



MAR 121-301

SPLIT

SEA WATER VERSIONS

SERVICE MANUAL

SPECIFICATIONS

The MAR Split is available in Sea Water/On Board Version only in two different models:

MAR 121
MAR 301

| MODEL | VOLTS | ICE PRODUCTION Kg/24 hr | | DRIVE MOTOR | | WEIGHT Kg lbs |
|---------|-----------|----------------------------|-------------|-------------|------|---------------------|
| | | SEA WATER | FRESH WATER | HP | AMPS | |
| MAR 121 | 400/50/3N | 850 | 1000 | 1/2 | 1.2 | 131 |
| | 230/50/3 | | | | 2.1 | 290 |
| MAR 301 | 400/50/3N | 1800 | 2200 | 1/2 | 1.2 | 223 |
| | 230/50/3 | | | | 2.1 | 490 |

The basic differences between the Fresh Water and Sea Water versions are:

- S.S. panels in AISI 316
- Corrosion proof painted Drive Motor



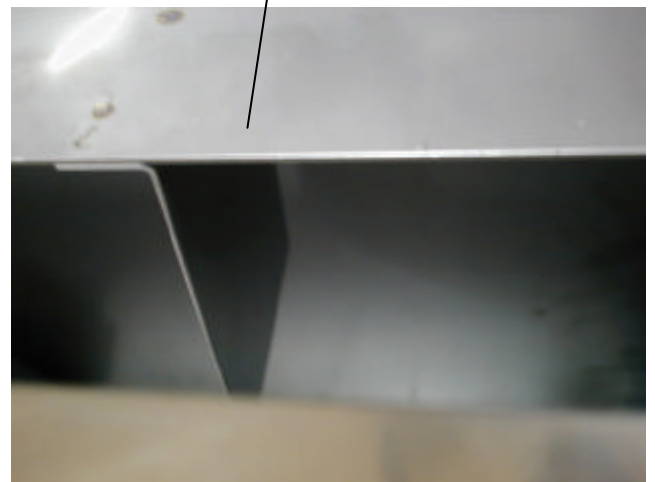
- Submersed Water Pump (it is used for both fresh and sea water versions)



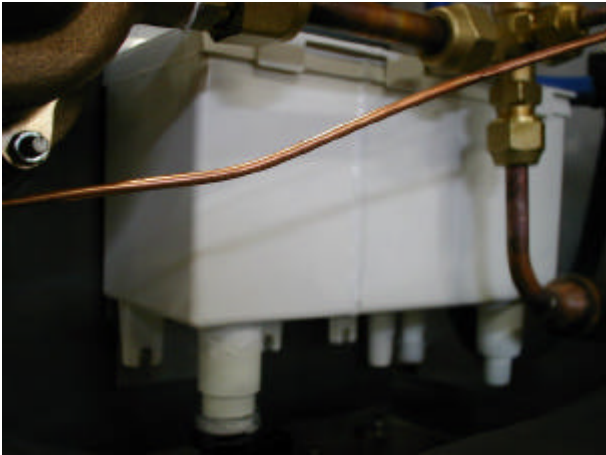
- An anti-splash device fitted on the back side of the evaporator chamber



ANTISPLASH



- Float valve and water reservoir located outside of the evaporator chamber



- Double plastic drain fittings one for the water drip tray located under the evaporator (the left one) and a second for the water reservoir overflow (the right one).



- Water pressure switch connected to the water inlet system with plastic tubes



The following components are not used on Sea Water/On Board versions:

- Heat exchanger
- Spout switch
- Liquid solenoid valve

Like all other MAR Split machines also the Sea Water/On Board versions are just the evaporating section of an Ice Machine.

The Evaporator must be connected to a Condensing System or Condensing Unit composed by Compressor + Sea Water Cooled Condenser that is not provided by Scotsman Europe.

The condensing system to be combined to the Sea Water MAR Split versions must have the following refrigerant capacities:

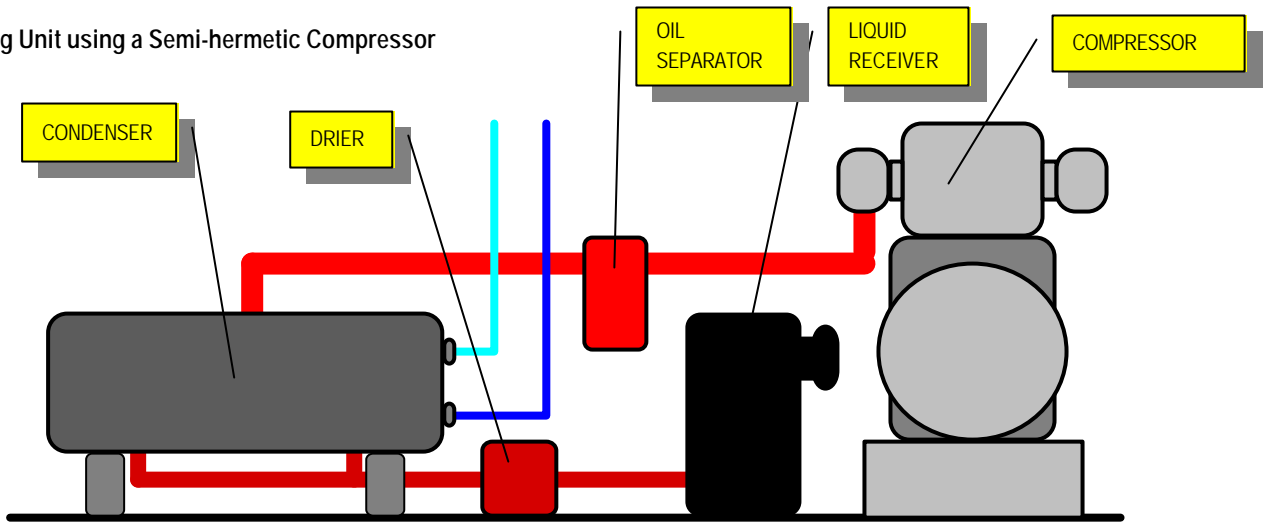
| Model | Cooling requirements | |
|---------|-------------------------|-----------------------|
| | Evaporating Temperature | Kcal/hr – Watts - BTU |
| MAR 121 | -24°C | 6000 – 7000 – 24000 |
| MAR 301 | -30°C | 9700 – 11250 – 38500 |

CONDENSING SYSTEMS

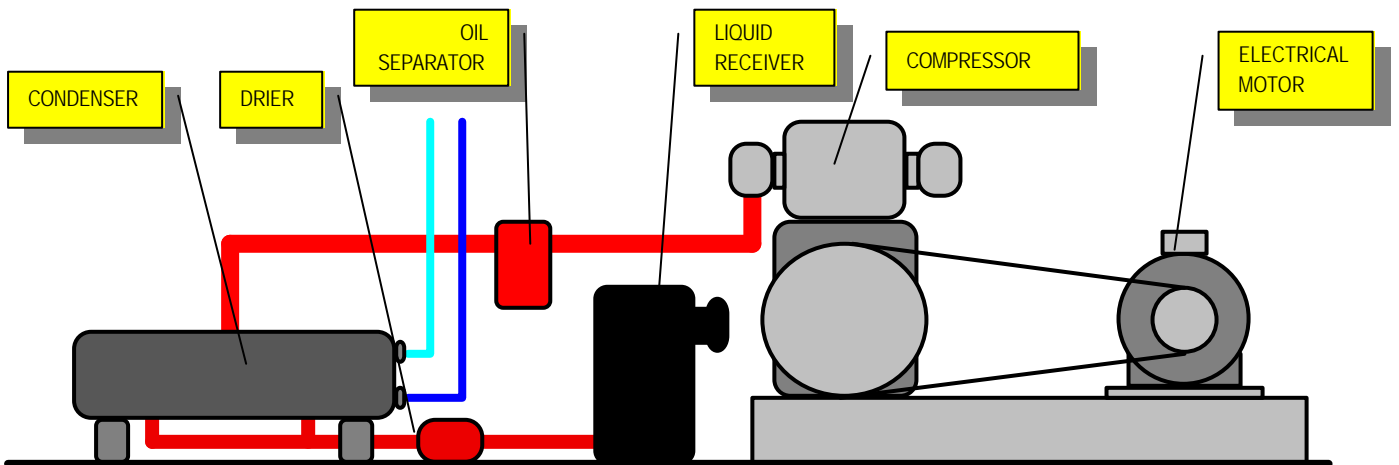
As Sea Water is free the condensing system to be used on board must have a Sea Water Cooling Condenser combined with a Compressor that can be Semi-hermetic (compressor and electrical motor built-in in the same casting) or Open type (Compressor only with output shaft).

The Semi-hermetic compressor requires an adequate power available on board that could be 400/3N/50 or 230/3/50-60 while the Open Type Compressor can be driven by a separate Electrical Motor (400/3N/50 or 230/3/50-60).

Condensing Unit using a Semi-hermetic Compressor



Condensing Unit using an Open Type Compressor drive by an Electrical Motor



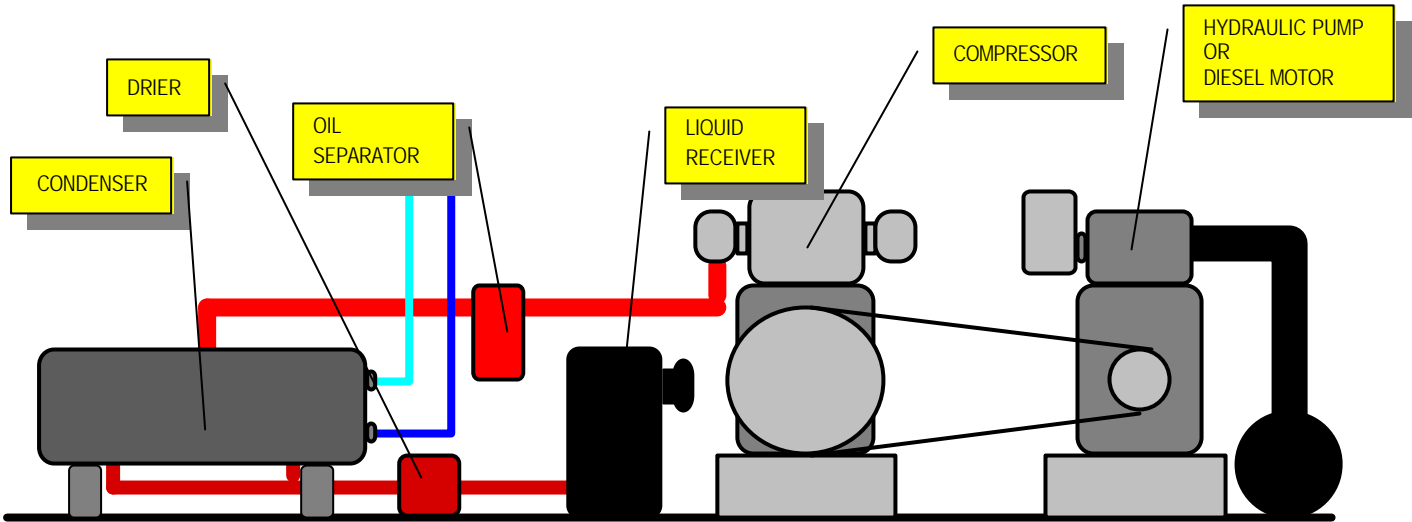
When **only 24 V DC is available on board**, the best possibility to drive the Compressor is the use an Hydraulic Pump or a Diesel Engine to be connected by V belt and pulleys to the Open Type Compressor.

The connection between the Open Type Compressor and the Main Engine of the fishing vessel is not recommended as there is no possibility to transmit a constant speed of the compressor.

In this case it is impossible to grant a constant and standard refrigerant capacity with problems in keeping the MAR Split producing the right quality and quantity of ice.

Hydraulic Pump or specific Diesel Engine assure a constant speed of Compressor and proper refrigerant capacity of compressor.

Condensing Unit using an Open Type Compressor driven by hydraulic pump or a diesel motor



The possible Semi-hermetic or Open Type compressors that can be used with MAR Split Sea Water/On Board versions are:

| | MAR 121 | MAR 301 |
|--------------------------------|----------|-----------|
| Semi-hermetic Compressor DORIN | K 470 CS | K 1000 CS |
| Open Type Compressor DORIN | 41 VSR | 51 VSR |

TYPICAL INSTALLATION – Refrigerant System

The components supplied with the machine by Scotsman Europe/Frimont are:

- Evaporator
- Automatic Expansion Valve

- Compressor
- Oil Separator
- Sea Water Cooled Condenser
- Liquid Receiver
- Liquid Solenoid Valve
- Drier
- Copper Tube for Liquid Line
- Copper Tube for Gas Line



while the following other components (required in a Typical Installation) must be find in the field:

Compressor

The right Semi-hermetic or Open Type Compressor must be choose according to the MAR Split model as shown on the upper charts where are listed the cooling capacity required (first chart) as well as some types of compressors manufactured by DORIN (second chart).

In place of DORIN compressors can be used any other type paying attention that their refrigerant capacities are in line with what requested by the two different Split evaporator.

Oil Separator

To avoid any circulation of the oil of compressor (mixed in small quantities with the refrigerant in hot gas state) it is advised to install an oil separator between compressor and condenser. As the oil separator will avoid any migration of oil into the refrigerant system, the best exchange of heat between condenser/evaporator and sea water is assured so to grant the maximum performance of the machine.

Sea Water Cooled Condenser / Liquid Receiver

The ideal Sea Water Cooled Condenser must be equipped in its bottom part of a liquid receiver with two outlets located on the bottom of condenser on its two opposite sides so to assure that refrigerant in liquid state is always supplied to the Automatic Expansion Valve.

If not available in the field, it is however imperative to install a suitable Liquid Receiver between Sea Water Cooled Condenser and Automatic Expansion Valve.

The cooling capacity of the condenser must be at least **1.5 times** the cooling capacity of the compressor used while the capacity of the liquid receiver must be calculated according to the length of the refrigerant system. In any case it should be not lower then the data shown on the following chart:

| Model | Liquid Receiver Capacity |
|---------|--------------------------|
| | liters |
| MAR 121 | 1.5 |
| MAR 301 | 2.5 |

| Model | Condenser Cooling Capacity |
|---------|----------------------------|
| | Kcal/hr – Watts - BTU |
| MAR 121 | 9000 – 10500 – 36000 |
| MAR 301 | 14500 – 17000 - 58000 |

Drier

It must be suitable for the refrigerant used and it must have a volume/capacity not lower then:

| Model | Capacity - cm ³ |
|---------|----------------------------|
| MAR 121 | 250 |
| MAR 301 | 500 |

Copper Tube for Liquid and Gas Line

According to the distance between the condensing unit and the evaporator, the O.D. diameter of the copper tubes connecting the condensing to the evaporator system must have the following dimensions:

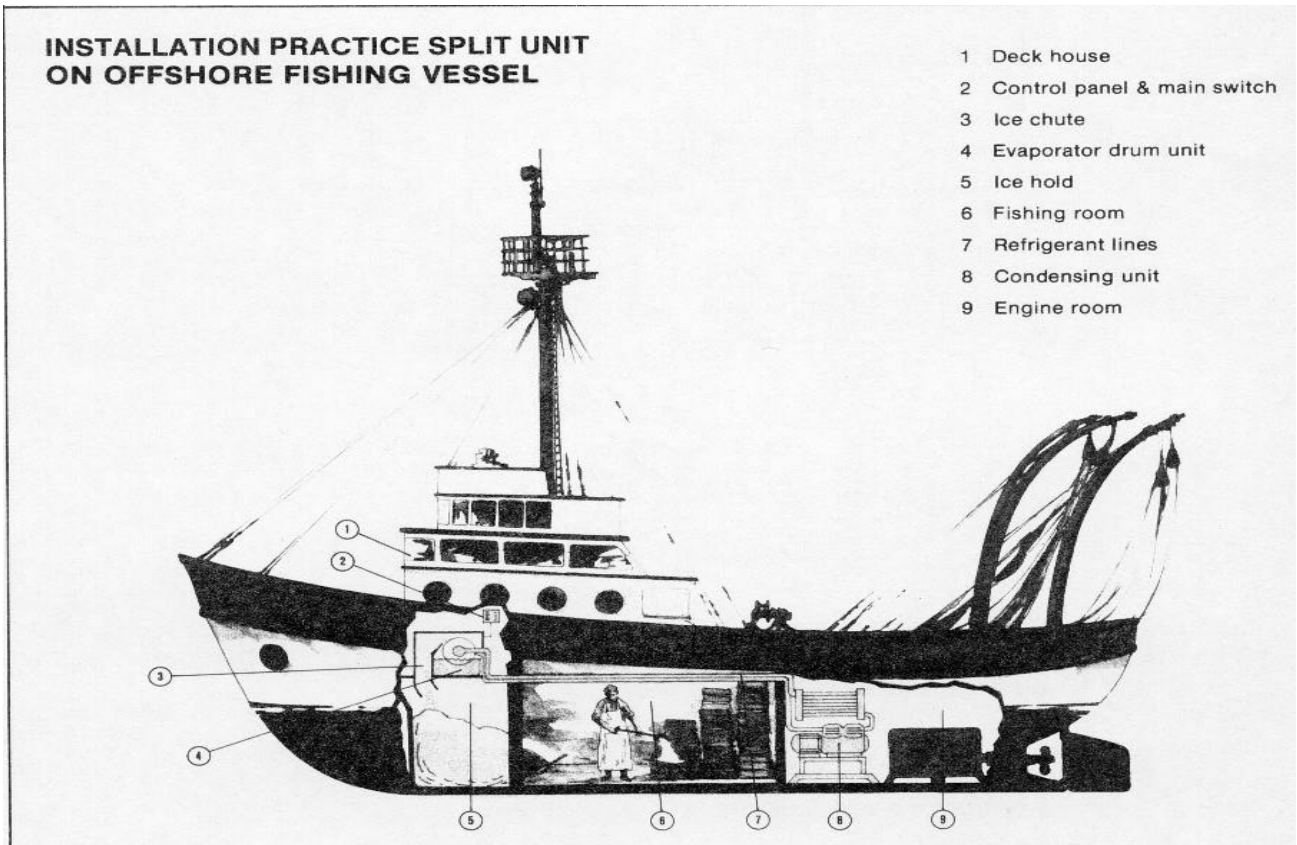
| | L < 15 m | L > 15 m |
|-----------------------------|----------------|----------------|
| O.D. Liquid line – MAR 121 | 3/8" – 10 mm | 1/2" – 12,5 mm |
| O.D. Suction line – MAR 121 | 7/8" – 22 mm | 1" – 25,4 mm |
| O.D. Liquid line – MAR 301 | 1/2" – 12,5 mm | 5/8" – 16 mm |
| O.D. Suction line – MAR 301 | 1 3/8" – 35 mm | 1 1/2" – 38 mm |

To reduce as much as possible the corrosion of the copper tubes it is advised to insulate the entire suction line (to avoid also any frost formation on the outside of the tube) and paint with a special corrosion proof painture the liquid line (red color).

Evaporator

Best location for the evaporator is on the center of the fishing vessel so to minimize the problem of rolling and pitching and reduce as much as possible the possibility to have splashing of water from the evaporator basin.

For the same reason it is also advised to install it on left to right direction (as shown on the bottom drawing).



Best location for the evaporator is also inside the cold room (where it is stored the ice) paying attention that the inside temperature should be no lower than 0°C for ice made by sea water or no lower than 5°C for ice made by fresh water (see water has a freezing temperature lower than fresh water so the cold room temperature can be a little bit lower compared with the minimum value typical of fresh water versions).

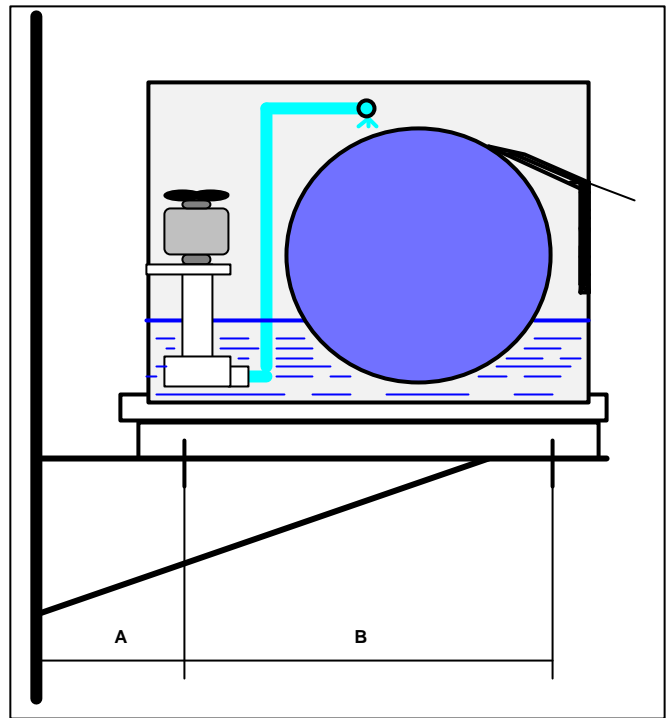


Moreover, with the evaporator installed directly into the cold room there is no need of any ice chute channel.

The evaporator must be firmly connected to a proper S.S. bracket well secured to the walls of the cold room. For this reason the MAR 121 and MAR 301 are provided with securing holes located in the bottom of the S.S. base as shown on the drawings.

A minimum of approximately 20 cm must be left on the rear side of the machine in order to have space enough to reach the control box for any check/connection.

The refrigerant inlet and outlet of the evaporator are located on its right side so to reduce as much as possible the need of space that it is always a premium in a fishing vessel installation.



| | MAR 121 | MAR 301 |
|---|---------|---------|
| A | 290 | 330 |
| B | 390 | 390 |

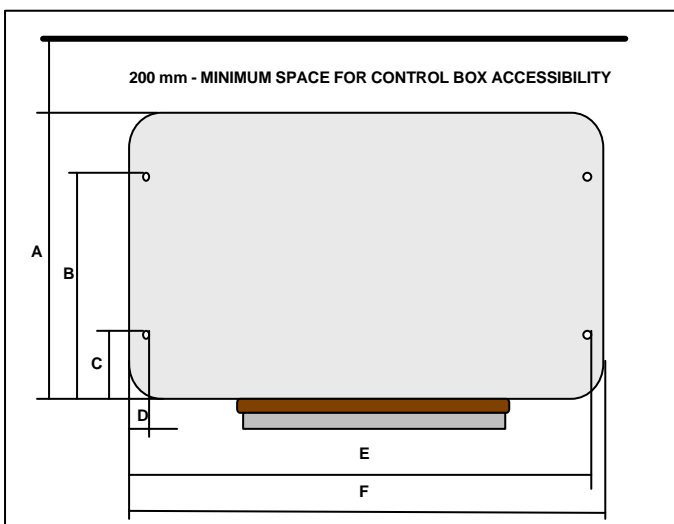
As the use of the ice machine on board of a fishing vessel is limited to the time that the vessel is operating on the sea it is advised to avoid the use of very sophisticated controls that can be also affected by the corrosion typical of marine use/environment.

For this reason controls like:



- ◆ Water regulating valve
- ◆ Spout switch

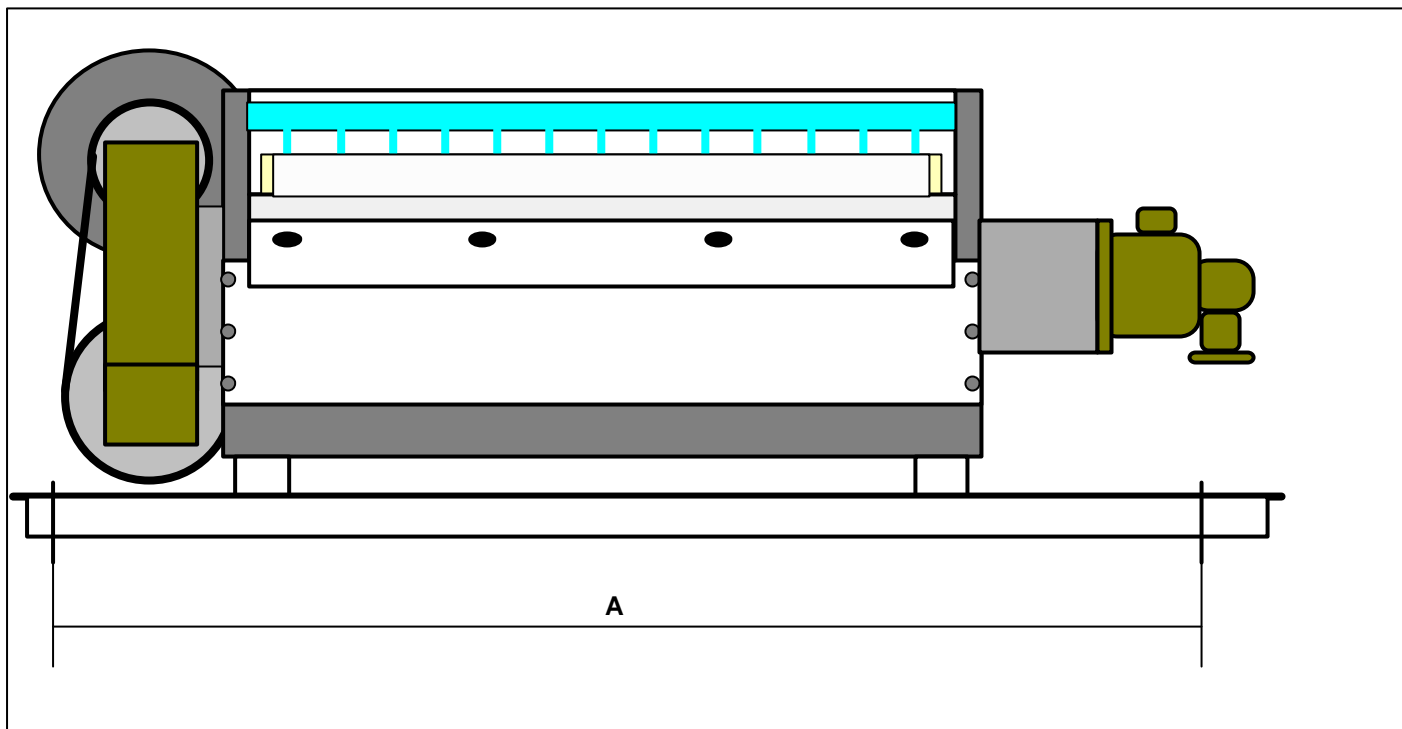
must be avoided.



| | MAR 121 | MAR 301 |
|---|---------|---------|
| A | 615 | 655 |
| B | 522 | 522 |
| C | 132 | 132 |
| D | 42 | 42 |
| E | 827 | 1247 |
| F | 870 | 1290 |

Moreover the constant control of the operation of the machine by means of the people on board can help a lot in the quick

diagnosis of any malfunction of component of the entire ice machine (evaporator + condensing unit).

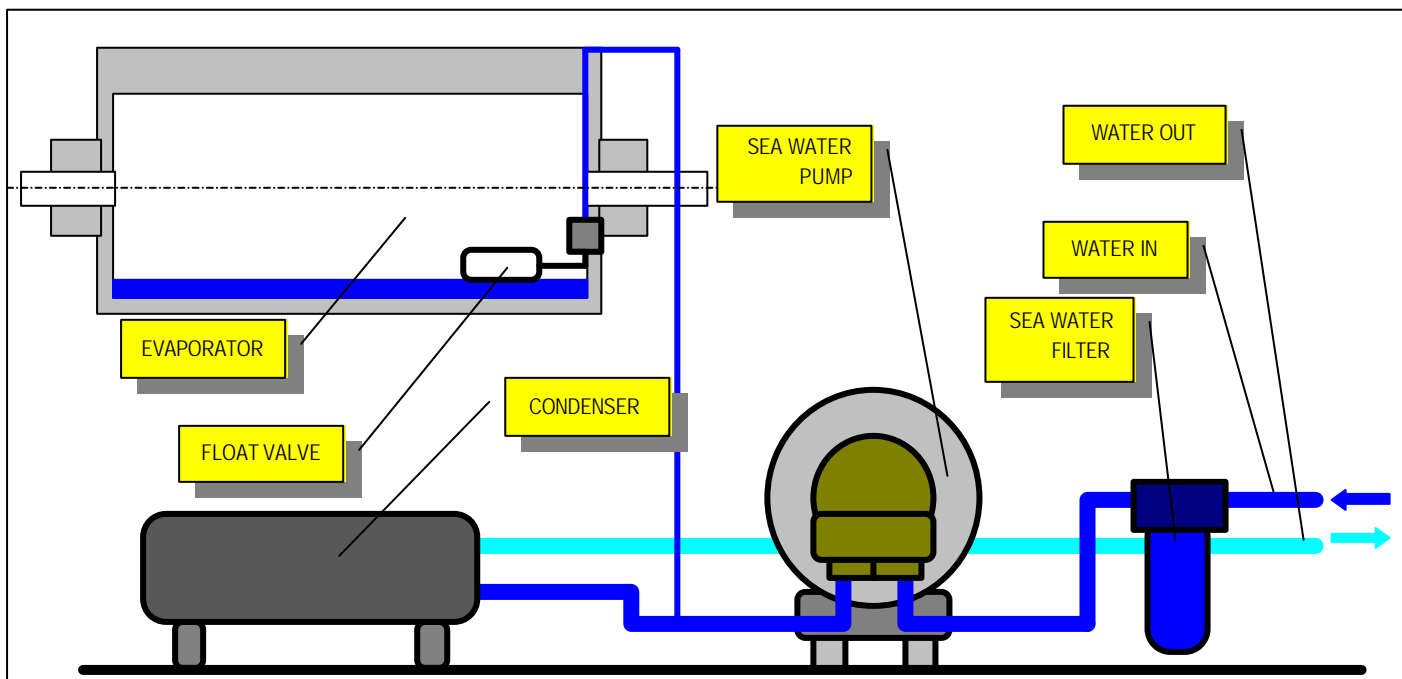


| | | |
|---|---------|---------|
| | MAR 121 | MAR 301 |
| A | 785 | 1205 |

TYPICAL INSTALLATION – Sea Water System

For the water connections to the evaporator and the condensing unit (as shown on the drawing of the Typical Installation of the water system) are required the following components:

- Sea Water Pump
- Sea Water Filter
- S.S. AISI 316 Water Pipes



Sea Water Pump

It must have an AISI 316 shaft and pump body with impeller in marine bronze. It must assure a water pressure between **1 and 5 bar** with a flow rate, according to the different water inlet temperature, as per the following chart:

| Flow Rate m³/h | 15°C | 20°C | 25°C |
|----------------|------|------|------|
| MAR 121 | 0,6 | 0,9 | 2,0 |
| MAR 301 | 1,6 | 2,1 | 3,2 |

Sea Water Filter

It must be in S.S. AISI 316 or in plastic capable to support hi pressures. Cartridge should be in cotton with a minimum filtration rate of 50 microns.

S.S. AISI 316 Water Pipes

For safety reason it is recommended to use S.S. pipes only rather than plastic ones.

The sizes of the S.S. tubes must be not lower then:

| | MAR 121 | MAR 301 |
|-----------------|---------|---------|
| O.D. Condenser | 12 mm | 25 mm |
| O.D. Evaporator | 5 mm | 5 mm |

TYPICAL INSTALLATION – Electrical System

As stated above the MAR SPLIT model 121 and 301 Sea Water Version are supplied with just the water pump and drive motor without any electrical controls typical of the standard MAR SPLIT as not necessary on the installation on board (less parts/components means also less problems).

The only protector (thermal protector) is installed inside the drive motor and it will switch off the operation of the machine when its temperature rise up to more then 130°C.

The two motors should be electrically connected to a contactor (not supplied by Scotsman Europe/Frimont) as per the wiring diagram 1.

Condensing unit (compressor) must be connected to the electrical power as per wiring diagram 2 with the installation of two safety pressure controls (hi and low) connected in series to the coil of a second specific contactor.

It is also advised to install a Oil Differential Pressure Control (connected in series with the other two pressure controls) so to switch off the compressor in case of too low oil pressure (minimum level of oil) in the compressor.

It is recommended to install all those electrical controls (as well as the condensing unit) inside the engine room so to be sure to minimize the effected of salty air.

On wiring diagram 3 is shown the electrical connection that assures the Pump Down operation of the entire system through the Master Switch.

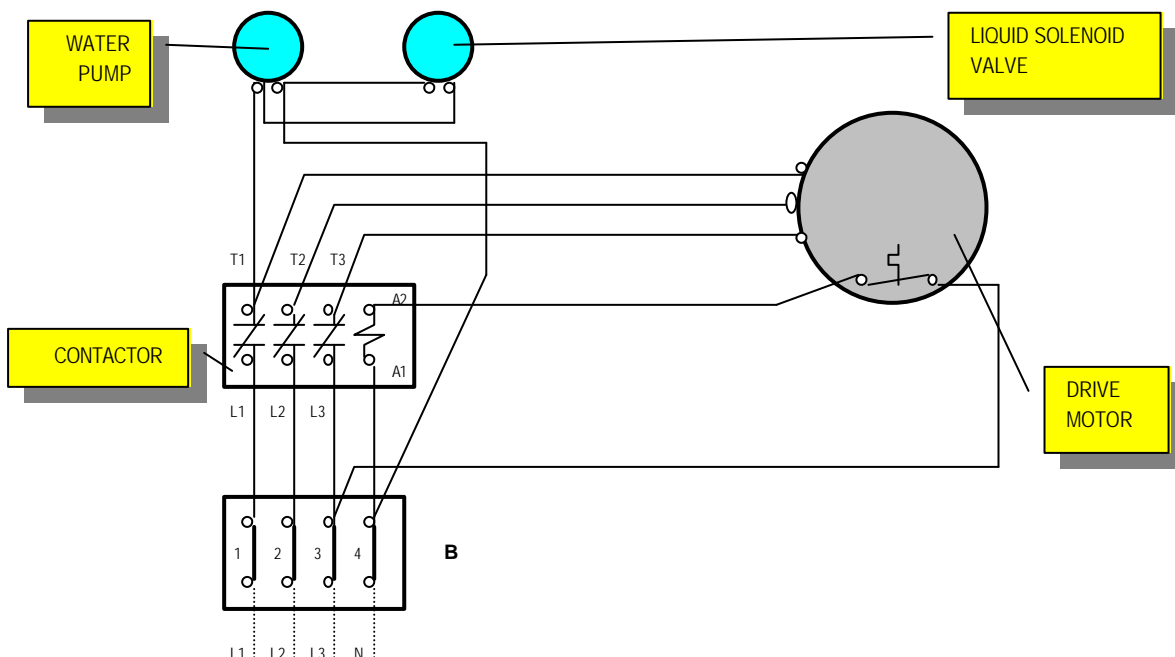
The liquid solenoid valve is de-energized first together with the water pump and drive motor.

In the meantime the compressor remains in operation till the suction pressure drops down to its minimum pre-set value.

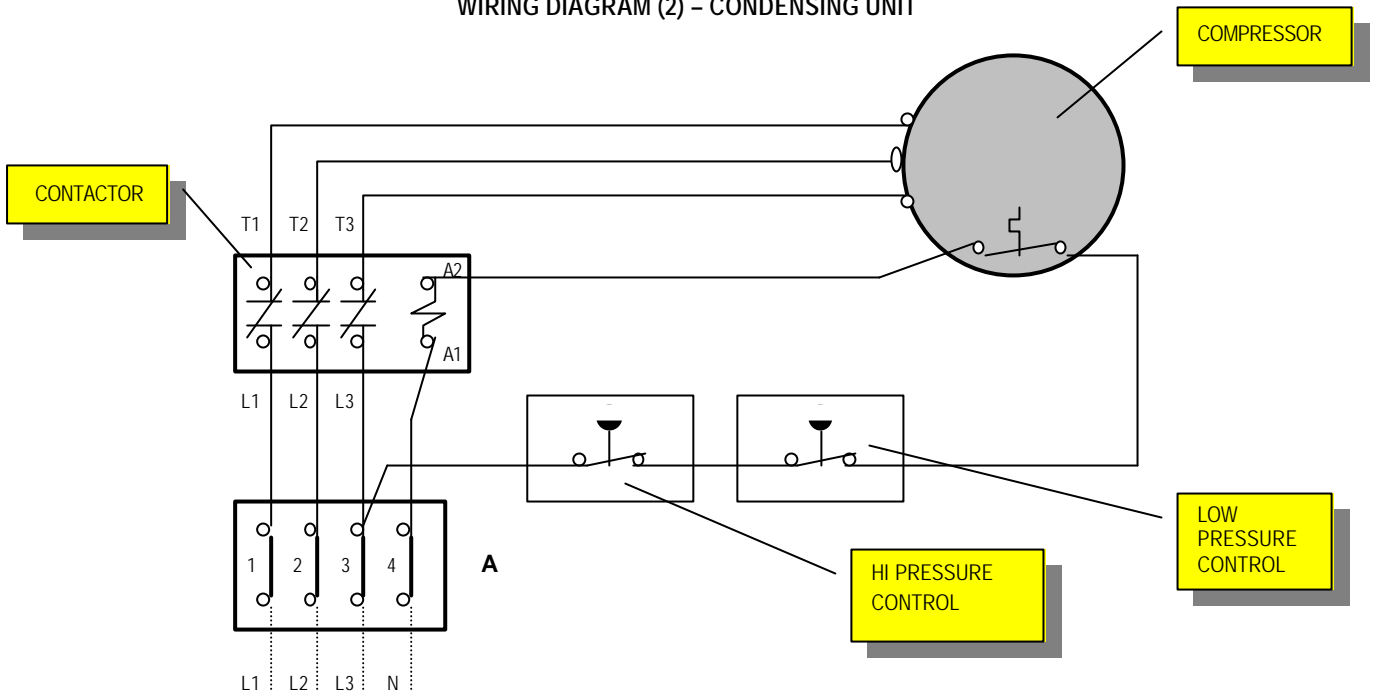
When machine is energized again the liquid solenoid, water pump and drive motor start first.

Few seconds later, as soon as the suction pressure rises up to its CUT IN value the compressor starts as well.

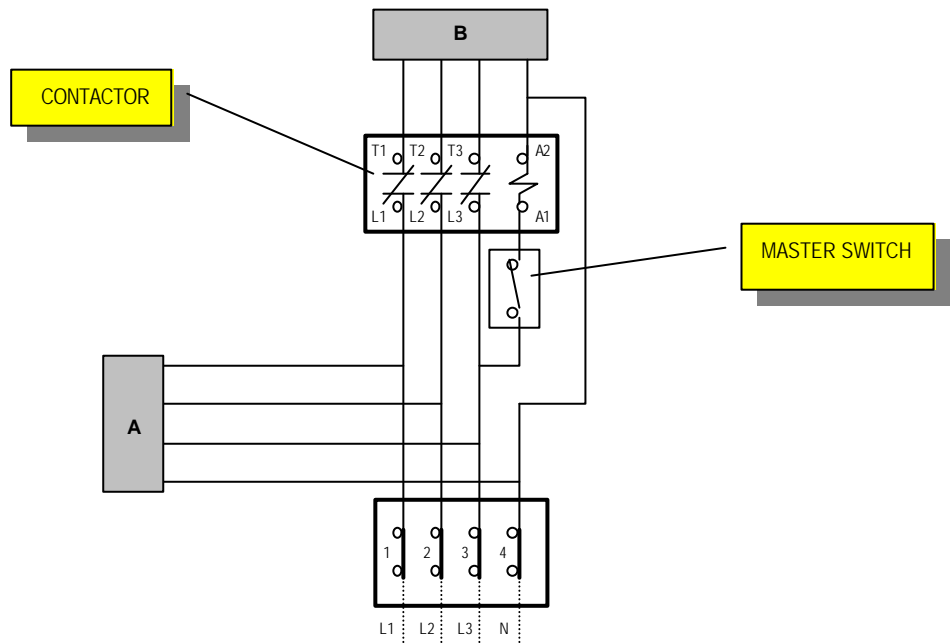
WIRING DIAGRAM (1) – EVAPORATOR



WIRING DIAGRAM (2) – CONDENSING UNIT



WIRING DIAGRAM (3) – CONTROL BOX



SIZE OF ELECTRICAL CABLES

| | EVAPORATING UNIT | CONDENSING UNIT | WATER PUMP |
|----------------|------------------|-----------------|------------|
| Ø mm – MAR 121 | 1.5 | 2.5 | 1.5 |
| Ø mm – MAR 301 | 1.5 | 2.5 | 1.5 |