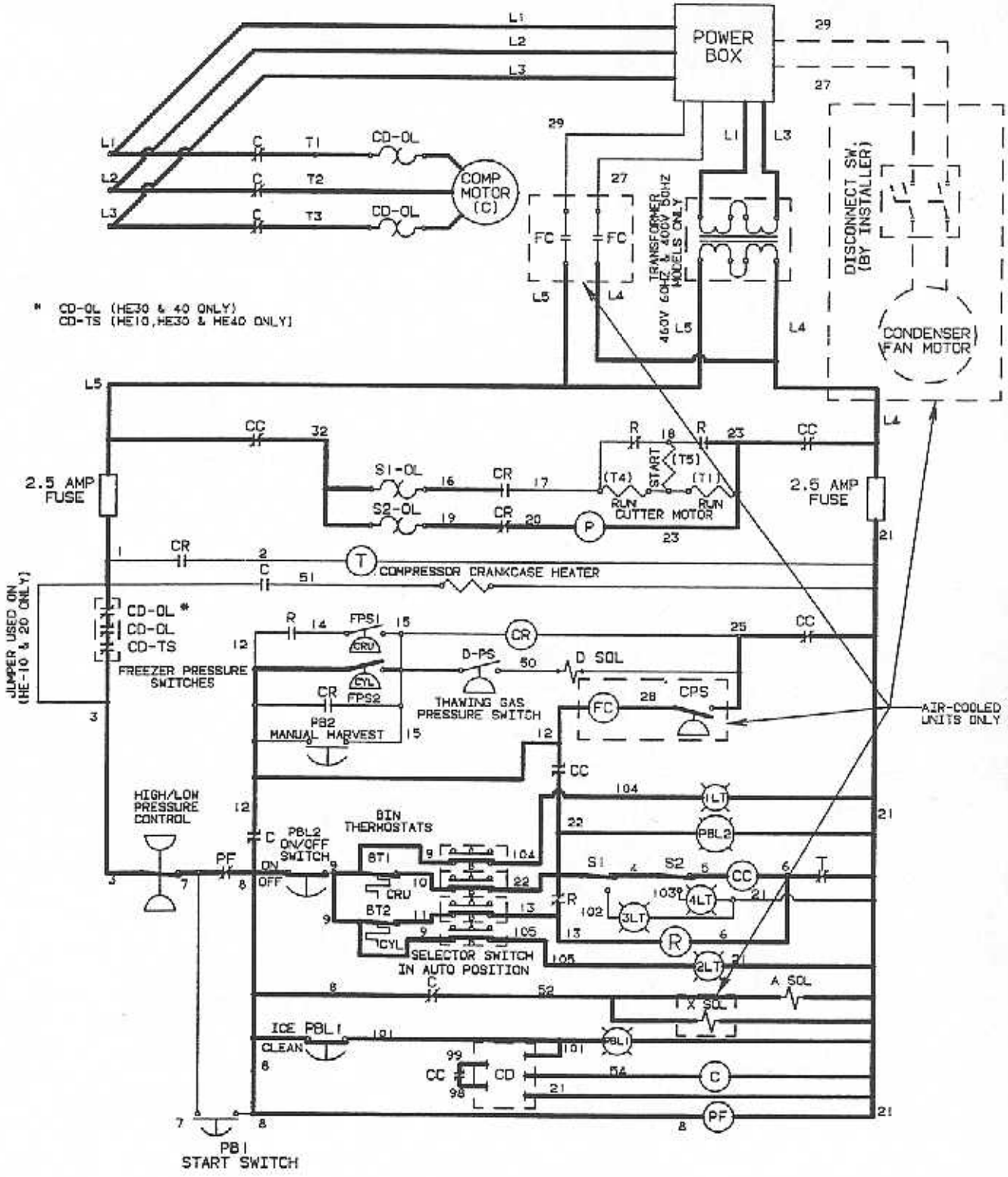
8. Wiring Schematics



Use Copper Conductors Only. Protected against primary single phase failure.

FIGURE 19. Machine Off

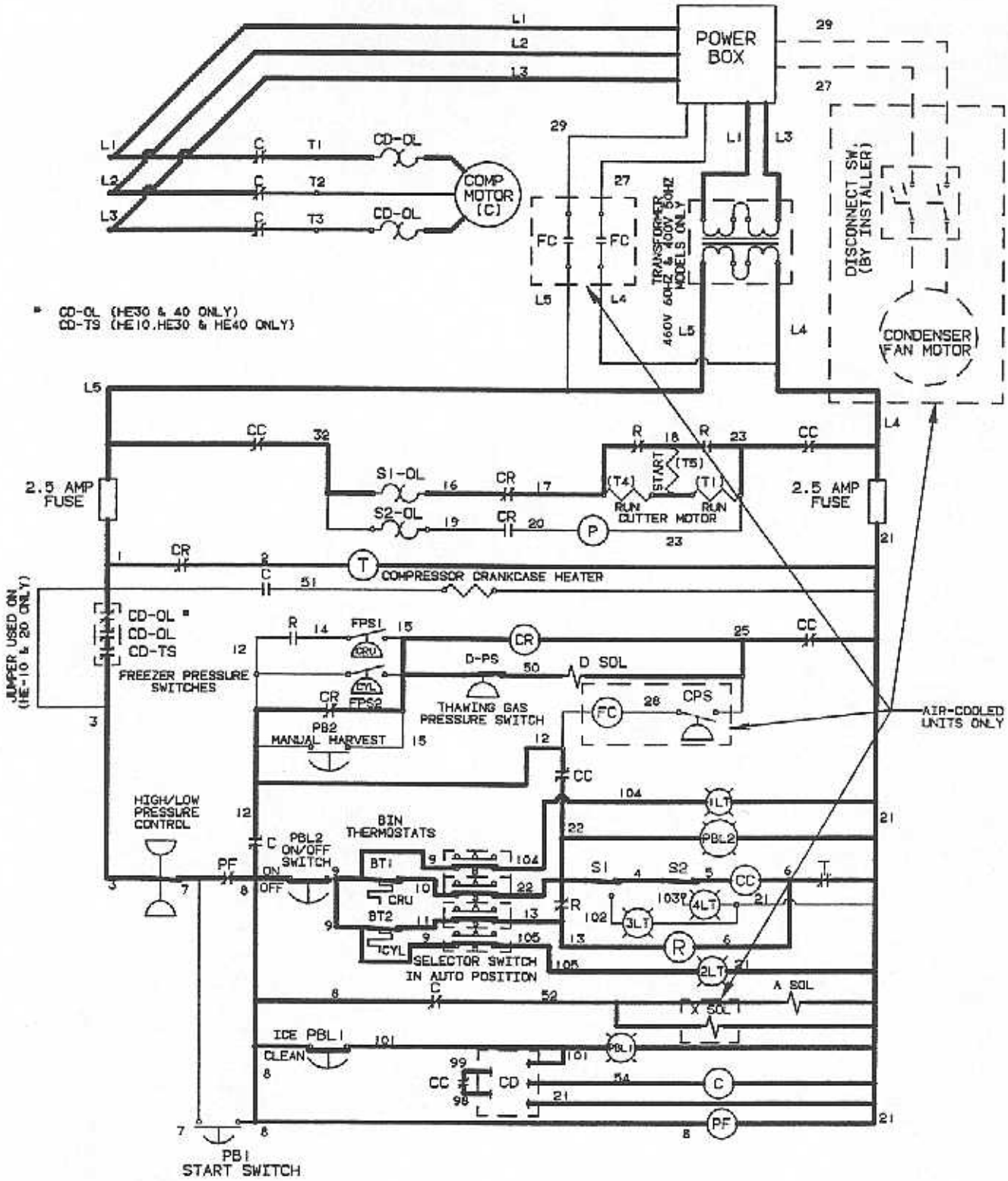
Revised April 1990



Use Copper Conductors Only. Protected against primary single phase failure.

FIGURE 20. Freeze Cycle (Cylinder Ice)

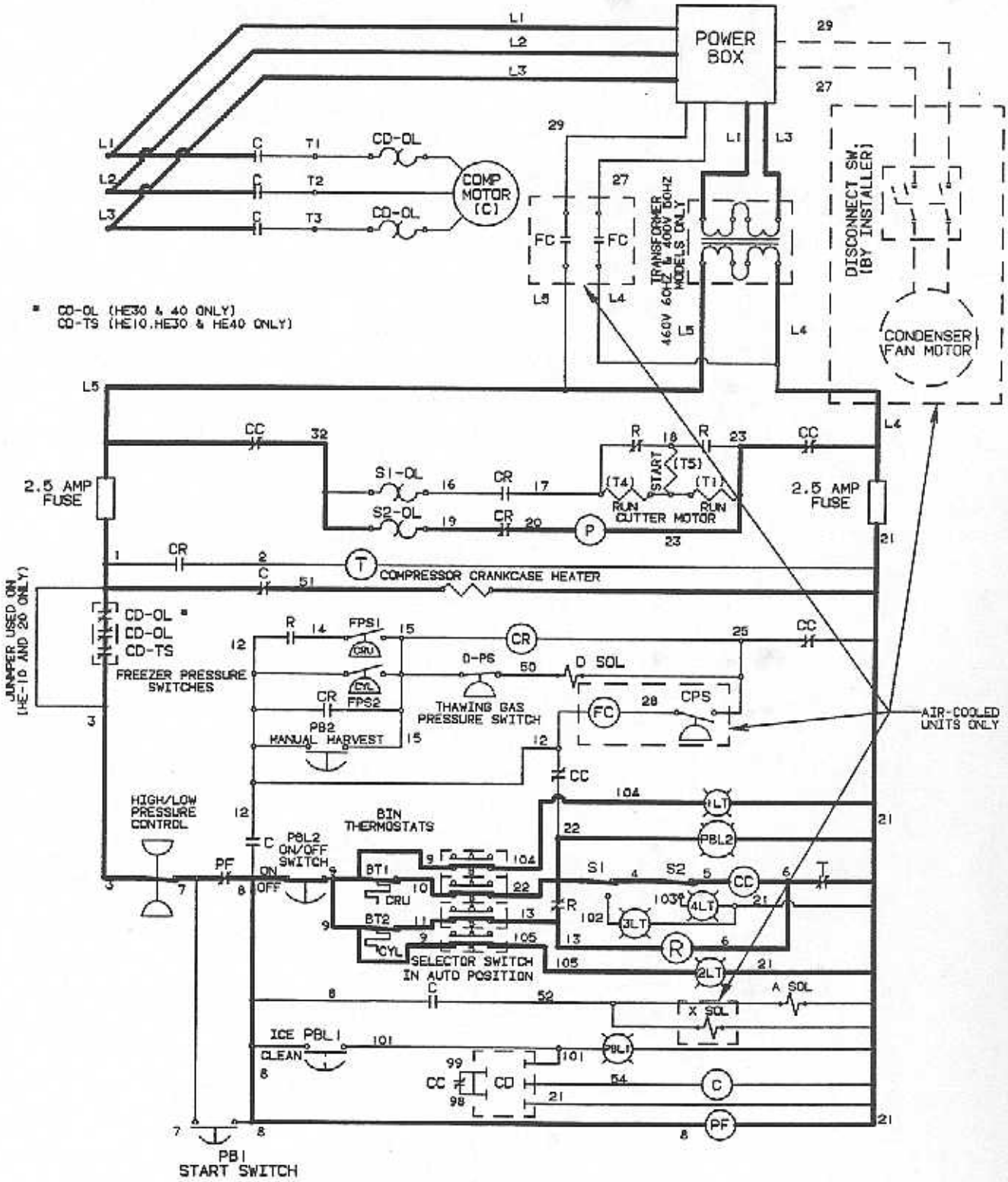
Revised April 1990



Use Copper Conductors Only. Protected against primary single phase failure.

FIGURE 21. Harvest Cycle (Cylinder Ice)

Revised April 1990



Use Copper Conductors Only. Protected against primary single phased failure.

FIGURE 22. Clean Cycle (A Maintenance Operation)

Revised April 1990

9. Maintenance

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—using an approved food-grade ice machine cleaner. The water pump is used to circulate the cleaner through the system by setting the "ICE-CLEAN" push button switch to the "CLEAN" position (button out) and starting and stopping the pump by the "ON-OFF" push button switch. For complete instructions, refer to the "CLEANING PROCEDURE" attached to the equipment and duplicated here.

Cleaning Procedure

1. SET "ON-OFF" switch to "OFF" position (button out, not illuminated). If the machine is running, it will shut down on completion of ice harvesting period.
2. Remove ice from storage area or cover opening into it.
3. Shut off water supply and drain tank (7). Remove any loose sediment from the tank.
4. Close drain valve and fill tank with 5 gallons cool water. On units equipped with a petcock on the water pump, set the petcock to wide open position and insert the discharge end of its plastic tubing into the water tank.
5. Add Calgon® Ice Machine Cleaner to water tank, in accordance with cleaner instructions.
6. To run pump only, put the "ICE" switch in the "CLEAN" position (button out). The pump is then started and stopped by the "ON-OFF" push button switch. If necessary to purge air from pump, return switch to "OFF" position for a few seconds, then back to "ON" position.
7. Circulate cleaning solution for 30 minutes or until deposits are dissolved.
8. Set switch to "OFF" position to stop pump, then drain and flush water tank with fresh water. Open water supply to machine.
9. Replace petcock plastic tubing to drain connection and start pump again by pushing switch to "ON". Operate for 15 minutes, then stop pump by returning switch to "OFF". Drain and flush tank. Refill with fresh water. Return the "ICE-CLEAN" switch to the "ICE" position (button in) for normal ice making operation.
10. Clean inside of ice storage area and remove any solution that entered during the cleaning process. Remove cover if one was installed over opening into storage area.
11. Your machine is now ready to resume ice production. Make sure the water tank drain valve is closed, and adjust setting of pump petcock per instructions in this service manual—to approximately 1 gallon per 15 minutes.

Water distributors. The water distributors are located under the freezer cover (8) at the top of the freezer. There are 78 distributors used in the models having an "S" suffix (i.e, Models HE10S, HE20S, HE30S and HE40S); 48 distributors are used in the models having an "M" suffix (i.e., Models HE10M, HE20M, HE30M, and HE40M). These distributors may require occasional or periodic cleaning to remove solids and foreign particles accumulated from the make-up water. The frequency of this cleaning operation will depend on the characteristics of the water supply.

The cleaning operation is indicated when the inside diameter of a large proportion of the ice becomes irregular (due to channeling of water), or if some of the ice is opaque, or if there is a noticeable decrease in ice capacity.

To clean distributors, stop the unit and remove the Freezer Cover (8) on top of the freezer. The water distributors (one in each tube) may then be removed for cleaning.

Water tank. The production of opaque ice usually indicates that the water in the water tank contains a concentrated amount of solids or salts.

Remove cover plate. Open Drain Valve (39). Clean tank thoroughly by flushing out with a hose and scrubbing with a stiff brush. Fill the water tank with fresh water.

When restarting the machine, be sure that the water pump is circulating water. It is possible that air may have collected in the pump impeller housing and the unit may have to be stopped and started several times to expel the air. This procedure can be done by use of "PUMP" or "CUTTER" circuit breaker switches.

Drip pan. If the machine is installed on a bin with a drip pan, it is important to keep the drip pan free of any foreign materials and to keep the drain for this pan open. This drain **must not** run through the ice compartment of the bin.

Water-cooled condensers. Checking operation. How often condensers need cleaning depends on so many variables that it is impossible to recommend a schedule. Some will seldom need cleaning, others perhaps need cleaning once a year. In rare cases, cleaning is required several times a year.

Proper operation of cooling towers will increase the interval beween cleaning considerably. The tower overflow rate should be checked frequently. If a tower is operated with insufficient overflow, nominal 1-1/2 to 3 GPH bleed depending on water quality, the resulting mineral concentration in the water can cause rapid and heavy fouling inside the condenser tubes, requiring excessively frequent cleaning. Also, these conditions often lead to severe corrosion.

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

It is advisable to double check the system to make sure that fouling is actually causing the trouble. High head pressure alone does not mean a fouled condenser. The following possibilities should always be checked before cleaning is undertaken.

1. Non-condensables in system, or faulty head pressure gauge? Check standby pressures against refrigerant tables.
2. Incorrectly set, or defective, water regulator valve? Check its setting and operation.
3. Partly closed compressor discharge service valve? Check its setting. Stem should be backseated.
4. High water temperatures entering condenser? Check tower fan and system.

After the above possibilities have been eliminated, determine the temperature difference between the water leaving the condenser and the refrigerant condensing temperature (saturation temperature, from pressure-temperature chart, corresponding to head pressure). If this difference is more than 10°F, cleaning is indicated, because this difference indicates a

good heat exchange is not being made. If this difference is less than 8°F, something other than a fouled condenser may be causing the high head pressure. In normal operation, this difference will stay between 5°F and 10°F regardless of water inlet temperature, when the water flow is regulated by a pressure operated water valve. If this difference is less than 5°F, restricted water flow, or a low supply pressure, is indicated. A restriction can occur with foreign matter in the condenser, but it is also likely to be somewhere else in the system.

Draining. Draining of water-cooled condensers is recommended in preparation for the winter cold, where units may be left exposed to ambients below 32°F. Theoretically, it is easy to drain a condenser. In practice, the problem can be complex.

Despite the fact that a condenser may have vent and drain fittings, the opening of these fittings is not sufficient for a natural gravity flow. Water will be retained in a tube due to (1) surface tension and (2) the normal curvature between tube supports. Our experience shows that as much as 20% of the water in the condenser can be retained. To break the surface tension on the tubes and to drain all tubes completely, it is necessary to remove the back plate and actually tilt the condenser a minimum of 5 degrees. Whether water left in the tubes will cause damage during a freeze-up will be dependent upon how quickly the freeze occurs and the location of the water inside the condenser.

In the field it is recommended that the tubes be blown out individually with air. Alternatively, a minimum of 25% ethylene glycol in the system will also prevent a freeze which can rupture the tubes.

Chemical cleaning. The Henry Vogt Machine Co. makes no recommendation for any particular chemical preparation. The same chemical may not be effective for all situations.

! CAUTION!
The following directions and precautions should be observed when cleaning is undertaken. The warranty on condensers is void if they are damaged by improper cleaning tools or methods. If harsh chemicals are used, be sure to follow the manufacturers recommendations regarding safety in handling those solutions.
! CAUTION !

(a) Use only preparations from an established, reliable source.

(b) Follow directions exactly, particularly regarding amounts to use, and flushing or neutralizing procedure after cleaning.

(c) Close the water supply stop valve. Remove the Condenser Water Regulating Valve (41).

(d) Circulate the solution through the condenser until it is considered clean.

(e) Flush the condenser according to directions.

(f) Install the Water Regulating Valve and Connecting Piping.

(g) Open the Water Supply Stop Valve and check for leaks.

Mechanical cleaning.
Part I.

(a) Close the Stop Valve in the water supply line.

(b) Drain the water from the condenser.

(c) Remove water regulating valve (41) and attached piping to the condenser.

(d) Remove the cover plate on the side of the frame to expose the condenser end plate.

(e) Remove the nuts, water plates, and gaskets from both ends of the condenser. If the gasket does not lift off with the end plate, do not try to pry it off. The seal surface may be damaged, which would cause a water leak. To free a sticking gasket, replace the water plate and tap it on the outside face with a mallet or a block of wood. After a few taps, the gasket will spring free, and will then slip off with the water end plate.

(f) Gaskets need only be rinsed in running water: rust, scale or dirt will not stick to the gasket material. A rag, or soft brush, is all that is required to remove any foreign matter.

Part II.

The inside of the water end plates, and the outer tube sheet surfaces, should be cleaned only with clear water and a rag or a soft bristle brush. A worn paint brush is excellent.

These surfaces have been coated with a special material which will give years of protection against corrosion, unless damaged. Never use a wire brush or a strong caustic on these surfaces.

Flush condenser tubes clear with air, water or a piece of rag on a stick or wire. In many cases this is all that is required. If the inside surfaces are smooth, even though discolored, further cleaning is not necessary. It is useless to try and get a bright copper surface on the inside of the tubes. They will discolor almost immediately in service, and the condenser has been designed with an adequate reserve for moderate fouling on these surfaces.

If, however, a rough coating remains inside the tubes after flushing and wiping, further cleaning is desirable. The color of this coating varies with water conditions, but roughness indicates cleaning tools should be used.

Any type tool to be considered should be tried first on a piece of copper tubing held in a vise or flare block. Nylon, brass or copper brushes are recommended. If any flakes of copper appear, or if score marks are made inside the tube, the tool should not be used. Never use anything with sharp or rigid edges which could cut into the copper tubing.

A cleaning tool is available from Vogt®, through your distributor. Ask for Part #12A-2055B01.

When using a cleaning tool, keep the inside of the tube wet, and move the tool slowly from one end to the other while rotating it at a moderate speed. A hand drill brace is recommended. If an electric drill is used, a low speed attachment on a 1/4" size drill is preferred. Larger units are powerful enough to damage a tube, if for any reason, the cleaning tool should stick. After one or two passes in each tube, they should be flushed and inspected. Often this is enough, although some desposits require more. In any case, stop when a few places begin to show a copper color.

After cleaning, wipe all foreign matter from the tube sheets and studs. Reassemble as outlined on gasket installation instructions.

If the gasket seal ridge was damaged, and a replacement is not immediately available, water leaks can be stopped by removing the gasket, drying it, and applying a thin film of a non-hardening gasket sealer, such as Permatex #2, around the seal ridge. This film should be no thicker than the height of the ridge itself, and about 3/16" wide. Then re-assemble.

If a new gasket is put on later, be sure to remove any grit or particles that stick to the sealer film on the tube sheet. It is not necessary to remove all traces of the sealer before installing a new gasket, as long as no particles that cut into the new gasket remain on the surface.

Air-cooled condenser cleaning. Visual inspection will indicate if dirt is accumulating and clogging the fin face of the condenser. A vacuum cleaner, compressed air or a brush may be used to remove any accumulation of loose direct from the fin section of the condenser.

For the removal of more severe accumulations of dirt or foreign materials, a detergent-type cleaner can be used. This cleaning agent can be supplied by your local refrigeration supply house. Follow the manufacturer's instructions when using a liquid cleaner.

If fins have been damaged, they should be straightened with the proper fin comb.

Lubrication

Compressor. In starting and charging the unit, the Oil Sight Glass (33) in the crankcase of the compressor should be watched carefully for the first hour to make certain the proper lubrication is being maintained. The oil may become low in the crankcase on an initial startup, if the electrical current has been interrupted to the machine, thus de-energizing the compressor crankcase heater.

Before starting the machine again, the heater should be energized for a time period of at least two hours to evaporate refrigerant that may have condensed in the crankcase during the shutdown period. If level is low after startup, it should begin to return after a short period of operation.

The oil level should be checked frequently, particularly during the startup operation, to see that a sufficient amount of oil remains in the crankcase. While it is important to observe the oil splash during operation, the true level can be obtained only when the compressor is stopped. With the compressor idle, the oil level should be at a height of 1/4 to 1/2 of the sight glass, but never out of sight above it.

Although the machine was shipped with the oil charge which was originally added for the test operation, it may be found necessary to add some oil when or if new refrigerant is added to the system.

An oil pump should be used to force any oil that may be required into the system. Oil may be added to the compressor of all units through the low-pressure test connection adjacent to the high/low pressure switch or through the Compressor Suction Service Valve. The Compressor Suction Service Valve should be "backseated" to shut off pressure to the gauge port when connecting the oil pump. Air should be purged from the oil pump discharge line, by forcing some oil through the line before tightening the charging connection.

Use "Dual Inhibited Sunisco 3GS" (Viscosity 150), or equal.

Cutter gear reducer. The oil level for the gear reducer should be checked if there is evidence of a leak. It should be level with the plugged opening in the side of the gear housing. Use Mobile 600W cylinder oil or equal. Change oil once a year.

Preventive Maintenance

For The Manager Who Depends Upon This Machine

For Efficient Operation.

"Preventive Maintenance" simply means that you, or a delegated employee, make a daily, visual check of your Tube-Ice® machine. Here is what to look for and why:

Daily checklist:

1. **Bin doors kept closed.**
2. **Thermostat bulb in bracket.**
3. **Ice quality.**
4. **Ice capacity.**
5. **Refrigerant level.**
6. **Compressor oil level.**
7. **Cleanliness**
8. **Unusual noises.**

Why? When you make these simple observations on a daily basis, you insure the smooth production of ice for your facility. When you are aware of the proper refrigerant and oil levels and observe them on a daily basis, changes in these levels can alert you to changes in the operation of the machine which may require Maintenance—long before a Service situation arises.

"An ounce of prevention is worth a pound of cure!"

Note To Manager or Owner:

The following page is a complete Preventive Maintenance Schedule that should be performed each 90 days. The Preventive Maintenance page may be copied and given to your service person. It should be signed, dated and returned to you for permanent record.

VOGT ® TUBE-ICE® MACHINE

PREVENTIVE MAINTENANCE PROGRAM

MODEL #_____ SERIAL #_____

Preventive Maintenace Location _____

Manager's Name_____

Date_____ Serviceman performing the work _____

The following services rendered:

_____ 1. Ice machine cleaner circulated thru system.

_____ 2. All drains freely draining.

_____ 3. All water distributors clear.

_____ 4. Scale condition of freezer tubes. _____

_____ 5. Water pump rotating in proper direction.

_____ 6. Machine voltage. _____

_____ 7. Comp. oil level. _____

_____ 8. Checked for leaks _____. Found _____.

_____ 9. Water pump amps._____

_____ 10. Cond. fan amps. _____

_____ 11. Suction pressure at end of freeze. _____

_____ 12. Discharge pressure at end of freeze. _____

_____ 13. Time of freeze cycle. _____

_____ 14. Suction line superheat at end of freeze. _____

_____ 15. Ice release time. _____

_____ 16. Discharge pressure at end of thaw. _____

_____ 17. Defrost time remaining after ice clears freezer. _____

_____ 18. Pounds of ice. _____

_____ 19. Air temperature _____degrees Fahrenheit.

_____ 20. Water temperature _____ degrees Fahrenheit.

_____ 21. Low pressure control checked out _____ PSIG.

_____ 22. Discharge pressure control checked out _____ PSIG.

_____ 23. Bin stat checked out _____ opens at _____ Makes _____.

_____ 24. Test operation of cutter breaker.

24 hour capacity is: Divide $\frac{\text{Pounds per batch}}{\text{Total Cycle Time}}$ = lbs. per minute

Pounds per minute _____ X 1440 =

_____24 hour capacity

Remarks: _____

_____

_____

10. Troubleshooting (A Checklist)

Symptom: Machine won't run

Possible Cause	Possible Remedy
No power to machine	Check Electrical Fused Disconnect or Circuit Breaker supplying power to the machine.If power has been off, make sure the compressor crank-case heater is energized for at least two (2) hours, and there is no liquid refrigerant in the crankcase prior to running the machine. Push "START" button and "ON" Button to run machine.
A power interruption has occurred.	Make sure no liquid refrigerant is in the compressor crankcase and the crankcase heater is energized at least two (2) hours prior to running the machine. Push start button to run machine.
Safety Pressure Switch stopped machine.	See FIGURE 24, SECTION 11 (High-Low Pressure Switch).
Motor Overload Protector Trips	See FIGURE 12, SECTION 3 (Switch Box), reset switch and check motor amperage.
Bin Thermostat Contacts Open.	Adjust Bin Thermostat. See FIGURE 27, SECTION 11. Make sure Thermostat Bulb is in proper location. FIGURE 10, SECTION 3.
Defective Thaw Timer, CC Contactor, PF Relay, On/Off Push Button Switch, Selector Switch, or Control Circuit Fuse.	See Wiring Schematic, FIGURE 19 and check for Open Circuit. Refer to FIGURES 17 and 18 for Control Panel and Switch Box Parts.

Symptom: Freeze-up due to extended freezing period.

Possible Cause	Possible Remedy
Freezer pressure setting too low.	See Freezer Pressure Switches, SECTION 11
Warm condenser water entering water tank (7) through overflow connection (40). WATER-COOLED UNITS.	Pipe Water Outlet (24) and drain (25) separately to floor drain. See SECTION 3, "Water Supply and Drains"
Drain valve (39) from water pan open or leaking.	Close valve or repair.
Solenoid valve (18) may be by-passing hot refrigerant gas into freezer (2) during the freeze mode.	Clean or replace solenoid valve. Check manual opening stem which should be at"ALL IN" position. See Solenoid Valve, FIGURE 31, SECTION 11
Makeup water float valve (12) stuck open.	Check operation of Float Valve and replace,if necessary. See FLOAT VALVE. (Makeup water), SECTION 11
Low refrigerant charge.	See Refrigerant Charge. Check system for leaks before adding refrigerant, SECTION 6
Expansion valve (17) overfeeding.	See Expansion Valve, SECTION 11

Symptom: Freeze-up due to ice failing to discharge

Possible Cause	Possible Remedy
Low condensing pressure during freezing resulting in insufficient heat for thawing.	See Head Pressure, SECTION 11
Thawing timer setting too short to allow ice to clear freezer.	See Thawing Timer, SECTION 11
Insufficient heat for thawing due to low refrigerant charge.	See Refrigerant Charge, SECTION 6
Non-condensible gases (usually air) in system.	See Non-Condensible Gases, SECTION 11
Cutter does not turn.	Check Cutter Drive for proper operation. See that Drive Gear is tight on Cutter Motor Shaft. Check circuit breaker. Replace breaker, if defective.
Ice backs up into cutter, jamming it.	If machine discharges into an ice chute check angle of chute (30° minimum angle for cylinder ice; 45° for crushed ice). Ice may not contact bin thermostat control bulb to stop machine when bin is filled. See Ice Bin Thermostat SECTION 3
Ice fails to discharge from cutter area properly.	Ice mushy due to concentration of solids in water pan. Drain and clean water tank. Check "blowdown" during thawing. See FLOAT VALVE (Makeup water), SECTION 11
Extended freezing period.	See "Freeze-up due to extended freezing period."
Inadequate flow of refrigerant through thawing chamber (16) to provide sufficient heat to prevent ice freezing at lower freezer tube head.	Irregular operation of expansion valve (Liquid line should stay frosted on outlet side during freezing). Check expansion valve bulb and re-insulate if necessary. Check for restriction in liquid line at Drier (46) or solenoid valve (20).
Thaw gas valve pressure switch set too low	Adjust switch, see FIGURE 32, SECTION 11

Symptom: Low Ice capacity

Possible Cause	Possible Remedy
Low refrigerant charge in freezer.	Add refrigerant and check for leak.
Restriction in liquid line.	Check for obstruction at expansion valve (17), drier (46), heat exchanger (13) or solenoid valve (20). The liquid line will normally have frost on the downstream side of any restriction.
Solenoid valve (18) may be leaking warm refrigerant gas into freezer (2) during the freezing period.	Repair or replace solenoid valve. Check manual opening stem which should be at "ALL-IN" position. See Solenoid Valve, FIGURE 31.
Water distributors at top of freezer may be stopped up.	See Water Distributors, SECTION 11.
Makeup Water Float Valve (12) provides inadequate quantity of water for ice making.	See Float Valve (Makeup Water), SECTION 11. Check water pressure at machine (30 PSIG minimum recommended).
Warm makeup water for ice making.	Capacity of machine is proportional to ice making water temperature. Warmer water will reduce the ice making capacity. (See Ice Capacity Table 6, SECTION 14
Makeup water float valve (12) stuck open.	See Float Valve (makeup water), SECTION 11
Water tank drain valve (39), open or leaking.	Close valve.
Warm condenser water entering water tank (7) through overflow connection (40).	Pipe water outlet (24) and drain (25) separately to floor drain. See SECTION 3, "Water Supply and Drain."
Controls for regulating freezing and thawing cycles improperly set.	See Freezer Pressure Switch and Thawing Timer. SECTION 11, FIGURE 23, 23A, and 28.
Excessive head pressure.	See Head Pressure, SECTION 11
Extended thawing perod.	Check setting of thawing timer. See Thawing Timer, Section 11, Figure 26
Expansion valve not operating properly.	Check setting of expansion valve (17). See Expansion Valve, Section 11. Also check for restriction in liquid line at expansion valve, drier (46) or solenoid valve (20)

Symptom:Safety pressure switches stop machine.

Possible Cause	Possible Remedy
Low pressure switch opens.	Compressor suction service valve (34) may be either closed or partially closed. Open valve wide. Check switch for improper setting (too high opening pressure). See FIGURE 24, SECTION 11.
High pressure switch opens.	Compressor discharge service valve (35) closed or partially closed. Open valve wide. Check cleanliness of condenser. Check water supply to condenser. See Head Pressure, SECTION 11.

Symptom: Motor overload protectors stop machine.

Possible Cause	Possible Remedy
Compressor motor overload (CD-OL) stops machine. **NOTE:** Overloads are automatic-reset type, located in junction box of compressor, Models HE 30 & 40 only.	Motor overloaded due to excessive condensing pressure. See Head Pressure, SECTION 11. Motor overloaded, due to a high suction pressure, warm water in water pan and warm inlet water to condenser during startup after a prolonged shutdown period. Machine should operate satisfactorily after temperature of water in water pan is reduced sufficiently so that the suction pressure is less than 60 PSIG. Check items under "Freeze-up due to extended freezing period." Compressor binding, or stuck—repair or replace compressor. Check fuses in disconnect switch. One fuse may be burnt out, resulting in single phasing compressor motor.
Compressor internal temperature thermal switch (CD-TS) stops machine. Model HE 10 will reset automatically. Model HE 30 & 40 will not reset. Call Vogt® Service Department.	Excessive temperature may be caused by gas leakage between suction and discharge valves of compressor valve plate. Check for broken valve plate gaskets or valves.

Possible Cause	Possible Remedy
Cutter motor circuit breaker or pump motor circuit breaker stops machine.	Crushed ice too thick, overloading cutter motor. Check setting of Freezer Pressure Switch. See Freezer Pressure Switches, FIGURES 23, 23A-SECTION 11. Crushed ice mushy, fails to discharge properly, overloading cutter motor. See Float Valve, SECTION 11. Cutter bearing worn in cutter hub, overloading cutter motor. Replace bearing, if defective. Gear reducer worn or binding, overloading cutter motor—install gear reducer, if necessary. Pump fails to rotate due to mineral build up or foreign materials in impeller housing—dismantle and clean pump.
One of the 2.5 amp. fuses or circuit breakers in the switch box stops machine.	Check compressor crankcase heater, coils of relays, coils of solenoid valves and thawing timer for a ground. Repair or replace defective part.

11. Servicing Operations

Adjustable blowdown (for clearer ice). A petcock is installed on the water pump to provide means for obtaining blowdown from the water pan during the freezing period. This supplements the blowdown that is discharged during the thawing period through the bypass piping connected to the drain of the water pan. (See "Automatic Blowdown," below.)

The petcock was set at the factory to discharge approximately one (1) gallon of water in fifteen (15) minutes. After installation it should be adjusted to the minimum rate required to maintain production of clear ice.

Automatic blowdown (harvest cycle). A patented feature of this machine is the automatic blowdown (40) which is provided to eliminate or reduce the necessity for frequent flushing or cleaning of the water tank (7) to remove accumulated salts or solids in the water as a result of the freezing action.

A principle of operation of the blowdown arrangement is a drain-bypass effect which is initiated during each thawing period when the water pump is stopped and the water in the freezer tubes returns to the water tank, thereby raising the water level higher than the bypass piping (40) and causing a portion of the water to drain from the bottom of the tank.

The water level, controlled by the float valve (12), regulates the quantity of blowdown during the thawing period.

Float valve (makeup water). The makeup 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 bypass or blowdown only during the thaw mode. The water level during the freeze mode should always be below the bypass 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 makeup 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.

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.

Expansion valve. The expansion valve was adjusted before shipment, and it is rarely necessary to change this setting.

If considerably less ice than shown in Table 6 is being produced per discharge, check the water supply, circulating water pump, water distributors, liquid line valves, refrigerant level, freezer pressure switch and all other avenues BEFORE changing the factory setting of the expansion valve.

The expansion valve should not be opened to the extent that frost will appear on the suction

line between the heat exchanger and the compressor. If this part of the suction line does frost, close expansion valve as required or compressor damage will result. If it becomes necessary to adjust expansion valve, refer to SUPERHEAT SETTINGS TABLE 7.

Freezer pressure switches. The freezing time period for the production of cylinder ice is controlled by the freezer pressure switch (FPS1) located inside the control panel. The freezing time period for crushed ice is controlled likewise, by the second switch (FPS2).

These switches were set at the factory to produce ice of recommended thickness. Look at the "Certificate of Test," which was provided with the machine, for a sample set of pressure readings with corresponding time periods and water temperatures. Also see TABLE 7 for typical settings. Do not make any adjustments until several ice discharging cycles have been made.

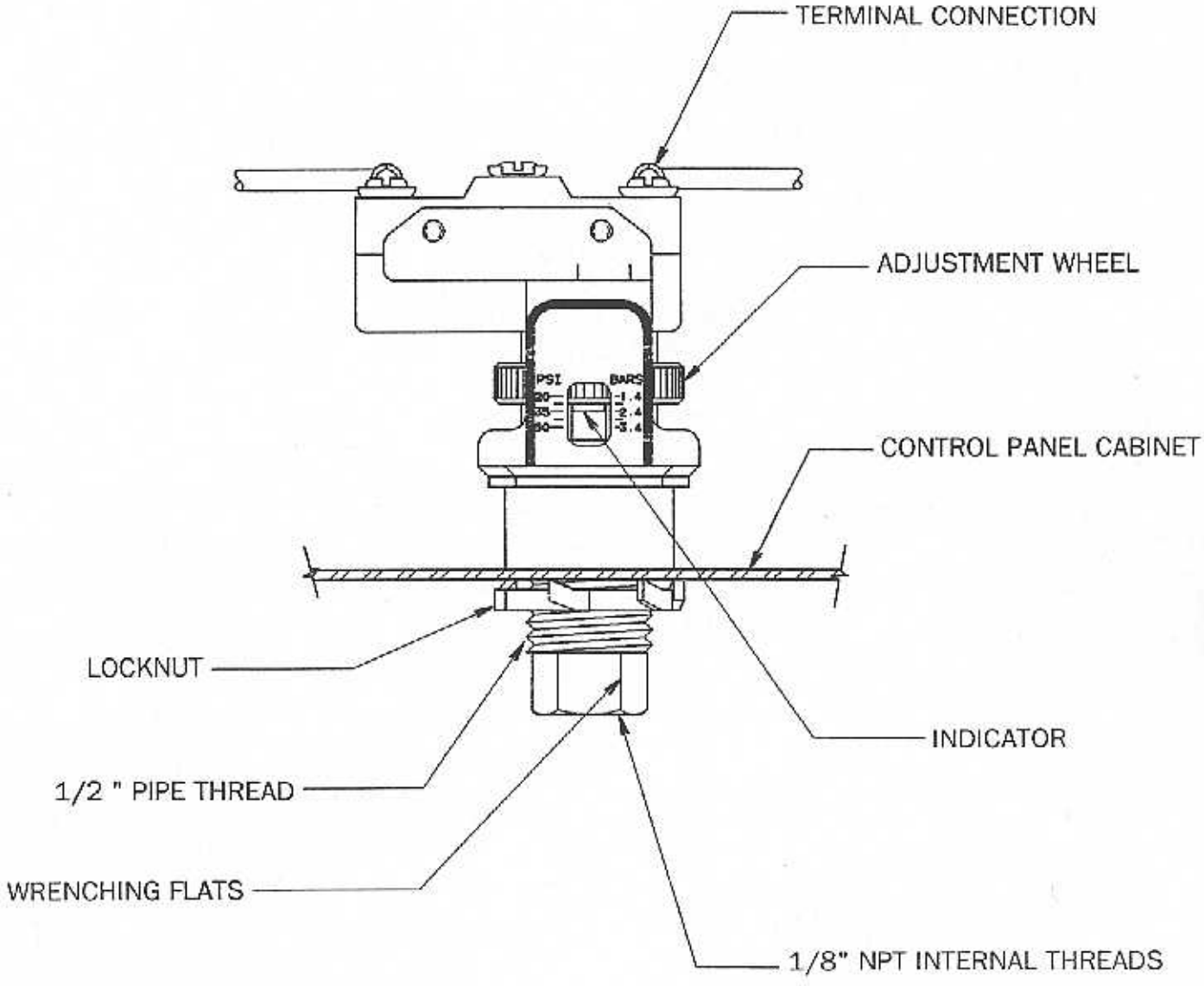


FIGURE 23. Freezer Pressure Switch (Asco)

If it becomes necessary to install a new freezer pressure switch, the following procedure is recommended for its adjustment.

Freezer Pressure Switches. Two types of switches have been used prior to February 1990. These are:

Asco Switches Vogt Part No. 12A2117C01000000 and
12A2117E03000000

Set the indicator close to the original factory setting and check ice thickness. To make the ice thicker (smaller hole) turn the adjusting wheel toward the wire terminals (see illustration). To make the ice thinner, turn the adjusting wheel toward the base of the switch (to left). NOTE: the lower the pressure setting, the thicker the ice.

Starting February 1990, Allen Bradley Switch Vogt Part No. 12A2117E04000000 is the replacement for factory and field use.

Allen Bradley Switch. The following procedure is recommended for initially setting an AB pressure switch which has **not** been previously adjusted:

1. Turn the bottom screw (differential) approximately 1/2 turn to the left (counter clockwise). The pointer arrow, which is at the top middle of the switch, will be at the "F" setting. See FIGURE 23A.

2. Turn the top screw (range adjustment) approximately 4 1/2 turns to the left (counter clockwise). The pointer on the range setting will be between 40 psi and 50 psi. See FIGURE 23A.

3. After the machine is running, the range adjustment (top screw) will have to be fine tuned to get the proper ice thickness. (Clockwise = Thinner Ice) (Counter Clockwise = Thicker Ice). Refer to Table 7.

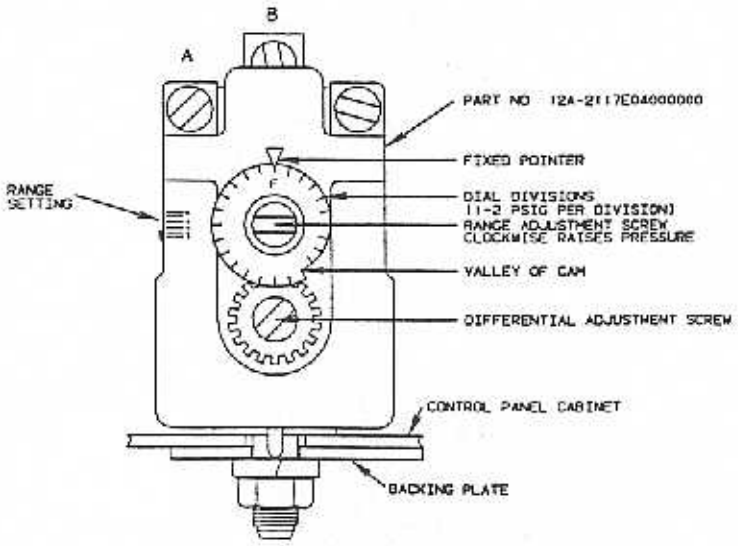


FIGURE 23A (Allen Bradley)

The freezing time can be such that a small percentage of the ice is frozen solid. If so, some ice from the top and bottom of the freezer should have a small hole in the center to insure that the freezing time has not been extended to where a loss in capacity would result.

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

When crushed ice is produced, the freezer pressure switch (FPS2) (FIGURE 23 or 23A) should be set to produce ice having a wall thickness of approximately 3/16".

High-low pressure switch. The high-low pressure switch (4PS) (FIGURE 24) is a two pole dual function switch. Located in the machine, outside the control panel, it protects the machine from possible damage due to abnormal pressure during operation.

! CAUTION! !
When this switch causes the machine to stop, the cause should be identified and corrected before resuming normal operation.
! CAUTION !

The low pressure cut-in should be set at 35 psig, and the cut-out set at 15 psig. After tripping at the cutout setting, the switch will reset automatically when the pressure rises to the cut-in setting.

The high pressure cut-out should be set at 300 psig. After tripping, reset the switch manually.

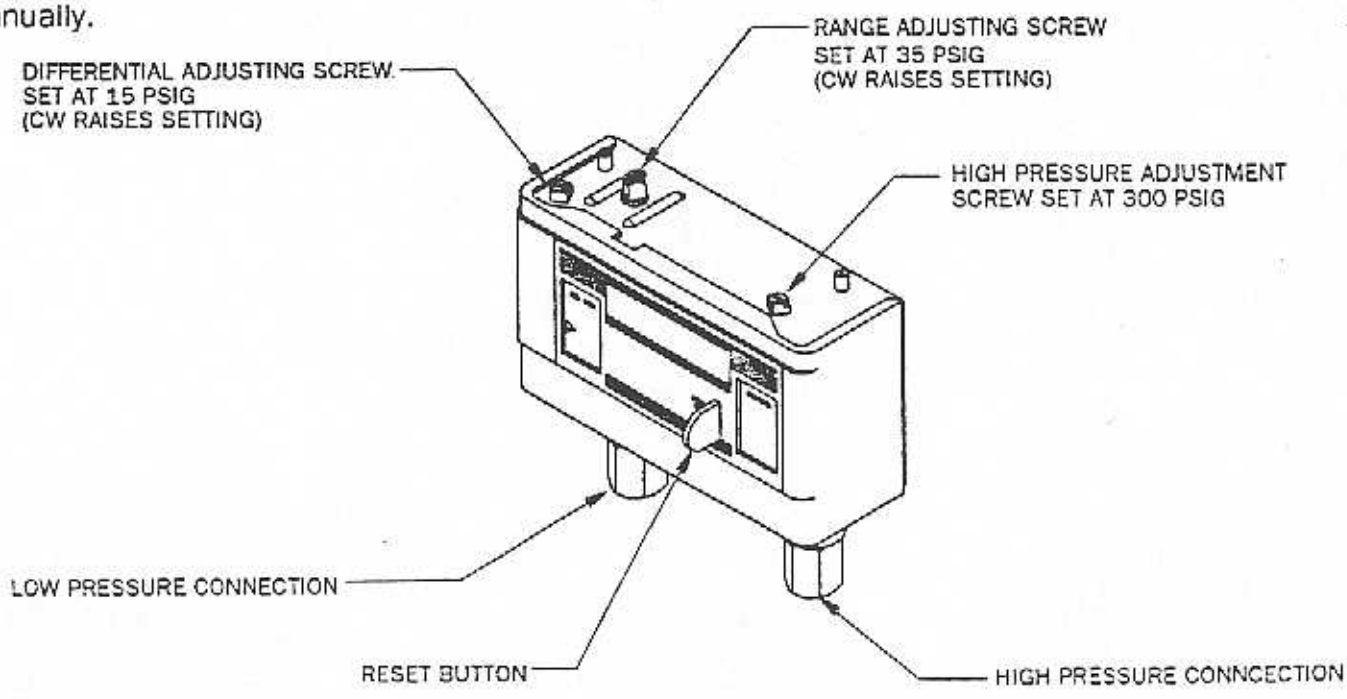


FIGURE 24. High-Low Pressure Switch.

If it becomes necessary to install a new high-low pressure switch, the following procedure is recommended for its adjustment:

Turn the adjusting screws clockwise to raise the pressure setting. Turn counter-clockwise to lower the setting. Adjust the switch to the indicated pressure settings and test with an accurate gage to be sure the switch functions properly.

Head pressure. The head pressure should be maintained at 190-210 psig during the freeze cycle. This pressure can be checked at the test connection in the high pressure line, near the high-low pressure switch.

Air-cooled units. The condenser fan switch (FIGURE 26) (CPS) is used to regulate the head pressure. This is an adjustable pressure switch located on the right-hand front of machine above the thawing gas pressure switch. It controls the operation of the condenser fan motor(s) through a contactor (FC) located in the control panel. The switch is set to cycle the fan motor(s) "ON" at 210 psig and "OFF" at 190 psig.

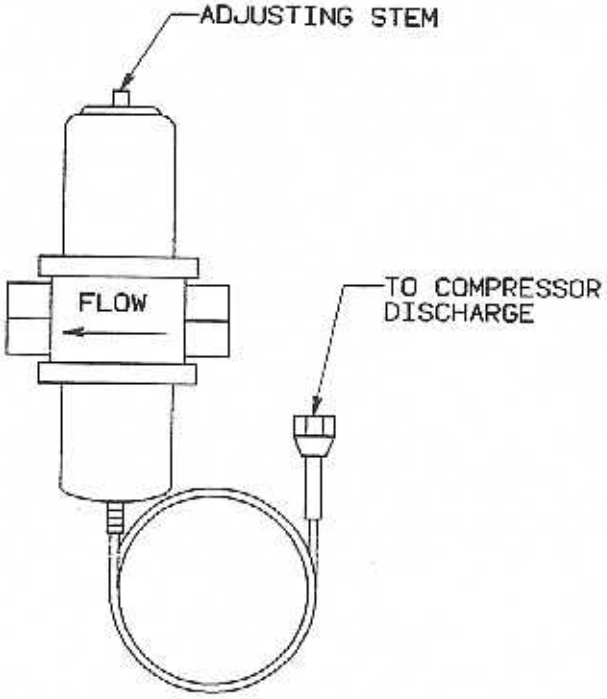


FIGURE 25. WATER REGULATING VALVE

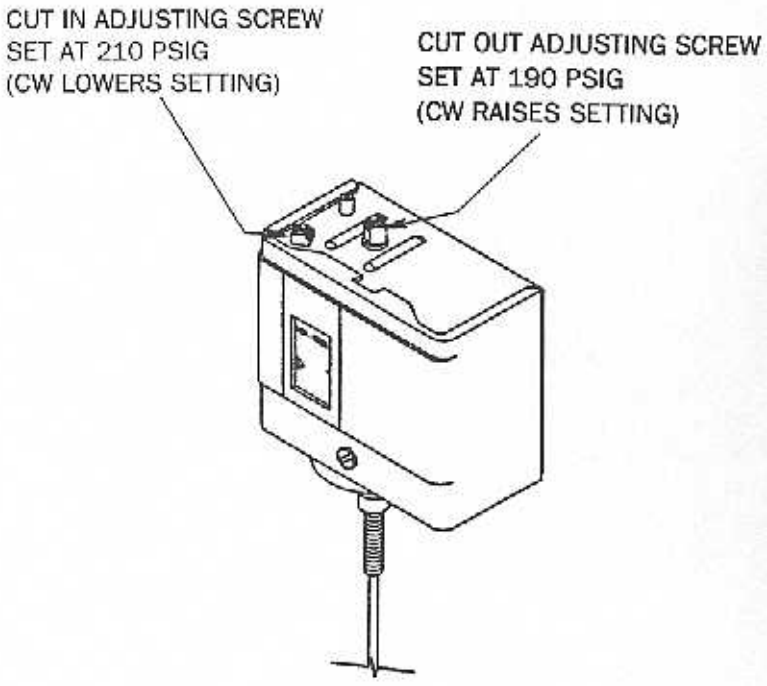


FIGURE 26. CONDENSER FAN SWITCH

Water-cooled units. A water regulating valve (FIGURE 25) located in the condenser water inlet line is used to control the water flow through the condenser. This valve should be adjusted to maintain a head pressure of 190-210 psig. Increasing the water flow lowers the head pressure and decreasing the water flow raises the head pressure. This valve is adjusted during the factory test.

Compressor crankcase heater. When electrical power is supplied to terminals L1, L2 & L3 of the power inlet box, the crankcase heater is energized when the machine is not operating.

! CAUTION!
In case of a power interruption or outage, be sure the compressor crankcase is warm and there is no liquid refrigerant in the crankcase prior to re-starting the machine.
! CAUTION !

Two control circuit fuses, (FU1 AND FU2), or circuit breakers, located in the switch box, protect the compressor crankcase heater, along with the control circuit.

If either of these two fuses "blow" trip for any reason, they must be replaced before the crankcase heater is energized and the machine will operate.

Ice bin thermostat(s) adjustments. The ice bin thermostats (FIGURE 27) are set prior to shipment. However, a MINOR adjustment may be necessary after installation, due to local conditions. The following procedure should be followed for initially setting or making adjustments to the ice bin thermostat.

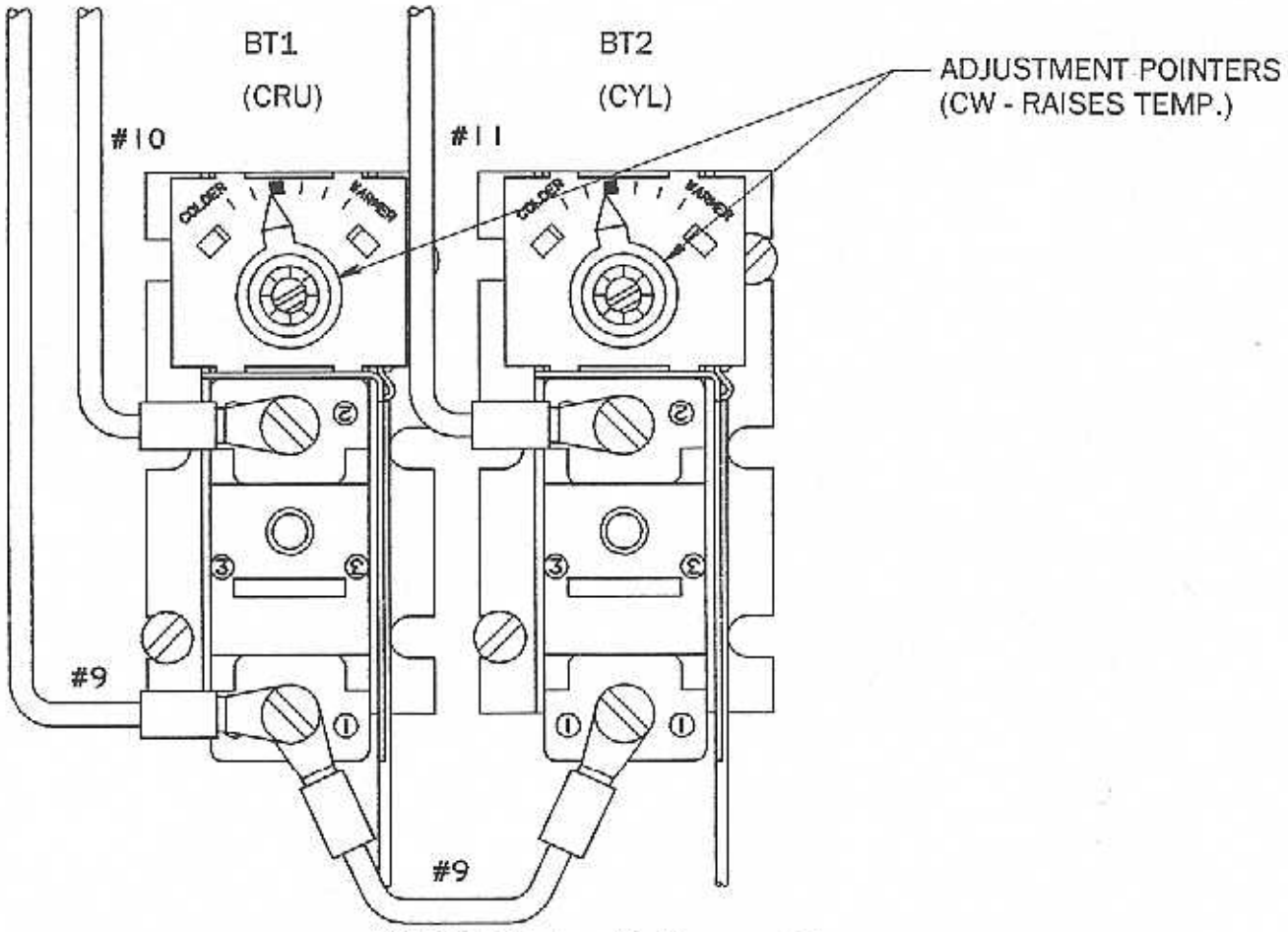


FIGURE 27. Ice Bin Thermostat

1. Cover bulb with ice. Use a continuity tester to see if the contacts are open. It should take approximately 10-15 seconds for the contacts to open.
2. Remove bulb from ice. check the time it takes for the contacts to close. It should take a minimum of 3 minutes (4 to 5 minutes preferred) for the contacts to close

when the bulb hangs free in a bin approximately 1/2 full of ice with the bin doors closed.

3. Turning the adjustment screw clockwise raises the setting. This adjustment makes the contacts open quicker, at a higher temperature.
4. Turning the adjustment screw counter-clockwise lowers the setting. This adjustment makes the contacts open slower, at a lower temperature.
5. Make sure the bulb is mounted firmly in the bin bracket after adjustment.
6. Form a "drip loop" in capillary tubing to thermostat bulb. See FIGURE 10, Thermostat Bulb Installation.

If it becomes necessary to install a new bin thermostat, the above procedure should be followed for making the adjustment.

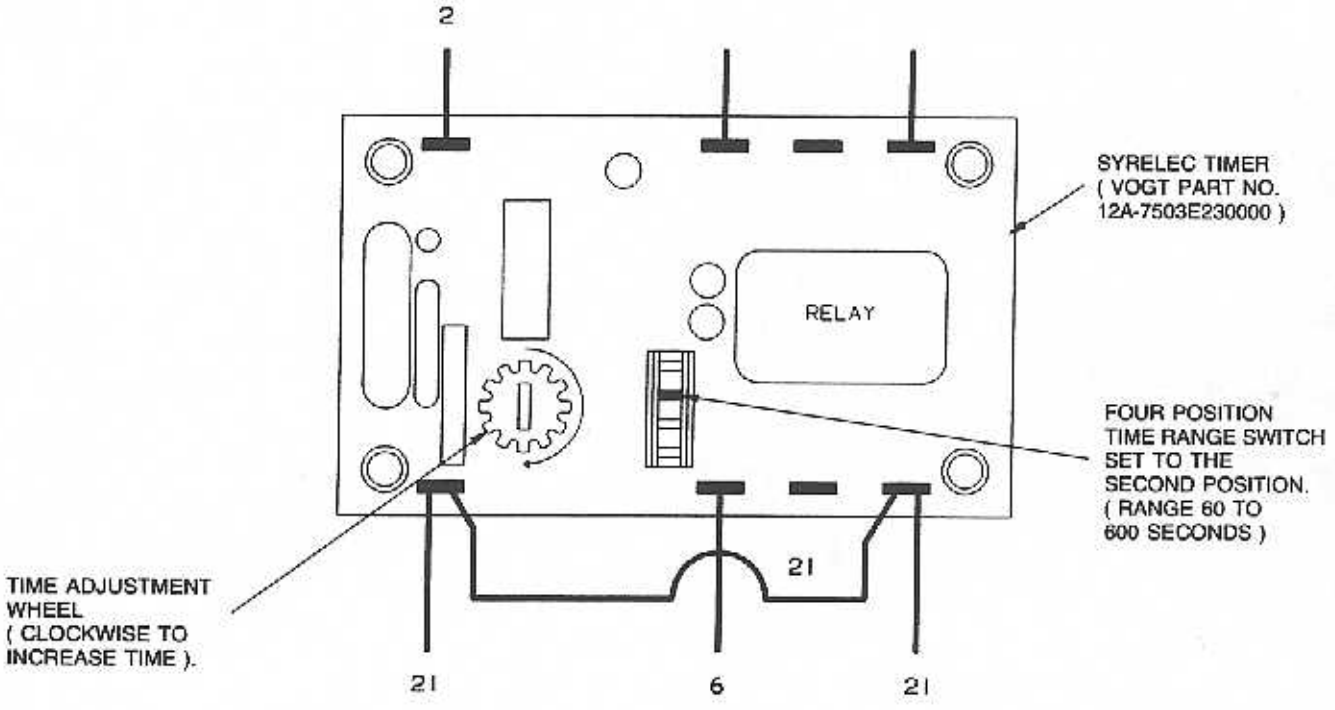
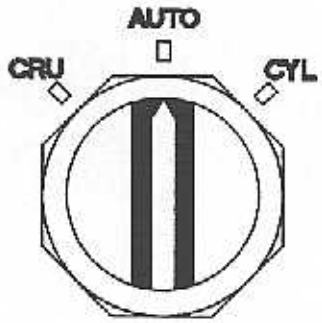


FIGURE 28. Thawing Timer.

Thawing timer. The thawing timer governs the ice thawing period. It is located inside the control panel. It is started by action of one of the freezer pressure switches (FPS1 or FPS2), which energizes the "CR" relay. This timer is set prior to shipment, for approximately a two-minute period.

Set the thawing period for at least 30 seconds longer than the time required to harvest the entire discharge of ice. If it should become necessary to change the setting of the timer, turn the adjustment wheel clockwise to increase the time or counter-clockwise to decrease the time. Check thaw time after each adjustment.



ICE
SELECTOR SWITCH

FIGURE 29. Ice Selector Switch

Ice selector switch. A 3-position rotary-type switch marked "CRU-AUTO-CYL" is located in the switch box. Set this switch on "AUTO" to produce and store both cylinder and crushed ice. To continuously produce either type of ice, set switch: to "CRU" for crushed ice only or to "CYL" for cylinder ice only.

Control circuit protection. The electrical control circuit of the machine is protected by two 2.5 amp fuses (or circuit breakers in early models). If either of these fuses/breakers should open, the machine will immediately stop. Before replacing a fuse or resetting a breaker, open the disconnect switch to machine and set the "on-off" push button to the "OFF" position. If the machine was off for an extended time the crankcase heater must be energized for a minimum of two hours before restarting the machine. When ready to re-start the machine, depress the "on" button, then the "start" button. Allow the machine to operate for approximately two minutes and then depress the "manual harvest" button to clear the freezer of any ice. The machine will automatically return to a freeze cycle upon completion of the harvest cycle.

Circulating water pump motor. The motor bearings are pre-lubricated and sealed. They require no further lubrication. 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.

Condenser cleaning. See Maintenance, SECTION 9, "Water Cooled Condensers"

Air-cooled condenser. Visual inspection will indicate if dirt is accumulating and clogging the fin face of the condenser. A vacuum cleaner, compressor air or a brush may be used to remove an accumulation of dirt from the fin section of the condenser. See SECTION 9.

Cutter gear reducer. The oil level for the gear reducer should be checked if there is evidence of a leak. It should be level with the plugged opening in the side of the gear housing. Use Mobile 600W cylinder oil or equal. Change oil once a year.

The motor bearings are pre-lubricated and require no further lubrication. For additional information, refer to manufacturer's instructions.

Cutter bearing. The cutter bearing is of the sleeve type and is made of Rulon, requiring no lubrication. If necessary to replace this bearing, follow instructions under heading "Cutter and Gear Drive."

Cutter and gear drive. To remove the ice cutter (21) when and if necessary, proceed as follows: Stop the machine. Close the stop valve in the makeup water line to water pan. After draining the tank, disconnect the makeup water line and drain line from the water tank. (Continued on page 72)

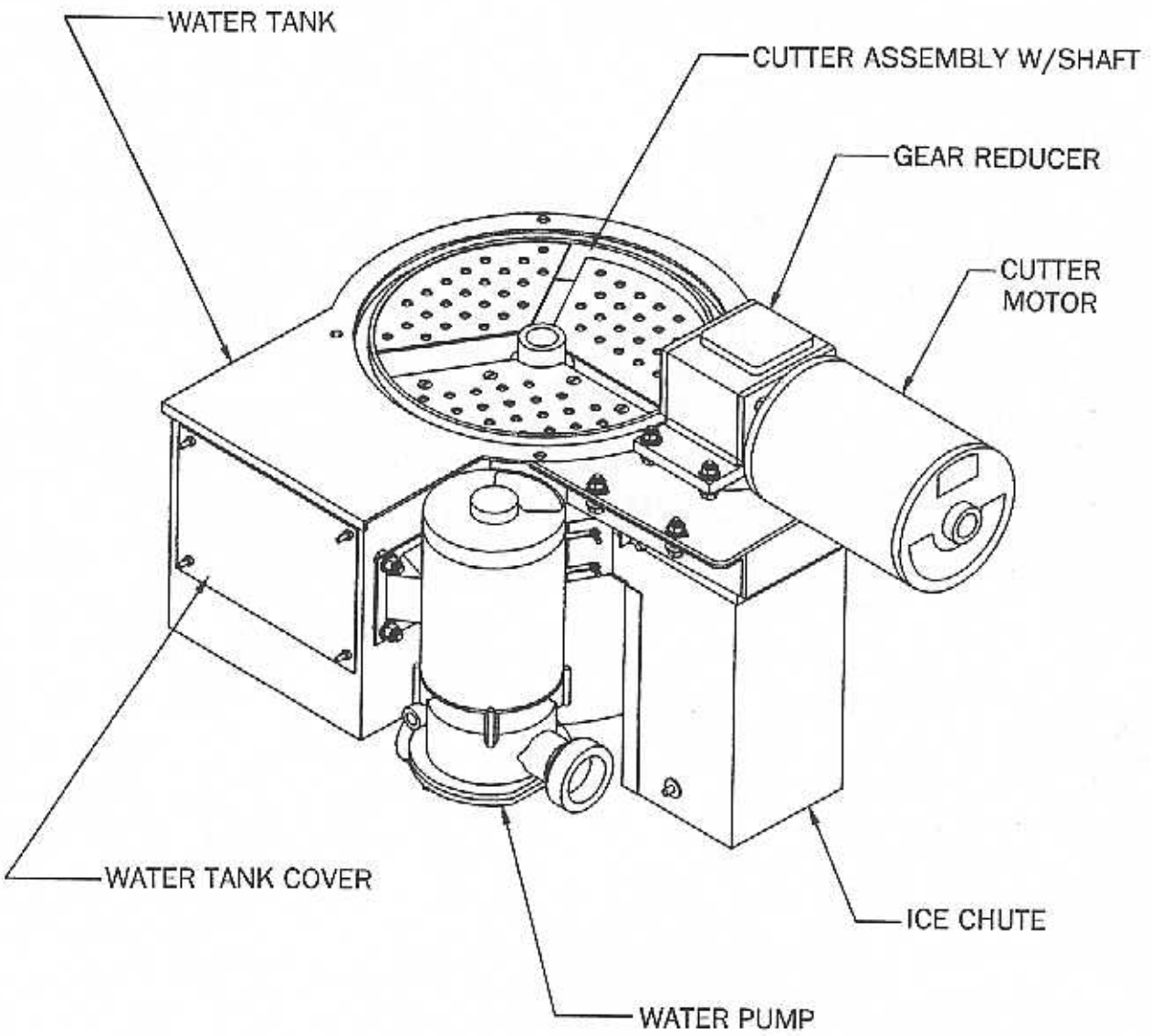


FIGURE 30. Cutter Water Tank Assembly With Water Pump and Cutter Motor.

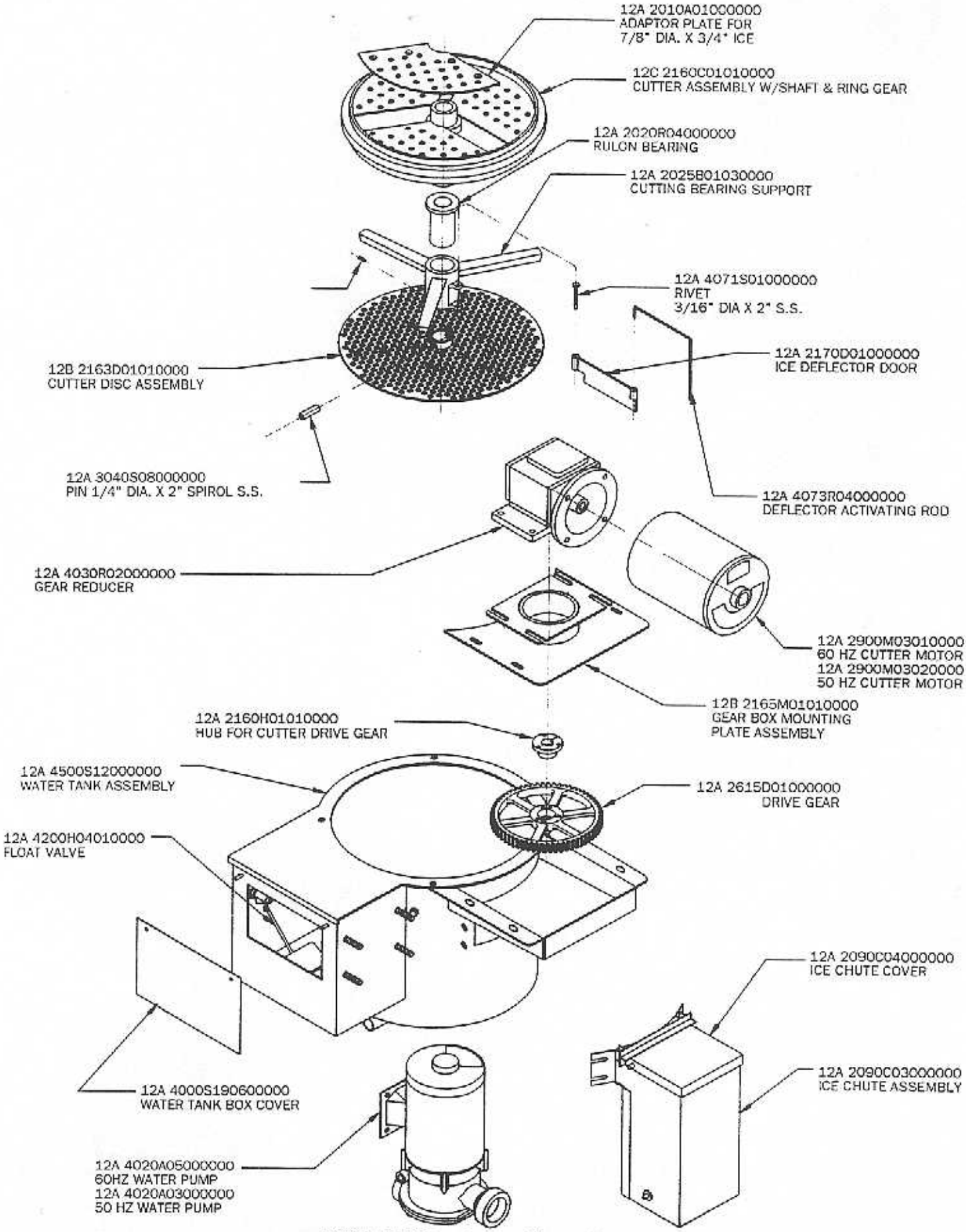


FIGURE 30A. Cutter Water Tank Parts

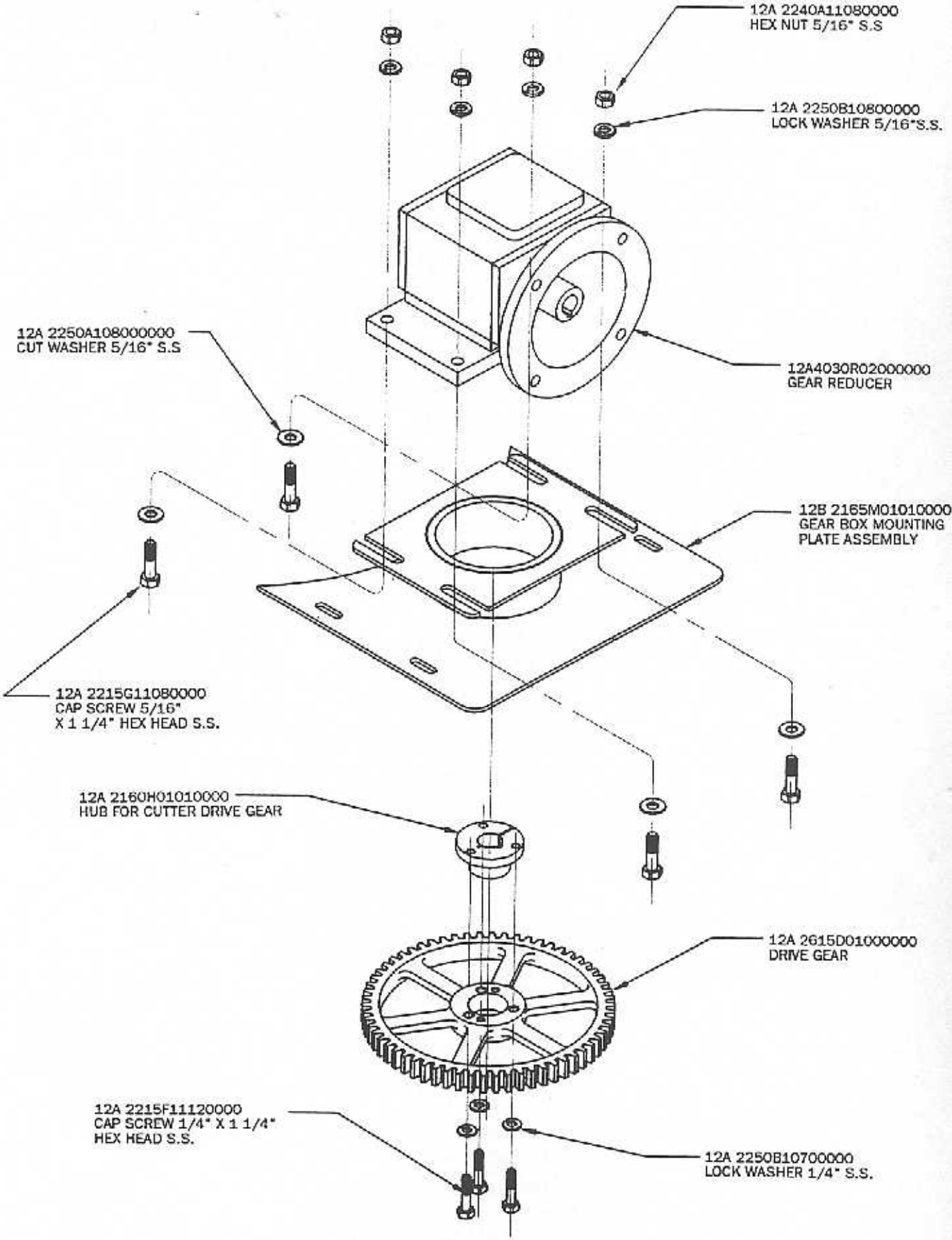


FIGURE 30B. Cutter Drive Parts

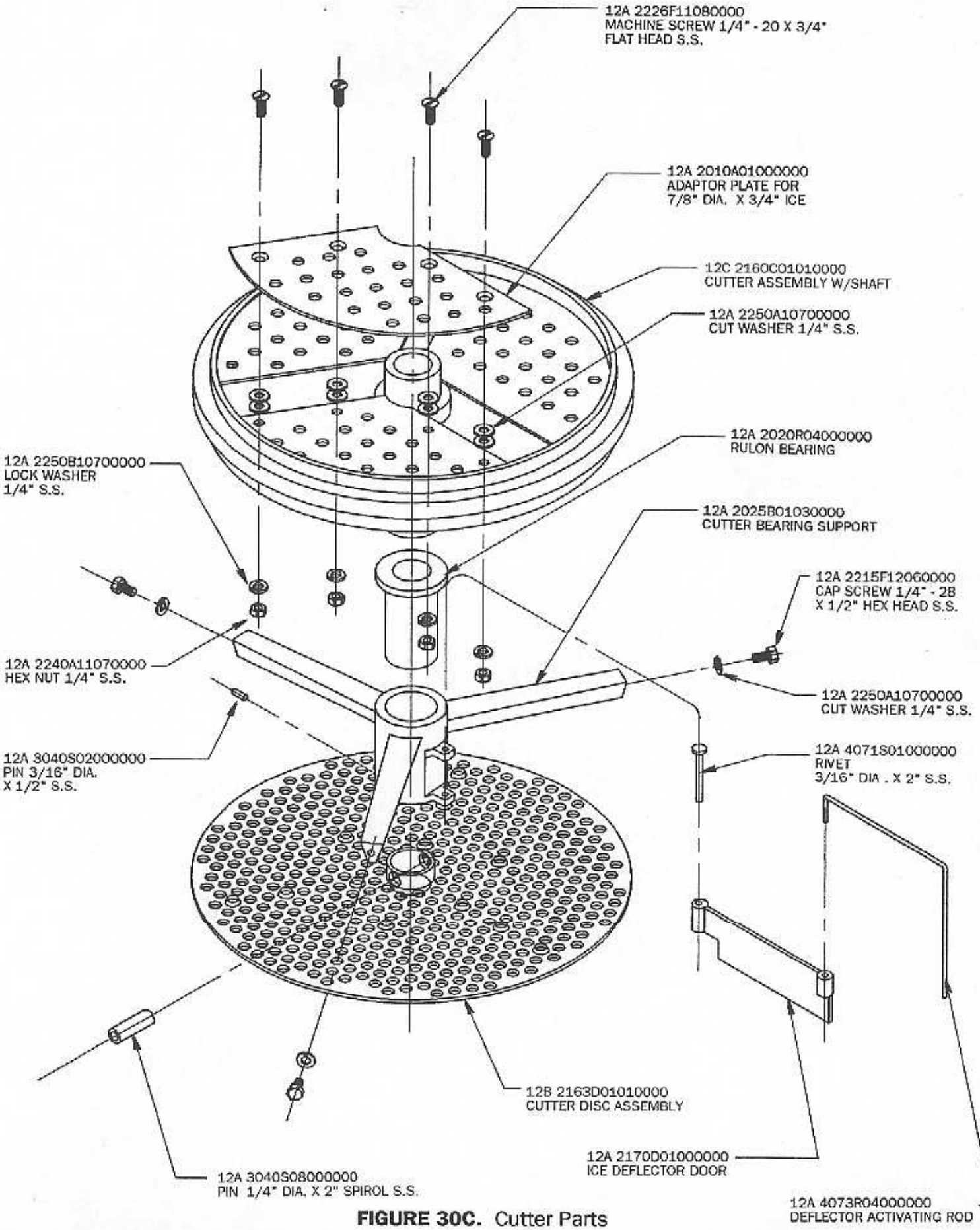


FIGURE 30C. Cutter Parts

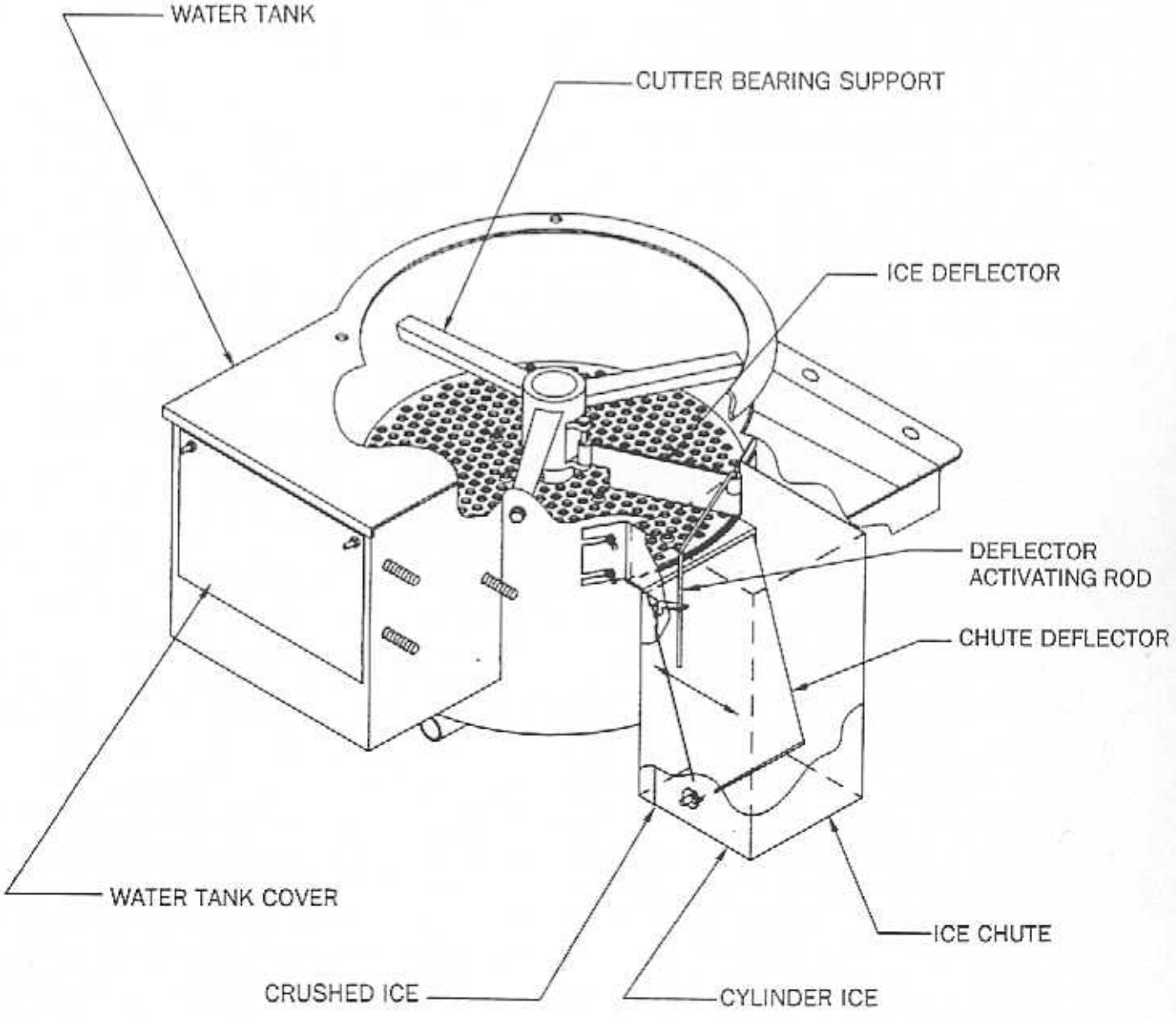


FIGURE 30D. Ice Discharge Arrangement (Deflectors in Cyl. Ice Position)

Cutter and Gear Drive

Cutter and Gear Drive
(Continued from page 67)

Separate motor from the cutter drive reducer by removing four (4) cap screws. Watch for shaft key when separating unit which must be installed in motor keyway when unit is re-assembled. It is not necessary to remove the reducer from its mounting plate on the water pan.

Remove the water pump which is attached to the side of the tank by 4 bolts and nuts. Remove ice discharge chute which is attached to the water tank by four 4 hex nuts.

Remove the water tank assembly, which contains the Cutter, by removing 4 bolts and nuts from around the top edge of the tank. Assembly may then be taken to a work bench for removal of cutter. The cutter bearing bracket is held in place by three 1/4" cap screws holding cutter support to side of the water tank. Before loosening these cap screws, remove the ice deflector by removing the hinge pin at the hub end, and the cutter disc assembly. The cutter disc assembly is held onto the shaft by a roll pin, which must be removed.

If the bearing requires replacement, first remove the worn bearing by driving the 3/16" lock pin, located in the side of bronze hub, thru the bearing wall with a 3/16" punch. Drive or press the bearing from hub. The new bearing may be driven into hub using old bearing as a driver. When bearing is fully seated, drill a 3/16" hole thru bearing wall using original hole in hub as a pilot. Lock new bearing in place with 3/16" lock pin. Insert the pin flush with outside of hub, check that pin does not extend beyond inner surface of the bearing.

The parts should be reassembled, reversing the procedure described for removal.

Pumping down freezer. If it should become necessary to pump the refrigerant out of the freezer, sufficient vapor should be retained to hold one pound pressure in the freezer so that air will not enter if the system is opened.

The following procedure should be followed to pump the refrigerant out of the freezer:

1. Close valve (69) to the freezer pressure switches.
2. Close (front seat) the Hand Stop Valve (58) in the liquid line at receiver.
3. Attach a refrigerant gage to the test connection in the low pressure line near the high/low pressure switch.
4. Start the machine and let operate until low pressure switch 4PS opens, which will stop the machine. Addition of warm water in the pumping tank will assure com plete removal of refrigerant from the freezer.

The low pressure switch will open at approximately 15 psig. To then reduce the freezer pressure below this setting, connect a jumper across the switch terminals and control the starting and stopping of the compressor with either circuit breaker (pump or cutter) located in the switch box.

! WARNING !
Disconnect switch to the machine MUST BE OPEN when adding or removing jumper wire. Remember to remove the jumper before resuming production.
! WARNING !

Removal of refrigerant from machine. To transfer the refrigerant charge from the machine into a separate container, connect a charging hose to an empty refrigerant cylinder with

cylinder valve closed. Cylinder should be positioned for packing in ice. Connect the other end of hose, to Drain Port (44) on liquid line valve (58) at receiver. proceed as instructed above under "Pumping Down Freezer." This will isolate the refrigerant in the Receiver

! WARNING!
Follow these instructions carefully. Severe personal injury can result from improper discharge of refrigerant.
! WARNING !

! WARNING !
It is not recommended that refrigerant be transferred from a refrigeration system 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.
! WARNING !

Pack the storage container in ice and be sure that the container has a storage capacity in excess of the amount (weight) of refrigerant in the system. Open (back seat) the condenser receiver drain valve (58) and the storage container valve. It may be necessary to apply heat to the lower portion of the condenser receiver to assist in removing the refrigerant. When the pressure in the condenser-receiver is reduced to approximately 60 psig. Close storage container valve and carefully remove tubing or hose. CAUTION! Some liquid refrigerant may escape when breaking this connection. Wear eye protection! Purge hose at cylinder end before opening cyclinder valve.

Refrigerant leaks. In addition to testing the machine for leaks as instructed under "Refrigerant Charge," it is advisable to again make a leak test after the unit has been in operation approximately one week. Any noticeable change in operating conditions, other than shown on the "Certificate of Test" may indicate a loss of refrigerant due to a leak. Always remove the refrigerant pressure from the vessel or tubing before repairs are attempted.

Non-condensable gases. 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.

Compressor motor burnout. There are several causes of compressor motor burnout. Some of these are described below.

1. Low Line Voltage. A compressor motor is designed to operate within the range of plus or minus 10% of its nameplate voltage. Low voltage requires the motor windings to carry more current at the same compressor load. When this current gets too high or is applied for an extended period, the motor windings overheat, resulting in a failure or burnout.

2. Loss of Refrigerant. The hermetic compressor motor is maintained at proper operating temperature by passing the cool suction gas over the motor windings. A loss of refrigerant can cause the winding to overheat, resulting in a failure or burnout.

3. High Head Pressure. The system is designed to operate at 200 psig. Excessive head pressure adds refrigerating load on the compressor which can cause the windings to overheat and result in a failure or burnout.

4. Moisture. Moisture in contact with refrigerant and oil in the presence of heat will form hydrochloric or hydrofluoric acid. The acid will destroy the insulation on the motor winding, causing a short circuit which can increase motor temperature in excess of 3000°F. This extreme temperature will also create a sludge or black residue in the system.

5. Mechanical Failure. Mechanical failure has been determined as a major cause of motor burnout. Bearing wear or wipe out may allow rotor to drag, overheating the windings and burnout.

Whenever there is a compressor failure due to a motor burnout, it is important that the system be thoroughly cleaned before replacing the damaged compressor, or otherwise the new compressor may also be damaged. A suction line filter should be installed and filter cores replaced until system is clean. Also replace the liquid line filter drier.

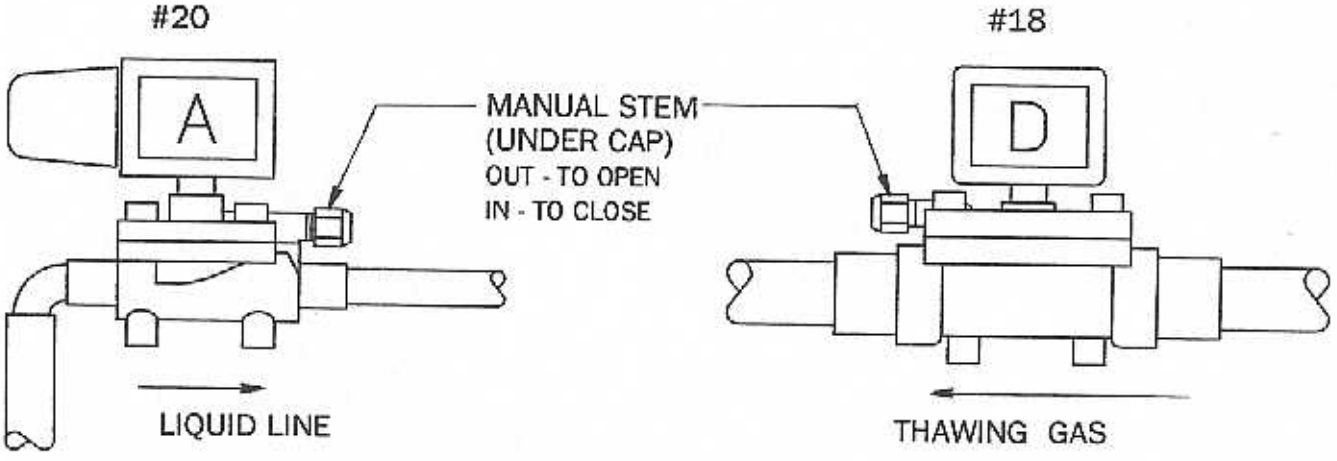


FIGURE 31. Solenoid Valves.

Solenoid valves. The solenoid valves (18 and 20) are pilot-operated with "floating" type diaphragm. For satisfactory operation be sure that the Manual Opening Stem, which is located in the valve bonnet on the outlet side of the valve, is in the "ALL IN" or closed position. These valves require only a quarter turn of the manual stem to cause valve to remain open.

These valves will operate on voltages within 10% of rating, but dirt or sludge will affect the operation.

Water distributors. The water distributors are located in the distributing head (8) at the top of the freezer. There are 78 distributors used in the models having an "S" suffix (i.e., Models HE10S, HE20S, HE30S, and HE40S); 48 distributors are used in models having an "M" suffix (i.e., Models HE10M, HE20M, HE30M, and HE40M). These may require occasional or periodical cleaning to remove suspended solids and foreign particles accumulated from the make-up water. The frequency of this cleaning operation will depend on the characteristics of the water supply.

The cleaning operation is indicated when the inside diameter of a large proportion of the ice becomes irregular (due to channeling of the water), or if some of the ice is opaque. Or if

there is a noticeable decrease in quantity.

To clean distributors, stop the unit and remove the distributing head (8) on top of the freezer. The water distributors may then be removed for cleaning by soaking in a solution of ice machine cleaner or 10% muratic acid and water.

! WARNING !
Acid can cause serious burns or blindness. Always add acid to water for dilution. Wear eye and body protection.
! WARNING!

Water tank. The production of opaque ice usually indicates that the water in the water tank contains a concentrated amount of solids or salts.

Remove cover plate, open drain valve (39) and clean tank thoroughly by flushing out with a hose and scrubbing with a stiff brush. Close the drain valve and refill tank with fresh water.

When restarting the machine after filling the water tank, be sure that the water pump is circulating water. It is possible that air may have collected in the pump impeller housing and the unit may have to be stopped and started several times to expel the air.

Thawing Gas Valve Pressure Switch.

The thawing gas valve (18) is closed and opened during the harvest cycle by an adjustable pressure switch located in the machine, outside the control panel. The pressure CUT-IN (contacts close) are to be set at 62 PSIG and CUT-OUT (contacts open) set at 68 PSIG.

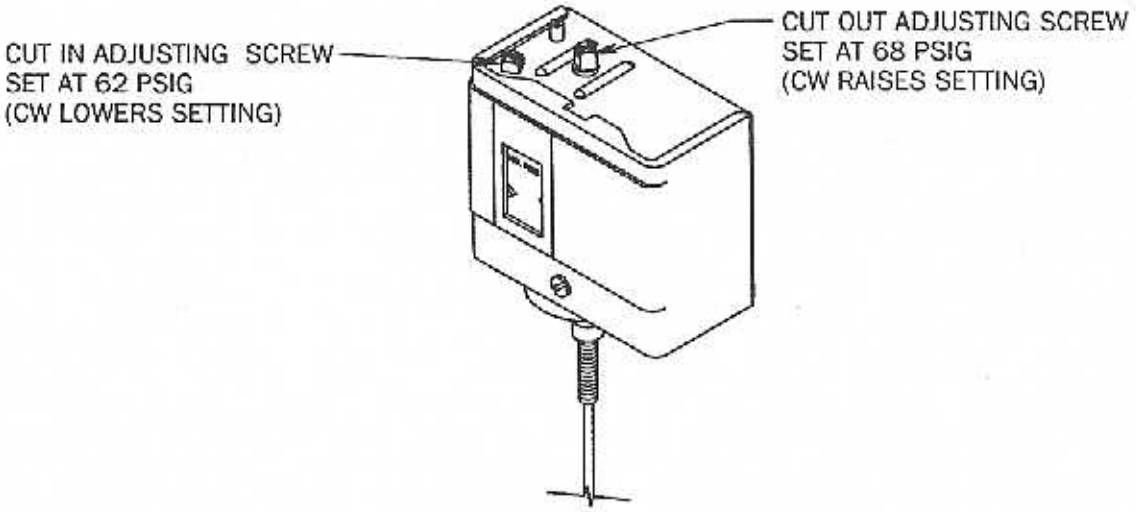


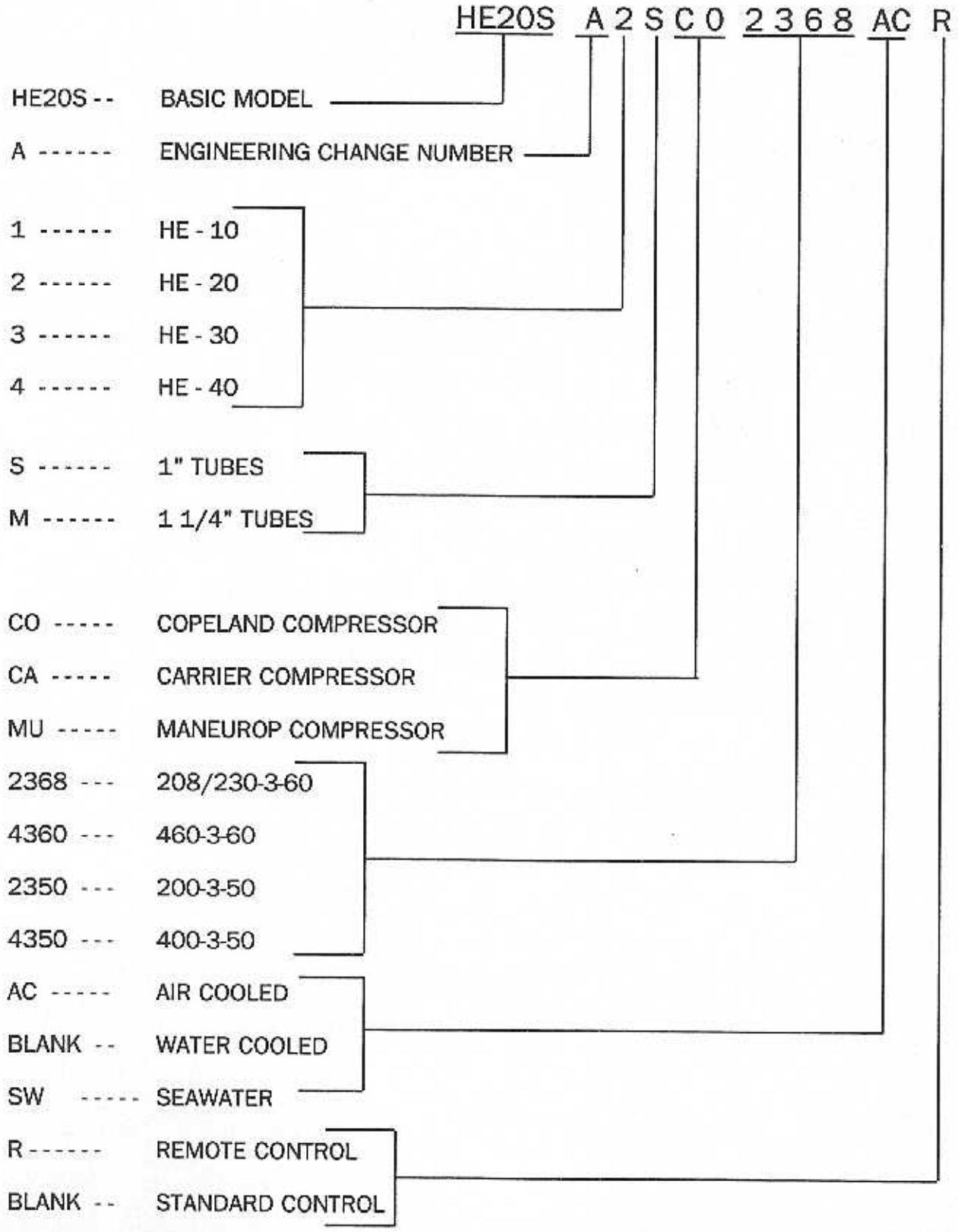
FIGURE 32. Thawing Gas Valve Pressure Switch

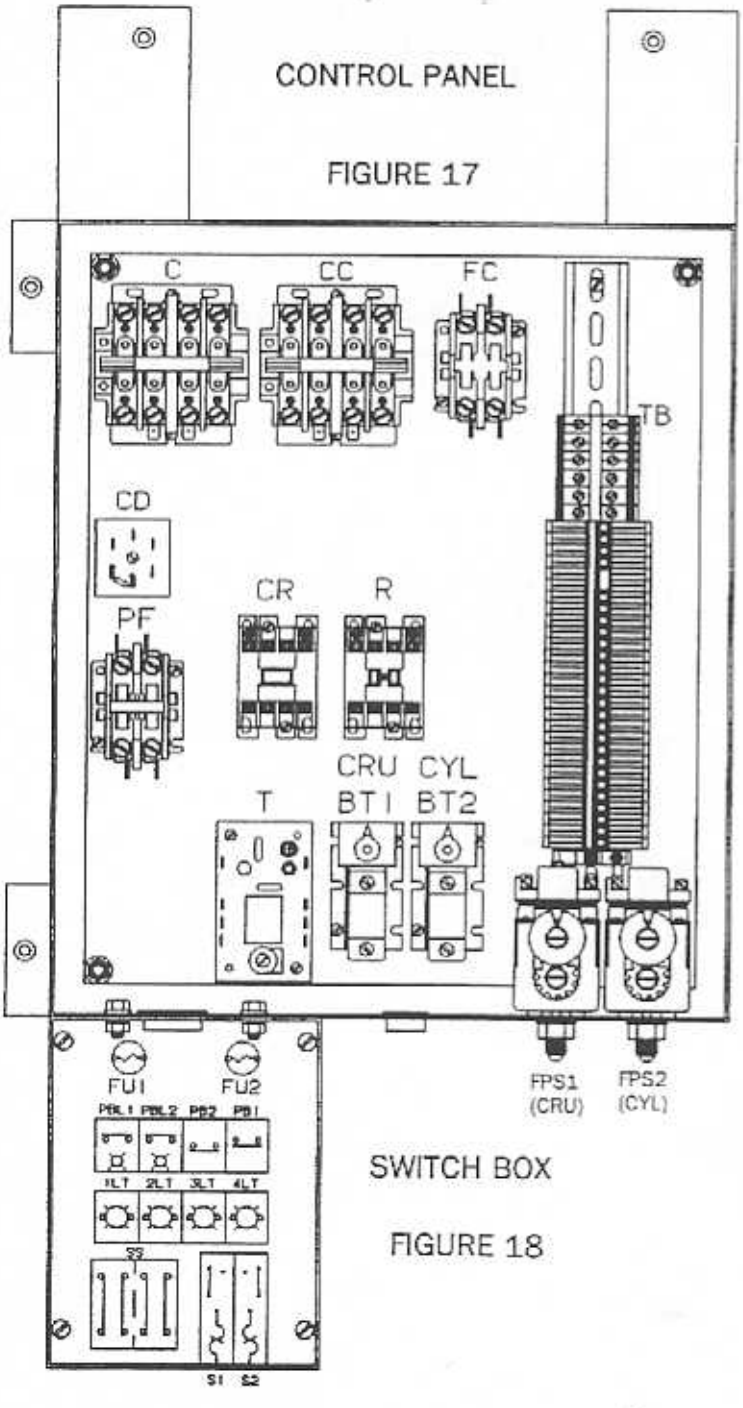
If it becomes necessary to install a new thawing gas valve pressure switch, the following procedure is recommended for its adjustment:

Set the cut-out pressure at 68 psig (CW raises setting). Set the cut-in pressure at 62 psig (CCW lowers setting).

Attach a refrigerant gage to the test connection in the low pressure line near the high/low pressure switch. Adjust the CUT-OUT and CUT-IN during a harvest cycle, using the refrigerant gage for reference.

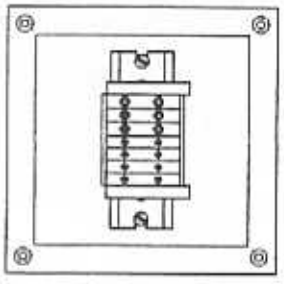
12. Model Number Structure for HE Series Ice Machines





SWITCH BOX

FIGURE 18



POWER INLET BOX

FIGURE 5

POWER INLET BOX PART

TBA - 12A 7501E14000000 - TERMINAL BLOCK

CONTROL PANEL PARTS

BT1 - 12A 2117G02000000 - BIN THERMOSTAT CRUSHED ICE
BT2 - 12A 2117G02000000 - BIN THERMOSTAT CYLINDER ICE
C - 12A 7516E05000000 - COMPRESSER CONTACTOR
CC - 12A 7516E05000000 - CONTROL CONTACTOR
CD - 12A 7503E12000000 - COMPRESSER CONTACTOR
CR - 12A 7517E16000000 - CONTROL RELAY
*FC - 12A 7516E01000000 - FAN CONTACTOR
FPSI - 12A 2117E04000000 - FREEZER PRESSURE SWITCH CRUSHED IC
FPS2 - 12A 2117E04000000 - FREEZER PRESSURE SWITCH CYLINDER ICE
PF - 12A 7516E01000000 - POWER FAILURE CONTACTOR
R - 12A 7517E15000000 - REVERSING FAILURE CONTACTOR
T - 12A 7503E13000000 - THAWING TIMER
TB - TERMINAL BLOCK (SUPPLIED W/CABINET
TB2 - 12A 7501E12000000 - TERMINAL BLOCK

* USED ON AIR-COOLED MODELS ONLY

SWITCH BOX PARTS

FU1 - 12A 7504E10000000 - FUSE 2.5 AMP
FU2 - 12A 7504E10000000 - FUSE 2.5 AMP
PBL1 - 12A 7500E01000000 - ICE/CLEAN LIGHTED PUSH SWITCH
PBL2 - 12A 7500E01000000 - ON/OFF LIGHTED PUSH SWITCH
PB1 - 12A 7500E03000000 - START PUSH BUTTON
PB2 - 12A 7500E02000000 - MANUAL HARVEST PUSH SWITCH
SS - 12A 7500E07000000 - SELECTOR SWITCH
SI - 12A 7515E01000000 - CUTTER OVERLOAD SWITCH
S2 - 12A 7515E02000000 - PUMP OVERLOAD SWITCH
1LT - 12A 7520E10000000 - CYLINDER LIGHT
2LT - 12A 7520E10000000 - CRUSHED LIGHT
3LT - 12A 7520E09000000 - CUTTER OVERLOAD LIGHT
4LT - 12A7520E09000000 - PUMP OVERLOAD LIGHT

14. Capacity Table

Pounds of Ice Per 24 Hours

MODEL	WATER TEMPERATURE					KWH/100 LBS AT 70° F
	90° F	80° F	70° F	60° F	50° F	
HE-10S	900	950	1000	1050	1100	4.50
HE-10M	790	825	870	910	950	5.20
HE-20S	1475	1600	1700	1800	1900	3.44
HE-20M	1290	1390	1450	1510	1575	4.01
HE-30S	2200	2400	2600	2750	2900	2.75
HE-30M	1725	2075	2275	2325	2415	3.21
HE-40S	3400	3600	3800	4000	4200	2.83
HE-40M	2975	3125	3250	3350	3475	3.30

ICE CAPACITIES ARE BASED ON 60 HZ. OPERATING CURRENT AND AN AMBIENT TEMPERATURE NOT EXCEEDING 85° F. REDUCE CAPACITY 17% FOR 50 HZ. OPERATION.

TABLE 6

		SUCTION PRESS (PSIG)		DISCHARGE PRESS (PSIG)		SUCTION SUPERHEAT** DEGREES F		FREEZE TIME * (MIN)	THAW TIME (MIN)	ICE PER CYCLE (POUNDS)	CONDENSER WATER (GPM) TEMP ° F				
		END OF FREEZE	END OF THAW	END OF FREEZE	END OF THAW	MINIMUM DURING FREEZE	MAXIMUM DURING FREEZE				90	80	70	60	50
CYLINDER ICE	HE10S	44	68	200	110	ADJUST THERMOSTATIC EXPANSION VALVE ONLY WHILE MAKING CRUSHED ICE		40	2	43	4.8	2.7	1.5	1.1	0.9
	HE10M	40	68	200	110			54	2	43	4.6	2.6	1.4	1.0	0.8
	HE20S	44	68	200	145			31	2	43	7.2	4.0	2.2	1.6	1.3
	HE20M	41	68	200	135			35	2	43	6.9	3.9	2.1	1.5	1.2
	HE30S	39	68	200	158			19	2	43	14.7	8.4	5.9	4.7	3.8
	HE30M	35	68	200	150			21	2	43	14.3	8.2	5.7	4.4	3.6
	HE40S	31	68	200	160			12	2	43	25.1	14.7	9.5	7.4	5.9
	HE40M	28	68	200	145			15	2	43	24.1	14.1	9.1	7.2	5.7
CRUSHED ICE	HE10S	47	68	200	120	8°	14°	26	2	31	4.8	2.7	1.5	1.1	0.9
	HE10M	45	68	200	120	8°	14°	38	2	31	4.6	2.6	1.4	1.0	0.8
	HE20S	47	68	200	145	8°	12°	21	2	31	7.2	4.0	2.2	1.6	1.3
	HE20M	45	68	200	135	8°	12°	24	2	31	6.9	3.9	2.1	1.5	1.2
	HE30S	42	68	200	155	7°	10°	13	2	31	14.7	8.4	5.9	4.7	3.8
	HE30M	39	68	200	160	7°	10°	16	2	31	14.3	8.2	5.7	4.4	3.6
	HE40S	36	68	200	165	8°	13°	9	2	31	25.1	14.7	9.5	7.4	5.9
	HE40M	30	68	200	165	8°	13°	11	2	31	24.1	14.1	9.1	7.2	5.7

FIRST ICE OUT: WITHIN 15 SECONDS
ALL ICE OUT: WITHIN 90 SECONDS

*BASED ON 70° MAKE-UP WATER TEMPERATURE
**MEASURED STARTING 2 MINUTES AFTER START OF FREEZE

NORMAL OPERATING VITALS

Temperature — Pressure Chart

Refrigerant 22

°F	°C	PSIG
-40	-40.0	0.5
-35	-37.2	2.6
-30	-34.4	4.9
-28	-33.3	5.9
-26	-32.2	6.9
-24	-31.1	7.9
-22	-30.0	9.0
-20	-28.9	10.2
-18	-27.8	11.3
-16	-26.7	12.5
-14	-25.6	13.8
-12	-24.4	15.1
-10	-23.3	16.5
-8	-22.2	17.9
-6	-21.1	19.3
-4	-20.0	20.8
-2	-18.9	22.4
0	-17.8	24.0
2	-16.6	25.6
4	-15.6	27.3
6	-14.4	29.1

°F	°C	PSIG
8	-13.3	30.9
10	-12.2	32.8
12	-11.1	34.7
14	-10.0	36.7
16	-8.9	38.7
18	-7.8	40.9
20	-6.6	43.0
22	-5.5	45.3
24	-4.4	47.6
26	-3.3	49.9
28	-2.2	52.4
30	-1.1	54.9
32	0	57.5
34	1.1	60.1
36	2.2	62.8
38	3.3	65.6
40	4.4	68.5
45	7.2	76.0
50	10.0	84.0
55	12.8	92.6
60	15.5	101.6

°F	°C	PSIG
65	18.3	111.2
70	21.1	121.4
75	23.9	132.2
80	26.6	143.6
85	29.4	155.7
90	32.2	168.4
95	35.0	181.8
100	37.8	195.9
105	40.6	210.8
110	43.3	226.4
115	46.1	242.7
120	48.9	259.9
125	51.7	277.9
130	54.4	296.8
135	57.2	316.6
140	60.0	337.3
145	62.8	358.9
150	65.6	381.5
155	68.3	405.1
160	71.1	429.8

TABLE 8

English — Metric Conversion

In (inches) x 2.54 = cm (centimeters)

Ft. (Feet) x 30.48 = cm (centimeters)

Ft. (Feet) x .3048 = M (Meters)

PSI (POUNDS PER SQ. INCH) x 6.895 = Kpa (Kilopascals)

Gal. (Gallon) x 3.7853 = L (Liters)

TABLE 9

Technical Service Bulletin

No. 88-5

All Models

Subject: Water Conditioning for Ice Cube Machines

The quality of the ice produced by a commercial ice cube machine can only be as high as the quality of the water which is used. Water which contains turbidity or sediment, or which has a high concentration of dissolved minerals or gases, will produce cloudy or opaque ice.

Ion exchange (zeolite) softening is used to advantage in many cases, as the softener removes iron and most forms of turbidity, and also prevents scale formation in the ice machines. However, softening the water by ion exchange does not reduce the concentration of minerals. In addition, most machines require a considerable blowdown to waste to prevent the buildup of the total dissolved solids, and thus a considerable amount of softened water will be wasted.

All the sulphates, chlorides and the sodium carbonate (listed below) have in general, the same effect on the appearance of raw water ice and therefore, in this rough tabulation, can be grouped together.

Generally, the sodium carbonates can be considered 1 1/4 times as objectionable as the sulphates, and the chlorides about 3/4 as objectionable as the sulphates. Therefore, total the sulphates and chlorides separately and apply the factors:

Calcium Sulphate	Calcium Chloride
Magnesium Sulphate	Magnesium Chloride
Sodium Sulphate	Sodium Chloride
Sodium Carbonate	

Total Sulphates x 1.0 = _____

Total Chlorides x 0.75 = _____

Sodium Carbonate x 1.25 = _____

Sum Total = _____

Dissolved solids below 171 ppm (10 grains per gallon) produces first quality ice, 256 ppm (15 g.p.g.) good quality ice, and 342 ppm (20 g.p.g.) an ice that is still marketable. If dissolved solids are between 342 ppm and 684 ppm (40 g.p.g.), acceptable ice quality is questionable, over 684 ppm, marketable ice cannot be expected.

When cloudy or opaque ice is produced because of the water quality, it is suggested that the water be analyzed by a reputable laboratory and their advice be followed.

Henry Vogt Machine Co.
Louisville, Kentucky
Herb Just
5-12-88

VOGT® TUBE-ICE® MACHINE
BASIC PRODUCT WARRANTY

The Henry Vogt Machine Co., hereinafter referred to as Seller, warrants every Vogt Tube-Ice Machine Model HE10, HE20, HE30, HE40, P118F and P218F to be free from defects in material and workmanship, if properly installed, maintained and operated, for a period of 24 months from date of original installation or 27 months from date of shipment from Seller's plant.

Seller's obligation under this warranty shall be strictly limited, at Seller's option, to: (i) repairing or furnishing replacement parts on an exchange basis, F.O.B. Louisville, Kentucky, without charge to the purchaser or original end-user, hereinafter referred to as Purchaser; or (ii) issuing written authorization for Purchaser or others to replace or repair, without charge to Purchaser, those parts proven defective upon examination by Seller; or (iii) in discharge of Seller's maximum liability herewith, refunding all monies paid by Purchaser to Seller for the product and, at discretion of Seller, having the product removed and returned to Seller at Purchaser's expense. All transportation charges relative to corrective work, defective parts or replacement parts shall be borne by Purchaser. Purchaser shall give Seller immediate notice upon discovery of any defect. The undertaking of repairs or replacement by Purchaser or its agents without Seller's written consent shall relieve Seller of all responsibility herewith.

Any alteration in material or design of Seller's product or component parts thereof by Purchaser or others without written authorization by Seller voids all obligations of Seller regarding the product and any associated warranty herein stated or implied.

Seller's sole liability shall be exclusively as set forth herein, and **Seller shall not be liable for any incidental or consequential damages due to its breach of any warranty herein contained, or otherwise.** *Without limitation to the foregoing, in no event shall Seller be liable for the loss of use of the product or for the loss of use of any other product, process, plant, equipment, or facilities of the Purchaser whether partially or wholly due to defects in material and / or workmanship and / or design of Seller's product, and in no event shall Seller be liable for removal of appurtenances or incidentals such as connections, pipe work and similar items of obstruction or for any cost brought about by the necessity of removing the product from its point of installation.*

Sellers makes no warranty of any kind whatsoever, express or implied, other than as specifically stated herein; and there are no warranties of merchantability and / or fitness for a particular purpose which exceed the obligations and warranties specifically stated herein.

Parts furnished without charge as replacements for original parts under warranty are warranted for that period of time during which the original parts warranty is effective.

FIVE-YEAR EXTENDED WARRANTY

At the termination of the two-year warranty period above, Seller hereby extends this warranty for three years to cover **COMPRESSORS AND CUTTER ASSEMBLIES, EXCLUDING THE CUTTER BEARINGS AND DRIVE TRAINS.**

LIFETIME WARRANTY *

This warranty is further extended for the life of the machine to cover the EVAPORATOR (FREEZER), FRAME, CIRCULATING WATER TANK AND REFRIGERANT RECEIVER, EXCLUDING GAGE GLASS ASSEMBLIES AND VALVES. Damage to evaporator tubes as a result of expansion caused by re-freezing of ice or corrosion damage due to water quality is specifically excluded.

These extensions of warranty apply only to **VOGT TUBE-ICE® MACHINE MODELS HE10, HE20, HE30, HE40, P118F, AND P218F** and only those **IN USE IN THE UNITED STATES OF AMERICA,** for the exclusive benefit of Purchaser or original end user, as defined above. All other obligations, terms and conditions of the Basic Product Warranty apply to the Extended Warranty.

* "Lifetime" is defined as 25 years.