

Introduction

This is the manual for the SCOTSMAN MAR SPLIT UNITS models MAR1400 and MAR2000. They are designed to operate only with fresh water.

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MAR1400 & MAR2000

Specifications

The standard machine includes a stainless steel cabinet, a 230 volt, 60 Hz, single phase drive motor, automatic expansion valve, heat exchanger, float reservoir, time delay switch, bin thermostat, water pump, ice spout switch, liquid line solenoid valve, EPR valve and low water pressure cut out.

The condensing unit, interconnecting refrigerant tubes and electrical system must be supplied by the purchaser as per the instructions given in this service manual.

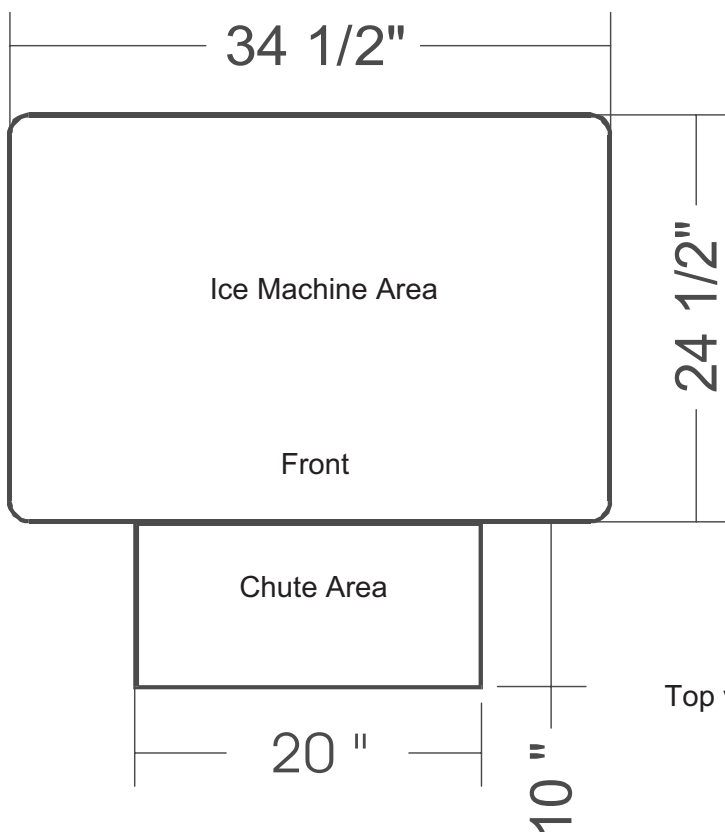
Take time now and read this manual which contains valuable information on the MAR Split System. For any further questions regarding the care or operation of the machine, please contact your local Scotsman distributor or call 1-800-533-6006.



MAR Unit, shown without chute

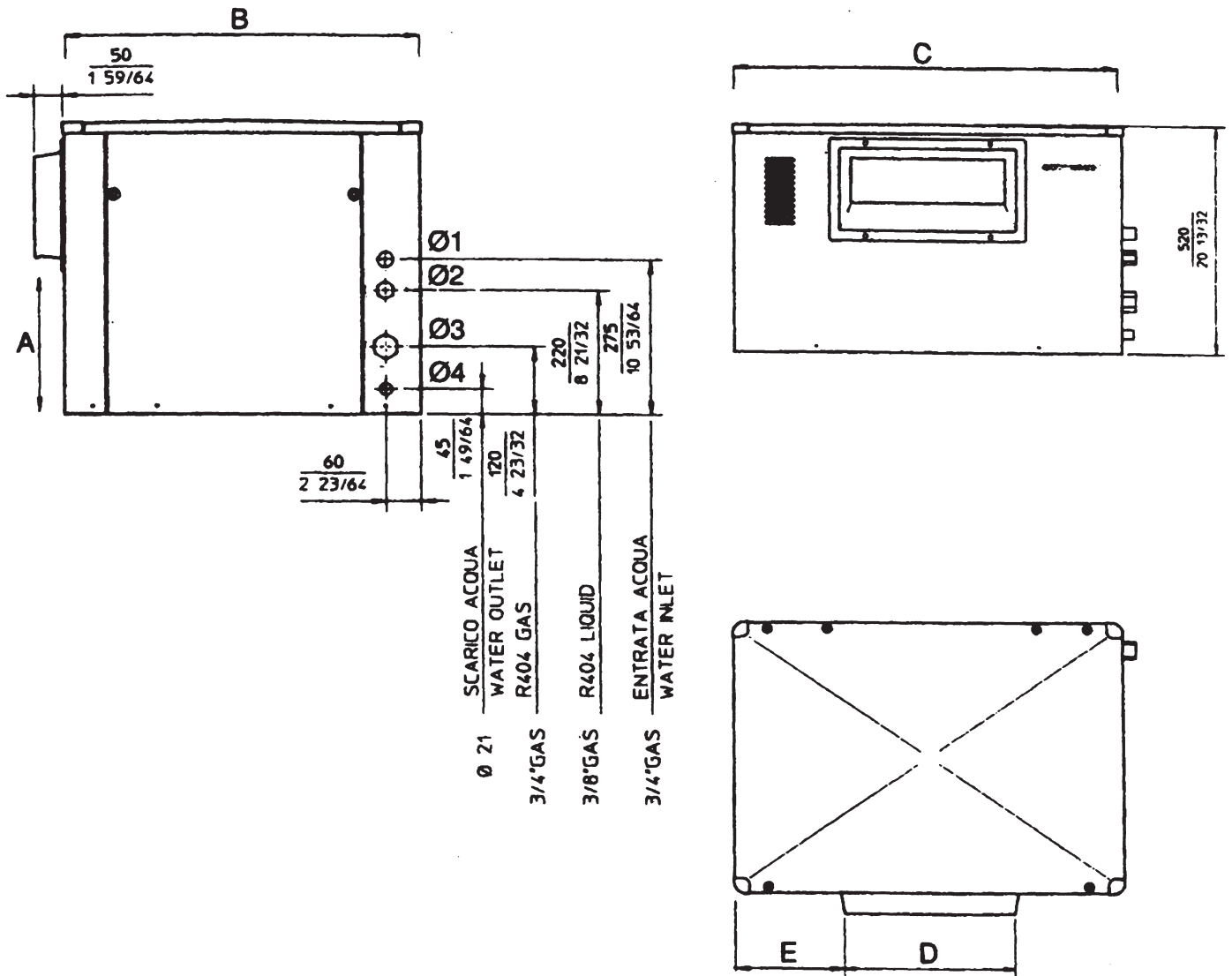
Basic Specifications

Model	Basic Electrical	Maximum Fuse Size	Minimum Circuit Ampacity
MAR1400RL-32A	208-230/60/1	15	2
MAR2000RL-32A	208-230/60/1	15	2



Top view of unit and chute.

MAR1400 & MAR2000



	A	B	C	Ø1 Water Inlet Fitting	Ø2 Liquid Line	Ø3 Suction Line	Ø4 Drain
MAR1400 OR MAR2000	876 mm (34.49")	621 mm (24.49")	876 mm (34.49")	3/4" Hose Coupling Thread*	3/8" **	5/8" **	21 mm

* Adapter shipped inside unit to go to 3/8" male flare.

** Line sizes may need to be larger, depending upon length of run.

MAR1400 & MAR2000

MAR1400

Set for Fresh water Operation

IMPORTANT OPERATING REQUIREMENTS:

WATER LEVEL IN DRUM RESERVOIR

- 115-120 mm (4.5 to 4.75 inches)

DRUM ROTATING SPEED

- 1.5 RPM (thick ice)
- 2.3 RPM (thin ice)

REFRIGERANT:

- R-404A

REQUIRED CONDENSING CAPACITY

- 4800 Kcal/h at -24°C Evap. Temp. (19,000 BTUH at -11°F)

WATER PRESSURE CONTROL SETTING

- 0.8 Bar (11 PSIG)

MAX. WATER TEMPERATURE

- 35 °C (95°F)

MIN. WATER TEMPERATURE

- 5 °C (41°F)

MIN. WATER PRESSURE

- 1 atm. (15 PSI)

MAX. WATER PRESSURE

- 5 atm. (75 PSI)

MIN. AMBIENT TEMPERATURE

- 5 °C (41°F)

MAX. AMBIENT TEMPERATURE

- 40 °C (104°F)

MAX. VOLTAGE VARIATION

- ± 10%

Suggested Condensing Unit Settings:

HEAD PRESSURE SETTING

- 15 Bar (218 PSIG) on air cooled and water cooled units

LOW PRESSURE SETTING

- 1.6 Bar (23 PSIG) on air cooled units

HI-PRESSURE CONTROL SETTING

- 36 Bar (522 PSIG)

LO-PRESSURE CONTROL SETTING

- 0.2 Bar (3 PSIG)

MAR2000

Set for Fresh water Operation

IMPORTANT OPERATING REQUIREMENTS:

WATER LEVEL IN DRUM RESERVOIR

- 115-120 mm (4.5 to 4.75 inches)

DRUM ROTATING SPEED

- 2.4 RPM (thick ice)

REFRIGERANT:

- R-404A

REQUIRED CONDENSING CAPACITY

- 6500 Kcal/h at -24°C Evap. Temp (26,000 BTUH at -11°F .)

WATER PRESSURE CONTROL SETTING

- 0.8 Bar (11 PSIG)

MAX. WATER TEMPERATURE

- 35°C (95°F)

MIN. WATER TEMPERATURE

- 5°C (41°F)

MIN. WATER PRESSURE

- 1 atm. (15 PSI)

MAX. WATER PRESSURE

- 5 atm. (75 PSI)

MIN. AMBIENT TEMPERATURE

- 5°C (41°F)

MAX. AMBIENT TEMPERATURE

- 40°C (104°F)

MAX. VOLTAGE VARIATION

- $\pm 10\%$

Suggested Condensing Unit Settings

HEAD PRESSURE SETTING

- 15 Bar (218 PSIG) on air cooled and water cooled units

LOW PRESSURE SETTING

- 1.6 Bar (23 PSIG) on air cooled units

HI-PRESSURE CONTROL SETTING

- 36 Bar (522 PSIG)

LO-PRESSURE CONTROL SETTING

- 0.2 Bar (3 PSIG)

MAR1400 & MAR2000

General information

Each MAR1400 or MAR2000 is an "Evaporating Unit Section", complete with driving mechanism and control devices, encased in a stainless steel cabinet. They only require a condensing unit to make a complete scale-ice maker system. Because they must be remotely connected to a properly sized Condensing Unit, it is very important that the right type and size of all the components be used to complete the refrigerant system. It is also very important that highly skilled refrigeration technicians be used to complete the system by making the refrigerant, water supply, drain and electrical connections.

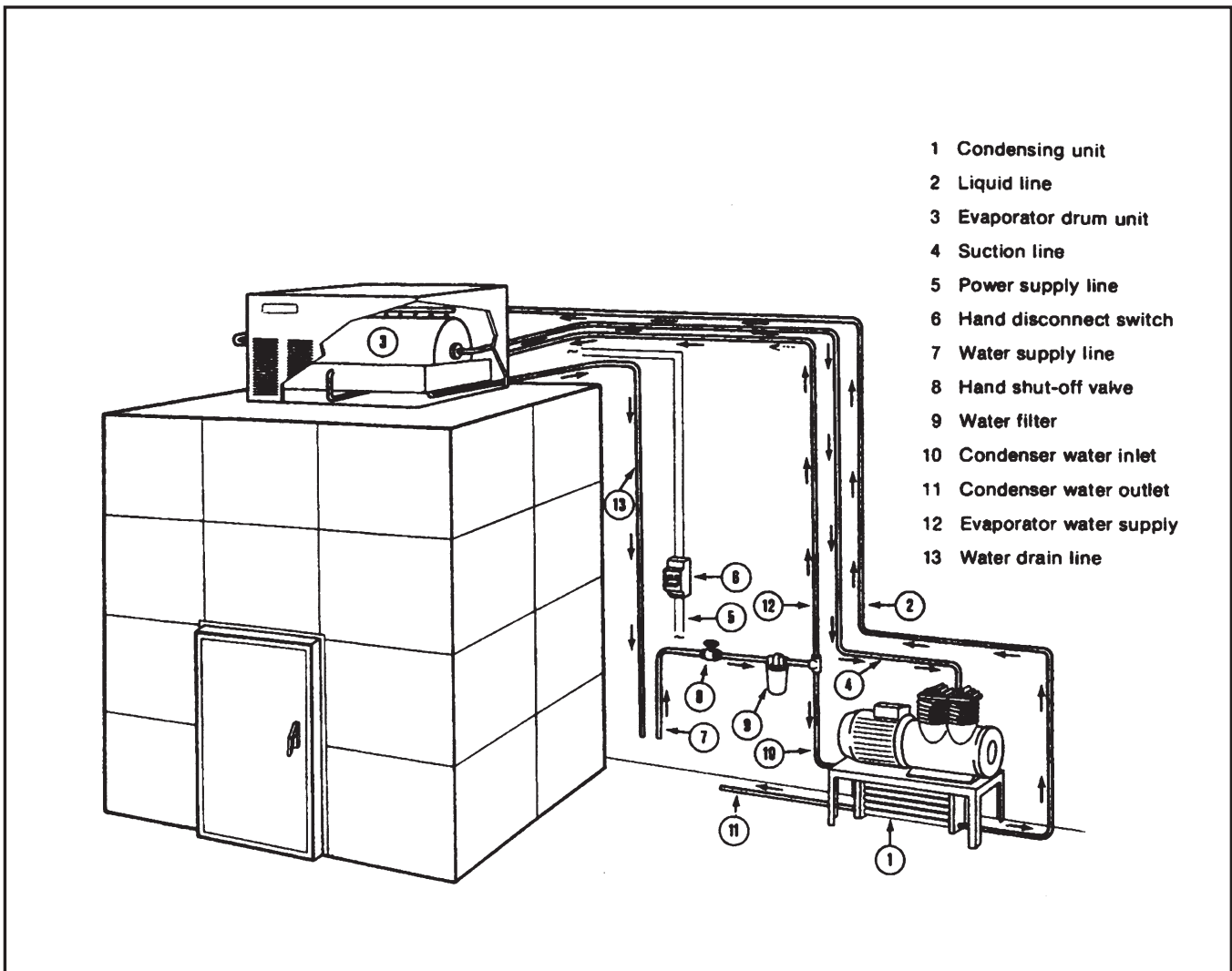
APPLICATIONS

The MAR units produce scale ice. Scale ice is a dryer and colder form of the familiar flake ice. The MAR split unit is a remote low side system. A remote low side allows more flexibility in placement of the ice machine section.

Some specific applications include:

- a) Fishing Vessels
- b) Fish Markets and Fish Processing Plants
- c) Supermarkets
- d) Meat packaging plants

Basically they can go in any place where there is a limited space situation or where the condensing unit (compressor/condenser) must be located in a room where noise and heat is not objectionable. MAR Split can be set to produce "THICK ICE" generally used in the fishing industry or the MAR1400 can be set to produce "THIN ICE" generally used in the meat processing industry. Standard versions are set for "THICK ICE" production (about 2 mm or 5/64" thickness) and for fresh water operation.



Complete System Installation

How it is made

The complete scale-ice making system can be divided in three major groups, they are:

- a) the condensing unit or rack system
- b) the evaporator drum unit (MAR1400 or MAR2000) complete with drive mechanism, drive motor, refrigerant and water lines fittings, refrigerants expansion valve and electric wire junction box.
- c) control panel and box with compressor ON/OFF switch, relay, timer, warning lights, pressure switches and electrical wire terminal block, connected to and controlling the condensing unit.

CONDENSING UNIT COMPONENTS - For Reference Only

The condensing unit is not part of the MAR1400 or MAR2000. They must either be connected to an existing rack system or a separate condensing unit.

The selection of proper type and size of compressor together with the proper type and size of condenser, their components and controls, is critical for proper system operation.

The available capacity of the system must equal at least

- 4800 Kcal/h at -24°C Evap. Temp. (**19,000 BTUH** at -11°F) refrigerating capacity for the MAR1400
- 6500 Kcal/h at -24°C Evap. Temp (**26,000 BTUH** at -11°F.) refrigerating capacity for the MAR2000

Dedicated Condensing Units: Suggested Models

MAR1400: Use MAR1400-RHS-A/C (air cooled) or MAR1400-RHS-W/C (water cooled)

MAR2000: Use MAR2000-RHS-A/C (air cooled) or MAR2000-RHS-W/C (water cooled)

Condensing Unit Component Guidelines

The **condenser** is basically a heat exchanger where the heat absorbed by the refrigerant during the evaporating process is discharged to the condensing medium, which could be air or water.

Water cooled condensers require the use of a water regulating valve. When using a marine type condenser a marine type water regulating valve is required. The required capacity of the condenser is about 30,000 BTUH for the MAR1400 and 39,000 for the MAR2000.

Particular care must be deserved to the selection of the water cooled condenser especially the marine type for fishing vessels installation. They must be marine type (cupro-nickel).

The **Liquid receiver** is a storage tank for liquid refrigerant. It is a common component used in refrigeration and should be large enough to hold all the refrigerant in the system.

A suggested component for some installations an oil separator. When the compressor operates small amount of oil is pumped out along with the hot compressed vapor and to prevent it from going any further in the system, the oil separator traps it to return, upon opening of its float valve, to the crankcase of the compressor.

Length of Tubing Run	Suction Line	Liquid Line
4 to 15 meters (11 to 50 feet)	18 mm ID (3/4" OD)	12 mm ID (1/2" OD)
Less than 3 meters (10 feet)	14 mm ID (5/8" OD)	14 mm ID (3/8" OD)

MAR1400 & MAR2000

Condensing Unit Component Control Devices

The scale-ice maker refrigeration system must have certain safety devices and controls in order to fully protect it, however an excess of automatic controls and protections may complicate the situation.

In order to help the installer to decide with which controls to use, a description of typical controls and their positive and negative points is listed below.

High Pressure Control

Strongly recommended for a condensing unit. Set to values shown on tech. spec.

Lo Pressure Control

Recommended for a condensing unit. Very important because in case of refrigerant leaks at the evaporator, it prevents the operation of the machine when the evaporator is in a vacuum. Operating the evaporator in a vacuum could draw into the system water from the drum reservoir. Vacuum could also cause air inflow through the compressor crank-shaft seal.

However, it may trip-out at system start-up and if the suction operating pressure is very close to the cut out point, it may trip out then as well.

Location Consideration

WARNING - MAR SCALE ICE MAKERS are not designed for outdoor installations where air temperature falls below 5°C (40°F) or may exceed 40°C (100°F)

Operating a machine with an unacceptable configuration will void the refrigeration system warranty.

For installation on board of fishing vessels, the location for the condensing unit is generally the engine room, while the evaporator unit can be permanently placed in some area of the deck-house or, if it is not too cold (not below 5°C or 40°F.), inside the fish and ice hold.

If the MAR unit will be mounted to a fabricated stand, it must be adequately fastened to it.

The stand must also be sturdy so it does not cause excessive vibration and must be able to be securely fastened to the wall or to the floor.

Placement of the MAR unit must take into consideration where the ice is discharged and what type of container (ice storage bin or walk-in) will be used.

REFRIGERANT LINES

The diameter of refrigerant lines going from condensing unit to evaporator unit and back must be of adequate size in relation to tubing length.

The table below show the recommended sizes of refrigerant lines:

Note: The tubing connections at the MAR unit are **3/8" liquid and 5/8" suction.**

Insulate any lines that will be exposed to temperatures that will be below freezing for extended periods of time.

Follow straight line routing, when possible, however pitch the suction line 2 cm per meter or 3/4" per yard.

Do not restrict the liquid line. Bends and fittings should be the minimum necessary as they can increase the resistance to the fluid flow.

If using a semi-hermetic compressor, the use of vibration absorbers near the condensing unit will help to reduce condensing unit vibration traveling into the lines.

Because the appearance of an installation is important, the piping should be put-in as neatly as possible.

For best sound absorption, it is best to put-in two absorbers in each line, one vertically and one horizontally.

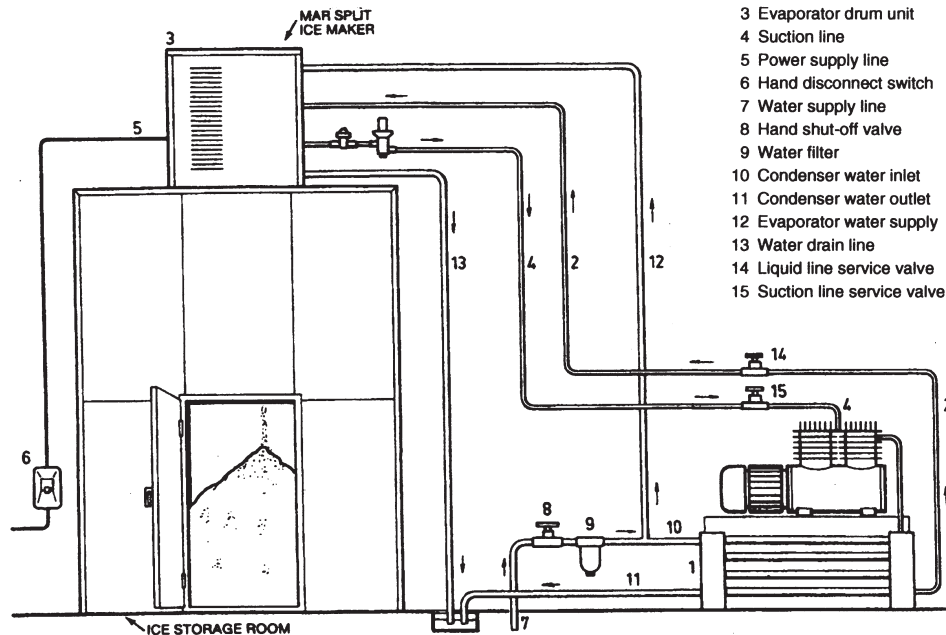
For evacuation and charging operations two service valves must be provided. One on the liquid line and one on the suction line.

A drier and a sight glass should be installed in the liquid line at the condensing unit.

Length of Tubing Run	Suction Line	Liquid Line
4 to 15 meters (11 to 50 feet)	18 mm ID (3/4" OD)	12 mm ID (1/2" OD)
Less than 3 meters (10 feet)	14 mm ID (5/8" OD)	14 mm ID (3/8" OD)

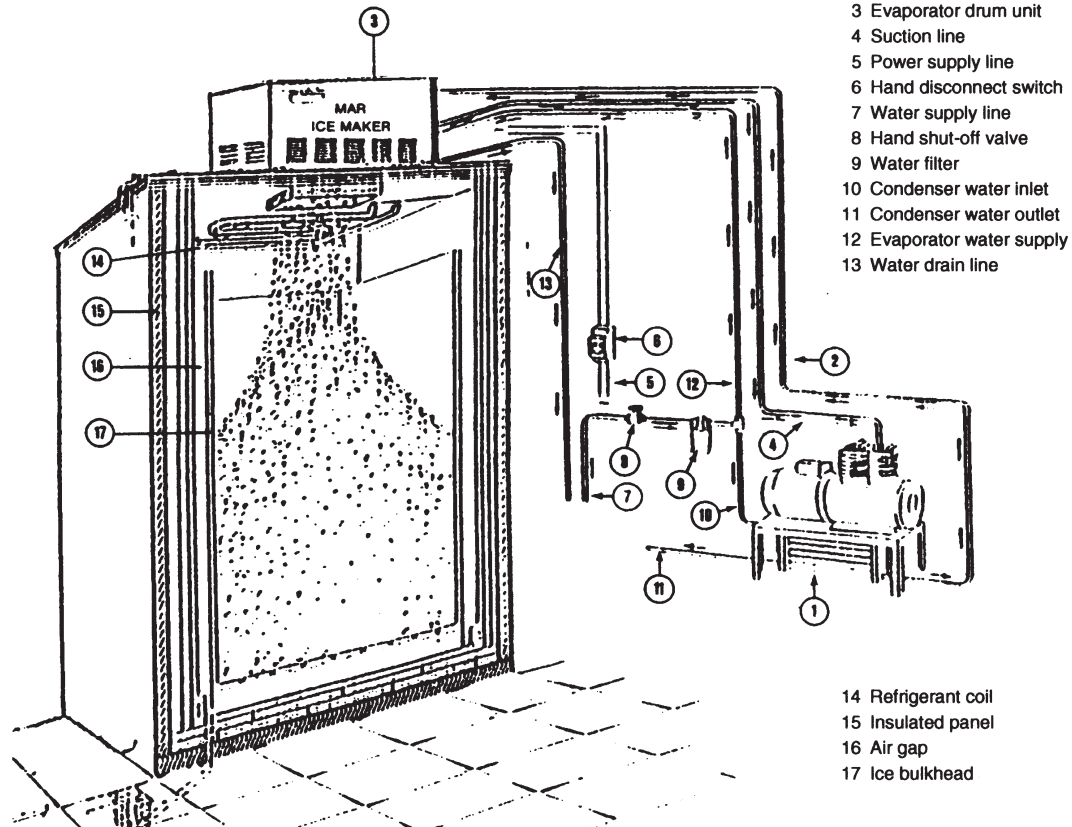
Installation Diagrams

NON REFRIGERATED ICE STORAGE ROOM



- 1 Condensing unit
- 2 Liquid line
- 3 Evaporator drum unit
- 4 Suction line
- 5 Power supply line
- 6 Hand disconnect switch
- 7 Water supply line
- 8 Hand shut-off valve
- 9 Water filter
- 10 Condenser water inlet
- 11 Condenser water outlet
- 12 Evaporator water supply
- 13 Water drain line
- 14 Liquid line service valve
- 15 Suction line service valve

REFRIGERATED ICE STORAGE ROOM (Jacket system)



- 1 Condensing unit
- 2 Liquid line
- 3 Evaporator drum unit
- 4 Suction line
- 5 Power supply line
- 6 Hand disconnect switch
- 7 Water supply line
- 8 Hand shut-off valve
- 9 Water filter
- 10 Condenser water inlet
- 11 Condenser water outlet
- 12 Evaporator water supply
- 13 Water drain line

Water Circuit

The ice machine must have an adequate water supply. Connect a water supply to the ice making section and to the condensing unit case a water cooled condenser is being used. Separate water lines are recommended with hand shut-off valve and water filter on individual line.

Remember:

- Maximum Water Temperature 35°C (95°F.)
- Minimum Water Temperature 5°C (40°F.)
- Minimum Water Pressure 1 atm (15 PSI)
- Maximum Water Pressure 5 atm (75 PSI)

MAR1400 requires 29 lt/hr (7.7 gallons/hour) of constant water supply for ice making.

MAR2000 requires 42 lt/hr (11 gallons/hour) of constant water supply for ice making.

For installation on fishing vessels, using seawater, to carry sea water from sea chest to the condensing unit and to evaporating unit through appropriate strainers, you may use aluminum brass pipes or PHE plastic pipes to avoid corrosion problems.

Never use copper tubes with sea water.

ICE STORAGE BINS

The ice storage bin for a MAR unit must be designed for use with the MAR. The ice chute position and the physical size of the cabinet must be accounted for. In some cases the MAR must be positioned with its side panel to the front of the bin.

See sales literature for more information.

ICE STORAGE ROOM

Ice storage situations are of two kinds:

- a) Short term storage
- b) Extended term storage

The scale ice made by MAR machines is flat, dry and subcooled, so there is some tendency for the ice to stick together. To improve ice handling, particular attention is required for proper ice storage conditions. An insulated ice storage bin or room is always required, then according to ice end use application, this can be refrigerated or non-refrigerated.

Also a weight volume ratio of 2,1 cubic meters per 1000 Kg of ice (30 lb per cubic foot) must be taken into consideration for correct ice storage.

a) Non-refrigerated room for short term storage

Ice can be produced continuously for 24 Hours per day, however the use period is generally for no longer than 8 hours per day. Therefore storage facilities should be provided for a minimum of 16 hours of production, or the amount required during a peak use period. This means that every MAR ice machine must be installed with a properly insulated storage room which should have a minimum capacity of 2/3 the daily ice production.

With a well insulated room and duly subcooled scale ice, the limited losses of heat through the walls of a properly designed room with adequate arrangements are largely offset, and excess melting will not occur. In most situations where whole quantity of ice produced is being used on a daily basis, it is not necessary to provide cooling for the ice storage room.

b) Refrigerated room for extended storage and long distance conveying

When scale ice is to be transported at a considerable distance, such as aboard fishing vessels, or in locations with normal ambient temperatures conditions, or when used in industrial plants where demand is intermittent, its subcooling power must be preserved in the storage bin by a proper cooling system keeping air temperature at a pre-established and constant value. The ideal ice storage room is the type with mechanically refrigerated jacket space surrounding the ice bin.

Good practice calls for an ice storage capacity of about two times the daily ice machines production with an inside temperature of -6°C minimum (20°F).

MAR1400 & MAR2000

Installation

MAR SPLIT UNIT - UNPACKING AND INSPECTION

1. Visually inspect the exterior of the shipping container and skid. Any severe damage noted should be reported to the delivery carrier and a concealed damage claim filled subject to internal inspection with the carrier representative present.
2. Remove the packing and remove the side panels, then remove the shipping bolts securing the unit to the skid.
3. Remove screws and all panels from cabinet and inspect for any concealed damage. Notify carrier of any concealed damage claims as stated in step 1 above.
4. Remove all internal packing from unit compartment.
5. Check that refrigerant lines do not rub or touch lines or surfaces and that all wires are securely fastened to their terminals.
6. Use clean damp cloth or disposable paper towel to wipe the exterior surface of the cabinet clean.
7. See DATA PLATE on the cabinet base and check that the location source voltage corresponds with the voltage specified on the data plate.

CAUTION - Improper voltage supplied to the ice maker will void the warranty.

LOCATION AND LEVELING

1. Position the MAR SPLIT UNIT in the selected permanent location which could be on top of ice storage bins, on the side of cold storage room supported by special pre-set stands or, in case of fishing vessel installation, inside or on top of the fish hold.

Note: See sales information for suggested bin applications. **Most will require the MAR unit to be placed sideways on the bin's top.**

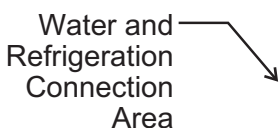
See illustration at the bottom of this page.

2. After having placed the unit on the support stand or bin, place thin rubber pads between the ice machine base and the stand to level the cabinet on both the left to right and front to rear directions. There are holes in the base of the cabinet, use them to secure the unit to the stand with the appropriate (stainless steel) bolts.

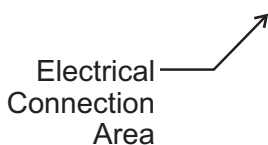
Make sure to leave enough space around the unit to allow access to internal components for inspection and servicing and also for the fitting of the ice chute.

3. If installing a separate condensing unit, position the condensing unit in its location and to mount it firmly to avoid a sudden shift that would endanger the refrigerant lines. Precautions to be observed vary with the kind of situation in which the unit is to be placed. The area should be well ventilated to permit escape of refrigerants in case unit develops a leak.

Water and Refrigeration Connection Area



Electrical Connection Area



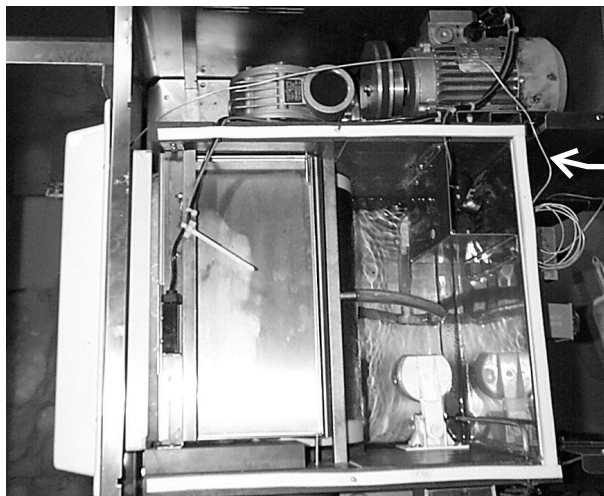
MAR Unit

Chute

Top View of MAR on 60" w x 40" d bin

Bin Thermostat

1. Remove bin thermostat bulb from its shipping position (on side of control box).
2. Remove the top panel of the ice machine.
3. Route the thermostat across the top of the ice machine to the chute (packed separately).
4. Route thermostat bulb between plastic chute and opening in front panel for the chute.
5. Insert cable tie mounts into holes in bottom of chute.



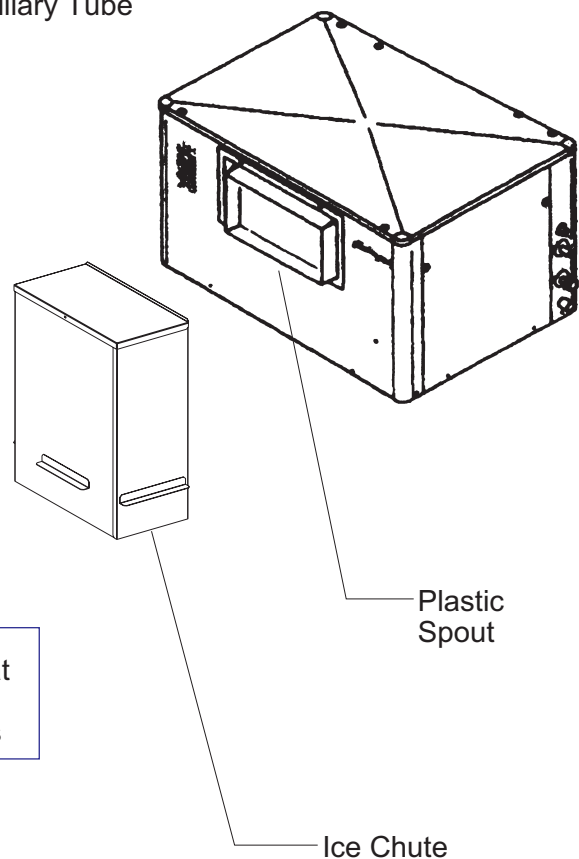
Top View of Unit, Reservoir Cover Removed

ICE CHUTE

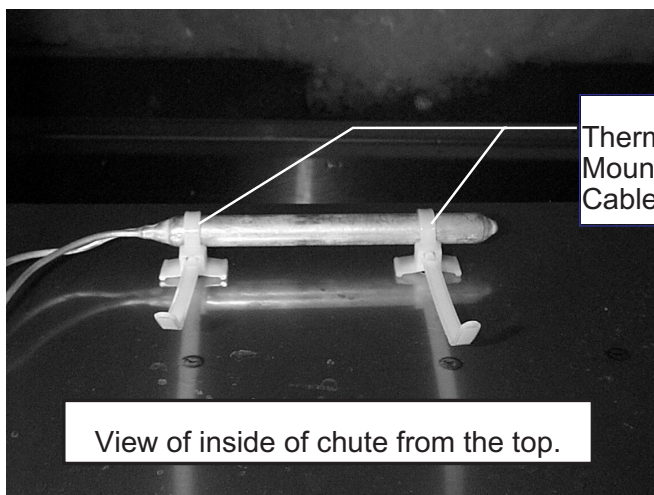
The ice chute is packed separately, and must be connected to the ice machine after it has been positioned on the ice storage bin.

1. Position the chute in front of the ice machine.
2. Install thermostat (see above).
3. Insert chute into hole in bin top.
4. Align chute cut out with plastic spout of ice machine.
5. Place cover on chute - lip on cover will insert behind front edge of top panel.
6. Return all panels to their original positions.

Thermostat
Capillary Tube



6. Insert bulb of thermostat through loops in cable tie mounts, pull loops to secure bulb.



7. Position excess capillary tube so that it is above the control box, not in chute or machine compartment.

MAR1400 & MAR2000

Component Assembly

1. Install the ice chute.
2. Route the bin thermostat from its shipping position on the control box to the ice chute.
3. Install the bin thermostat bulb in the ice chute.

MAR SPLIT UNIT - REFRIGERANT PIPING CONNECTION

Fitting sizes:

Liquid Line	Suction Line
3/8"	5/8"

Note: Connect the proper size tubing according to the length of run. **Runs longer than 10 feet will require larger diameter tubing than these connection sizes.**

The MAR unit is shipped with a small holding charge of R-404A. Recover this charge before connecting the refrigeration tubing.

Take extreme care to keep refrigeration tubing clean and dry prior to installation.

Following procedure should be followed:

- a) Do not leave dehydrated compressor or filter-drier open to the atmosphere any longer than it is absolutely necessary. (One or two minutes maximum suggested).
- b) Use only refrigeration grade copper-tubing, properly sealed against contamination.
- c) Permanent suction line filter and liquid line filter-driers are recommended in all field installed systems.
- d) When brazing refrigerant lines, an inert gas must be passed through the line at low pressure to prevent scaling and oxidation inside the tubing. Dry nitrogen is preferred.
- e) Line connections to vibration eliminators must be made with silver solder alloy. Arrange that refrigerant lines run along the walls and ceilings and be supported at intervals frequent enough to keep tubing straight and firmly in place. In all cases the tubing should be run horizontally and vertically with neat looking bends of as perfect radius as possible.

The liquid line is not critical regarding its slope and position, but the suction line must be installed so the tubing will drain toward the compressor.

After all lines are connected, the entire system must be leak tested.

The complete system should be pressurized to no more than 11 atm (170 PSIG) with a trace of R-22 refrigerant and dry nitrogen for leak testing with an electronic type leak detector.

For pressurizing, evacuating and charging the system, two service valves are necessary; one should be in the Suction Line at the inlet side of suction filter and one should be in the Liquid Line at the outlet side of filter dryer.

The two Service Valves, if properly capped, can be left permanently in the system. Connection should be 3/8" or 1/2" size.

WATER PIPING CONNECTIONS (PLUMBING)

The MAR is supplied with float valve that maintains the water level in drum reservoir at the height required for fresh water operation or if required, for sea water operation. The water inlet line connects directly to the float valve line fitting which is 3/4" hose coupling thread, (copper tubing is not recommended for sea water supply).

Note: An adapter fitting to go from 3/4" hose coupling thread to 3/8" male flare is packed inside the MAR unit.

Make sure to use a hand shut-off valve close enough to MAR unit and a proper kind and size of filter strainer.

Incoming water goes through the float reservoir first and then to drum basin.

The drain water line should be shaped adequately to drain by gravity any water passing through it.

Water drain fitting from float reservoir requires a 20 m/m I.D. (3/4" ID) water hose.

All plumbing connections should be made in accordance with local plumbing codes.

Electrical Connection

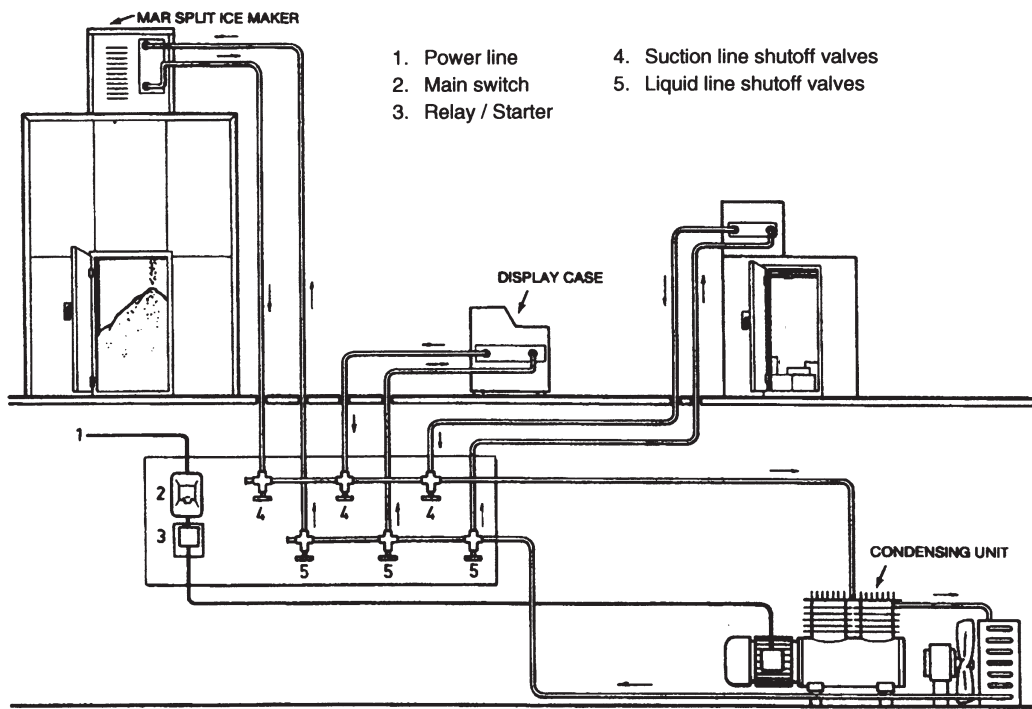
The supply power, voltage frequency and phase must coincide with unit nameplate. MAR Split units are internally wired and ready for field wiring connections which must be made in accordance with any local codes that may apply. Wires should be of adequate size to handle the connected load, individually fused (see specifications) and provided with ground line.

The maximum allowable voltage variation must not exceed ten percent of the nameplate rating, even under starting conditions. Low voltages can cause erratic operation and may be responsible for serious damages to the overload switch and motor windings.

Connect power to terminals 3 and 4 on the terminal strip.

Dedicated Condensing Unit:

Follow all applicable codes.



MAR1400 & MAR2000

Multiple Installations

In a multiple installation various types of commercial refrigerating equipment are connected to the same condensing unit.

The MAR can be one of the refrigeration units connected to a multiple-use condensing unit or rack. **Hand shut-off valves** on both liquid and suction line is recommended for these installations. One to be placed on the liquid line and the other on suction line to isolate MAR SPLIT unit when necessary.

Suction and Liquid line access valves must be installed in the MAR circuit to evacuate its system.

In many multiple installations check valves are put in the suction line of the coldest evaporator to prevent warmer higher pressure low-side vapor from moving into the colder evaporator during the off periods.

The MAR liquid line connection must NOT be connected downstream of any other unit's liquid line solenoid valve to insure that the MAR receives refrigerant when it is required.

Installation of MAR SPLIT in multiple system should be done in the following order.

1. Put MAR SPLIT unit in place.

See Location & Leveling.

2. Install valves and controls.

3. Install tubing.

See Refrigerant piping connections.

4. Make water piping connections.

See Plumbing.

5. Make electrical connections

See Electrical connections.

6. Check for leaks.

See Leak Test.

7. Dehydrate (evacuate) installation.

See Evacuation / Charging.

8. Start unit.

See Operational Check-out.

Testing

COMPLETE SYSTEM LEAK TESTS

During pressure testing for leaks, keep the compressor suction service valve and discharge service valve closed to prevent air and moisture from entering the compressor. All other valves in the system must be open. Add just enough liquid refrigerant R-22 to the system to raise the pressure slightly, then add dry nitrogen to obtain the desired test pressure (11 atm or 170 PSIG is sufficient).

Leak testing shall be performed with an electronic leak detector. Refrigeration piping will not be acceptable unless it is gas tight.

If any leaks are found, isolate the defective area, discharge the gas and repair the leaks and then repeat the test. When testing has been completed release all pressure freely to atmosphere.

COMPLETE SYSTEM EVACUATION

Use a vacuum pump that has a capacity of pulling a vacuum of 50 microns or less.

Evacuation of the system must never be done by the use of the refrigerant compressor. The vacuum pump should be connected to both the low and high side evacuation valves with vacuum hoses. The hand valves should remain closed to isolate the new part of the system from the rack. A high vacuum gauge capable of registering pressure in microns should be attached to the system.

Evacuate the system to 300 microns.

CHARGING: DEDICATED SYSTEM

When a dedicated condensing unit (a condensing unit that is only used by the MAR flaker) is used, charge the system through the fitting in the liquid line. Weigh the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side on the compressor, charge in vapor form only. Charge the system until the sight glass in the liquid line shows a clear flow of liquid refrigerant.

Bubbles or foam usually indicate insufficient refrigerant, even if there could be other reason for the bubbles or foam to appear in the sight glass. So, the practice to rely on the sight glass only to determine whether the systems is correctly charged is certainly good but not fully positive.

After the final leak test, refrigerant lines exposed high ambient conditions should be insulated to reduce heat pick-up and prevent the formation of flash gas in the liquid lines.

Suction line should be insulated if exposed, to prevent condensation.

CHARGING: RACK SYSTEM

Open the liquid and suction line valves.

MAR1400 & MAR2000

Start-Up

Condensing Unit:

Follow the manufacturer's start up check list.

MAR1400 or MAR2000:

After system has been charged and checked-out make sure to correctly position the ice chute. Perform a through re-check of entire system as per following steps.

1. Make sure to open the water supply line shut-off valve and that water flows freely from float valve into the drum basin.

2. Connect power to the system in order to start-up the evaporator drive motor, the water pump and the compressor.

Note: For the first 8 - 10 minutes after power is connected to the MAR unit, only the water pump and the time delay relay are powered. There will be a red light in the upper left corner of the time delay relay. After the time delay relay's off time has expired, there will be red lights in both the upper left and the upper right corners of the front of the relay. At that time the liquid line valve and contactor will power up, and the unit will soon begin to make ice.

3. Observe that evaporator drum rotates in the right direction, namely towards the scraping blade.

WARNING - Care must be taken to ensure of the correct rotation direction of drum.

4. Check compressor head and suction pressures. If not within system design limits, determine why and take corrective action.

5. For a water cooled condensing unit check the water flowing out of the condenser to see if it drains properly.

6. Observe if ice skin tends to cover entire drum surface and is being scraped-off correctly by the blade.

7. Check liquid line sight glass and expansion valve operation. If there are indications that more refrigerant is required leak test all connections before adding refrigerant.

8. Observe oil level in compressor crankcase sight glass and add oil as necessary to bring level to center of the sight glass.

9. Let the system operate for at least two hours, then check one by one the operation of each

individual control and protective device for proper setting.

10. Eliminate any excessive vibration or noise and pulleys misalignment.

11. Observe that evaporator drum is frosted all over from end to end. If this is not the case setting of refrigerant expansion valve may be necessary.

For proper adjustment of this valve turn the valve adjustment stem of one eighth of a turn counter-clockwise to allow more refrigerant to flow until the evaporator drum surface is evenly frosted from end to end.

In case there is an excessive frost back on the suction line and frost start to form on compressor suction service valve, slightly turn clockwise the expansion valve setting stem until the frost back on the compressor service valve melts over.

Indicative Operating Pressure - With Fresh Water Supply - Water Cooled System

- Head Pressure (bar) 17 (245 PSIG)
- Suction at EPR valve: 1.6 (22 - 23 PSIG)
- MAR1400 Drum R.P.M. (thick ice) 1.5
- MAR2000 Drum R.P.M. 2.4

12. In relation to the desired quality of scale ice, review the position of float reservoir to see if water in drum reservoir is at the corresponding level.

The correct water level is:

- 115-120 mm
- 4.5" to 4.75"

13. Observe that ice slides through spout opening with no difficulties. Clearance between the blade and drum surface must be 0,10 m/m (.004"). Transparent plastic chute must be flat.

14. When the system is performing satisfactorily go over with the owner/user to all significant specifications, the start-up and operations. Answer all questions about the care and attention to give to the ice making system.

Electrical Sequence:

After power has been connected, because the bin thermostat bulb is warm, the water pump will start.

After water has been supplied to the machine, the Time Delay Relay is energized and, after its preset wait time has expired (about 8 - 10 minutes), it connects power to the contactor coil and the liquid line valve.

The gear motor begins to turn the drum.

When the bin thermostat opens the pump, contactor coil, time delay relay coil, gear motor and liquid line coil all open or stop.

The unit will not restart until the time set in the time delay relay has expired.

made for the refrigerant flow becomes the evaporator's serpentine.

Metered refrigerant enters through the manifold and enters the evaporator serpentine. There it boils and evaporates as it comes into contact with the drum's metal jacket, reducing the temperature of the drum. About one third of the cylinder drum is constantly submerged in water. This allows the cylinder metal jacket to draw a film of water that, as soon as it comes out of the water, freezes almost instantly due to the heat absorption created by the boiling refrigerant circulating in the serpentine.

On fresh water systems a water pump and water distributor tube provide a constant flow of cold water to the upper side of the evaporator drum. The extra water increases the effective freezing surface and results in a thicker ice layer.

The ice layer on the emerging cylinder then quickly solidifies, dries and eventually subcools before contacting the edge of the horizontal scraping blade.

The heavy duty metal scraping blade causes the ice sheet to peel off of the drum jacket by scraping it as it advances on the revolving drum.

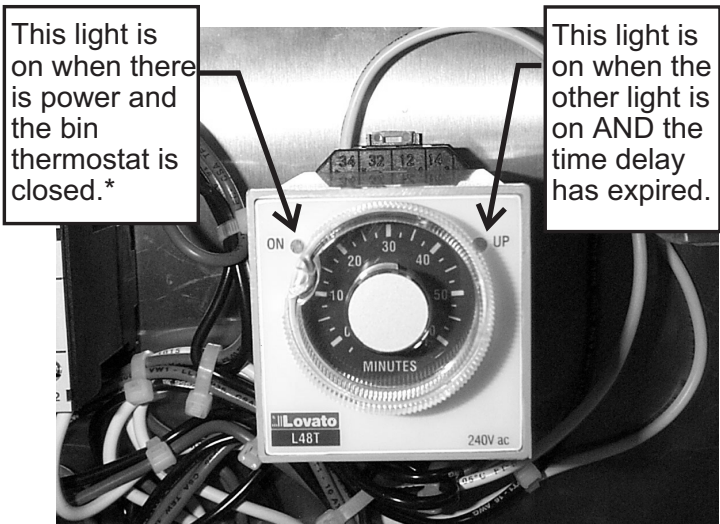
The ice sheet is so dry that, when it gets in contact with the scraping blade, it cracks in a form of irregular shaped chips.

The refrigerant leaves the evaporator serpentine to return to the compressor via suction line through the inner bore of the manifold.

The refrigerant is sealed in the inlet/outlet head manifold by a specially designed sealing device.

The cylinder is driven by separate drive motor and gear reducer located on the opposite side of the refrigerant manifold.

The gear reducer, the driving belt with its pulley, the revolving drum with the rotating part of the sealing devices and the water pump on fresh water installation are the mechanical parts in motion.



Time Delay Relay, Set at Normal Delay Position

*** And all safety switches are closed.**

PRINCIPLES OF OPERATION - HOW IT WORKS

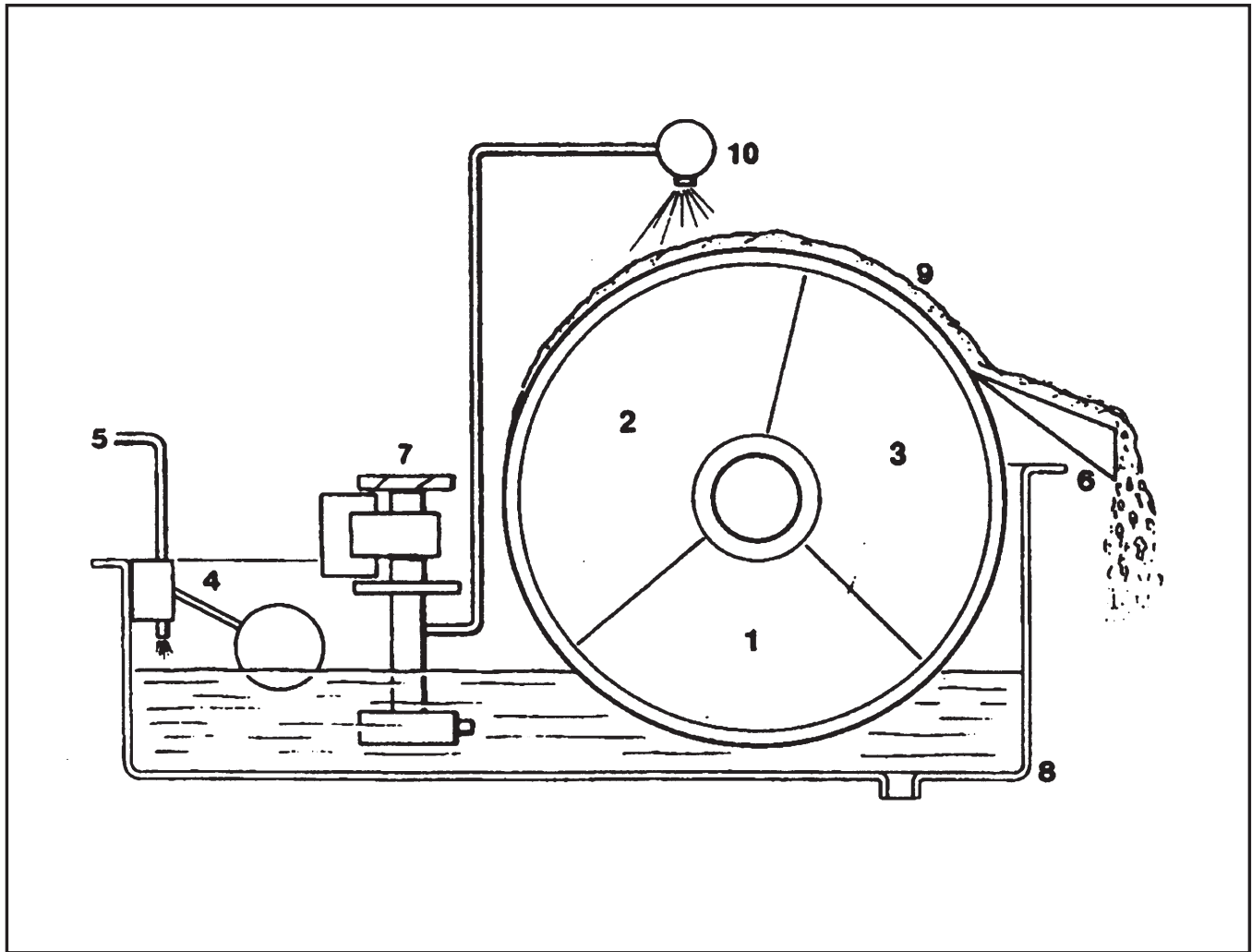
1. ICE MAKER

The revolving drum is made of a cylinder shaped skeleton covered by a stainless steel jacket.

Just under the stainless steel jacket is a channel, about 15 m/m (9/16") deep and 15 m/m wide. The channel is in a spiral pattern that goes from one end of the cylinder to the other.

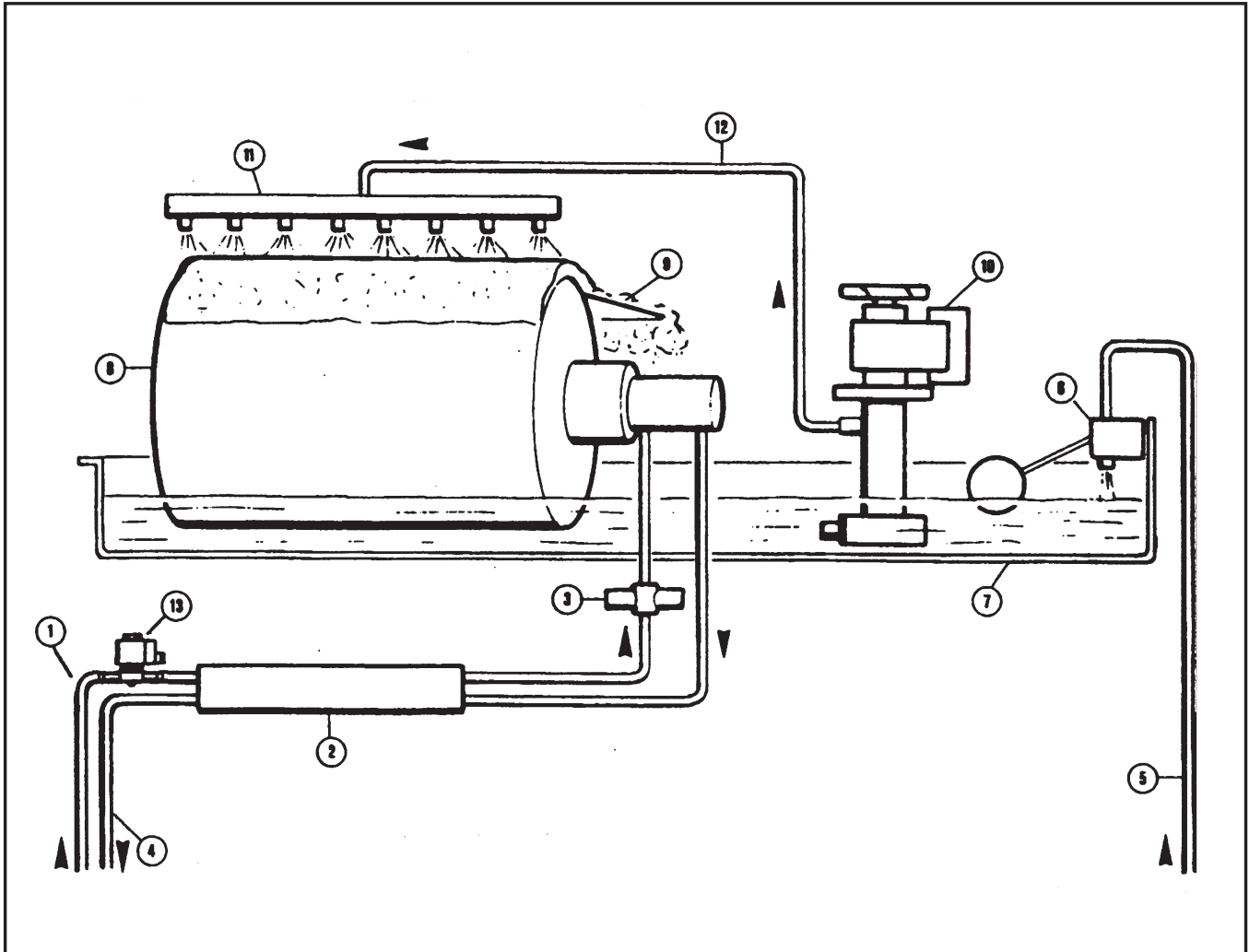
Both ends of the channel are connected with a bore made in the right cylinder journal. The manifold on the right side is for both liquid refrigerant inlet and vapor refrigerant outlet.

Since the cylinder's stainless steel jacket is tightly sealed onto the drum, the spiral pattern channel



1. Water drawing area
2. Water sprayed onto freezing cooling area
3. Sub-cooling area
4. Float valve
5. Water line
6. Scraping blade
7. Water pump
8. Water basin
9. Revolving drum
10. Water distributing tube

Water and Refrigeration Schematics



- | | |
|------------------------------|-----------------------------------|
| 1. Liquid Line | 8. Evaporator drum |
| 2. Heat exchanger | 9. Scraping blade |
| 3. Automatic expansion valve | 10. Water pump |
| 4. Suction line | 11. Spray bar |
| 5. Water inlet | 12. Water tube - Pump / Spray bar |
| 6. Float valve | 13. Liquid line valve |
| 7. Water basin | |

MAR1400 & MAR2000

MAR Split - Electrical / Refrigeration

The electrical circuit consists of drive motor, water pump, water pressure switch, spout switch and time delay safety device.

A. Drive motor

The evaporator drum drive motor is a single phase motor of 1/2 HP wired for 220 Volts 60 Hz – 2.1 Amps - 1400 R.P.M. with inherent thermal protector. In normal operation this motor draws between .8 and .9 amps.

IMPORTANT Make sure that drive motor rotates clockwise facing the unit's front.

Failure to this, may result in wrong rotation of evaporator drum with the risk of major damages to the system.

B. Water failure Switch

This switch used as safety device when low or interrupted supply water conditions are encountered.

Operates on pressure between supply line and feed line to water reservoir.

Range is 0,8 atm (10 psi) off and 1,2 (17 psi).

Cuts off complete unit and Resets automatically.

C. Ice Spout Safety Switch

Located on top of the Ice Spout, the Safety Switch is operated by a plate on top of the ice chute by the ice backing up in the spout.

The switch will shut-off the liquid line valve and gear drive motor. It will automatically reset when the ice melts.

D. Timer - Time Delay - With settings from 0 to 30 min. It delays the energizing of main contactor in relation to its time setting, preventing short cycling of unit's motor compressor and drive motor.

E. Automatic Expansion Valve (A.E.V.)

The automatic expansion valve meters the refrigerant from the liquid line to the evaporator. As the pressure decreases on the low side, the expansion valve opens and refrigerant escapes into the evaporator drum channel where it absorbs heat from water while evaporating. The valve maintains a constant pressure in the evaporator coil when the system is running independently of the amount of refrigerant in the system.

This valve has a manual adjustment to give the evaporator coil the desired pressure of refrigerant.

Turning the adjustment to the left, counterclockwise, will increase the rate the pressure in the evaporator.

When the compressor is not running the valve will remain closed as the low side pressure will be high enough to close the expansion valve.

- MAR1400 or MAR2000 are each equipped with an expansion valve having an orifice of 2,5 m/m.

F. Evaporator Drum

Refrigerant inlet/outlet takes place on left side journal.

The drum body is covered by a jacket in special stainless steel resistant to the water corrosion.

The front edge of the scraping blade must have a minimum clearance of 0.10 m/m(.004 inch) from cylinder metal jacket.

G. Refrigerant Seal System

Housed in the refrigerant inlet/outlet manifold located on the evaporator drum left side journal, is a leakproof joint. This joint is made with seals that are carefully designed and installed. The seals use two rubbing surfaces. One surface turns with the cylinder journal and is sealed to it with an O ring of synthetic material. The other surface is stationary and fitted in its housing with leak-proof O rings.

The rubbing surfaces (optically flats) are made of two different materials: hardened steel for the rotating ring and graphite for the stationary ring.

The rotating parts are:

- a) the spring collar
- b) the compression spring
- c) the stainless steel seal ring with O ring.

The stationary parts are:

- a) the graphitic ring with O ring
- b) the stainless steel housing ring with gasket and O rings.

H. Heat Exchanger

There is a heat exchanger mounted in the suction and liquid line to reduce flash gas in the liquid line, to reduce liquid refrigerant in the suction line, and to subcool the liquid refrigerant thereby increasing the operating efficiency.

MAR Split - Electrical / Refrigeration

I. Strainer Filter

There is a strainer in the liquid line to prevent the expansion valve from becoming clogged with debris.

L. Motor Shaft Pulley

MAR Split units are generally equipped with "Step pulley" and by changing the belt from one groove to the other the speed of drum can be changed. The motor pulley must be reversed and the belt re-tightened to change speeds.

MAR1400 machines are factory delivered with V belt on smaller dia V groove of step pulley to rotate the evaporator drum at the lowest possible R.P.M. to obtain "THICK" (2 m/m or 5/64" thick) scale ice.

Normal drum R.P.M.s for "THICK" ice production are:

MAR1400 - 1.5 RPM

MAR2000 – 2.4 RPM

M. V Belt

V belts used on motor shaft pulley and gear box are type Z 33

When changing the V belt from one groove to another, be careful to adjust it for proper tension and alignment. It should be snug not tight. A way to roughly check belt tension is to apply a firm hand pressure in the middle of the longest belt span. If the belt is correctly tensioned, you should be able to depress it about 5 m/m (3/16") out of line.

N. Gear Reducer

The gear reducer is mounted to the side frame of the evaporator drum basin. The gear reducer bore in which passes the drum shaft to be driven, has a key way.

Two fiber keys are used to engage the gear reducer to the drum shaft, they are in line in the gear reducer bore and shaft key ways.

Should the driving strain be excessive, the two fiber keys will shear.

Both the MAR1400 and the MAR2000 are equipped with a gear reducer having a ratio of 1/570.

The gear reducers are greased for life, therefore they do not require any maintenance.

O. Water pump / spray bar

Used only on FRESH WATER version the water pump is mounted on the rear left side of evaporator drum basin.

It supplies water under gentle pressure to the spray bar located on top of evaporator drum.

Amp draw of the pump during normal operation is .3 amps.

MAR2000 has an additional spray bar at the front of the evaporator drum.

P. Ice Level Control – Bin Thermostat

Note: It is subject to corrosion in marine applications. Mounted in the control box. Must be deployed at the time of installation.

R. Master Relay or Contactor

With electric coil connected in series with safety controls for operation in safe conditions of condensing and evaporating unit. Mounted in the control box.

T. Time Delay Relay

The relay must be energized for about 10 minutes before it will actuate its contacts and power the liquid line valve (which will start the compressor on dedicated condensing units) and the evaporator drive motor.

This type of relay prevents compressor and evaporator drive motor short cycling which could be harmful to evaporator drive mechanism due to ice skin being formed on the evaporator drum jacket that get thicker and stiffer during evaporator drive motor off-momentum. Mounted in the control box.

V. Liquid Line - Solenoid Valve

Stops refrigerant flow when not desired. Located on the liquid line, it is electrically connected to the contactor or relay to stop flooding the evaporator and suction side during compressor off periods.

MAR1400 & MAR2000

Adjustments

The procedures provided in this section are arranged in order to make specific adjustment and removal and replacement information easy to locate.

Read the instructions thoroughly before performing any adjustment or removal or replacement procedures.

1. ADJUSTMENT OF THE AUTOMATIC EXPANSION VALVE

End to end frost on the evaporator drum is the result of the correct expansion valve setting.

This valve may be manually regulated by means of the adjusting stem.

Turning the adjustment to the left (counter-clockwise) will increase the rate of refrigerant flow.

Turning the adjustment to the right (clockwise) the refrigerant flow to the evaporator is reduced.

Use the stem cap of the AXV for manual adjusting operations.

Set the EPR first to -24°C (-11.2°F) or 22 - 23 PSIG, then adjust the AXV to frost the refrigerant drum completely.

If adjusting the EPR does not lower the suction pressure to the desired level, and the suction pressure at the condensing unit is lower than the suction pressure at the EPR, the AXV is overfeeding and should be adjusted to reduce refrigerant flow.

When connected to a dedicated condensing unit, frost back to the compressor may occur. If the compressor is heavily frosted, adjust the AXV to reduce refrigerant flow.

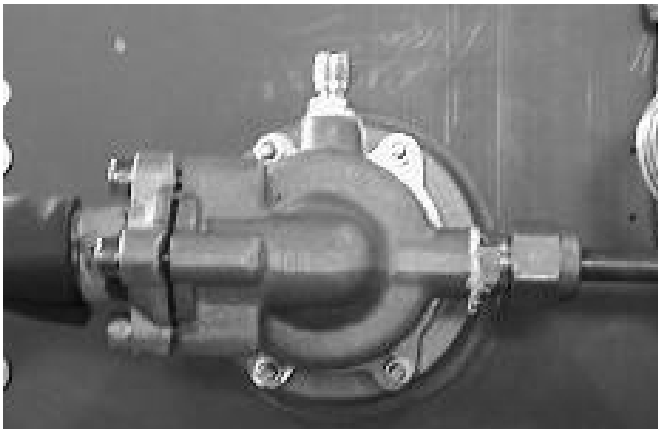
Adjustment & Removal & Replacement Procedures

WARNING - Be sure the electrical power supply and water supply are OFF, before starting any of the following REMOVAL AND REPLACEMENT procedures as a precaution to prevent possible personal injury or damage to equipment.

2. REMOVE AND REPLACEMENT OF EVAPORATOR DRUM REFRIGERANT SEALING DEVICES – must use seal kit.

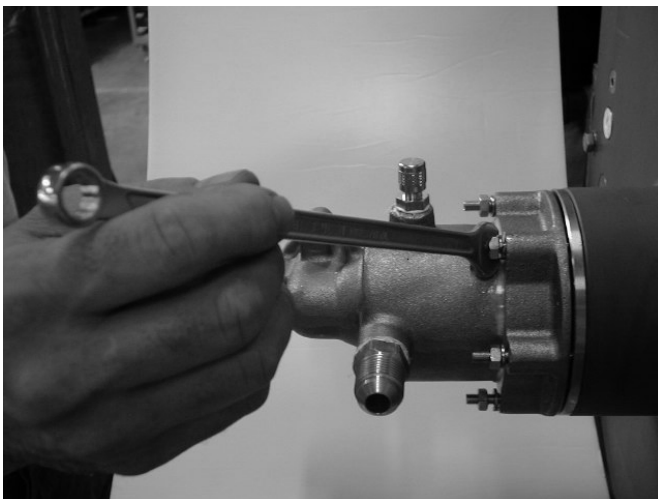
1. Switch the MAR unit off and isolate it from the condensing unit by shutting its liquid and suction line valves. Recover any refrigerant from the MAR unit.

After that the flare fitting at the inlet of refrigerant manifold can be disconnected as shown.

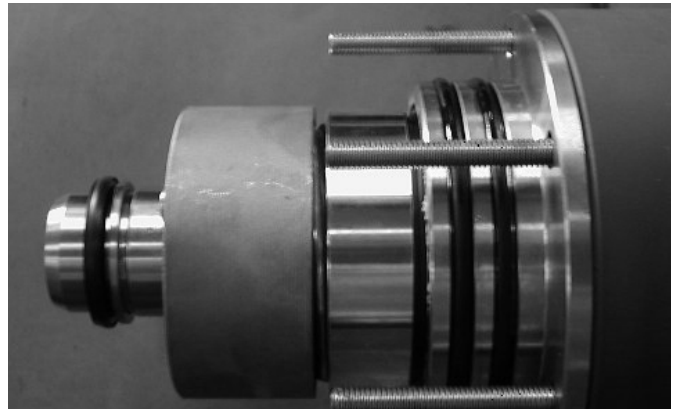


2. Remove the 4 allen screws connecting the refrigerant outlet fitting to the manifold.

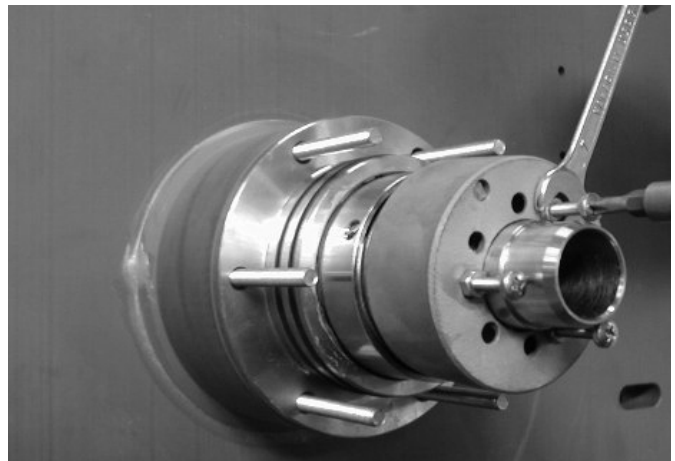
3. Loosen and remove the 6 nuts that secure the refrigerant manifold (1).



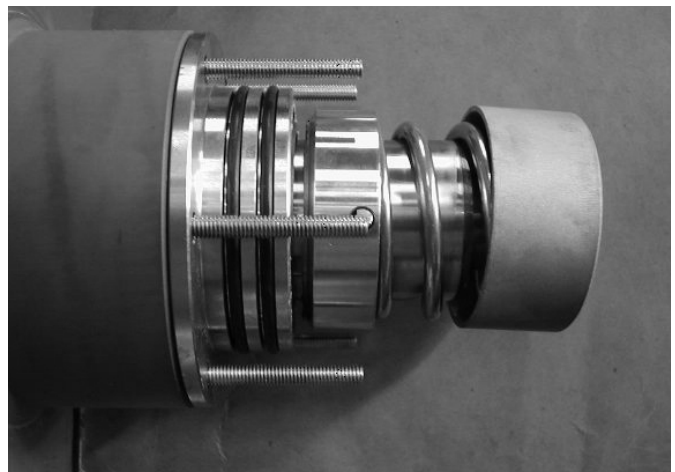
4. Loosen and remove **one** of the three screws securing the seal mechanism ring to the drum shaft journal.



5. Fit in place of it (screw removed in prior step) the screw of 4 MA supplied in the kit then tighten its nut.



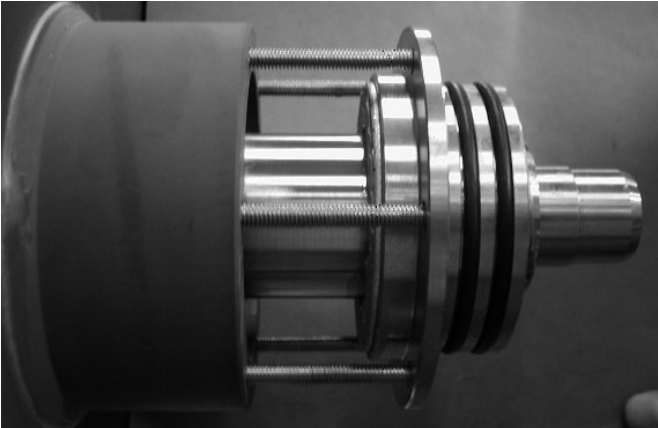
6. Gradually loosen the two remaining screws and the nut to release the spring of the seal mechanism.



MAR1400 & MAR2000

7. Loosen the last screw to remove the seal mechanism ring as well as the seal mechanism S.S. ring and its spring.

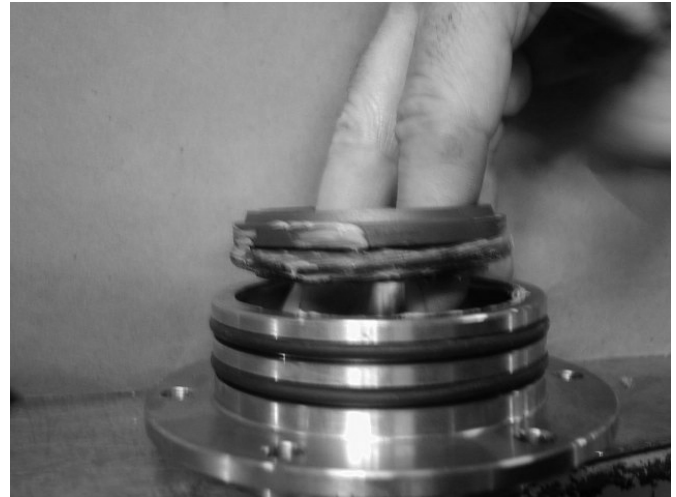
8. Remove the stainless steel ring that houses the graphitic seal ring.



9. Check to see the surface conditions of cylinder shaft journal. It is of extreme importance that this surface be clean, smooth and polished.



11. Examine carefully the graphitic surface of the seal ring. If this surface is no longer perfect and optically flat, proceed to replace the seal ring in the following way.



12. Lubricate the outer surface of the new seal ring with compressor oil and place it at the inferior of the housing ring.

In case of scored surface it is necessary to stroke on it a very fine sand paper stripe.

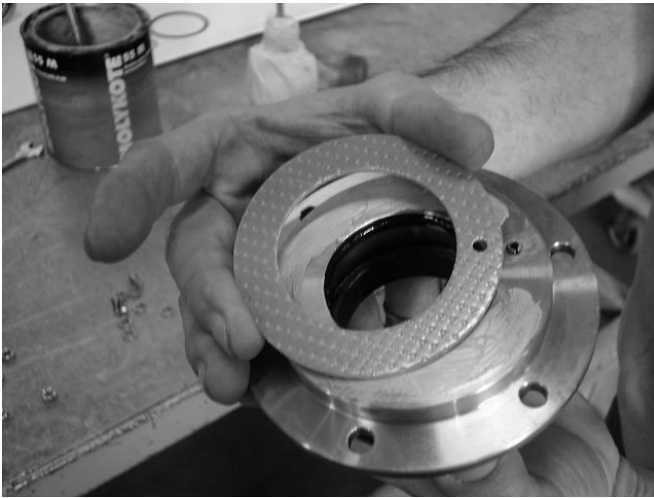
Check to see that washer be properly clean and positioned with keyway to match the key.

10. If necessary replace the O rings of the S.S. ring that houses the graphitic ring.

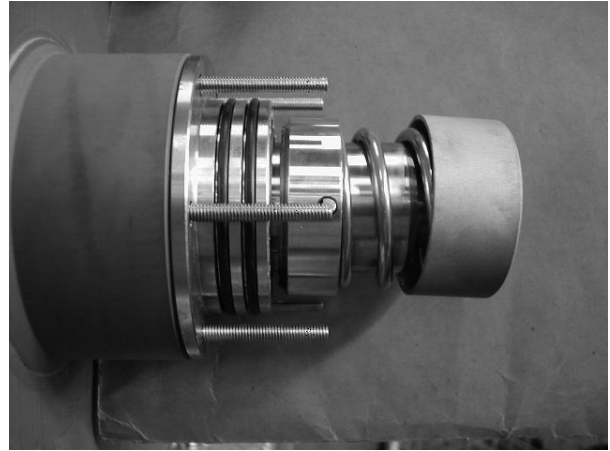


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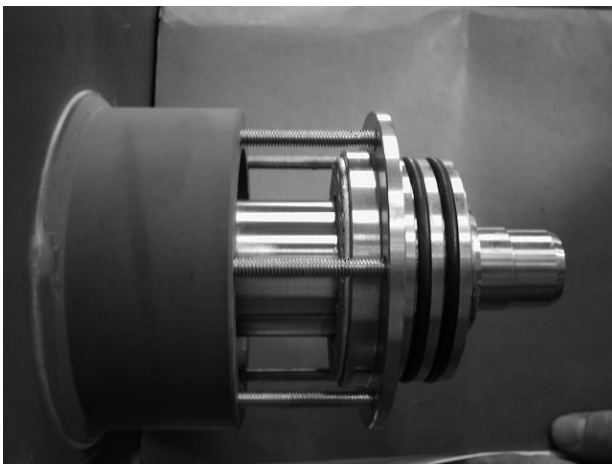
13. Place trust washer with teflon coated surface facing spacer matching pin with hole



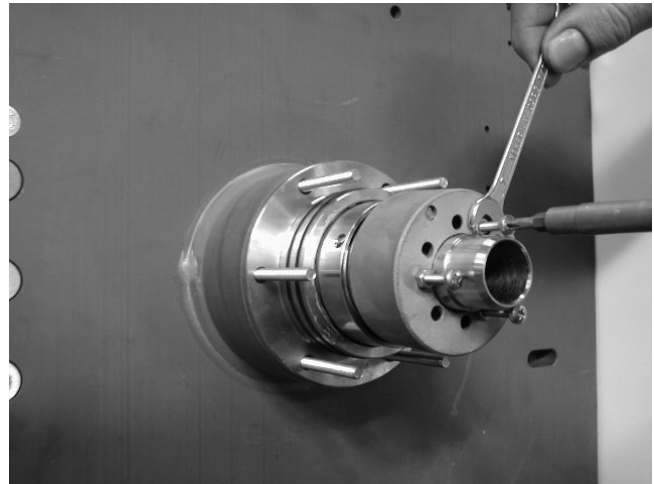
16. Mount on drum shaft journal the remaining portion of seal mechanism (S.S. ring and spring) then the seal mechanism ring.



14. Place on drum shaft the steel ring housing the graphite ring.



17. Fit the screw of 4 MA with its nut in one of the three threaded holes then screw down the nut in order to compress the spring.



15. Lubricate the O ring inner surface of seal mechanism with refrigerant oil

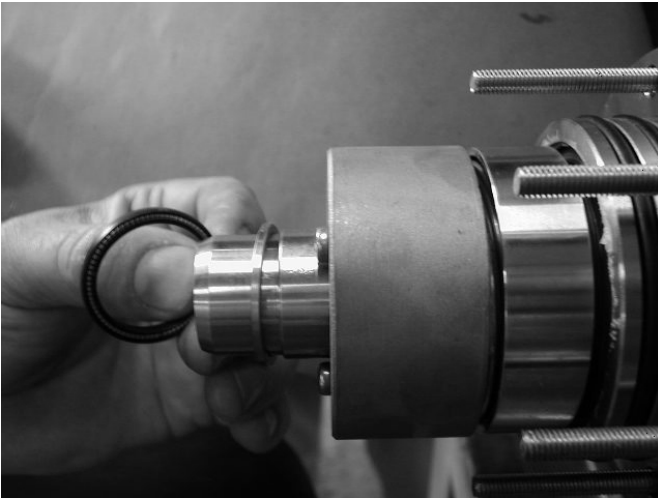


18. When the seal mechanism spring has been partially compressed fit the other two screws and fully compress the spring by gradually screwing down the three screws.

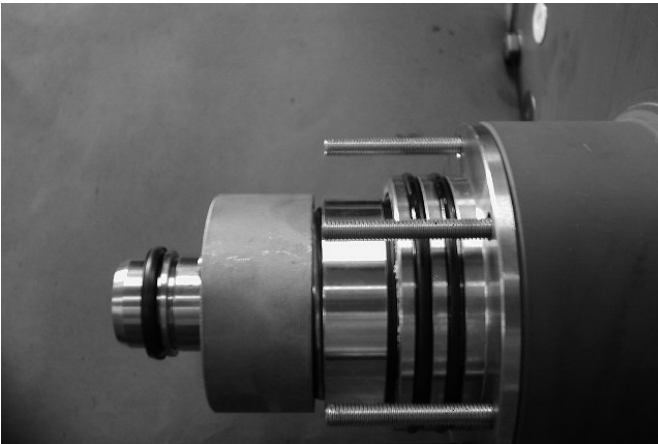
19. After having tightened the screws loosen the tie rod screw and replace it with the third one.

MAR1400 & MAR2000

20. Place the the S.S. Ring on the shaft end first....



.....then the spring ring with the inside spring facing the S.S. ring.



21. Clean the inner surface of refrigerant manifold carefully. Check to see the good condition of the seal ring and fit it in its seat inside the refrigerant manifold. Fit on shaft end the washer which keeps in place the seal ring inside the refrigerant manifold and fit inside the manifold the gasket.



22. Position the manifold on the six mounting studs, fit the six mounting nuts and washers and tighten all them down by means of a 10 mm. wrench.

23. Connect the outlet refrigerant line to the corresponding port of the manifold and tighten it with the four head recessed screw.

24. Connect the refrigerant inlet line on its manifold fitting and tighten the fitting flare nut.

Adjustment & Removal & Replacement Procedures

3. REMOVAL AND REPLACEMENT OF THE DRIVE MOTOR

A. To remove the drive motor assembly:

- 1) Remove screws and front, top and right side panels.
- 2) Slid-off V belt from motor pulley.
- 3) Loosen and remove hex head screw securing the pulley to motor shaft.
- 4) Disconnect wire leads to motor.
- 5) Remove two hex head bolts, lock washers and washer, and nut which attach the sleigh support plate of motor to the side frame of evaporator drum basin.
- 6) Lift the sleigh plate with the drive motor out of the Chassis.
- 7) Loosen and remove 4 Nuts securing the motor to the sleigh plate.

B. To replace the Drive Motor Assembly reverse the removal procedure.

4. REMOVAL AND REPLACEMENT OF GEAR BOX

A. Remove screws and front, top and right side panels.

- 1) Slid V Belt from gear box pulley.
- 2) Remove screw securing pulley on gear box input shaft.
- 3) Remove four nuts and washers which secure the gear box to the evaporator basin side frame.
- 4) Gently tap on the gearbox with a mallet to loosen it from its mounting position.
- 5) Pry with two screw drivers inserted between basin wall and flanged end of gear box to force the gear box away from basin wall. If you encounter any excessive resistance in this, use a 2-jaw puller.
- 6) When gear box is cleared away from the wall where it is mounted, pull it out from cylinder shaft.

A. To install the Gear Box Assembly reverse the removal procedure taking care to center keyway of gear box bore to keys on cylinder shaft.

5. REPLACEMENT OF FIBER KEYS

A. Replacement of the fiber keys is only necessary when the keys are broken and do not engage the gear motor output shaft with the evaporator drum drive shaft.

B. Replacement of the fiber keys requires removal of the complete gear box.

For this operation perform all steps above in section 4.

MAR1400 & MAR2000

Maintenance & Cleaning Instructions

1. GENERAL

The periods and procedure for maintenance and cleaning are given as guides and are not to be construed as absolute or invariable.

Cleaning especially will vary depending upon local water conditions and the ice volume produced and each ice maker must be maintained individually in accordance with its own particular location requirements.

2. ICE MAKER / CONDENSING UNIT

THE FOLLOWING MAINTENANCE MUST BE SCHEDULED AT LEAST TWO TIMES PER YEAR ON THIS ICE MAKER. CALL YOUR AUTHORIZED SCOTSMAN SERVICE AGENCY.

1. Check and clean/replace water line Strainer or Filter (when used).

2. Remove top panel and depress the float to ensure that a full stream of water enters the reservoir.

3. Check that the ice maker cabinet is level in side-to-side and front-to-rear directions.

4. Check that the water level in the Drum basin is high enough to surround the wanted portion of revolving drum.

5. Clean the water reservoir and exterior of the drum assembly using a solution of SCOTSMAN Ice Machine Cleaner. Refer to procedure on the following page, CLEANING ICE MAKER.

NOTE. Cleaning requirements vary according local water conditions and individual user operation.

6. When doubtful about refrigeration charge, check gauge for compressor head pressure according to model technical specification.

7. Check gauge for Suction Line Pressure which varies depending upon models, inlet water temperature and ambient temperature.

8. Check drive motor operation. Normal operating temperatures are about 60°C (160°F) which is hot to touch. Check with ammeter for Amps drawn.

9. Check V belt for concealed signs of wear and that has the correct tension. Check pulley alignment and also that drive motor and gear box hold down bolts are tight enough.

10. Make sure that water lines in water cooled condenser are free from any excess of water minerals: otherwise arrange to clean the tubes with

a power driven wire brush or running through it a weak acid solution made with 20 percent of hydrochloric acid.

11. Check for refrigerant leaks and for proper frost line, which should frost out of accumulator at least half way to the compressor and in some areas, back to service valve.

Check for dryness of system through moisture indicator if any.

12. Check for water leaks. Tighten drain line connections. Pour water down drain to be sure that drain line is open and clear.

13. Check the quality of ice. Ice flakes should be dry and have a thickness gauge of about 2 mm.

14. Check compressor oil level through sight glass. Stop unit operation and after two/three minutes see that oil level is 2/3 millimeters above center line of sight glass.

15. Be sure of proper position and condition of plexiglass chute on spout opening.

Cleaning Instruction

1. Disconnect power front the unit.
2. Remove screws and top panel
3. Remove evaporator cover panel
4. Lock the float valve adjusting screw to avoid water incoming during the operation of machine.

Make sure that during cleaning no ice will be stored in any bin or cooling room in order to avoid any kind of contamination by cleaning solution.

5. Dump the contents from the drum basin by withdrawing drain plug located at the bottom refrigerant side of the evaporator. Once empty place again plug in its seat.

Note: Plug may be covered by sealant. Remove sealant to release plug.

6. Prepare a solution in a bucket by mixing 2 lt. (68 ounces) of Scotsman Ice Machine cleaner with 16 liter (444 oz.) of water.

WARNING: When using any chemical, protection of hands (gloves). SCOTSMAN Ice Machine Cleaner contains phosphoric and Hydroxiacetic acid. These compound are corrosive and may cause burns if swallowed. DO NOT induce vomiting. Give large amount of water or milk. Call Physician immediately. In case external contact flush with water. KEEP OUT OF THE REACH OF CHILDREN.

7. Slowly pour 90% of the solution in the evaporator basin.
8. Connect the machine to the power and let the unit in operation for about 10 minutes.
9. Disconnect again unit from power.
10. Repeat "5".
11. Close the water supply shut-off valve externally connected onto the water inlet line.
12. Open a little bit the float valve holding arms and remove it from the holder.
13. Remove screws and clip-ring securing float valve bracket to the nozzle.
14. Withdraw bracket from float valve nozzle.
15. Place the float valve and its bracket in the solution remained in the bucket and remove any kind of scale or mineral deposit.

16. Carefully rinse bracket and float valve by fresh water.
17. Prepare as per step "6" using a sanitizer rather than a cleaner. Possible sanitizing solution may be made by mixing 3 cl. (1 ounce) of liquid house hold bleach with 8 liters (272 oz.) of warm potable water.

NEVER MIX THE CLEANING WITH SANITIZING SOLUTION.

18. Soak float valve and bracket in the sanitizing solution for 1 minute then rinse all parts with fresh water.
19. Install again first the plastic bracket then float valve.
20. Open the water supply shut-off valve.
21. Leave water filling until the level inside the basin reaches approx 8-9 cm (3-4").
22. Lock-in again float valve screw.
23. Connect the machine to the power and let the unit in operation for about 5 minutes for rinsing the water system.

CAUTION - DO NOT use ice produced from the cleaning solution. Be sure none falls into storage room.

24. Disconnect unit from power.
25. Repeat 6 then pour sanitizing solution in the drum basin; sanitizing should last approx 5 minutes. At the end dump solution again as per step "5". Seal plug with food grade silicon.
26. Unlock the float valve adjusting screw.
27. Replace again evaporator cover an top panel.
28. Reconnect unit to the power.

MAR1400 & MAR2000

Service Diagnosis

The Service Diagnosis Section is for use in aiding the servicemen in diagnosing a particular problem for pin-pointing the area in which the problems lines, thus an ever available reference for proper corrective action.

The following chart lists corrective actions for the causes of known symptoms of certain problems that can occur in the ice making refrigeration system.

SYMPTOM	POSSIBLE CAUSE	CORRECTION
Lo-refrigerant press.	Incorrect refrigerant suction pressure	Add refrigerant to raise suction pressure.
		Raise head press. Control setting.
	Moisture in system. Overcharge of oil in system.	Check moisture indicator and remove charge and drier. Replace & recharge the system.
	Not enough refrigerant.	Check for refrigerant leak.
Lo-water level.	Intermittent water supply or too low water pressure.	Water shut-off valve closed. Check and clean water strainer.
The compressor runs but the unit does not make ice.	Drive motor gear reducer inoperative.	Check. Repair or replace.
	V-belt loose or broken	Check. Repair or replace.
	Key may sheared.	Check. Repair or replace.
	Gear reducer with one gear stripped - off.	Check. Repair or replace.
	Pulley loose on motor shaft.	Check. Repair or replace.
	Water not entering reservoir.	Check and clean. Water float valve to be cleaned.
Excessive Hi-pressure	Hi-pressure unit operation	Check cooling water at condenser. Condenser tube clogged-up. Water regulating valve to be re-adjusted.

Service Diagnosis

REFRIGERATION SYSTEM

SYMPTOM	POSSIBLE CAUSE	CORRECTION
Unit will not run.	Blown fuse.	Replace fuse and check for cause of blow fuse.
	Loose electrical connection.	Check wiring.
	Switch in OFF position.	Turn switch to ON.
	Inoperative master switch.	Replace switch.
	Spout switch cut-out.	Check ice chute arrangement.
Excessive noise	Misaligned V-belt.	Align V-belt.
	Gear reducer loose on frame.	Tighten.
	Drive motor end-play or worn bearings.	Repair or replace.
Excessive vibration.	Ice formation underneath blade - frictioning against rotating drum.	Remove blade and melt-up ice formation. Lower water level to correct value.
Making wet ice	Surrounding air temperature above 40°C (100°F)	Correct or move unit to cooled location.
	Under-or-over-charge of refrigerant.	Re-charge with proper amount.
	Closed AEV.	Adjust valve for correct refrigerant flow.
	Faulty compressor valve plate.	Repair or replace.
Low ice production.	Loss of refrigerant, under or overcharge of refrigerant	Check and recharge with proper amount of refrigerant.
	Plugged condenser water tubes	Clean condenser.
	Low water level in the reservoir.	Check float valve operation.
	Overcharge of oil in system.	Check at oil sight glass. Lower to 1/2 sight glass.
	Water pump out of operation.	Replace water pump.
	Spray bar clogged.	Clean spray bar.