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scotsman

SERVICE MANUAL

AC 105

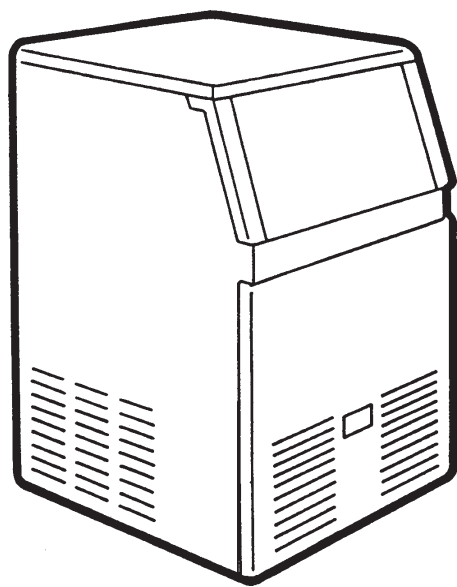
**Electronic cubers
with storage**

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SPECIFICATIONS

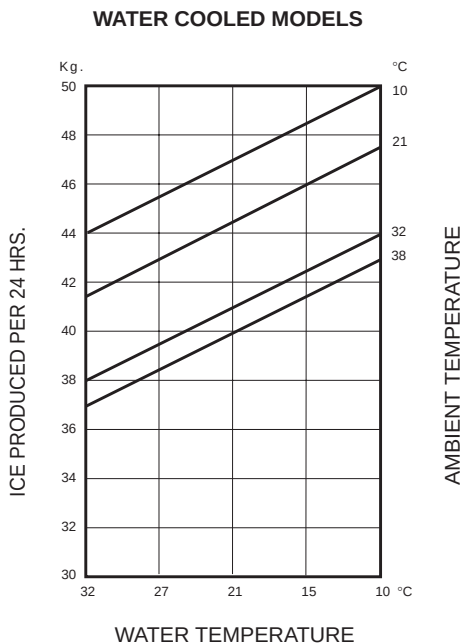
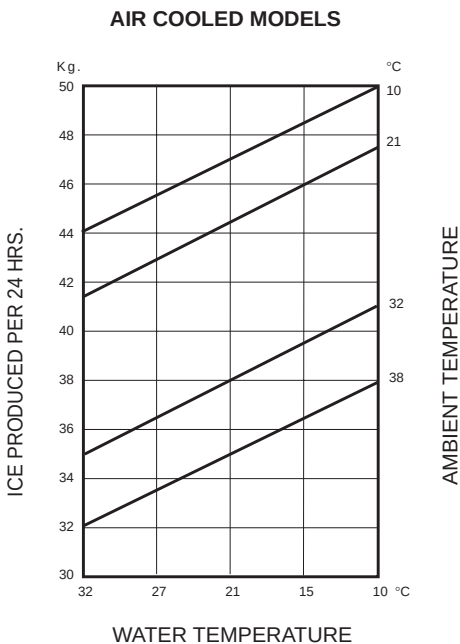
ELECTRONIC CUBER MODEL AC 105



Important operating requirements:

	MIN	MAX
Air temperature	10°C (50°F)	40°C (100°F)
Water temperature	5°C (40°F)	40°C (100°F)
Water pressure	1 bar (14 psi)	5 bar (70 psi)
Electr. voltage variations from voltage rating specified on nameplate	-10%	+10%

ice making capacity



NOTE. With the unit in “built-in” conditions, the ice production is gradually reduced in respect to the levels shown in the graf, up to a maximum of 10% at room temperatures higher than 32°C. The daily ice-making capacity is directly related to the condenser air inlet temperature, water temperature and age of the machine. To keep your SCOTSMAN CUBER at peak performance levels, periodic maintenance checks must be carried out as indicated on page 26 of this manual.

SPECIFICATIONS (CONT'D)

FRONT VIEW

HEIGHT (without legs)	813 mm.
HEIGHT (with legs)	950 mm.
WIDTH	535 mm.
DEPTH	534 mm.
WEIGHT	44 Kgs.

AC 105 - CUBER MACHINE SPECIFICATION

Model	Cond.	Finish	Comp. HP	Ice bin cap. Kgs.	Water requirem LTx24 HR	
AC 105 AS	Air	S/Steel	3/8	18	180	
AC 105 WS	Water	S/Steel			530*	
Basic electr.	Amps.	Start Amps	Watts	Electr. power cons. Kwh per 24 Hrs	No of Wires	Amp. Fuse
230/50/1	3.5	18	550	10	3 x 1 m/m ²	10
Cubes per harvest: 32 medium						
* At 15°C (60°F) water temperature						

GENERAL INFORMATION AND INSTALLATION

A. INTRODUCTION

This manual provides the specifications and the step-by-step procedures for the installation, start-up and operation, maintenance and cleaning for the SCOTSMAN AC 105 icemakers.

The Electronic Cubers are quality designed, engineered and manufactured.

Their ice making systems are thoroughly tested providing the utmost in flexibility to fit the needs of a particular user.

NOTE. *To retain the safety and performance built into this icemaker, it is important that installation and maintenance be conducted in the manner outlined in this manual.*

B. UNPACKING AND INSPECTION

1. Call your authorized SCOTSMAN Distributor or Dealer for proper installation.

2. Visually inspect the exterior of the packing and skid. Any severe damage noted should be reported to the delivering carrier and a concealed damage claim form filled in subject to inspection of the contents with the carrier's representative present.

3. a) Cut and remove the plastic strip securing the carton box to the skid.

b) Remove the packing nails securing the carton box to the skid.

c) Cut open the top of the carton and remove the polystyrene protection sheet.

d) Pull out the polystyrene post from the corners and then remove the carton.

4. Remove the front and (if any) the rear panels of the unit and inspect for any concealed damage. Notify carrier of your claim for the concealed damage as stated in step 2 above.

5. Remove all internal support packing and masking tape. (Leg package is located in the storage bin compartment).

6. Check that refrigerant lines do not rub against or touch other lines or surfaces, and that the fan blade moves freely.

7. Check that the compressor fits snugly onto all its mounting pads.

8. Use clean damp cloth to wipe the surfaces inside the storage bin and the outside of the cabinet.

9. See data plate on the rear side of the unit and check that local main voltage corresponds with the voltage specified on it.

CAUTION. **Incorrect voltage supplied to the icemaker will void your parts replacement program.**

10. Remove the manufacturer's registration card from the inside of the User Manual and fill-in all parts including: Model and Serial Number taken from the data plate.

Forward the completed self-addressed registration card to the SCOTSMAN Europe Frimont factory.

11. If necessary fit the four legs into their seats on the machine base and adjust them to the desired level.

C. LOCATION AND LEVELING

WARNING. **This Ice Cuber is designed for indoor installation only. Extended periods of operation at temperature exceeding the following limitations will constitute misuse under the terms of the SCOTSMAN Manufacturer's Limited Warranty resulting in LOSS of warranty coverage.**

1. Position the unit in the selected permanent location.

Criteria for selection of location include:

a) Minimum room temperature 10°C (50°F) and maximum room temperature 40°C (100°F).

b) Water inlet temperatures: minimum 5°C (40°F) and maximum 40°C (100°F).

c) Well ventilated location for air cooled models. Clean the air cooled condenser at frequent intervals.

d) Service access: adequate space must be left for all service connections through the rear of the ice maker. A minimum clearance of 15 cm (6") must be left at the sides of the unit for routing cooling air drawn into and exhausted out of the compartment to maintain proper condensing operation of air cooled models.

2. Level the unit in both the left to right and front to rear directions.

D. ELECTRICAL CONNECTIONS

See data plate for current requirements to determine wire size to be used for electrical connections. All SCOTSMAN icemakers require a solid earth wire.

All SCOTSMAN ice machines are supplied from the factory completely pre-wired and require only electrical power connections to wire cord provided at the rear of the unit.

Make sure that the ice machine is connected to its own circuit and individually fused (see data plate for fuse size).

The maximum allowable voltage variation should not exceed -10% and + 10% of the data plate rating. Low voltage can cause faulty functioning and may be responsible for serious damage to the overload switch and motor windings.

NOTE. All external wiring should conform to national, state and local standards and regulations.

Check voltage on the line and the ice maker's data plate before connecting the unit.

E. WATER SUPPLY AND DRAIN CONNECTIONS

GENERAL

When choosing the water supply for the ice cuber consideration should be given to:

- a) Length of run
- b) Water clarity and purity
- c) Adequate water supply pressure

Since water is the most important single ingredient in producing ice you cannot emphasize too much the three items listed above.

Low water pressure, below 1 bar may cause malfunction of the ice maker unit.

Water containing excessive minerals will tend to produce cloudy coloured ice cubes, plus scale build-up on parts of the water system.

WATER SUPPLY

Connect the 3/4" male fitting of the solenoid water inlet valve, using the flexible tube supplied to the cold water supply line with regular plumbing fitting and a shut-off valve installed in an accessible position between the water supply line and the unit.

If water contains a high level of impurities, it is advisable to consider the installation of an appropriate water filter or conditioner.

On Water Cooled version the water inlet solenoid valve has two separate outlets one for the condenser and the second for the production of ice.

WATER DRAIN

The recommended drain tube is a plastic or flexible tube with 18 mm (3/4") I.D. which runs to an open trapped and vented drain. When the drain is a long run, allow 3 cm pitch per meter (1/4" pitch per foot)

A vent at the unit drain connection is also required for proper sump drainage.

WATER DRAIN - WATER COOLED MODELS

Connect the 3/4" male fitting of the condenser water drain, utilizing a second flexible tubing to the **open trapped and vented drain**.

NOTE. The water supply and the water drain must be installed to conform with the local code. In some case a licensed plumber and/or a plumbing permit is required.

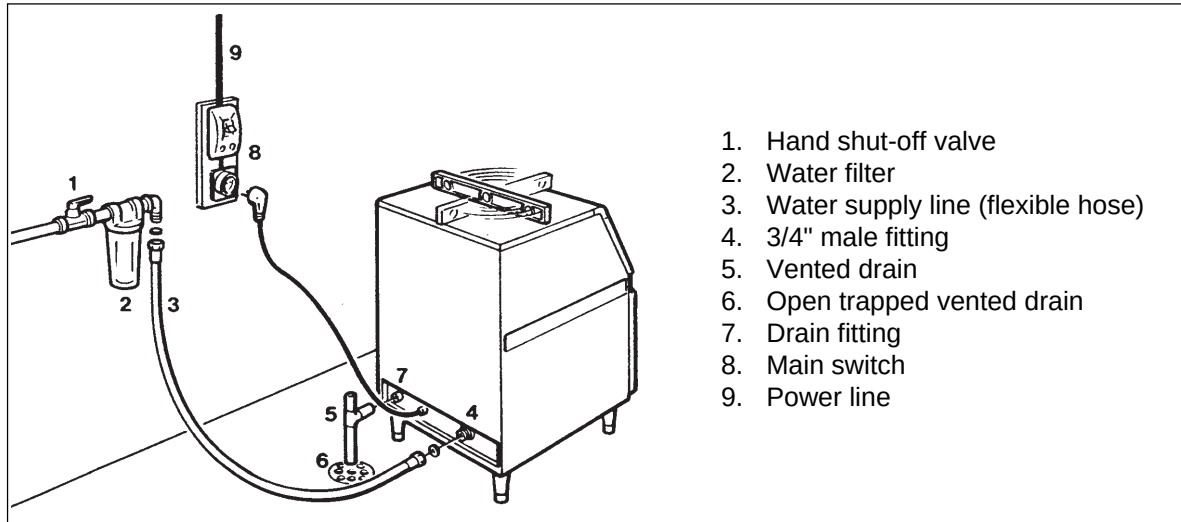
F. FINAL CHECK LIST

1. Is the unit level? (IMPORTANT)
2. Have all the electrical and plumbing connections been made, and is the water supply shut-off valve open?
3. Has the voltage been tested and checked against the data plate rating?
4. Have the bin liner and cabinet been wiped clean?
5. Have the bolts holding the compressor down been checked to ensure that the compressor is snugly fitted onto the mounting pads?
6. Has the owner/user been given the User Manual and been instructed on the importance of periodic maintenance checks?
7. Has the Manufacturer's registration card been filled in properly? Check for correct model and serial number against the serial plate and mail the registration card to the factory.
8. Check all refrigerant lines and conduit lines to guard against vibrations and possible failure.
9. Is the unit in a room where ambient temperatures are within a minimum of 10°C (50°F) even in winter months?
10. Is there at least a 15 cm (6") clearance around the unit for proper air circulation?

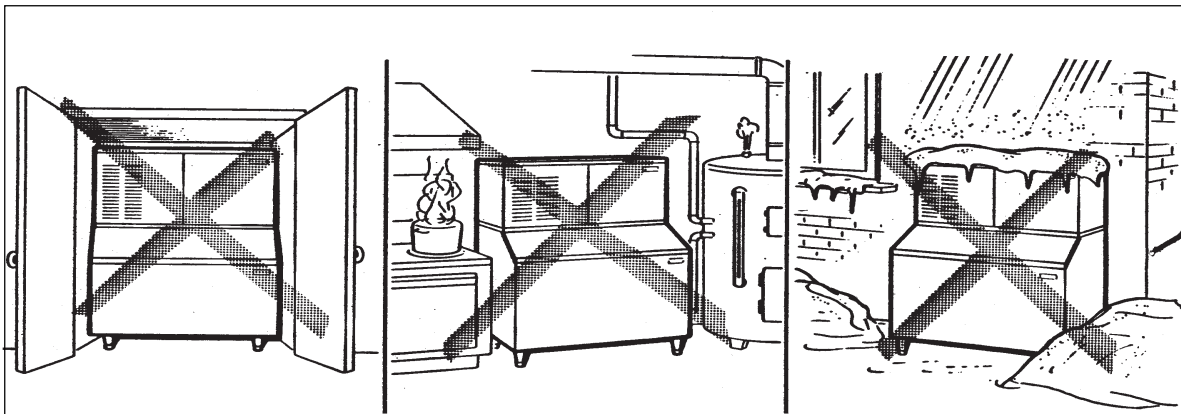
11. Has the water supply pressure been checked to ensure a water pressure of at least 1 bar (14 psi).

12. Has the owner been given the name and the phone number of the authorized SCOTSMAN Service Agency serving him?

G. INSTALLATION PRACTICE



WARNING. This icemaker is not designed for outdoor installation and will not function in ambient temperatures below 10°C (50°F) or above 40°C (100°F). This icemaker will malfunction with water temperatures below 5°C (40°F) or above 40°C (100°F).



OPERATING INSTRUCTIONS

START UP

After having correctly installed the ice maker and completed the plumbing and electrical connections, perform the following "Start-up" procedure.

- A.** Give power to the unit to start it up by switching "ON" the power line main disconnect switch.

NOTE. Every time the unit returns under power, after having been switched off, the water inlet valve, the hot gas valve and the water drain valve get energized for a period of 5 minutes, thus to admit new water to the machine sump reservoir to fill it up and, eventually, to wash-off any dirt that can have deposited in it during the unit off period (Fig.1).

- B.** During the water filling operation, check to see that the incoming water dribbles, through the evaporator platen dribbler holes, down into the

sump reservoir to fill it up and also that the incoming surplus of water flows out through the overflow pipe into the drain line.

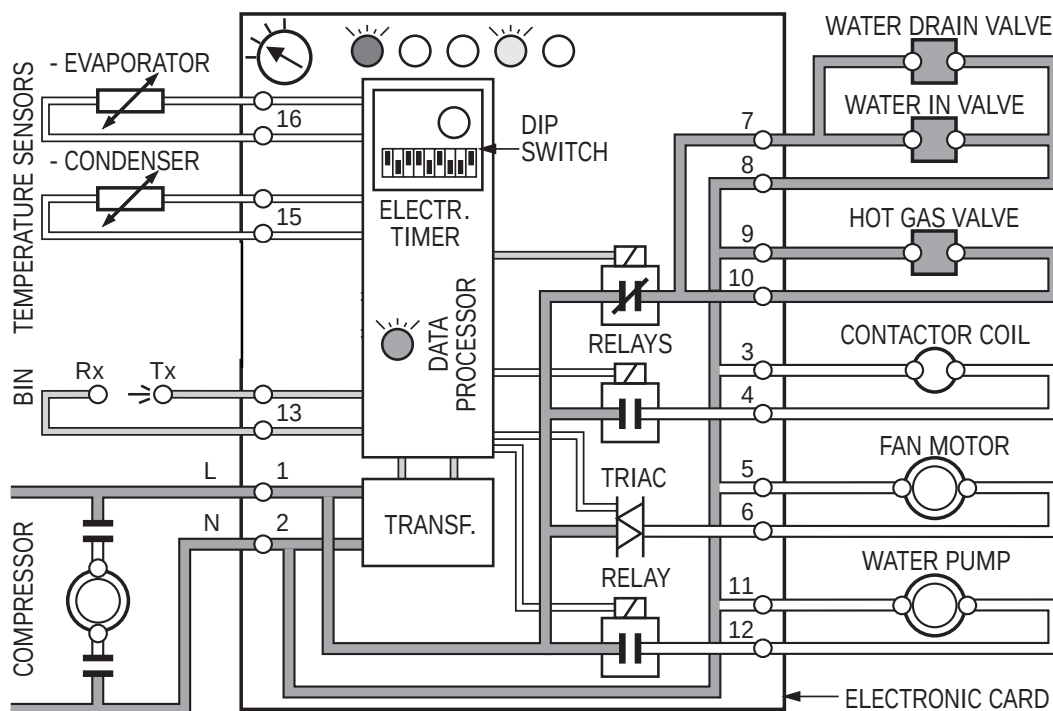
During the water filling phase the components energized are:

THE WATER INLET SOLENOID VALVE
THE HOT GAS SOLENOID VALVE
THE WATER DRAIN SOLENOID VALVE

NOTE. If in the 5 minutes lenght of the water filling phase the machine sump reservoir does not get filled with water up to the rim of the overflow pipe, it is advisable to check:

1. The water pressure of the water supply line that must be at least **1 bar (14 psig)** Minimum (Max 5 bar-70 psig).
2. The filtering device installed in the water line that may reduce the water pressure below the Minimum value of 1 bar (14 psig).
3. Any clogging situation in the water circuit like the inlet water strainer and/or the flow control.

FIG. 1



C. At completion of the water filling phase (5 minutes) the unit passes automatically into the freezing cycle with the start up of:

COMPRESSOR

WATER PUMP

FAN MOTOR (in air cooled version) controlled by the condensing temperature sensor located within the condenser fins (Fig.2).

OPERATIONAL CHECKS

D. Install, if required, the refrigerant service gauges on both the high side and low side Scraeder valves to check the compressor head and suction pressures.

NOTE. On air cooled models, the condenser temperature sensor, which is located within the condenser fins, keep the head (condensing) pressure between 8.5 and 9.5 bar (110÷130 psig).

In case of condenser clogging such to prevent the proper flow of the cooling air or, in case the fan motor is out of operation or shortage of water in the water cooled condenser, the condenser temperature rises and when it reaches 70°C (160°F) - for air cooled version - or 62°C (145°F) - for water cooled version - the condenser temperature sensor shuts-off the ice maker with the consequent light-up of the RED WARNING LIGHT (Fig.3).



*After having diagnosed the reason of the rise of temperature and removed its cause, it is necessary to turn the head of the selector - always using an appropriate screwdriver - first on the **RE-SET** position then return it on previous **OPERATION** position or unplug (wait few seconds) and plug in again the unit, thus to put the machine in condition to initiate a new freezing cycle.*

The machine restarts with the usual 5 minutes water filling phase in order to provide enough water into the sump tank.

FIG. 2

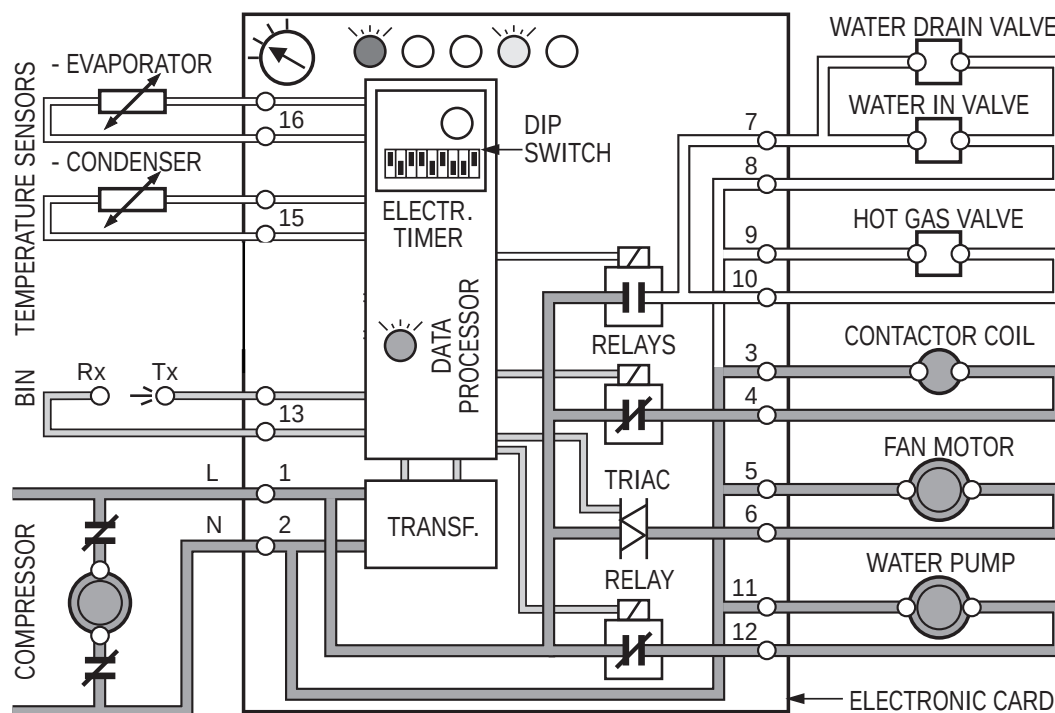
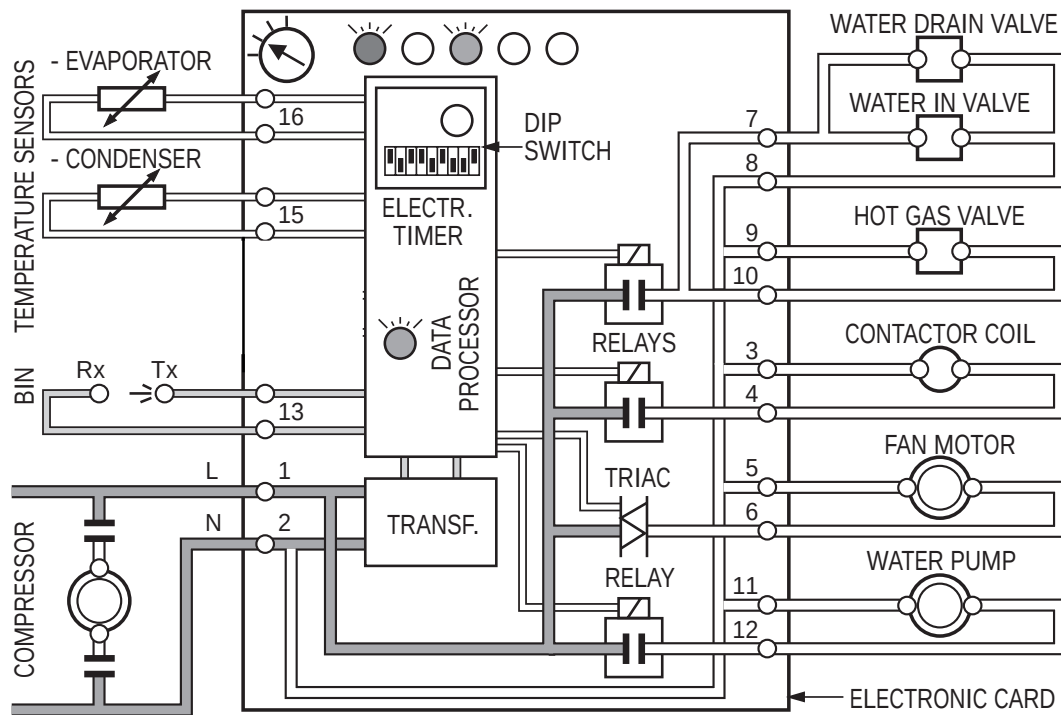


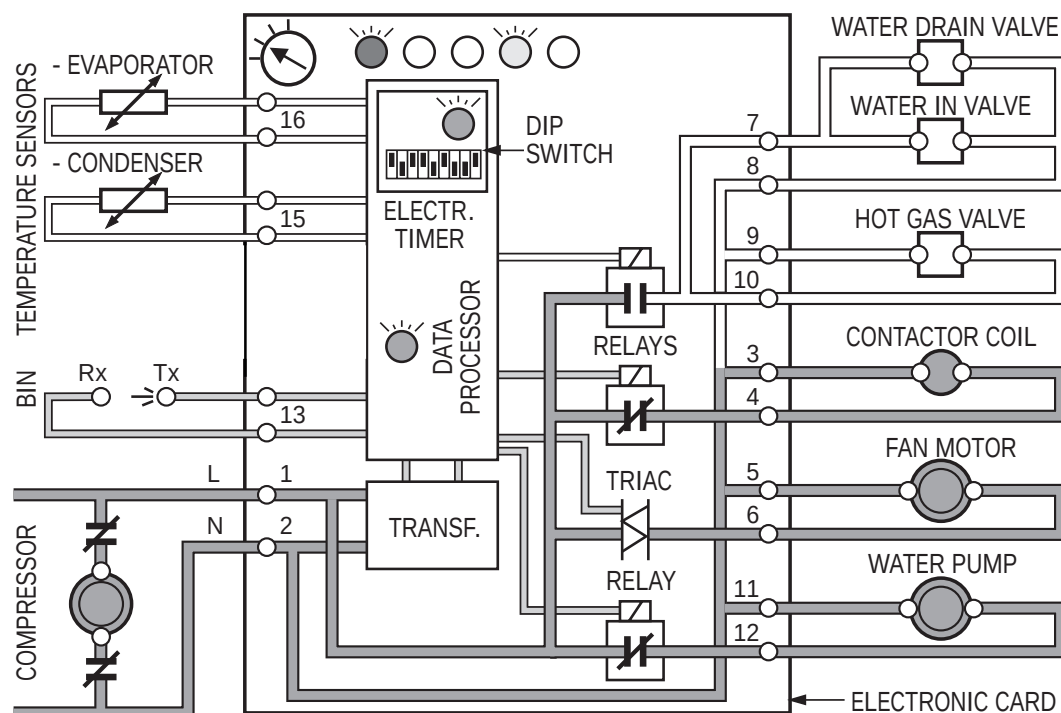
FIG. 3



E. Check to see through the ice discharge opening that the spray system is correctly seated and that the water jets uniformly reach the

interior of the inverted mold cups; also make sure that the plastic curtain is hanging freely and there is not excessive water spilling through it.

FIG. 4



F. The ice making process takes place thereby, with the water sprayed into the molds that gets gradually refrigerated by the heat exchange with the refrigerant flowing into the evaporator serpentine. During the freezing process, when the evaporator temperature falls below an established value, the evaporator temperature sensor supplies a low voltage power signal to the electronic control device (P.C.BOARD) in order to activate an electronic timer. This one takes over the control of the freezing cycle up to the complete formation of the ice cubes (Fig.4).

NOTE. The length of the entire freezing cycle is governed by the evaporator temperature sensor which has its probe placed in contact with the evaporator serpentine (Non adjustable) in combination with the electronic timer (Adjustable) incorporated in the P.C.BOARD. The timer adjustment is factory set in consideration of the ice maker type, cooling version and ice cube size (Small, Medium, Large). It is possible, however, to modify the timed length of the freezing cycle, by changing the **DIP SWITCH** keys setting. In Table B of PRINCIPLE OF OPERATION are shown the various time extensions of the freezing cycle second phase, in relation with the different DIP SWITCH keys setting.

G. After about 17÷20 minutes from the beginning of the freezing cycle, in an hypothetic ambient temperature of 21°C, the defrost cycle takes place with the hot gas, the water inlet and the water drain valves simultaneously activated (Fig. 5).

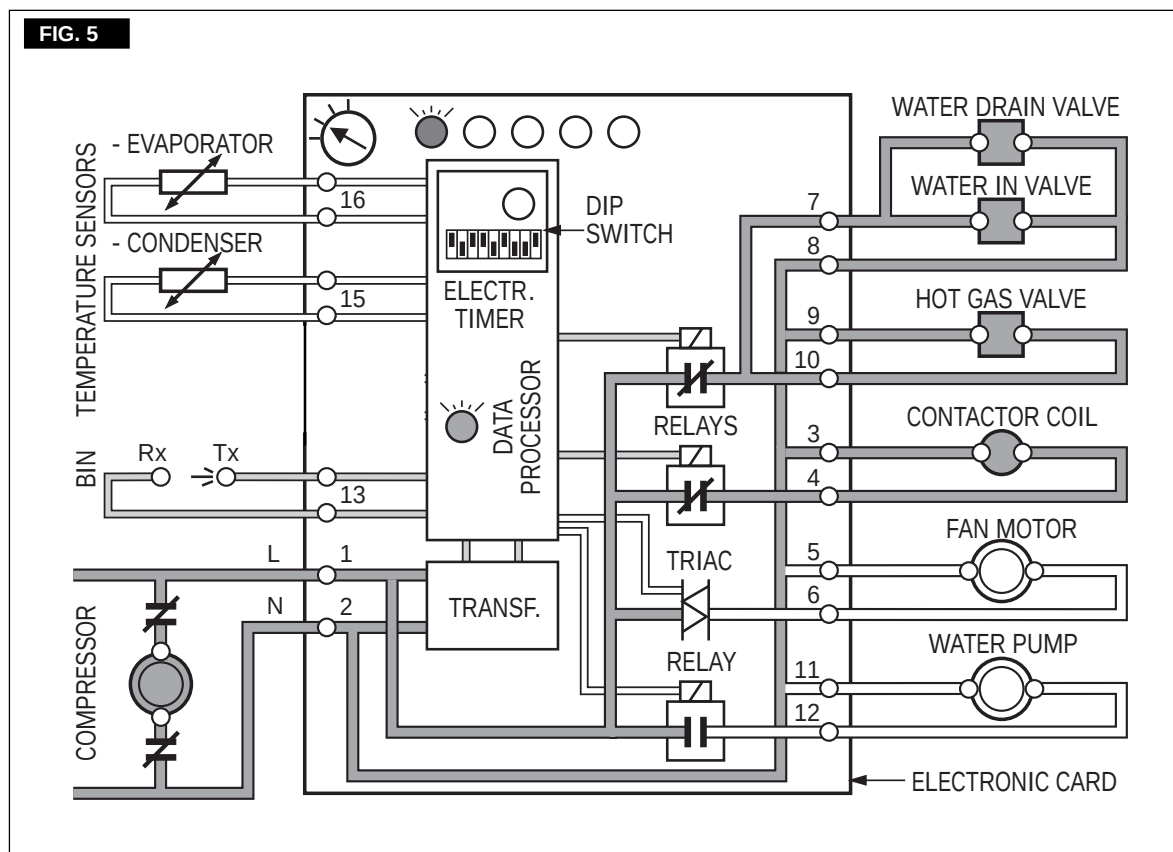
The electrical components in operation on models are:

COMPRESSOR
WATER INLET VALVE
HOT GAS VALVE
WATER DRAIN VALVE
 and the
WATER PUMP

on the first 15 seconds.

NOTE. The length of the defrost cycle (not adjustable) is automatically determined by the micro-processor of the P.C. BOARD in relation of the time necessary for the unit to reduce the evaporator temperature from 0°C (32°F) to -13°C (8.5°F) - TIME T2.

H. Check, during the defrost cycle, that the incoming water flows correctly into the sump reservoir in order to refill it and that the surplus overflows through the overflow drain tube.



I. Check the texture of ice cubes just released. They have to be in the right shape with a small depression of about 5-6 mm in their crown. If not, wait for the completion of the second cycle before performing any adjustment. If the ice cubes are shallow and cloudy, it is possible that the ice maker runs short of water during the freezing cycle second phase or, the quality of the supplied water requires the use of an appropriate water filter or conditioner.

J. To be sure of the correct operation of ice level control device, place one hand between its sensing "eyes" to interrupt the light beam. The **RED LIGHT** located in the front of the P.C.BOARD goes immediately OFF, and after 60 seconds, the unit stops with the simultaneous glowing of the **2nd YELLOW LIGHT** to monitor the **BIN FULL** situation (Fig.6).



Take the hand out from the ice level control sensors to allow the resumption of the light beam; the **RED LIGHT**, located in the front of the P.C.BOARD, will glow immediately. After approximately 6 seconds the ice maker resume its operation with the immediate glowing

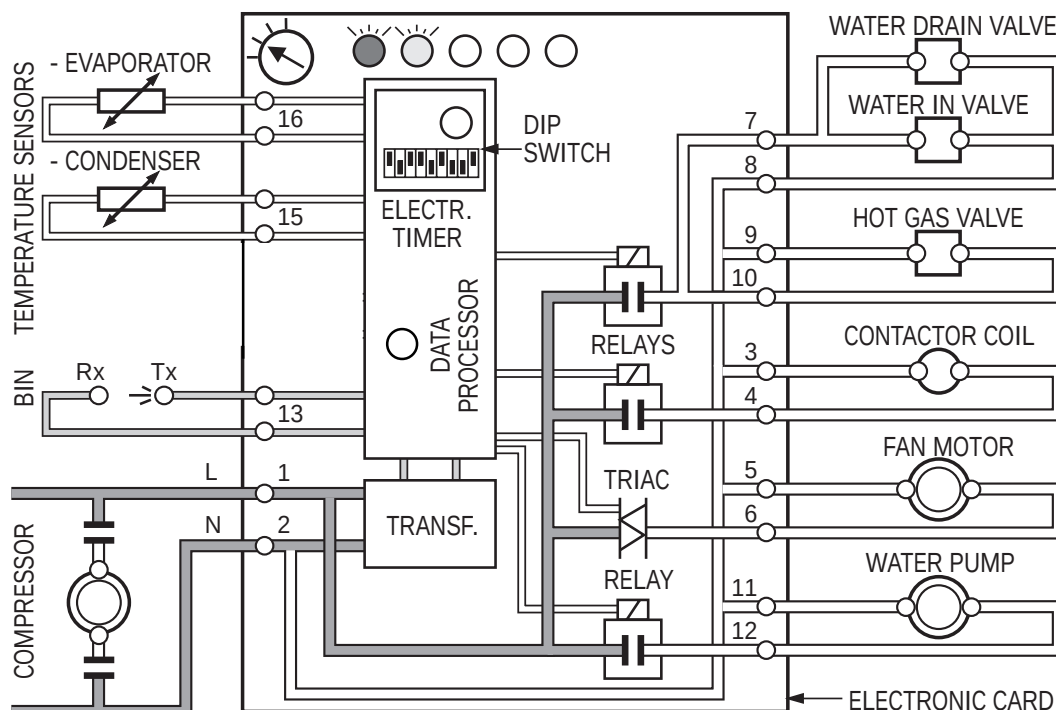
of the **FOURTH YELLOW LIGHT** indicating **UNIT IN OPERATION** and the extinguishing of the **"BIN FULL" YELLOW LIGHT**.

NOTE. The **ICE LEVEL CONTROL (INFRARED SYSTEM)** is independent of the temperature however, the reliability of its detection can be affected by external light radiations or by any sort of dirt and scale sediment which may deposit directly on the light source and on the receiver. To prevent any possible ice maker malfunction, due to negative affection of the light detector, it is advisable to locate the unit where it is not reached by any direct light beam or light radiation, also it is recommended to keep the bin door constantly closed and to follow the instructions for the periodical cleaning of the light sensor elements as detailed in the **MAINTENANCE AND CLEANING PROCEDURES**.

K. Remove, if fitted, the refrigerant service gauges and re-fit the unit service panels previously removed.

L. Instruct the owner/user on the general operation of the ice machine and about the cleaning and care it requires.

FIG. 6



PRINCIPLE OF OPERATION

How it works

In the **SCOTSMAN** cube ice makers the water used to make the ice is kept constantly in circulation by an electric water pump which primes it to the spray system nozzles from where it is diverted into the inverted mold cups of the evaporator. A small quantity of the sprayed water freezes into ice; the rest of it cascades by gravity into the sump assembly below for recirculation.

FREEZING CYCLE

The hot gas refrigerant discharged out from the compressor reaches the condenser where, being cooled down, condenses into liquid. Flowing into the liquid line it passes through the drier filter, then it goes all the way through the capillary tube where, due to the heat exchanging action, it loses some of its heat content so that its pressure and temperature are lowered as well.

Next the refrigerant enters into the evaporator serpentine (which has a larger I.D. than the capillary) and starts to boil off; this reaction is emphasized by the heat transferred by the sprayed water.

The refrigerant then increases in volume and changes entirely into vapor.

The vapor refrigerant then passes through the suction accumulator (used to prevent that any small amount of liquid refrigerant may reach the compressor) and through the suction line. In both the accumulator and the suction line it exchanges heat with the refrigerant flowing into the capillary tube (warmer), before to be sucked in the compressor and to be recirculated as hot compressed refrigerant gas.

The freezing cycle is controlled by the evaporator temperature sensor (which has its probe in contact with the evaporator serpentine) that determines the length of its first portion of the cycle.

When the temperature of the evaporator serpentine drops to a pre-set value, the evaporator sensor probe changes its electrical resistance allowing a low voltage current (15 volts) to flow to the P.C. BOARD which in turn activates an electronic timer.

The timer, which is built-in the P.C. BOARD, takes over from the evaporator temperature sensor, the control of the freezing cycle up to its completion.

NOTE. The change of the electric potential of the evaporator sensor with the consequent activation of the timer (Time mode) is signalled by the glowing-up of the RED LED located in the front of the P.C. BOARD.

ATTENTION. In case, after 15 minutes from the beginning of the freezing cycle, the temperature of the evaporator sensor probe is higher than 0° C (32°F) (shortage of refrigerant, inoperative hot gas valve, etc.) the P.C. BOARD switch OFF immediately the unit with the simultaneous blinking of the WARNING RED LED.

The length of this second portion of the freezing cycle is pre-fixed and related to the setting of the first four DIP SWITCH keys.

The DIP SWITCH keys setting is made in consideration of the type of condenser used.

In Table B are indicated the various lengths of the second portion of freezing cycle (Time mode) in relation to the different combinations of the DIP SWITCH KEYS.

In Table A herebelow are illustrated the DIP SWITCH keys combinations for the three different models and versions as they are set in the factory.

The electrical components in operation during the freezing cycle are:

COMPRESSOR

FAN MOTOR (in air cooled version)

WATER PUMP

CONTACTOR COIL

and during the second phase of freezing cycle (Time mode) they are joined by the

ELECTRONIC TIMER

The refrigerant head pressure, in the course of the freezing cycle, ranges between 8.5 and 9.5 bars (110÷130 psig) in the air cooled version,

TAB. A DIP SWITCH FACTORY SETTING COMBINATIONS (PER MODEL AND VERSION)										
DIP SWITCH	FREEZING CYCLE				DEFROST CYCLE			DIAGN.	W.PUMP	KWD
	1	2	3	4	5	6	7	8	9	10
ACM 105 A & W	ON	ON	OFF	ON	ON	ON	ON/OFF	OFF	ON	OFF
ACL 105 A & W	OFF	OFF	OFF	ON	ON	ON	ON/OFF	OFF	ON	OFF

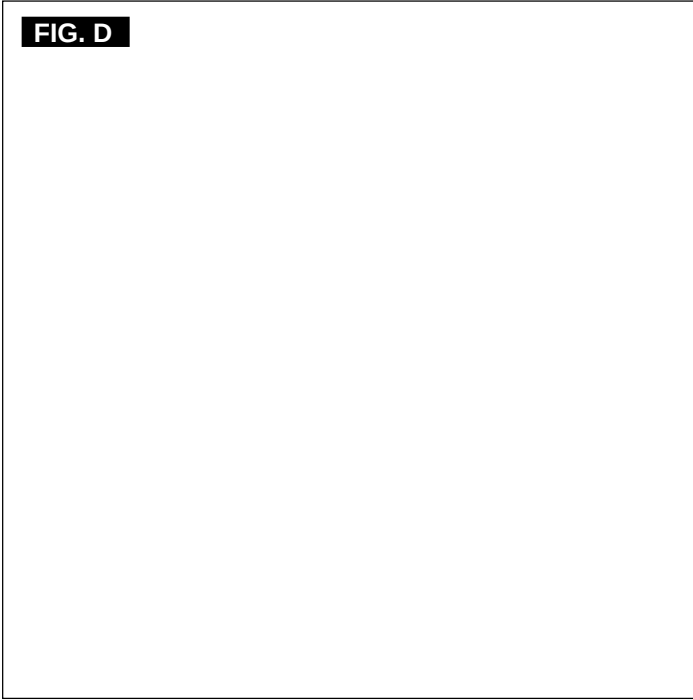
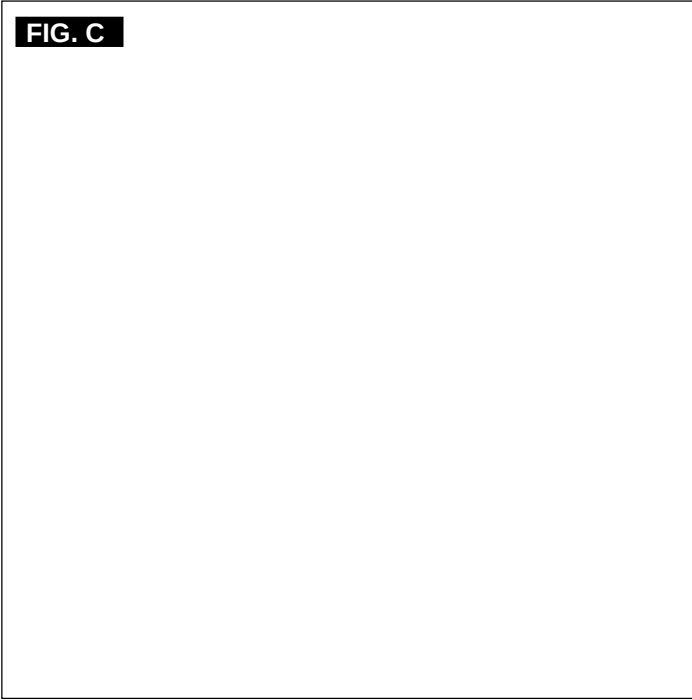
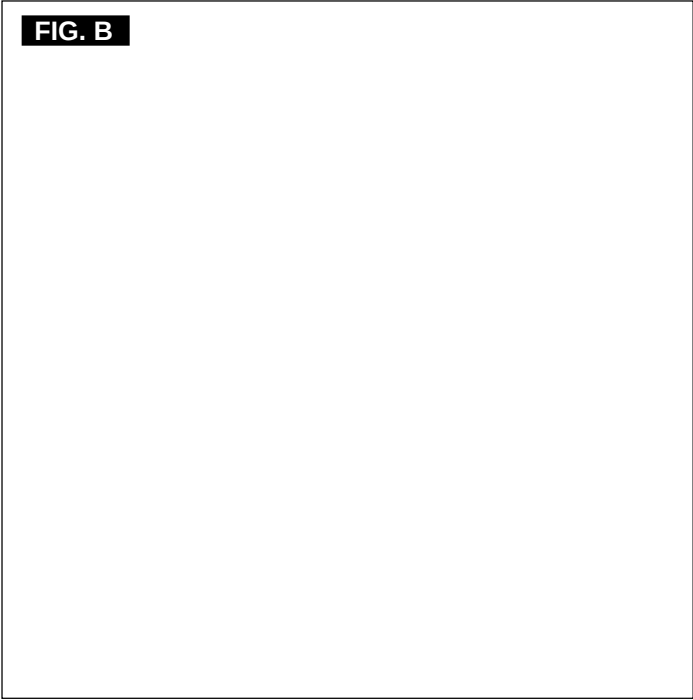
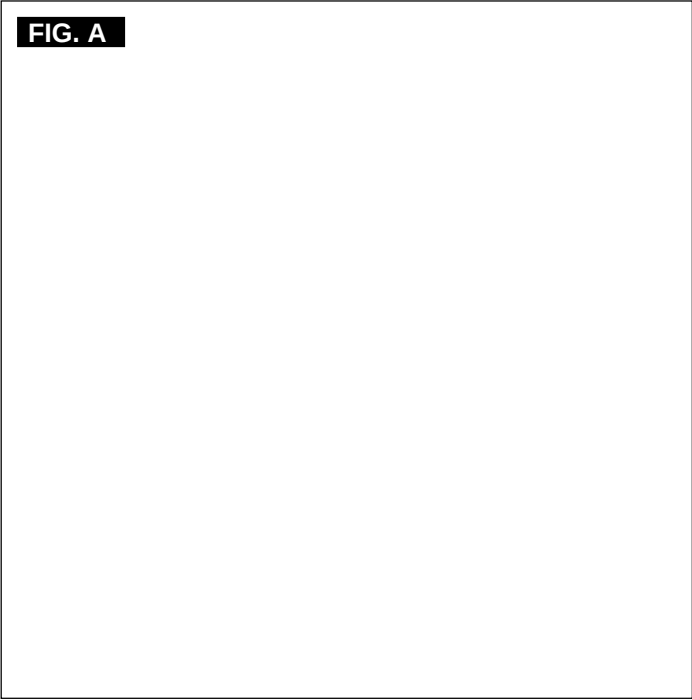


FIG. E

FIG. F

FIG. G

FIG. H

and between 9.5 and 10.5 bar (135÷150 psig) in the water cooled version, being controlled by the temperature sensor probe located within the condenser fins (air cooled version) or, on the condenser tube coil (water cooled version). On the air cooled version, the condenser temperature sensor, when senses a rising of the condenser temperature beyond the pre-fixed limit, changes its electrical resistance and transmits a low voltage power flow to the Micro Processor of P.C. BOARD which in turn energizes, through a **TRIAC**, the **FAN MOTOR**.

When the opposite situation occurs, i.e. the condenser temperature gets below the pre-fixed limit, the temperature sensor changes again its electrical resistance reducing therefore the current flow to the P.C. BOARD to cause the fan motor temporary cut-off.

NOTE. In case the condenser temperature probe senses that the condenser temperature has risen to 70°C (160°F) - on air cooled versions - or 62°C (145°F) - on water cooled versions - for one of the following reasons:

CLOGGED CONDENSER (Air cooled version)

INSUFFICIENT FLOW OF COOLING WATER (Water cooled version)

FAN MOTOR OUT OF OPERATION (Air cooled version)

AMBIENT TEMPERATURE HIGHER THEN 40°C (100°F)

it causes the total and immediate **SHUT-OFF** of the machine in order to prevent the unit from operating in abnormal and dangerous conditions.

When the ice maker stops on account of this protective device, there is a simultaneous glowing of the **RED LED**, warning the user of the **Hi Temperature** situation.

After having eliminated the source of the condenser hi-temperature, to restart the machine it is necessary first to rotate for a while the program selector on **RE-SET** position then again on **OPERATION** position or to unplug (wait few seconds) and plug in again the unit. The ice machine resumes its normal operation by going through the 5 minutes water filling phase.

At the start of the freezing cycle the refrigerant suction or lo-pressure lowers rapidly to 1 bar - 14 psig then it declines gradually - in relation with the growing of the ice thickness - to reach, at the end of the cycle, approx. 0 bar - 0 psig with the cubes fully formed in the cup molds. The total length of the freezing cycle ranges from 20 to 25 minutes.

DEFROST OR HARVEST CYCLE (Fig.E and G)

As the electronic timer has carried the system throughout the second phase of freezing cycle, the defrost cycle starts.

ATTENTION. In case the unit is able to reach 0°C (32°F) evaporating temperature within 15 minutes, but after 45 minutes from the beginning of the freezing cycle it has not yet reached the evaporator temperature of -15°C (5°F) the machine goes straight into the defrost cycle omitting the timed portion of the freezing cycle relied to the setting of the first four DIP SWITCHES.

NOTE. The length of the defrost cycle (not adjustable) is related to the length of the second phase of freezing cycle T2. (Time to drop the evaporating temperature from 0°C (32°F) to -13°C (8.5°F).

The electrical components in operation during this phase are:

COMPRESSOR

WATER INLET VALVE

HOT GAS VALVE

WATER DRAIN VALVE

and the

WATER PUMP

on the first 15 seconds.

The incoming water, passing through the water inlet valve and the flow control, runs over the evaporator platen and then flows by gravity through the dribbler holes down into the sump/reservoir. (Fig. F and H)

The water filling the sump/reservoir forces part of the surplus water from the previous freezing cycle to go out to the waste through the overflow pipe. This overflow limits the level of the sump water which will be used to produce the next batch of ice cubes.

Meanwhile, the refrigerant as hot gas, discharged from the compressor, flows through the hot gas valve directly into the evaporator serpentine by-passing the condenser.

The hot gas circulating into the serpentine of the evaporator warms up the copper molds causing the defrost of the ice cubes. The ice cubes, released from the cups, drop by gravity onto a slanted cube chute, then through a curtained opening they fall into the storage bin.

NOTE. The length of the defrost cycle, factory set, changes in accordance with the duration of the second portion of the freezing cycle (Time T2) that is related to the ambient temperature.

At the end of the defrost cycle, the hot gas valve, the water inlet valve and the water drain valve close and the machine starts again a new freezing cycle.

OPERATION - CONTROL SEQUENCE

At the start of freezing cycle the evaporator temperature sensor controls the length of the first part of the freezing cycle. As it reaches a predetermined temperature it supplies a low voltage current to the P.C. BOARD in order to activate the electronic timer which takes over the control of the freezing cycle for a pre-fixed time according to the DIP SWITCH keys setting (see Tab. B).

NOTE. The evaporator temperature sensor, factory pre-set, is the same for all the models and is not adjustable in the field.

Once completed the freezing cycle 2nd phase the system goes automatically into the defrost cycle which has also a pre-fixed length. At completion of the defrost cycle the P.C. BOARD command the unit to start again a new freezing cycle.

OPERATION - ELECTRICAL SEQUENCE

The following charts illustrate which switches and which components are ON or OFF during a particular phase of the icemaking cycle. Refer to the wiring diagram for a reference.

BEGINNING FREEZE

Electrical components (Loads)	ON	OFF
Compressor	•	
Fan Motor (Air cooled only) and TRIAC	•	
Hot Gas Valve		•
Water Inlet Valve		•
Water Drain Valve		•
P.C.Board Relay 1 Coil		•
P.C.Board Relay 2 & 3 Coil	•	
Water Pump	•	
Contacteur Coil	•	
P.C.B. Timer		•
Electronic Controls & Sensors	ON	OFF
Evaporator Sensor		•
Condenser Sensor	•	
Ice Level Control	•	

TIMED FREEZE

Electrical components (Loads)	ON	OFF
Compressor	•	
Fan Motor (Air cooled only) and TRIAC	•	•
Hot Gas Valve		•
Water Inlet Valve		•
Water Drain Valve		•
P.C.Board Relay 1 Coil		•
P.C.Board Relay 2 & 3 Coil	•	
Water Pump	•	
Contacteur Coil	•	
P.C.B. Timer	•	
Electronic Controls & Sensors	ON	OFF
Evaporator Sensor	•	
Condenser Sensor	•	•
Ice Level Control	•	

HARVEST (Drain portion - first 15 sec.)

Electrical components (Loads)	ON	OFF
Compressor	•	
Fan Motor (Air cooled only) and TRIAC		•
Hot Gas Valve	•	
Water Inlet Valve	•	
Water Drain valve	•	
P.C.Board Relay 1 & 2 Coil	•	
P.C.Board Relay 3 Coil	•	
Water Pump	•	
Contacteur Coil	•	
P.C.B. Timer	•	
Electronic Controls & Sensors	ON	OFF
Evaporator Sensor		•
Condenser Sensor		•
Ice Level Control	•	

HARVEST (Water filling portion)

Electrical components (Loads)	ON	OFF
Compressor	•	
Fan Motor (Air cooled only) and TRIAC		•
Hot Gas Valve	•	
Water Inlet Valve	•	
Water Drain valve	•	
P.C.Board Relay 1 & 2 Coil	•	
P.C.Board Relay 3 Coil		•
Water Pump		•
Contacteur Coil	•	
P.C. Board Timer	•	
Electronic Controls & Sensors	ON	OFF
Evaporator Sensor		•
Condenser Sensor		•
Ice Level Control	•	

OPERATING CHARACTERISTICS**AC 105****Freeze Cycle**

Average Discharge

Pressure A/C: 9.5÷8.5 bar (130÷110 psig)

Average Discharge

Pressure W/C: 10.5÷9.5 bar (150÷135 psig)

Suction Pressure

End Freeze Cycle: 0 ÷ 0.1 bar (0 ÷ 1 psig)

REFRIGERANT CHARGE (R 134 A)

	Air cooled	Water cooled
AC 105	320 gr (11 oz.)	250 gr (9 oz.)

COMPONENTS DESCRIPTION**A. EVAPORATOR TEMPERATURE SENSOR**

The evaporator temperature sensor probe, located in contact with the evaporator serpentine, detects the dropping of the evaporator temperature during the freezing cycle and signals it by supplying a current flow to the micro processor of P.C. BOARD.

According to the current received, the micro processor supplies power to the electronic timer built into the P.C. BOARD so that it takes control of the length of the 2nd phase of freezing cycle. The length of the timed phase is pre-fixed by the setting of the keys 1, 2, 3 and 4 of the DIP SWITCH.

The activation of the electronic timer is indicated by the lighting up of the RED LED placed in the front of the P.C. BOARD.

This lighting up occurs usually in the mid period of the freezing cycle and signals the switching from the first to the second phase of the freezing cycle.

NOTE. Whenever, after 15 minutes from the beginning of the freezing cycle, the evaporating temperature have not yet reached the value of 0°C (32°F), the P.C.Board switches OFF the machine with the BLINKING of RED LED.

B. CONDENSER TEMPERATURE SENSOR

The condenser temperature sensor probe, located within the condenser fins (air cooled version) or in contact with the tube coil (water cooled version) detects the condenser temperature variations and signals them by supplying current, at low voltage, to the P.C. BOARD.

In the air cooled versions, in relation to the different current received, the micro processor of the P.C. BOARD supplies, through a TRIAC, the power at high voltage to the fan motor so to cool the condenser and to reduce its temperature.

In case the condenser temperature rises and reaches **70°C (160°F)** - on air cooled models - or **62°C (145°F)** - on water cooled models - the current arriving to the micro processor is such to cause an immediate and total stop of the machine operation.

C. ICE BIN LEVEL LIGHT CONTROL

The electronic ice bin level control, located into the storage bin, has the function to stop the operation of the ice machine when the light beam between the light source and the sensor is interrupted by the ice cubes stored into the bin.

When the light beam is interrupted the RED LED located in the front of the P.C. BOARD goes off; in case the light beam is constantly interrupted for more than 60 seconds, the ice machine stops with the glowing-up of the **2nd YELLOW LED** to monitor the situation of ice bin full.

The 60 seconds of delay prevent that an ice scoop movement or the ice dropping through the ice chute (interrupting for a while the light beam) can stop the operation of the unit.

As soon as the ice is scooped out (with the resumption of the light beam between the two infrared sensor of ice level control) the RED LED is lighted up and after 6 seconds the ice machine restarts again with the extinguishing the 2nd YELLOW LED.

D. P.C. BOARD (Data processor)

The **P.C. BOARD**, fitted in its plastic box located in the front of the unit, consists of two separated printed circuits one at high and the other at low voltage integrated with a program selector, of two fuses one on power in (100mA) and one on power out (16A), of five aligned **LEDS** monitoring the operation of the machine, of two extra monitoring **RED LEDS**, of one **DIP SWITCH** with ten keys, of one small jumper located on its back side, of input terminals for the leads of the sensor probes and input and output terminals for the leads of the ice maker electrical wires.

The P.C. BOARD is the brain of the system and it elaborates, through its micro processor, the signals received from the four sensors in order to control the operation of the different electrical components of the ice maker (compressor, water pump, solenoid valves, etc.).

By turning the program selector it is possible to put the unit in the following different situations:

CLEANING/RINSING. The water pump is the only electrical component in operation and it must be used during the cleaning or the rinsing procedure of the water system of ice machine.

STAND BY. The unit remain under electrical power but OUT of operation. It can be used by the service engineer in order to stop the unit during the service and inspection operations.

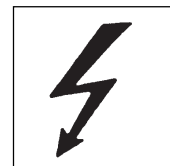
IN OPERATION. The unit is running through the freezing and defrost cycles stopping automatically only at full bin situation.

RE-SET/HI TEMPERATURE. To be selected to resume the unit operation when the ice maker shuts off due to the intervention of the condenser temperature sensor (too high condensing temperature) or evaporator temperature sensor (too high after 15 minutes from the beginning of the freezing cycle).

The five LEDS, placed in a row in the front of the P.C. BOARD, monitor the following situations:

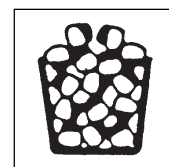
GREEN LIGHT

Unit under electrical power



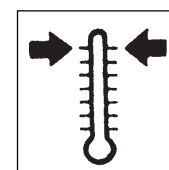
YELLOW LIGHT

Unit shut-off at full storage bin



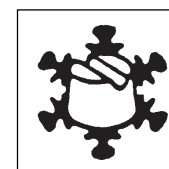
RED LIGHT

Unit shut-off due to hi condensing temperature



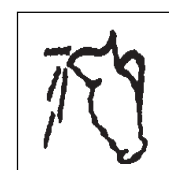
RED LIGHT BLINKING

Unit shut-off due to hi evaporating temperature



YELLOW LIGHT

Unit in freezing cycle mode



YELLOW LIGHT

Unit in cleaning/rinsing mode (not appearing in the front panel)

By means of one small jumper, located on the back side of the P.C. Board, can be modified the cut-OUT condensing temperature (safety temperature) from 70°C (160 °F) - for air cooled versions to 62° (145 °F) - for water cooled versions.

E. DIP SWITCH

The P.C.BOARD which controls the entire operation of the ice maker, has a **DIP SWITCH with ten switching keys** which allow to set up the micro processor program in order to extend or to shorten the length of freezing cycle in relation to the different model and versions of ice machines.

The **DIP SWITCH first four keys setting** determines the length of the 2nd phase of

freezing cycle (controlled by the electronic timer) as detailed in the table B.

TAB. B													
LENGTH OF TIMED PORTION OF FREEZING CYCLE ACCORDING TO THE DIP SWITCH SETTING COMBINATIONS													
		1	2	3	4				1	2	3	4	
1	ON OFF	■	■	■	■	25 min.	8	ON OFF	■	■	■	■	11 min.
2	ON OFF	■	■	■	■	23 min.	9	ON OFF	■	■	■	■	9 min.
3	ON OFF	■	■	■	■	21 min.	10	ON OFF	■	■	■	■	7 min.
4	ON OFF	■	■	■	■	19 min.	11	ON OFF	■	■	■	■	5 min.
5	ON OFF	■	■	■	■	17 min.	12	ON OFF	■	■	■	■	3 min.
6	ON OFF	■	■	■	■	15 min.	13	ON OFF	■	■	■	■	1 min.
7	ON OFF	■	■	■	■	13 min.							

The **DIP SWITCH keys 5 & 6 setting** determines the length of the defrost cycle according to the size of the cubes (Large or Medium). **It is not possible** to modify the length of the defrost cycle (factory setting).

The **7th D.S. key** is not used in this release of the P.C. BOARD.

The **8th DIP SWITCH key** allows to make a rapid check up of the P.C. BOARD output connections (compressor, water pump, fan motor, water inlet and hot gas solenoid valves) energizing them in rapid sequence (2 seconds) one by one. DURING THE AUTOMATIC OPERATION OF THE ICE MAKER THIS KEY MUST BE SET IN OFF POSITION.

ATTENTION. The check up of the P.C.BOARD output must be performed in a very short time in order to avoid frequent start and stop (every few seconds) of the electrical components which may damage them specially the compressor.

The **9th key** allows the operation of the water pump even during the defrost cycle, as required when it is necessary to drain out the remaining water from the sump.

The **10th key** is used to supply power to the water pump for the first 15 seconds of the defrost cycle - position OFF - and for the first 30 seconds - position ON.

F. WATER SPRAY SYSTEM

Through its nozzles, the water pumped, is sprayed in each individual cup to be frozen into ice. It consists of one spray tube where are located several spray nozzles.

G. WATER PUMP

The water pump operates continually throughout the freezing cycle and on the first 15 or 30

seconds of the defrost cycle so to such the remaining water from the sump tank (reach in mineral salts) and drain it out.

During the freezing cycle the pump primes the water from the sump to the spray system and through the spray nozzles sprays it into the inverted cup molds to be frozen into crystal clear ice cubes.

It is recommended that the pump motor bearings be checked at least every six months.

H. WATER INLET SOLENOID VALVE - 3/4 MALE FITTING (Water cooled version)

A special water inlet solenoid valve with one inlet and two outlets (one for condenser and the second for the production of ice) is used on water cooled version.

An automatic hi pressure control activates the second coil of the water inlet solenoid valve so to supply a metered amount of water to the condenser and drop down its temperature and pressure.

I. HOT GAS SOLENOID VALVE

The hot gas solenoid valve consists basically in two parts: the valve body and the valve coil. Located on the hot gas line, this valve is energized through the micro processor of P.C. BOARD during the defrost cycle as well as during the water filling phase.

During the defrost cycle the hot gas valve coil is activated so to attract the hot gas valve piston in order to give way to the hot gas discharged from compressor to flow directly into the evaporator serpentine to defrost the formed ice cubes.

J. FAN MOTOR (Air cooled version)

The fan motor is controlled through the P.C. BOARD and the TRIAC by the condenser temperature sensor. Normally it operates only during the freezing cycle to draw cooling air through the

condenser fins. In the second part of the freezing cycle, the fan motor can run at intermittance as the condenser pressure must be kept between two corresponding head pressure values.

K. COMPRESSOR

The hermetic compressor is the heart of the refrigerant system and it is used to circulate and retrieve the refrigerant throughout the entire system. It compresses the low pressure refrigerant vapor causing its temperature to rise and become high pressure hot vapor which is then released through the discharge valve.

L. HI PRESSURE CONTROL (Water cooled version)

Used only on the water cooled versions it operates to keep between 9.5 and 10.5 bars (135 ÷ 150 psig) the hi-side or discharge pressure of the

refrigerant system by energizing the coil of the water inlet solenoid valve that control the cooling water flow to the condenser.

M. WATER DRAIN SOLENOID VALVE

The water drain solenoid valve, electrically connected in parallel to the water inlet and to the hot gas solenoid valves, is energized for all the length of the defrost cycle.

By means of the water pump, that remains energized for 15 seconds at the beginning of the defrost cycle, it allows the drain out of all remaining water (rich of minerals deposited during the previous freezing cycle) from the sump tank.

By doing so it allows to the ice maker to make every new freezing cycle with new fresh water, avoiding thereby the accumulation of sediments and scales, which soon or later will cause the partial or total clogging of the water system on the unit.

ADJUSTMENT PROCEDURES

A. ADJUSTMENT OF THE CUBE SIZE

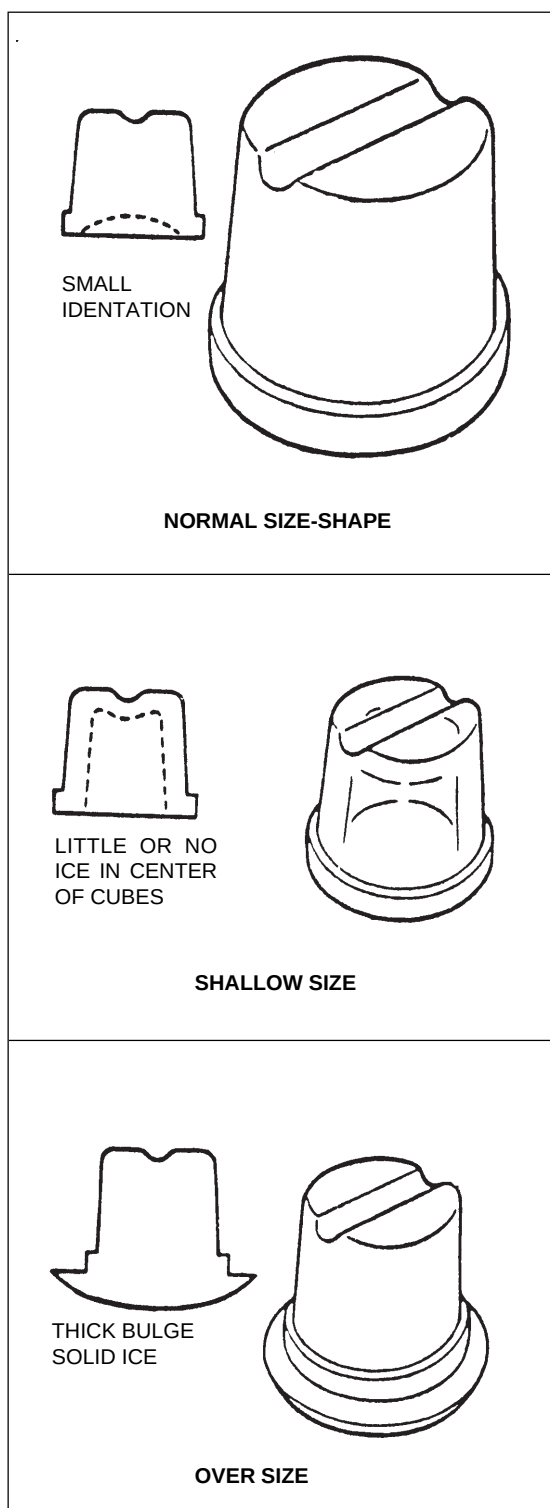
CAUTION. Before performing actual adjustment of the cube size, check other possible causes for cube size problems, refer to the Service Diagnosis Section for problem review and analysis. Do not perform any adjustment till the icemaking system has progressed through several complete freezing and harvest cycle, to observe size and quality of ice cubes and whether or not the cube size problem exists.

I. If the cubes are shallow size (Indentation is too deep) probably the length of the second phase of the freezing cycle is too short so, to extend such length you have to:

1. Locate the DIP SWITCH on the front of the P.C.Board.
2. Take note of the combination of the first four DIP SWITCH KEYS and check the corresponding length of freezing cycle 2nd phase on Table B.
3. Set the same DIP SWITCH KEYS to correspond to the prior combination shown on Table B which allow an extension of two more minutes of the length of the freezing cycle.
4. Observe the ice cubes in the next two harvests and eventually repeat steps 2 and 3 above until proper ice cubes size is achieved. See figure.

II. If the cubes are oversize size (Indentation is too full) probably the length of the second phase of the freezing cycle is too long. To shorten such length you have to:

1. Locate the DIP SWITCH on the front of the P.C.Board.
2. Take note of the combination of the first four DIP SWITCH KEYS and check the corresponding length of freezing cycle 2nd phase on Table B.
3. Set the same DIP SWITCH KEYS to correspond to the next combination shown on Table B which allow a reduction of two minutes of the length of the freezing cycle.
4. Observe the ice cubes in the next two harvests and eventually repeat steps 2 and 3 above until proper ice cubes size is achieved. See figure.



WIRING DIAGRAM

AC 105 - AIR AND WATER COOLED 230/50/1

SERVICE DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	SUGGESTED CORRECTION
Unit will not run (No warning LEDS glows)	Blown power in fuse in P.C.Board Main switch in OFF position Inoperative P.C.Board Loose electrical connections	Replace fuse & check for cause of blown fuse Turn switch to ON position Replace P.C.Board Check wiring
(Green LED-Power ON glows)	P.C.Board selector in STAND BY Blown power out fuse in P.C. Board	Move to OPERATING position Replace fuse & check for cause of blown fuse
(Bin full LED glows)	Inoperative ice level control Inoperative P.C.Board	Clean or replace ice level control Replace P.C.Board
(Red-alarm LED glows)	High head pressure	Dirty condenser. Clean Inoperative fan motor. Replace Shortage of water (WC)
(Red-alarm LED blinks)	High evaporating temperature after 10 mins. beginning freeze	Hot gas valve leak - Replace it. Water inlet valve leak - Replace it. Evap. sensor inoperative - Replace it. Short of refrigerant.
Compressor cycles intermittently	Low voltage Contactor with burnt contacts Non-condensable gas in system Compressor starting device with loose wires Mechanical problem	Check circuit for overloading Check voltage at the supply to the building. If low, contact the power company Clean or replace Purge the system Check for loose wires in starting device Replace compressor
Cubes too small	Freezing cycle too short Capillary tube partially restricted Moisture in the system Shortage of water Shortage of refrigerant Inoperative evaporator sensor	Review setting of DIP SWITCH keys Blow charge, add new gas & drier, after evacuating system with vacuum pump Same as above See remedies for shortage of water Check for leaks & recharge Replace sensor
Cloudy cubes	Shortage of water Dirty water supply Accumulated impurities	See remedies for shortage of water Use water softner or water filter Use SCOTSMAN Ice Machine cleaner

SERVICE DIAGNOSIS

SYMPTON	POSSIBLE CAUSE	SUGGESTED CORRECTION
Shortage of water	Water spilling out through curtain Water solenoid valve not opening Water leak in sump area Water flow control plugged Leak of water drain valve	Check or replace curtain Replace valve Locate and repair Replace water inlet valve Replace valve
Irregular cubes size & some cloudy	Some jets plugged Shortage of water Unit not level	Remove jet cover and clean See shortage of water Level as required
Cubes too large	Freezing cycle too long	Review setting of DIP SWITCH keys
Decreased ice capacity	Inefficient compressor Leaky water valve Non-condensable gas in system Poor air circulation or excessive hot location (Red-alarm LED glows) Overcharge of refrigerant Capillary tube partially restricted Hot gas solenoid valve leaking Undercharge of refrigerant Discharge head pressure too high	Replace Repair or replace Purge the system Relocate the unit or provide for more ventilation Correct the charge. Purge off slowly Blow charge, add new gas & drier, after evacuating system with vacuum pump Replace valve Charge to data plate indication See incorrect discharge pressure
Poor harvest	Restriction in incoming water line Water inlet valve not opening Hot gas valve orifice restricted Air vented holes in mold cups Discharge head pressure too low	Check water valve strainer and flow control. If necessary enlarge the flow control orifice Valve coil with open winding Replace valve Replace hot gas valve assy Clean out holes plugged See incorrect discharge pressure

SERVICE DIAGNOSIS

SYMPTON	POSSIBLE CAUSE	SUGGESTED CORRECTION
Unit won't harvest	Inoperative P.C.Board Hot gas valve not opening Water solenoid valve not opening	Replace P.C.Board Valve coil with open winding Replace valve Valve coil with open winding Replace valve
Incorrect discharge pressure	Inoperative condenser sensor Inoperative P.C.Board Water regulating valve misadjusted	Replace sensor Replace P.C.Board Adjust its setting stem
Excessive water in unit base	Water tubing leaking	Check. Tighten or replace

MAINTENANCE AND CLEANING INSTRUCTIONS

A. GENERAL

The periods and the procedures 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 and ambient conditions and the ice volume produced; and, each icemaker must be maintained individually, in accordance with its particular location requirements.

B. ICEMAKER

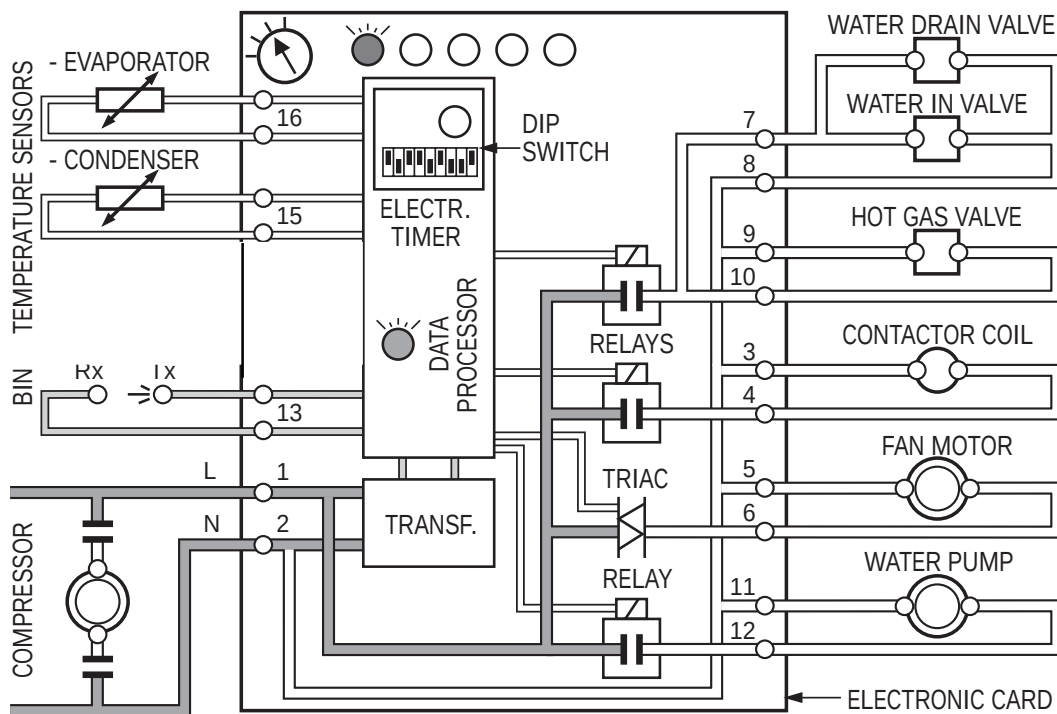
The following maintenance should be scheduled at least two times per year on these icemakers.

1. Check and clean the water line strainer.
2. Check that the icemaker is levelled in side to side and in front to rear directions.
3. Clean the water system, evaporator, bin and spray jets using a solution of SCOTSMAN Ice Machine Cleaner. Refer to procedure C cleaning instructions and after cleaning will indicate frequency and procedure to be followed in local areas.

NOTE. Cleaning requirements vary according to the local water conditions and individual user operation. Continuous check of the clarity of ice cubes and visual inspection of the water spraying parts before and after cleaning will indicate frequency and procedure to be followed in local areas.

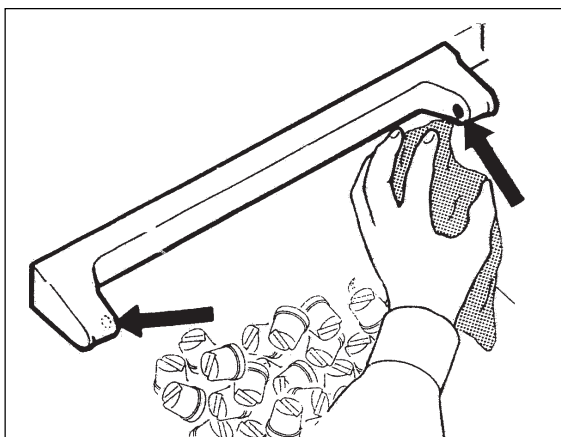
4. With the ice machine and fan motor OFF on air cooled models, clean condenser using vacuum cleaner, whisk broom or non metallic brush taking care to do not damage both the condenser and ambient temperature sensors.
5. Check for water leaks and tighten drain line connections. Pour water down bin drain line to be sure that drain line is open and clear.
6. Check size, condition and texture of ice cubes. Perform adjustment of DIP SWITCH keys as required.
7. Check the ice level control sensor to test shut-off. Put your hand between the light source and the receiver so to cut off the light beam for at least one minutes. This should cause the ice maker to shut off and the light up of the 2nd LED (yellow light).

FIG. 7



IMPORTANT. Perform the above check only at the end of harvest cycle or at the beginning of freezing cycle in order to do not cause to the unit to make a double freezing cycle.

NOTE. Within few seconds after the removal of the hand from the Infrared sensing light the icemaker restarts in freezing cycle. The ice level control uses devices that sense light, therefore they must be kept clean enough so they can "see". Every month clean/wipe the sensing "eyes" with a clean soft cloth.



9. Check for refrigerant leaks.

C. CLEANING INSTRUCTIONS OF WATER SYSTEM

1. Remove the front and the top panels to gain access either to the control box and to the evaporator.
2. Wait till the end of defrost cycle then, with the help of a normal screwdriver, turn the program selector head on **STANDBY** position to temporarily stop the operation (Fig.8).

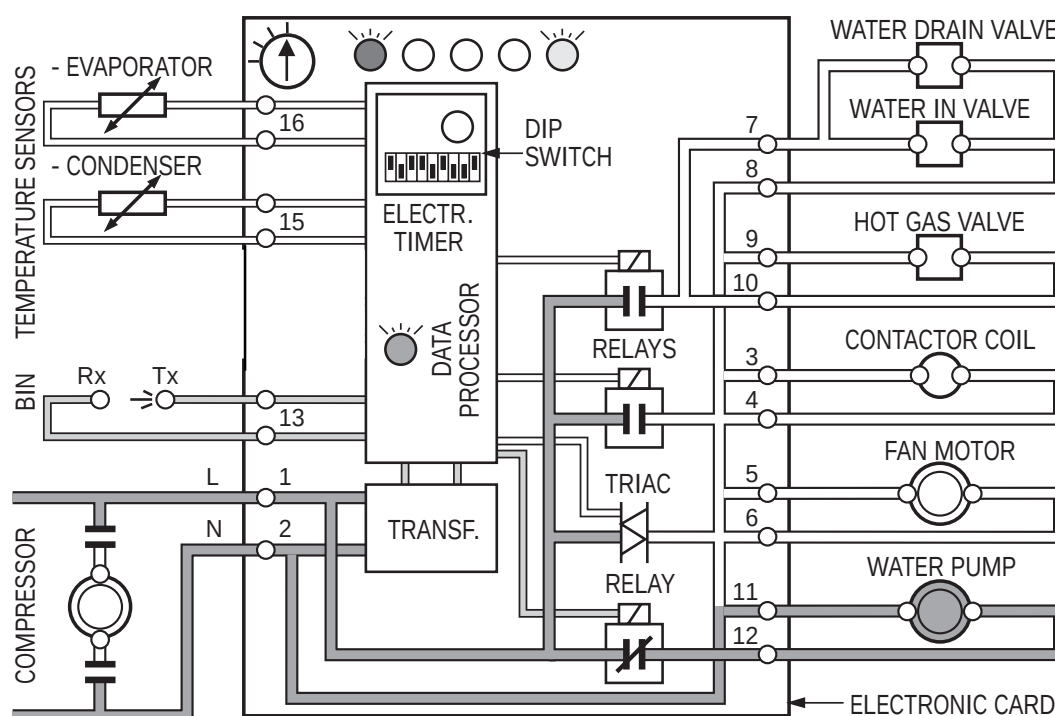
Cleaning

3. Prepare the cleaning solution by diluting in a plastic container two liters of warm water (45°-50°C) with a 0,2 liters of SCOTSMAN Ice Machine Cleaner.

WARNING. The SCOTSMAN Ice Machine Cleaner contains Phosphoric and Hydroxyacetic acids. These compounds are corrosive and may cause burns if swallowed, DO NOT induce vomiting. Give large amounts of water or milk. Call Physician immediately. In case of external contact flush with water. **KEEP OUT OF THE REACH OF CHILDREN**

4. Scoop out all the ice cubes stored into the bin in order to prevent them from being contaminated with the cleaning solution then flush out the water from the sump reservoir by removing the overflow stand-pipe.

FIG. 8



5. Remove the evaporator cover then slowly pour onto the evaporator platen the cleaning solution. With the help of a brush dissolve the most resistant and remote scale deposits in the platen.

6. Set the program selector head on **CLEANING/RINSING**. The 5th YELLOW LED lights-up (Fig.9).

NOTE. With the system in **CLEANING/RINSING** mode the water pump is the only component in operation to circulate the cleaning solution in the entire water system.

7. Let the unit to remain in the **CLEANING/RINSING** mode for about 20 minutes then turn the program selector on **STAND BY** again.

8. Flush out the cleaning solution from the sump reservoir then pour onto the evaporator cavity two or three liters of clean potable water to rinse the mold cups and the platen. If necessary remove the water spray bar and spray jets to clean them separately.

9. Turn again the program selector on **CLEANING/RINSING**. The water pump is again in operation to circulate the water in order to rinse the entire water system.

10. Flush out the rinsing water from the sump reservoir then turn the program selector on **RE-SET/HI TEMPERATURE** position and immediately afterward to **FREEZING OPERATION**.

NOTE. By setting the selector on **RE-SET** first and then to **FREEZING OPERATION** the ice maker will perform the 5 minutes **WATER FILLING** phase i.e. the water inlet solenoid valve opens to allow the incoming water to rinse again the water system and to properly fill-up the sump reservoir for the next freezing cycle.

Sanitation

NOTE. *Sanitation of the water system is recommended to be done **once a month**.*

11. Prepare in a plastic container the sanitation solution as per manufacturer dilution using warm water (45-50 °C).

NOTE. *Never mix the cleaning with the sanitising solution.*

12. Follow the procedures as per cleaning (from item 4 to item 10) just shorting the operation of the water pump to 10 minutes.

13. Place again the evaporator cover and the unit service panels.

14. At completion of the freezing and harvest cycle make sure of proper texture and clearness of the ice cubes and that, they do not have any acid taste.

ATTENTION. *In case the ice cubes are cloudy, white and have an acid taste, melt them immediately by pouring on them some warm water. This to prevent that somebody could use them.*

15. Wipe clean and rinse the inner surfaces of the storage bin.

REMEMBER. *To prevent the accumulation of undesirable bacteria it is necessary to sanitize the interior of the storage bin with an anti-algae disinfectant solution every week.*