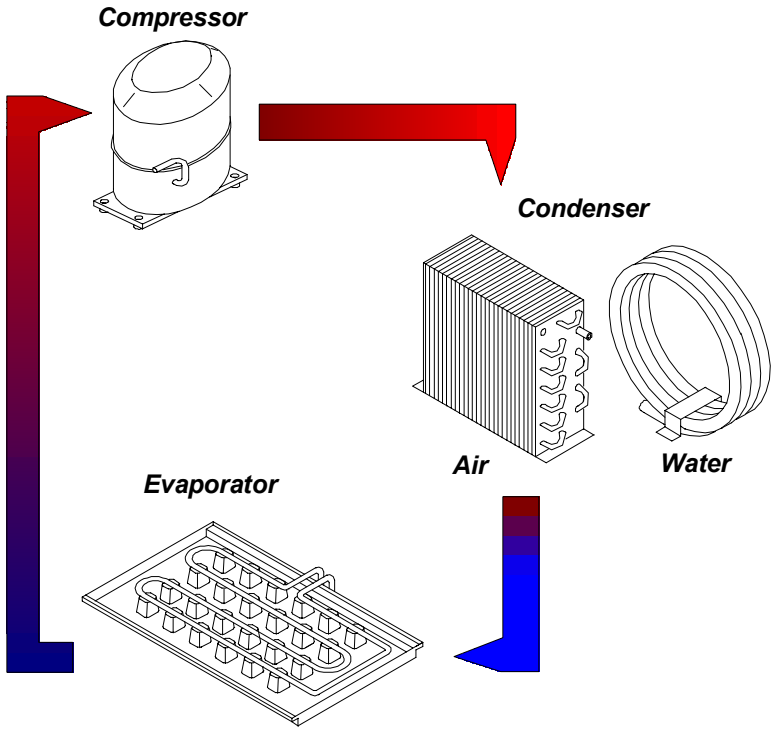
ICE CUBE MAKERS "SPRAYERS" SYSTEM

Last Update: ***01/06/2006***

SL Line

The following diagram shows the main concepts of the ice cube makers working ('sprayers' system).



Each ice maker uses the properties of compression and expansion of the liquefiable gases; its main principle is that each change of bodies state is got by producing or absorbing heat.

More precisely, the change of the refrigerating fluids from the liquid to the steam state is always followed by heat absorption.

That means that, by placing the side of the machine, in which the evaporation takes place in the ambient to cool, calories are taken away from the ambient (so giving it frigories).

The steams got after the expansion are then liquefied for compression.

The **compressor** sucks up the gases, generated by the evaporation, and compresses them, increasing their temperature and pressure.

A **condenser**, made up of a series of tubes (refrigerated by cold water or ventilated air), carries away the heat, comprised in the gas from the compressor and helps, in this way, the gas liquefacting.

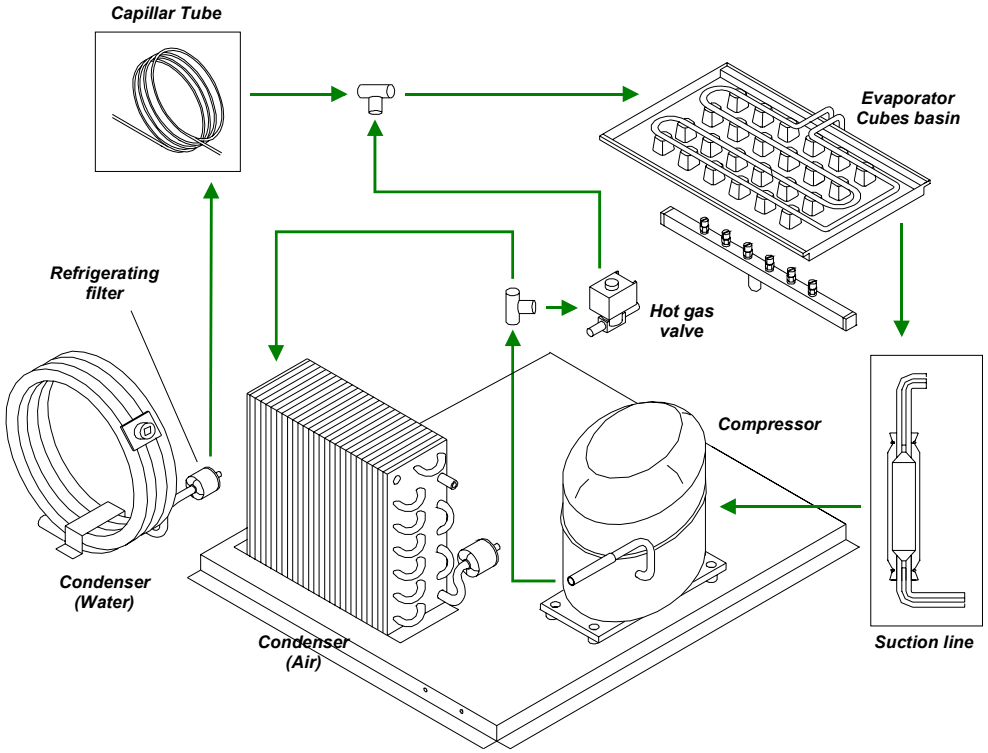
The refrigerating fluid, now in liquid state, circulates, then, in an **evaporator** that permits an optimal heat exchange with the out-room, by taking away calories and producing ice, which is got by means of the freezing of the water sprayed in the cubes forms by the spray-bar.

The working of this machine is cyclical: ice cubes are produced during the first phase and fall in the built-in bin during the second phase.

Refrigerating Circuit

The working of this machine is cyclical.Each cycle is divided into two phases: ice cubes are produced during the first phase and fall in the built-in bin during the second phase.

The following diagram shows the main concepts of the refrigerating circuit:



Production Phase of the Ice Cubes

The hot gas valve is closed; the refrigerating fluid, after having been cooled by the condenser, circulates through the evaporator coil (welded to the cubes basin), and cools each small copper cup.

Water is sprayed on the evaporator cubes-basin through the spray-bar nozzles. An ice layer, due to the refrigerating fluid, begins forming in the cups, till these are completely full (after some minutes).

Ice Falling Phase (Defrosting)

Once the ice-production time is finished, the spray-bar stops spraying water on the cubes-basin and the hot gas valve, assembled on the compressor delivery side, opens.

This opening permits to pipe the refrigerating fluid (now overheated, after the compression) directly to the evaporator, without letting it pass through the condenser.

Due to such overheated fluid, the evaporator warms up and the ice cubes formed in the cups, fall in the below bin.

At the end of the defrosting phase, the cycle starts again.

The compressor is always working: during both the production and the defrosting phase.

Refrigerating Circuit *(Components)*

Compressor

It sucks up the gases, generated by the evaporator by means of a suction line and compresses them, increasing their temperature and pressure.

Hot Gas Valve

It controls a circuit that starts from the compressor and arrives to the evaporator, bypassing the condenser.

The opening of the valve permits to pipe the refrigerating fluid (overheated after the compression) directly to the evaporator, without letting it pass through the condenser thus warming up the evaporator.

Condenser (Air/Water)

If 'Water', it is made up of a series of tubes, refrigerated by cold water.
If 'Air', it is made up of a radiator, that exchanges heat with the out-room, and is refrigerated by ventilated air, coming from a fan, run by an electric motor.

Both of them carry away the heat, comprised in the gas that comes out from the compressor, helping, in this case, the gas liquefaction.

Refrigerating Filter + Capillar Tube

The refrigerant filter stops possible impurities and the circuit humidity.
The gas, in liquid status, goes to the evaporator through this filter and the capillar tube.

Evaporator

It permits an optimal heat exchange with the water sprayed on it and produces ice by means of the water freezing.
It is made up of a series of small tin-plated cups, plunged into a plastics support and welded to a copper coil, where the refrigerating gas circulates.

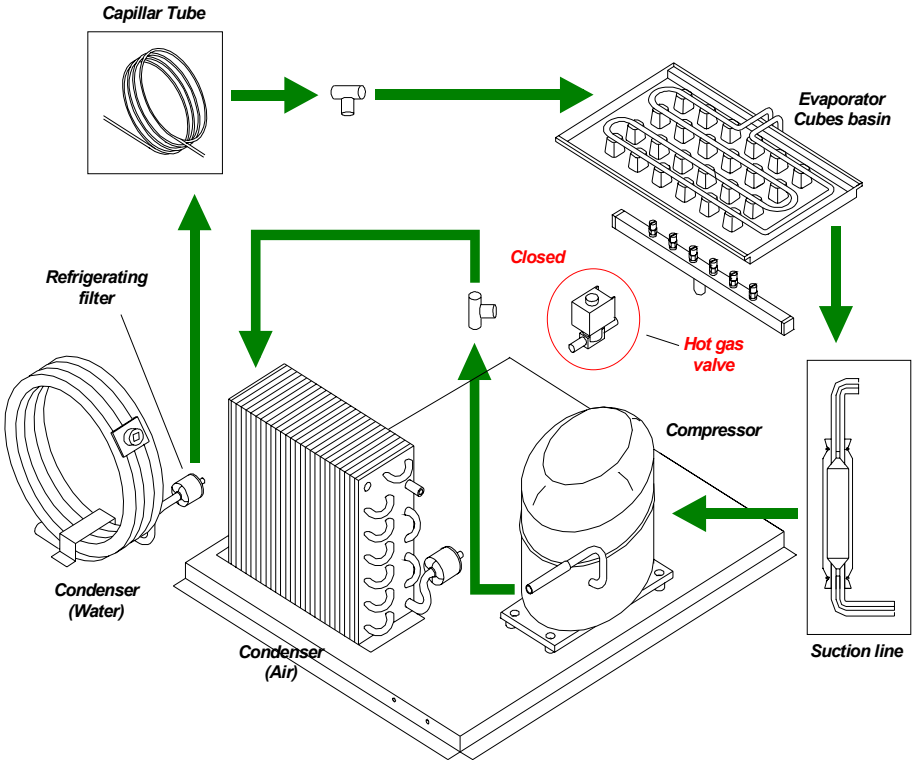
Suction line

It permits the refrigerating gas circulation from the evaporator to the compressor.
The suction line also controls and keeps constant the circulation of the gas, coming out from the evaporator The liquid gas is trapped in a specific expansion boiler, that prevents its arrival to the compressor.

Refrigerating Circuit (Production Cycle)

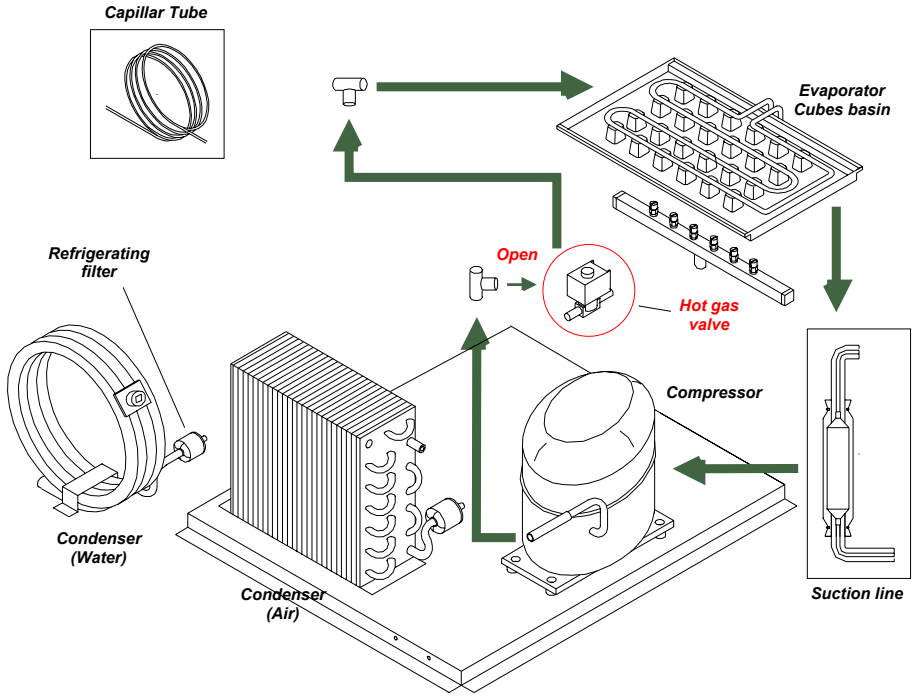
Ice cubes production

The hot gas valve is closed; the compressed gas from the compressor, is piped to the condenser, in order to get cool.



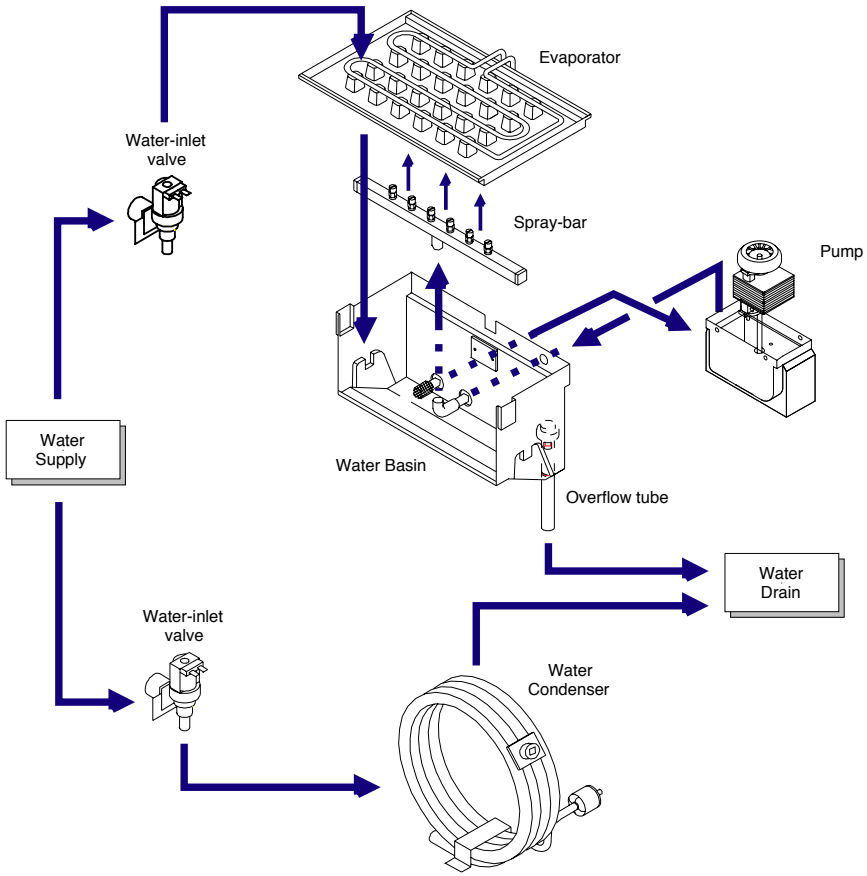
Defrosting

The hot gas valve is open; the compressed gas from the compressor, is piped to the evaporator, by-passing the condenser.



Hydraulic Circuit

The following diagram shows the main concepts of the hydraulic circuit:



The water supply circuit of the basin, the water-inlet valve, the pump and the evaporator are on all machines of the 'SL'-line; the water condenser circuit, on the contrary, is on water-cooled versions.

Water-inlet valve

It works during the defrosting phase and permits the water to flow on the evaporator, having two goals: 1st. one is to warm the evaporator help, in this way, the ice cubes detaching; 2nd. one, the water to falls into the basin, restores the ideal level to start a new production cycle.

The second water-inlet valve allows the water to flow through the water condenser.

Water basin

It gets water from the water mains and the pump draws out from it by means of a specific tube provided with filter.

Pump

It draws out water from the inside bin and pipes it, under pressure, to the spray-bar.

Spray-bar

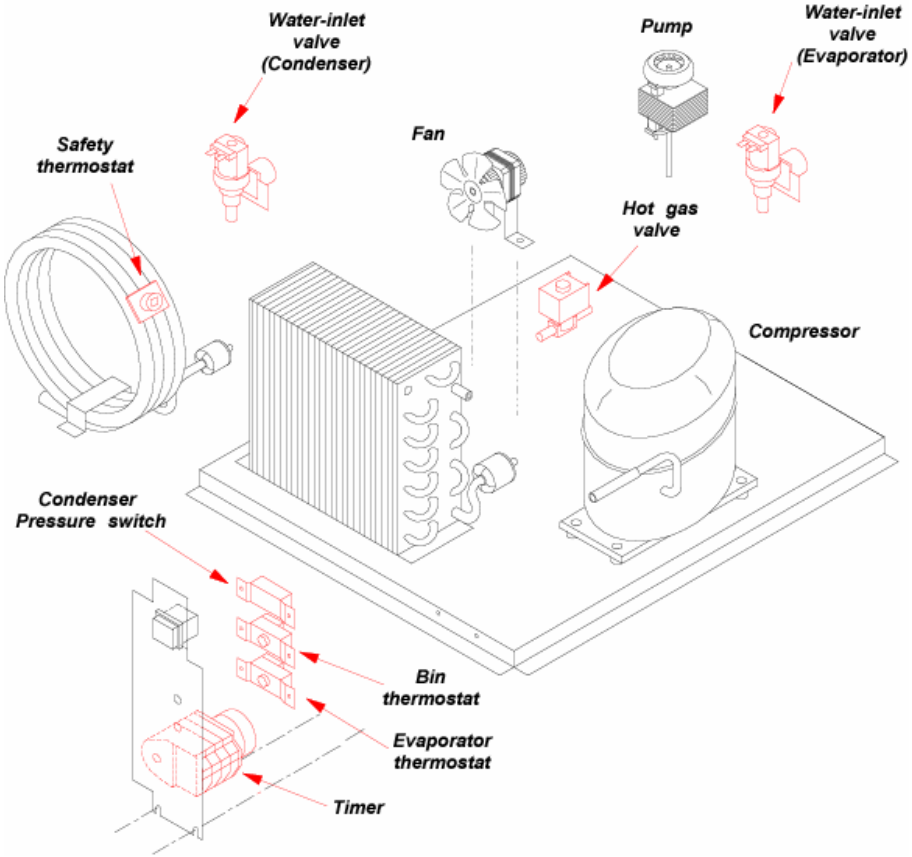
It gets water from the pump and, by means of its nozzles, sprays it towards the cubes basin of the evaporator. The water that does not freeze, by contacting the cups (refrigerated by the evaporator coil), falls in the inside bin and is drawn by the pump once again.

Overflow tube

It is a floodway. All the surplus water, entering into the inside bin, comes out from it.

Electric Circuit

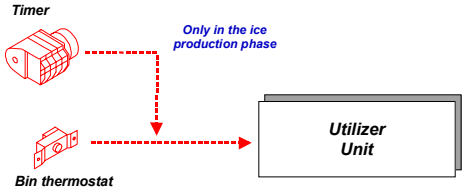
The following diagram shows the main concepts of the electric circuit:



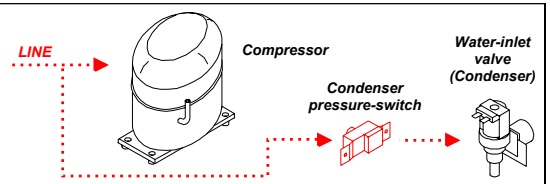
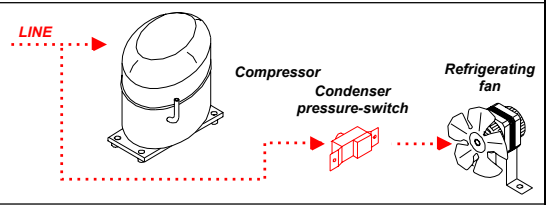
The ice maker is energized by the bin thermostat, that stops machine when the bin is full.

The timer is designed in such a way that it is connected upstream the bin thermostat during the ice production phase, so that the ice maker will stop only when only when the ice production phase is over.

The following scheme shows this working system:



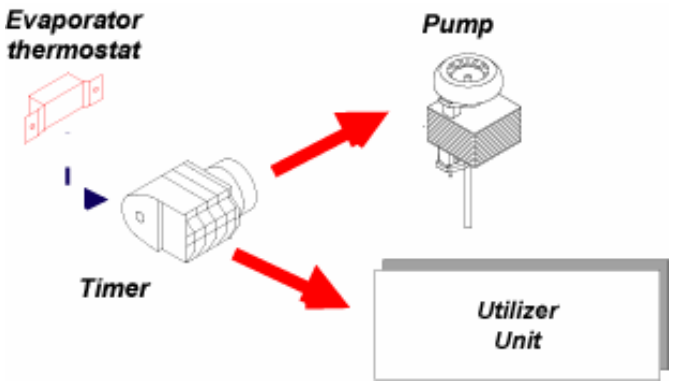
NB: some components of the electrical circuit (called Utilizer Units) are always energized and do not depend on the timer status. See the following table:

SL35-280 Water	
Air Machines	

Electric Circuit (Timer Status)

Ice cubes production

The timer, in the first phase, starts up the pump and the utilizer units, as described in the scheme of the previous page.

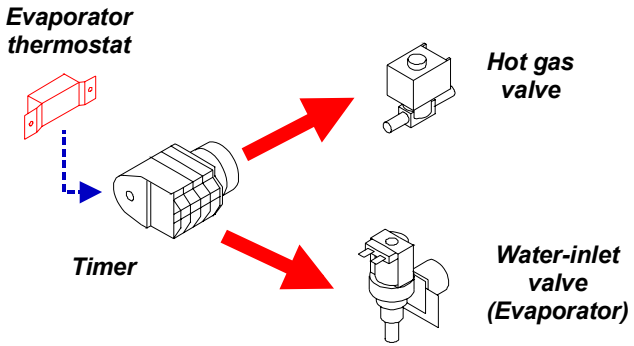


Some minutes after the beginning of the ice production phase, due to the refrigerant in expansion in the coil, an ice layer starts to form inside the cups.

The evaporator thermostat, by perceiving a drop in temperature of the evaporator, starts up the timer, so to complete the ice production phase.

Defrosting

The timer, once reached the set up time, simultaneously commutes three contacts, letting the defrosting phase begin.



The pump is stopped and also the sprays working stops; on the contrary, the hot gas valve is started in order to pipe the refrigerating fluid (overheated) directly to the evaporator.

The water inlet valve opens and allows the water to flow from water mains into the basin.

The evaporator thermostat, perceiving a temperature rise (due to the circulation of hot fluid), starts up the timer again, so to complete the defrosting phase.

Electric Circuit (Components)

Controls systems

Hot gas valve – The opening of the valve permits to pipe the refrigerating fluid (overheated after the compression) directly to the evaporator, without letting it pass through the condenser and warming up the evaporator.

Evaporator thermostat – It feels the evaporator temperature and drives the timer, as previuosly described.

Condenser pressure-switch – It controls and keeps constant the condensing pressure;it drives the refrigerating fan, it drives the condenser water inlet valve.

Timer – See previous description.

Water-inlet valve (evaporator) – It is open during the defrosting phase, permitting the water to flow on the evaporator and, then, into the water basin, to restore the ideal level to start a new cycle of ice cubes production.

Water-inlet valve (condenser) – This second water-inlet valve allows the water to flow throught the water condenser.

Safety systems

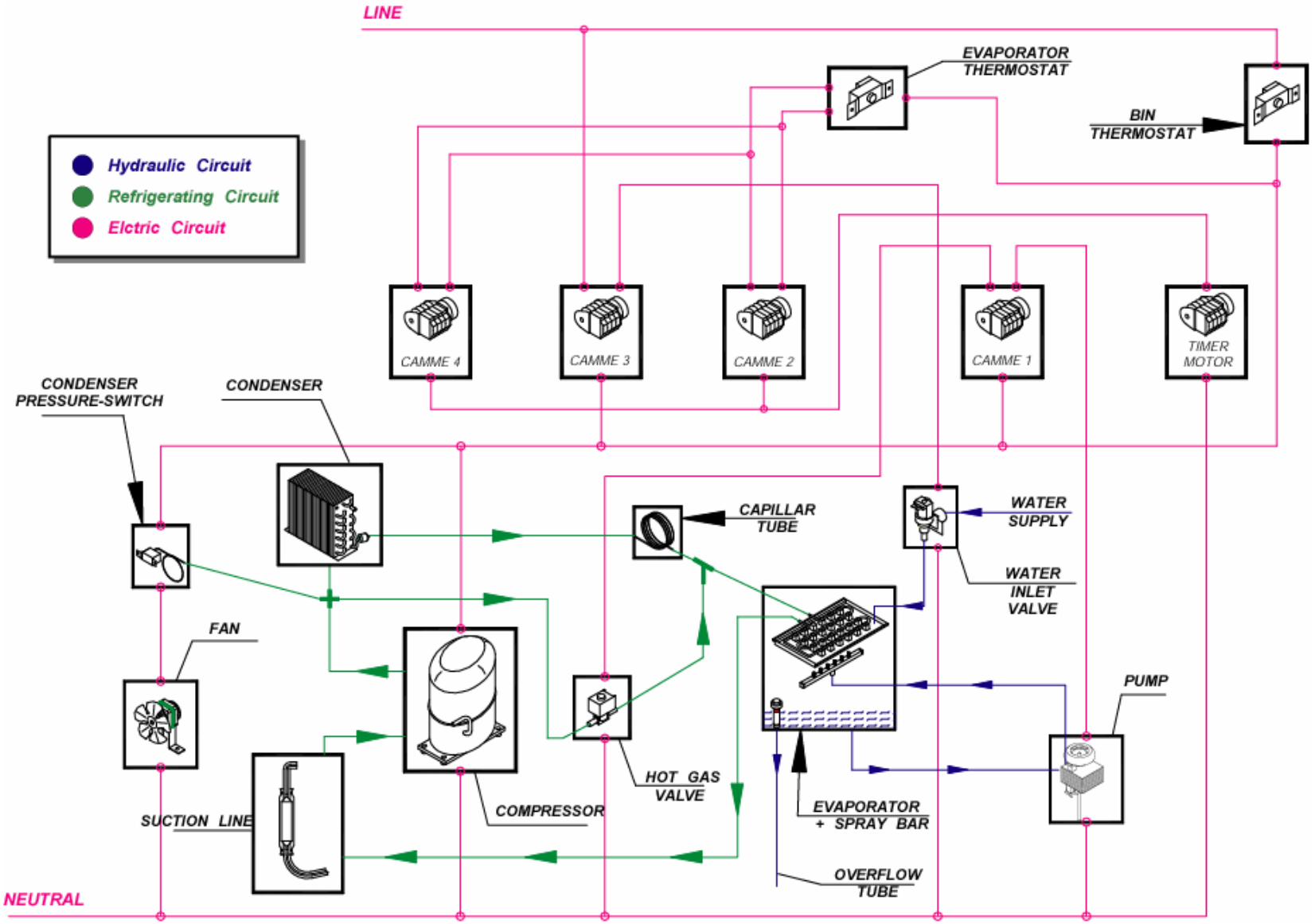
Safety thermostat – Placed on the condenser of the water models.
It stops the ice machine working when the temperature of the water condenser exceeds a preset threshold value.

Bin thermostat – There is a little pipe in the bin that includes the bin thermostat feeler.

When the thermostat perceives a drop in temperature (due to the ice cubes accumulation in the bin), it opens the contact, disconnecting the power flux, and stops the ice machine working.

The machine only stops during the defrosting phase, as the timer keeps a second power source active during the production phase till the phase commutation.

Working Scheme SL 50 ÷ 350 (Air Version)



Working Scheme SL 35 ÷ 280 (Water Version)