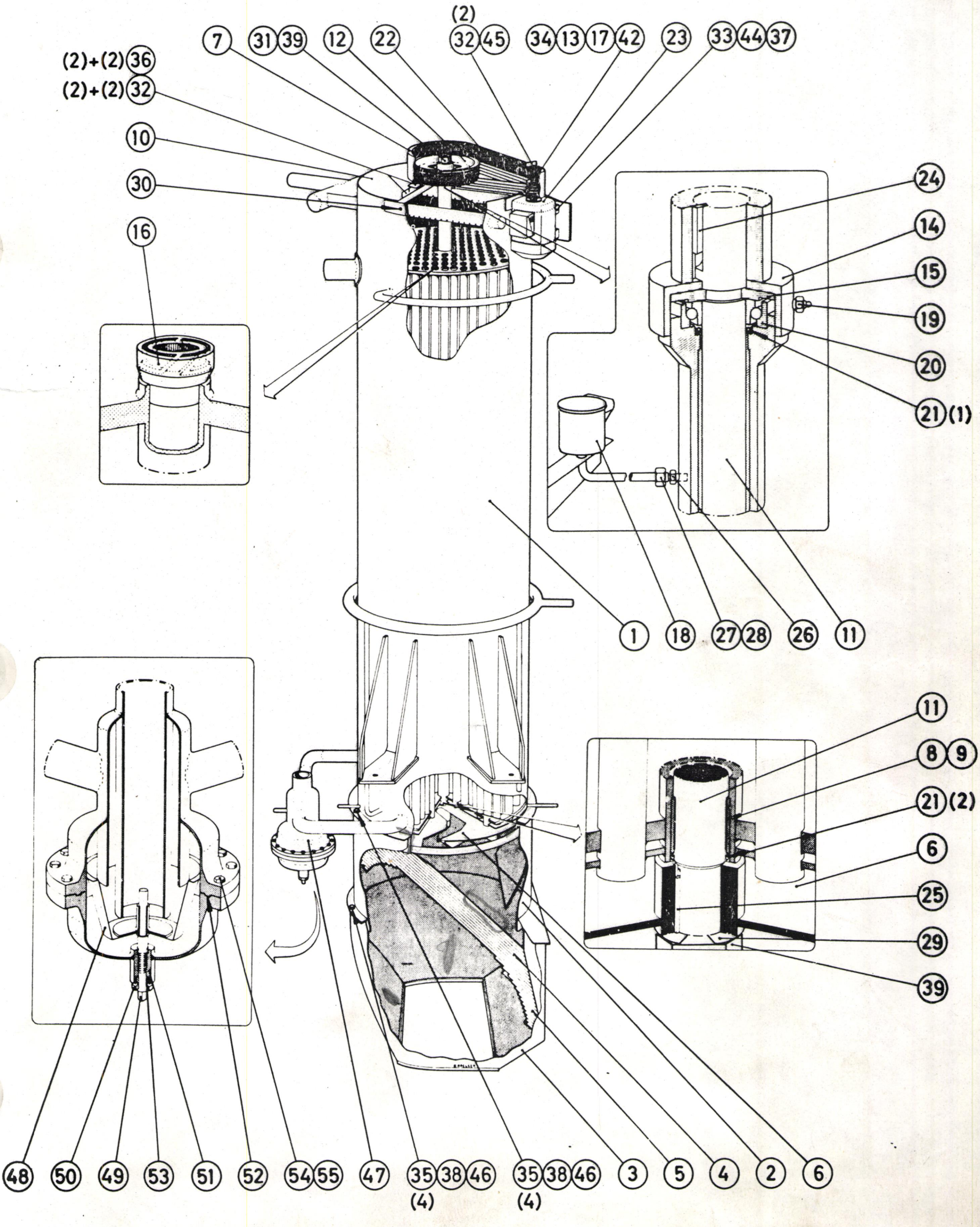
TUBISMASKIN | TUBE-ICE MACHINE FA 70 Form A | ROHREISMASCHINE

Tubisgenerator | Tube-ice freezing unit | Rohreiserzeuger



R e m o v a l o f c u t t e r

- o Remove the V-belts.
- o Remove the grating under the ice cutter.
- o Construct a platform over the water tank on which you can stand and work beneath the generator.
- o Pass a wire through two tubes and secure the lower ends of these wire in the holes in the ice cutter. The upper ends of the wires must be long enough to enable the ice cutter to be lowered slowly. Secure the wire ends very carefully.

  Note! The ice cutter weighs roughly 100 Kg.

- o Back off the nut and slacken the wires slightly enabling the ice cutter to slide down. Use a puller if the ice cutter is jammed on the shaft end. See Fig. 7.
  Note! Support the ice cutter carefully to avoid damage. Turn the ice cutter over after taking it out.

  Note! Proceed with the utmost caution when working with the cutter to prevent damage to bearing and sealing sleeves.

- o Raise the shaft roughly 300 mm, using the lifting eyelet screwed into the shaft end.
- o Remove the lower bearing and sealing rings. See Fig. 8.
- o Support the shaft from underneath.
- o Remove the pulley. Use the same tools as for the ice cutter. See Fig. 9.
- o Remove the ball bearing cup and split ring.
- o Remove the upper sealing ring.
- o Lift the shaft out of the machine.

F i t t i n g t h e c u t t e r

The procedure for fitting the cutter is the same as that for removal, but in the reverse order.

- o When fitting the ball bearing, use Loctite 641 between the shaft and the inner bearing ring.
- o Special tools are used to fit the pulley and ice cutter. See Fig. 10.
- o Before driving the steel sleeve into the centre tube, fit the sliding layer of the bearing, the support rings and support layer in and on the sleeve.
- o A special arbor is available to facilitate fitting lower bearing and the sealing rings.

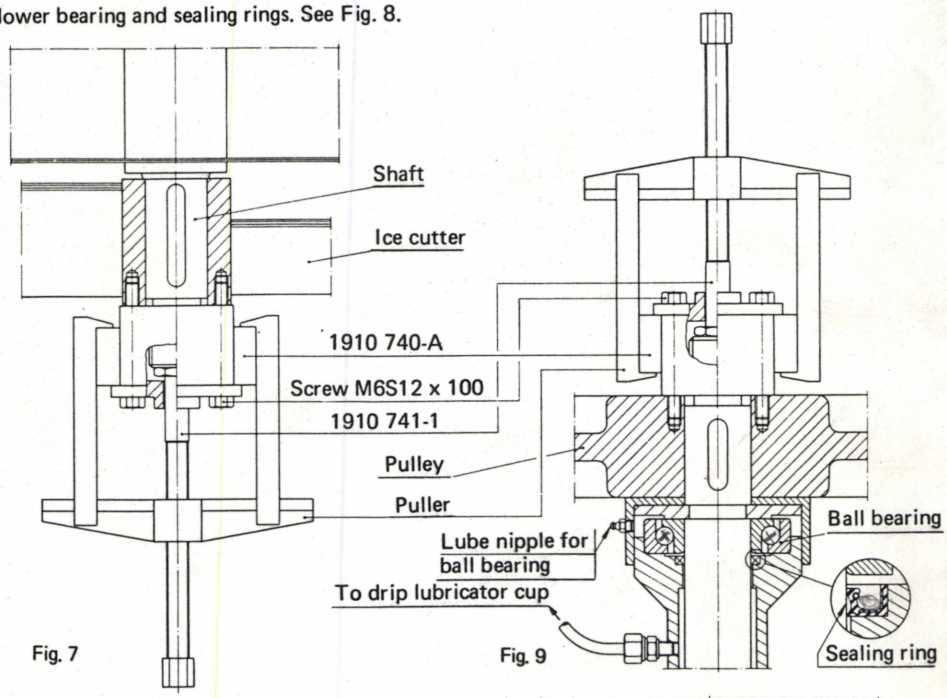


Fig. 7   Fig. 9

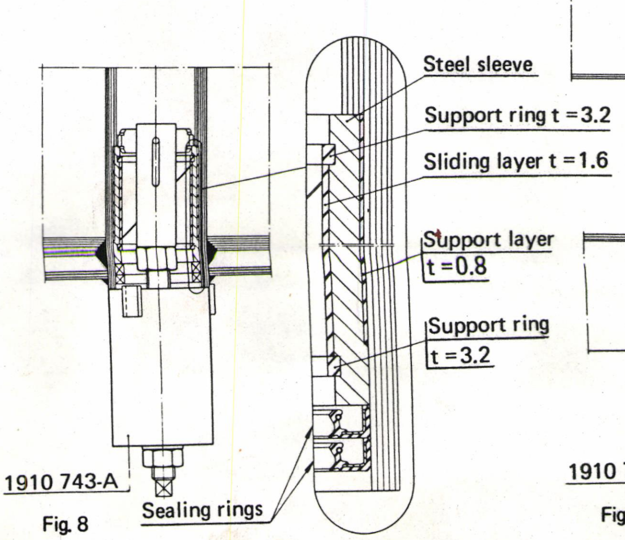


Fig. 8

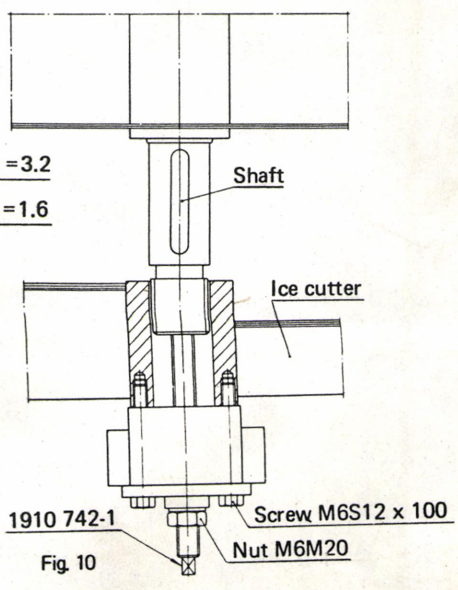


Fig. 10

TUBE-ICE MACHINE
Type FA702A, FA703A, FA704A and FA705A

Refrigerant: NH_3

GENERAL

In the tube-ice production, there is a tendency towards the use of ever bigger units. To meet this increasing demand, a series of tube-ice machines has been designed for capacities of more than 100 tons per day.

The design is based on STAL's wide experience of medium-sized tube-ice machines. The principle for ice-freezing is the same, but the treatment of the ice has been adapted to the bigger generator. Moreover, the new machine has been equipped with a precooler for feed water. Experience from most of the plants in operation proves that the results of our endeavours to develop a tube-ice machine for large capacities have amply satisfied our anticipations.

ICE PRODUCTION

the tube-ice machine, the refrigerant evaporates directly nd the tubes in which the water freezes. This method rs better heat transfer and gives a smaller temperature erence between the water and the refrigerant than is the when using brine in a conventional block-ice plant. In er words, the capacity of the refrigerating compressor is d in the optimum economic manner.

y varying the duration of the ice-freezing cycle it is possible o obtain ice of different thicknesses. By a suitable balance of ice thickness and temperature difference, the active refrigeration surfaces can be very effectively utilized. This implies compact units with small space requirements.

The difference in temperature between the water and the evaporated refrigerant is kept relatively small and can be adjusted to give clear ice. A further contributory factor in this respect is the device that forces the water to circulate over the ice during the freezing process.

The tube-ice machine is fully automatic and is controlled by the STALECTRONIC ® 1000 electronic control system.

The name "tube-ice" is derived from the fact that the ice is frozen in the shape of tubular bars on the inside of tubes.

TYPE DESIGNATION

Example: FA – 70 3 A

- A — Version
- 3 — Number of generators: 2, 3, 4, 5
- 70 — Size designation
- FA — Type

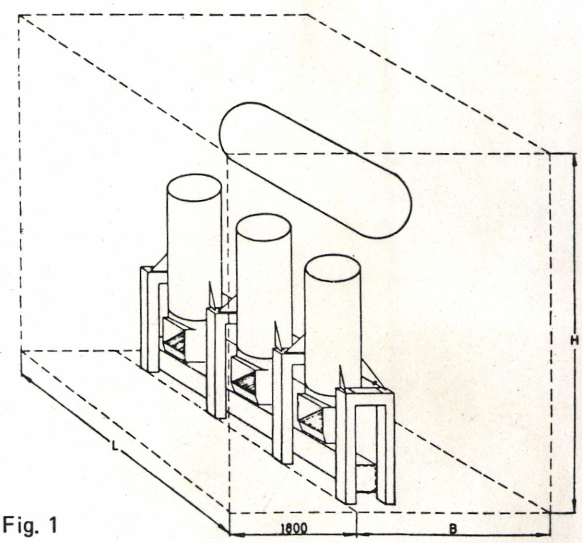


Fig. 1

DATA

Some characteristic data for the different tube-ice machines

Type designation	Dimensions acc. to figure mm L	B	H	Service weight tons	NH_3 1) charge tons	Aux. motors Installed output kW	Aux. motors Power consumption kWh/h	Capacity Refrig. 2) capacity kW	Capacity Ice production tons/24h
FA702A	5500			28	3.0	19	10	815	140
FA703A	7200	2800	9000	40	4.0	28.5	15	1130	200
FA704A	9000			50	5.5	38	20	1630	275
FA705A	10700	3000	9300	60	7.0	47.5	25	2100	350

1) Excluding the charge in the high-pressure side with heat-accumulator, if any, of a complete plant

2) The refrigerating capacity, which is nominal, is valid for an evaporating temperature of -10°C and a feed-water temperature of +5°C

ELECTRICAL APPARATUS AND AUTOMATIC CONTROLS

The delivery of a tube-ice machine includes a special control panel in which the various components necessary for control of the tube-ice machine are installed. These include the STALECTRONIC ® 1000, the electronic control system for the tube-ice machine, contactors, fuses, terminals for connection to other control panels belonging to the tube-ice installation, etc.

This control panel is included in the order No. for the tube-ice machine.

The automatic controls include easily adjustable electronic units, which controls the duration of the ice-freezing and harvesting periods etc. They are described separately.

Experience of numerous plants, accumulated over a long period of years, has facilitated the choice of a practical and dependable automatic control system.

The control panel is furnished with signal lamps, which gives a clear picture of the function of the entire plant.

DESCRIPTION OF PARTS INCLUDED IN THE TUBE-ICE MACHINE

In designing the tube-ice-machine, the relevant regulations and recommendations issued by the Workers' Protection Board have been followed.

TUBE-ICE GENERATOR

Tube set

The tubes are of quality steel, precision-drawn and straightened. All outlets are corrected to give the best possible ice-release during harvesting. The tubes are welded to the tube plates in accordance with current standards. The cylindrical shell is made of pressure-vessel steel and is welded in accordance with the standards valid for pressure vessels. The outside of the shell-and-tube unit is rust preventive painted.

Cutter driving device

Drawn through the tube set is a centre tube, with bearings at its ends to carry the vertical shaft. In the lower end the bearing consists of a radial bearing of teflon, in the upper end of an angular contact ball bearing. Attached to the upper end of the shaft is a pulley, driven by V-belts from an electric motor. The latter is mounted on a clamping plate attached to the outer side of the shell-and-tube unit. The pulley-and-belt arrangement is fitted with a semi-protected guard as required by law.

Ice-cutter knife

Attached to the lower top of the aforesaid shaft is a knife. It consists of a circular, slotted disc, shaped as a screw surface. The edges of the slot are displaced 50 mm in the vertical direction, the length of the ice blocks being determined by this displacement. One edge forms the cutting edge of the knife. The cutting edge has a curved shape which contributes to low prower consumption and ensures good distribution of the ice pieces over the ice-separator grating. The disc prevents the pieces of ice from dropping down onto the grating before they have been cut off by the knife.

The ice-cutter knife is fully galvanized.

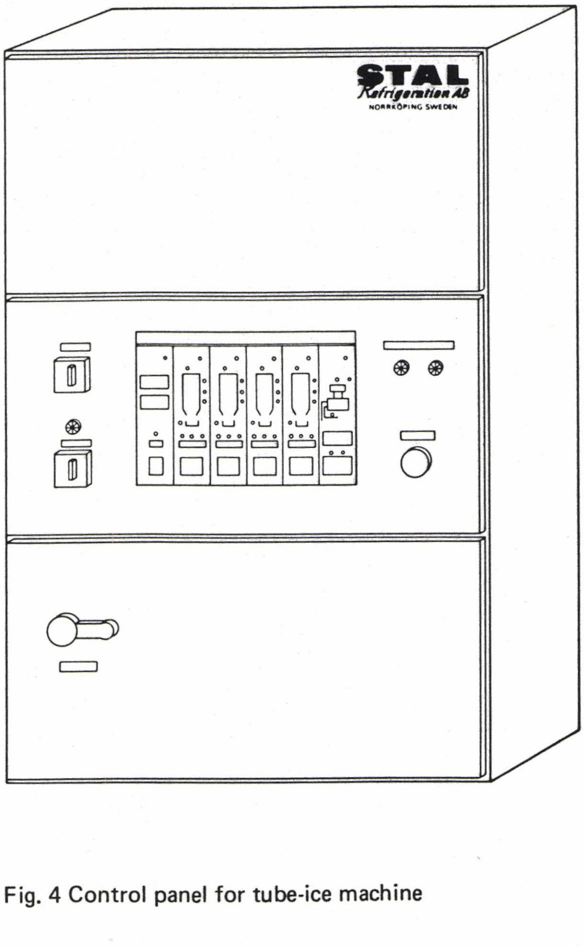


Fig. 4 Control panel for tube-ice machine

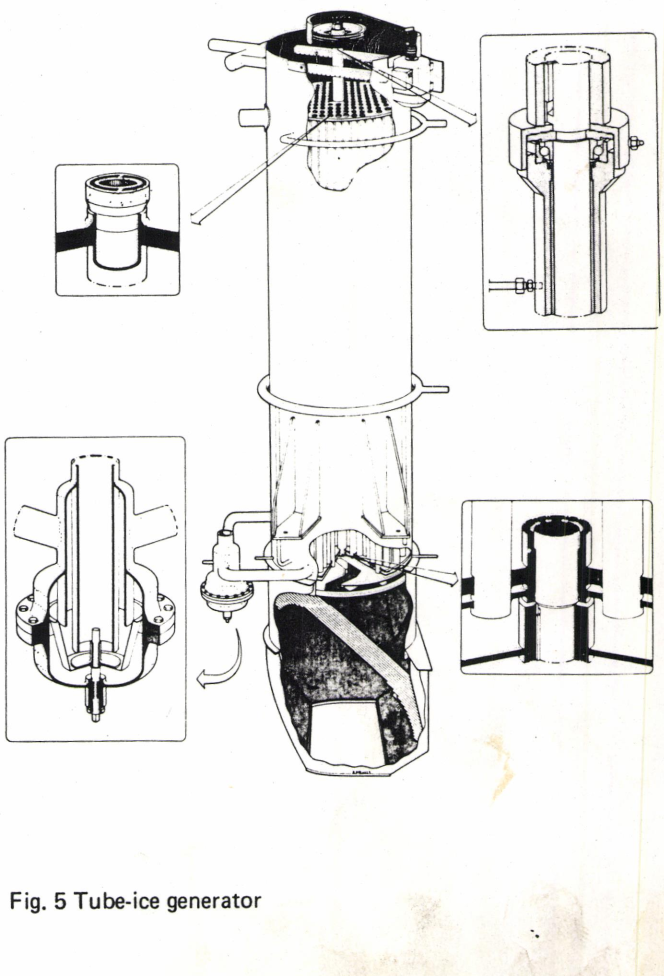


Fig. 5 Tube-ice generator

Ice-separator grating
The grating is made of round bar iron of rust proof steel. It is located at a slant beneath the knife, so as to separate the pieces of ice and make them leave the generator while the melted ice-water flows down into the tank.

Water distributors
The water distributors are made of plastic and are so shaped as to cause the water to flow spirally down the inside of the tubes. They are easily inserted in position in the tube and are simple to clean.

Gast-trap valve
The patented gas-trap valve is easily adjustable and works with perfect precision.

AUTOMATIC VALVE
The automatic valve, which is of STAL's design, is governed by pilot valves. The valve is actuated with the aid of high-pressure liquid and no extra pressure drop over the valve is required to keep it open. The low pressure drop contributes actively to the good economy of the ice machine.

SURGE DRUM
The surge drum is made of pressure-vessel steel and includes the customary fittings such as safety valve, level indicator, etc. It is externally rust preventive painted.

CIRCULATION PUMP
This is of the centrifugal type and is direct-driven by an electric motor. The pump and motor are mounted on the same base plate.

PRECOOLER
The precooler is of STAL's design and can be included as standard. It consists of a horizontal shell-and-tube unit with a built-on surge drum and is dimensioned for an input feed-water temperature of +25°C.

The precooler is coupled to the surge drum of the tube-ice machine via a suction pressure regulator. The liquid supply is regulated by means of a low-pressure float system. The safety equipment comprises an anti-freeze thermostat and a safety valve. Also provided are thermometers, manometer and oil collector.

If required, the precooler can also be coupled to a separate compressor.

WATER TANK (not included in the order)
In view of transportation problems, the water tank is not included in the delivery undertaking for a tube-ice machine except by special request.

Instead, we provide the drawings necessary for manufacturing the water tank on the erection site. The tank is to be made of heavy-gauge plate and is to be equipped with strainers and flange connections for the pumps, connections for float valve and spillway, rust-preventive painting and insulation.

FOUNDATION (not included in the delivery)
The foundation should be built of concrete or steel.

OTHER EQUIPMENT
The tube-ice machines are delivered complete with the necessary stop and safety valves, pressure gauges, thermometers and piping for the refrigerant within the tube-ice machine itself. The delivery also includes the necessary stop and check valves for the water system of the tube-ice machine.

TRANSPORT
The tube-ice machines are of such shapes and sizes that they cannot conveniently be delivered fully assembled. They are therefore delivered to the erection site in sub-units suitable for transport.

SUNDRY POINTS TO BE OBSERVED
Expansion valves
The tube-ice machines are normally delivered with a high-pressure float system. If a low-pressure float system is to be used, this must be expressly stated in the order.

Heat accumulator
This is not included in the delivery undertaking. Whether or not a heat accumulator will be required will depend entirely on how big a refrigerating capacity the compressors connected to the same condenser as the ice machine have. A suitable accumulator can be chosen from a separate sheet of the refrigeration manual on the basis of the capacity data. This applies to FA702 only.

Transport of ice
During the harvesting period, all the ice leaves the generator during the space of about 30 seconds. The ice receiver must be dimensioned accordingly. The following table shows the approximate amount of ice per harvest and the number of harvests per hour.

Ice machine type	FA702	FA703	FA704	FA705
Amount of ice per harvest m^3	2.5			
No. of harvests per hour	5	7	10	13

INSTRUCTIONS
The delivery undertaking includes the necessary maintenance instructions.

ORDER PROCEDURE
In placing an order, state the order number of the ice machine followed by the type designation with alternatively without precooler and specification of current type

Example:

One 1883 660-A type FA704, with precooler, 380/220 V, 50 Hz

Type	Order number with precooler	Order number without precooler
FA702	1884 499-A	–
FA703	1881 050-A	1887 257-A
FA704	1883 660-A	1887 258-A
FA705	1887 140-A	1887 200-A

TUBE-ICE MACHINES FA701-705

Capacity data

Refrigerant: NH_3

These tube-ice machines can incorporate a water chiller, so dimensioned that it cools the feed water down to +5 °C. To obtain the total refrigerating capacity of the machine, the capacity required by the water chiller unit must be added to the refrigerating capacity obtained from the nomogram. In calculating this capacity, allowance must be made for the water drainage (normally 5 %) from the tube-ice machine. The water chiller can, depending on the circumstances in each individual case, be coupled to a separate compressor or to the same compressor as the ice generators. In the latter case, however, a throttling must take place from +1 to +2 °C to the compressor suction pressure, which corresponds to about -10 °C.

The requisite nominal refrigerating capacity is represented by the compressor capacity at t_2 = -10 °C.

The temperature of the feed water to the tube-ice machine may not be less than +3 °C.

The capacity data are valid for feed water of good quality, for which 5 % drainage is satisfactory.

The tube-ice machines must be insulated.

If the wall thickness S of the ice is chosen within the "Medium" range, the ice obtained is easy to handle, the crushing will not be too large, and at the same time the power consumption per ton will be relatively low. "Medium" corresponds to an ice wall thickness of 10-12 mm.

DETERMINATION OF CONDENSER LOAD

$$q = \frac{Q_{2nom}}{n \cdot 155} \quad (1)$$

$$Q_1 = Q_{2nom} \cdot f_{t_1} \quad (2)$$

Q_1 = condenser load (kW)

t_1 = condensing temperature (°C)

n = number of generators

f_{t_1} = factor from diagram

EXAMPLE

Given: 4 generators

Q_{2nom} = 1360 kW

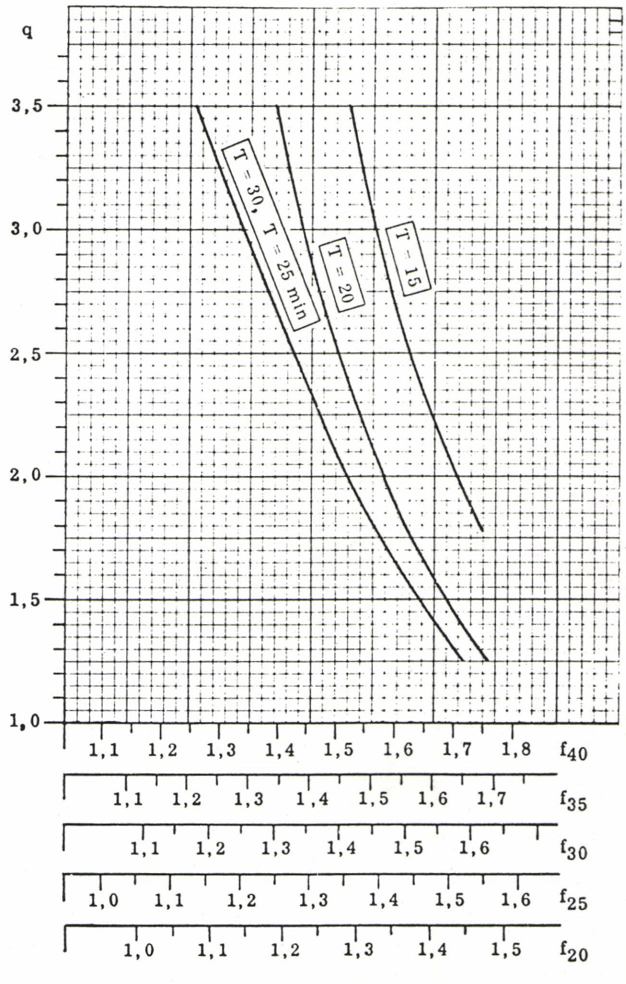
T = 25 min.; t_1 = +30 °C

(1) gives $q = \frac{1360}{4 \cdot 155} = \underline{2.19}$

According to the diagram, f_{30} = 1.37

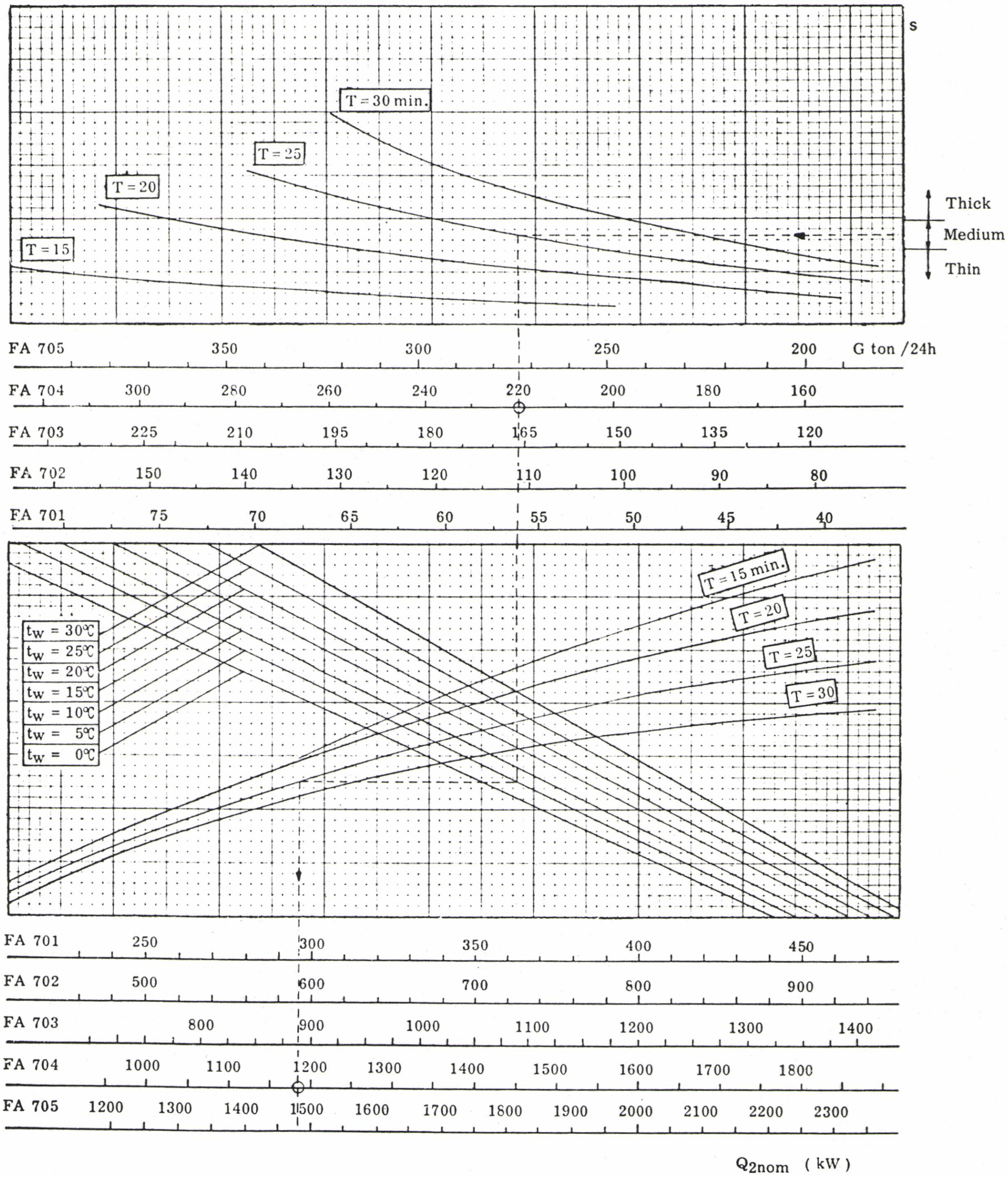
Thus:

Q_1 = 1360 x 1.37 = 1863 kW



Tube-ice machine FA701-705

Ice capacity as a function of compressor capacity and length of cycle and wall thickness of ice as a function of ice capacity and length of cycle



DESIGNATIONS

G	= ice capacity at 5 % water drainage (t/24h)
Q_{2nom}	= nominal refrigerating capacity (= compressor capacity at t_2 = -10 ℃) (kW)
t_w	= input temperature of feed water (℃)
t_2	= evaporating temperature (℃)
T	= length of freezing cycle (min.)
S	= wall thickness of ice

EXAMPLE

Given: G = 220 ton/24h
t_w = 20 ℃
Normal water quality

To be found: Requisite refrigerating capacity

From the nomogram: (compare the line plotting)

FA704 with water cooler gives at T = 25 min. and an ice thickness in the "Medium" range the ice capacity G = 220 ton/24h

The corresponding refrigerating capacity Q_{2nom} = = 1190 kW (t_2 = -10 ℃)

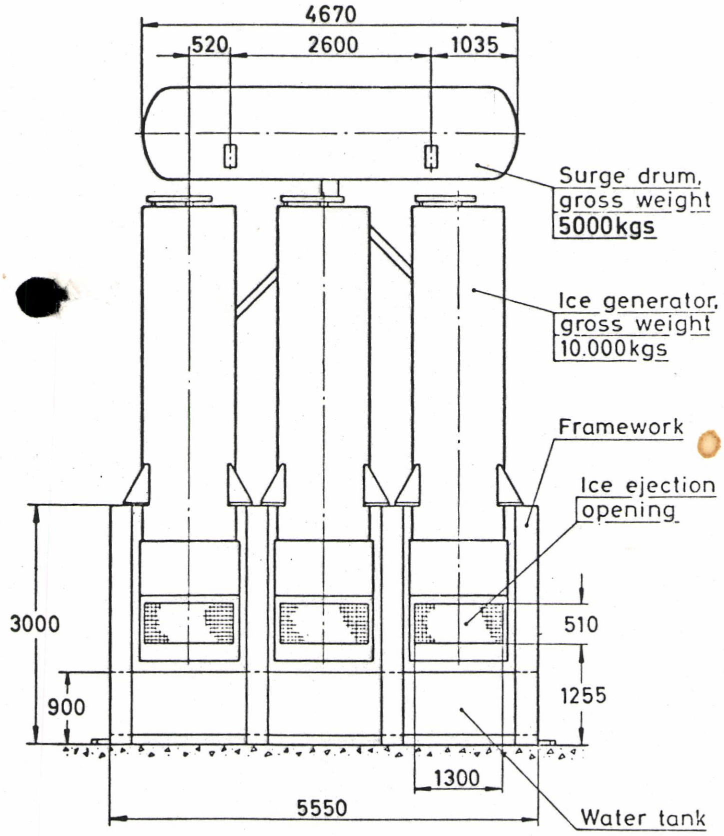
To this refrigerating capacity must be added that of the water chiller (see introductory text):

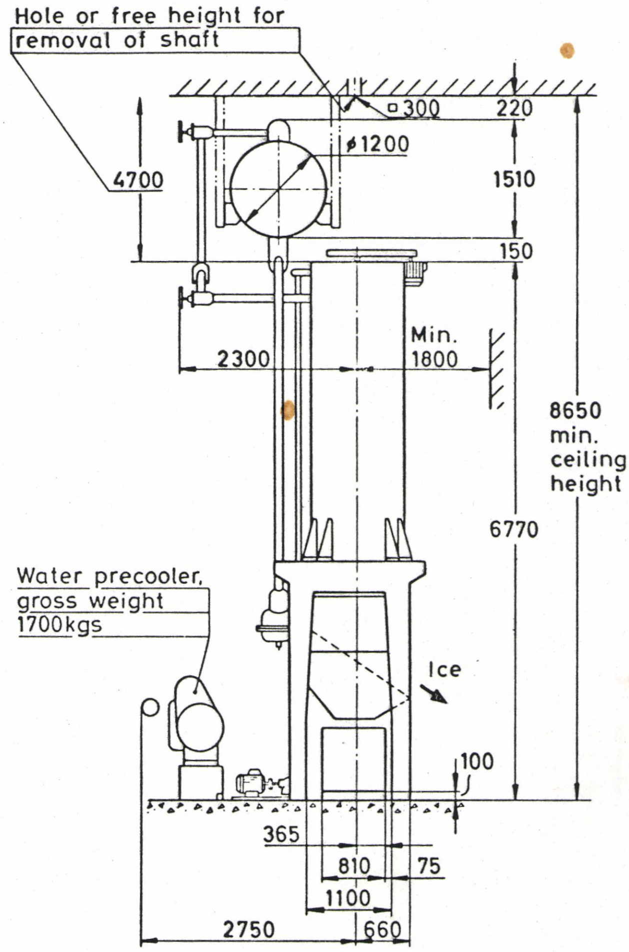
$$Q_2 = 1.05 \frac{220 \cdot 10^3}{24 \cdot 860} (20 - 5) = 168 \text{ kW } (t_2 = +2 \text{ ℃})$$

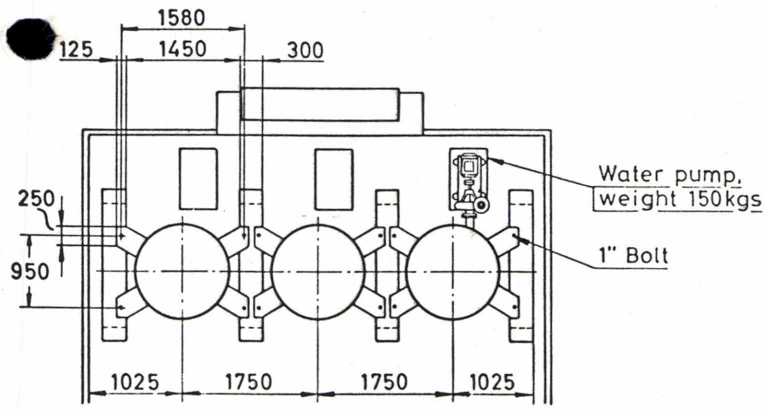
TUBE ICE MACHINE FA703

In different assembly, inquire for information

Dimensions in mm







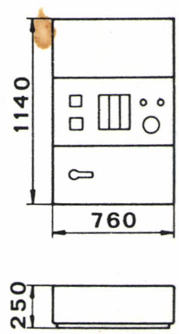
Other arrangement of water precooler is possible.

Frame work is not included. It can be made of concrete or steel.

Gross weight	ton	44
Operating weight	ton	40
NH_3-charge	ton	4
Shipping volume	m^3	106
Shipping weight	ton	34

Electric installation:

3 motors a 5,5 kW for ice cutters
3 motors a 3 kW for water pumps } 220/380 V 50 Hz
Solenoid valves for 220 V, 50 Hz



CONTROL PANEL

TUBE-ICE MACHINE
FA702 - 705

Refrigerant: NH_3

Maintenance Instructions

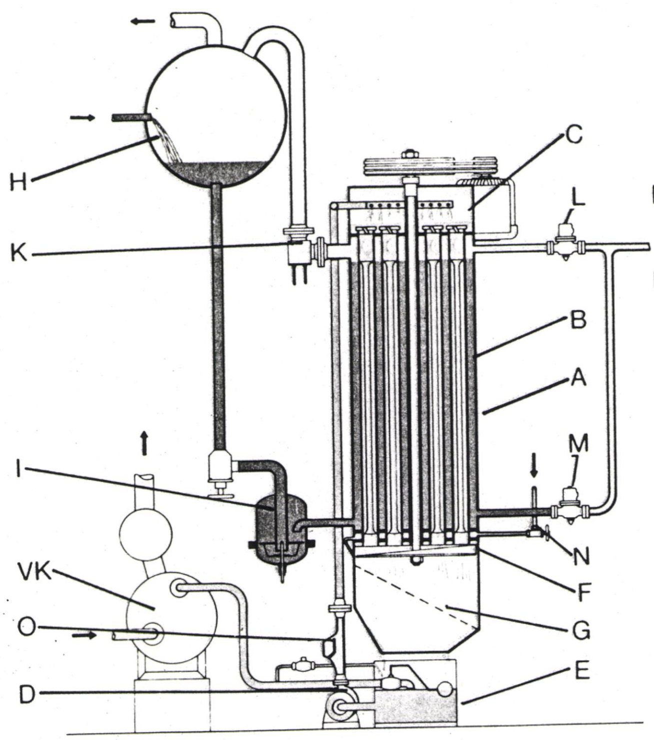


Fig. 1 Freezing

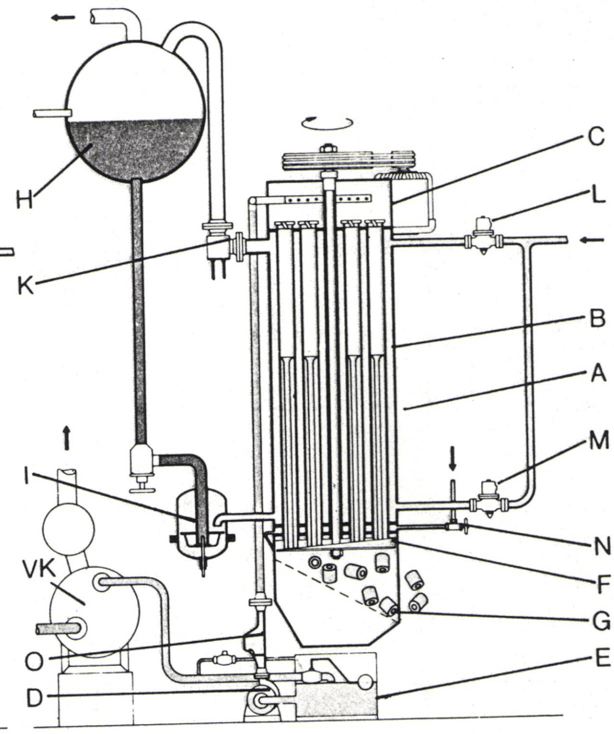


Fig. 2 Harvesting

PRINCIPLE AND MODE OF OPERATION

A tube-ice generator consists of a vertical shell-and-tube unit (A), the tubes (B) of which pass gastight through the lower and upper tube plate. While ammonia is being evaporated in the shell-and-tube unit (A), the pump (D) raises water from the bottom water tank (E) to the upper water tank (C), from whence it flows to special distributors in the upper ends of the tubes (B). The special configuration of these distributors causes the water to flow spirally down along the insides of the tubes, where it becomes partially frozen. The surplus water flows back to the bottom water tank (E) and is pumped round again. By this means, clear ice of good quality is obtained, provided that the feed water is not excessively contaminated. The evaporating temperature or applied compressor capacity also influences the appearance of the ice.

The feed water is cooled in the water precooler (VK) and conducted into the bottom tank (E) through the action of a float valve (or a solenoid valve controlled by a float switch).

The freezing and harvesting cycles are controlled by the ice machine sequencer (IMS) and ice generator cooler (IGC) included in the STALECTRONIC® 1000 electronic control system for ice machines. The equipment is set to give the desired ice thickness (ice capacity). A water precooler controller (PCC) for control of the water cooler is also included in the system.

The harvesting cycle is initiated when the pump (D) cuts out. All the water then flows down to the bottom tank (E), except that retained in the discharge line of the pump by the flap valve (O). The valve (K) in the suction line between the evaporator and the surge drum is closed and evaporation stops.

Valve (L) opens and admits hot high-pressure gas to the shell-and-tube unit (A). This hot gas rapidly presses the cold liquid refrigerant to the surge drum (H). At the instant when all the liquid has left the shell-and-tube unit, the gas trap valve (I) closes, so that the hot high-pressure gas is no longer able to flow into the surge drum.

A few seconds later, the upper hot gas valve (L) closes and the lower one (M) opens, causing the hot gas to flow in to the lower part of the shell-and-tube unit.

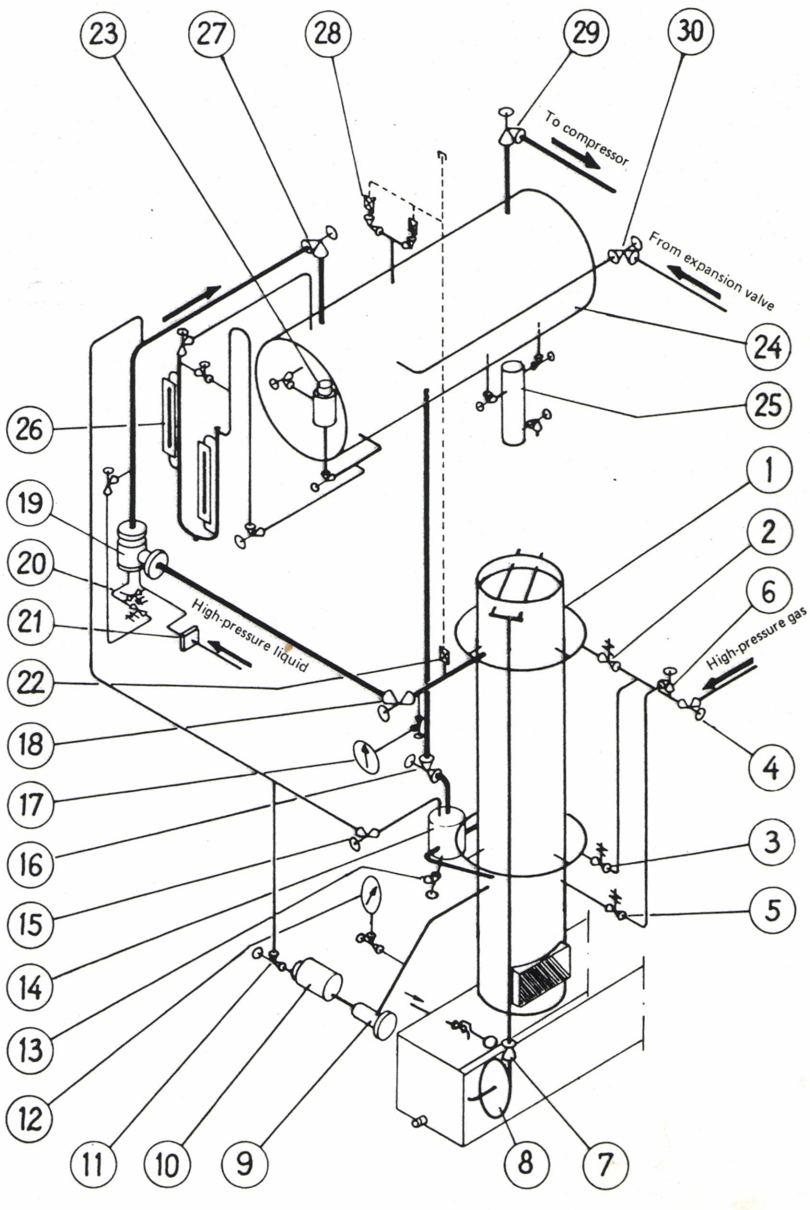
The hot gas heats the tubes (B) sufficiently for the tubes of ice to loosen. The ice cutter (F) starts just before the ice begins to fall. The ice cutter (F) is driven by an electric motor via V-belts and a long shaft which passes through the central tube. The ice cutter chops the falling tubes of ice into blocks of a specific length. These drop into an inclined grating and slide out through an aperture in the side of the ice generator. Water and ice sludge from the ice are drained to the bottom tank (E) through the grating (G).

Upon completion of the harvesting cycle, the hot gas is shut off, the cutter (F) stops and the pump (D) starts. The valve (K) in the suction line opens and consequently the pressure in the shell-and-tube unit falls, causing the gas-trap valve (I) to open automatically. The liquid refrigerant in the surge drum (H) flows back to the shell-and-tube unit and a new ice-freezing period commences. To prevent the ice cutter (F) from freezing up, the lower end of the shell-and-tube unit is double-bottomed. Hot gas is injected continuously between the tube plates in the double bottom and permitted to condense. The liquid is then drained through a high-pressure float valve. The hot gas supply to the double bottom is controlled manually with valve (N).

If two or more generators are connected to the same surge drum, harvesting cycles are distributed so that they will be performed at equal intervals of time. The desctiptions and instructions are valid regardless of the number of tube ice generators, except that the piping diagram is valid for a single generator.

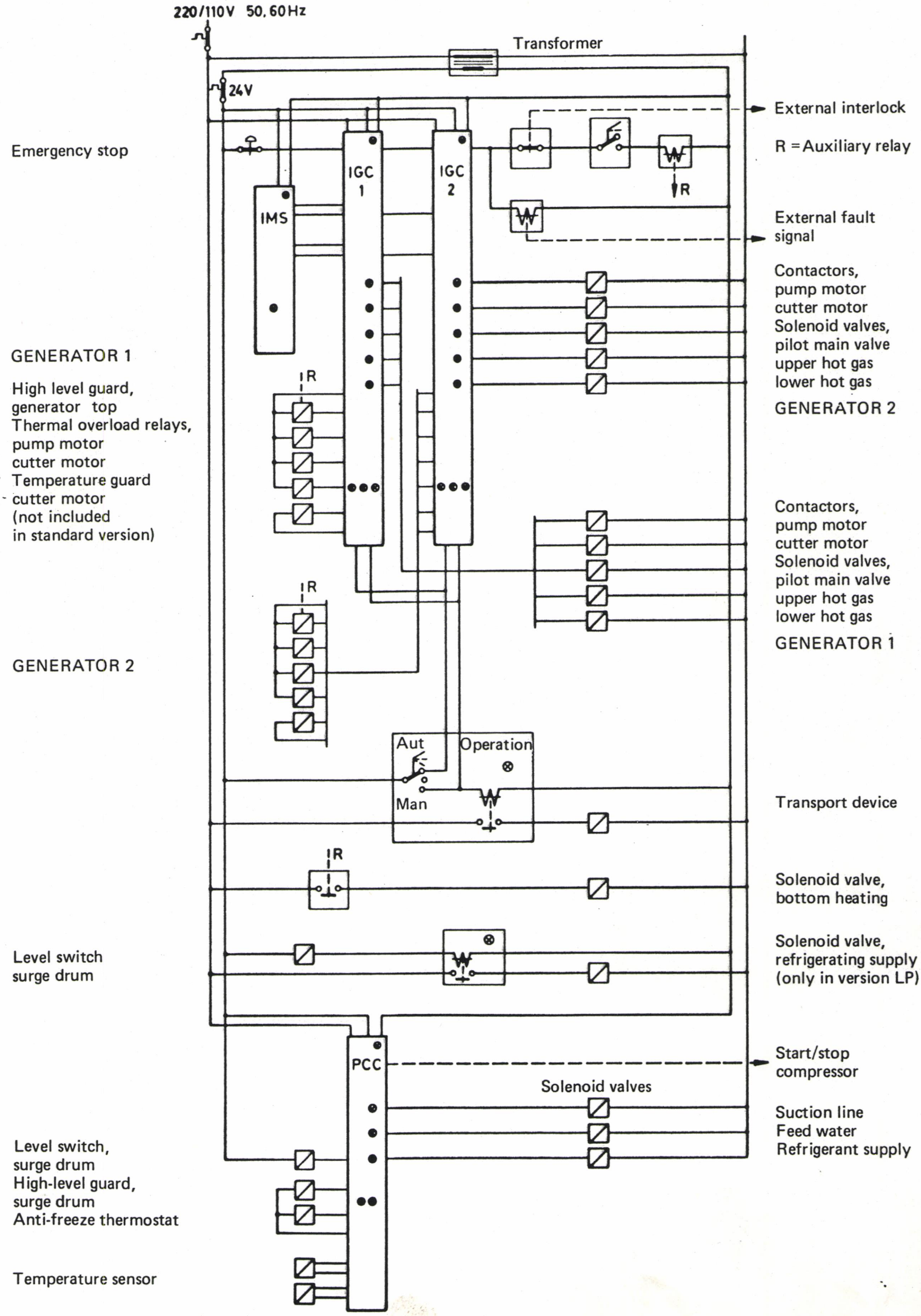
PIPING DIAGRAM (see Fig. 3)

Item	Description	Item	Description
1	Tube-ice generator	16	Stop valve in gravity line
2	Solenoid valve in hot-gas line to top	17	Pressure gauge in suction line
3	Solenoid valve in hot-gas line to bottom	18	Stop valve in suction line
4	Stop valve in hot-gas line	19	Main valve in suction line
5	Solenoid valve for bottom heating	20	Control valves for main valve
6	Control valve for bottom heating	21	Filter
7	Flap valve in circulation-water line	22	Safety valve for shell-and-tube unit
8	Circulation pump	23	Float switch (not included in standard version)
9	Strainer	24	Surge drum
10	High-pressure float valve	25	Oil accumulator for surge drum
11	Stop valves	26	Level indicator
12	Pressure gauge for bottom heating	27	Stop valve in suction line
13	Oil drain valve for gas-trap valve	28	Safety valve for surge drum
14	Gas-trap valve	29	Stop valve in suction line
15	Drain valve	30	Stop valve in liquid line



AUTOMATIC PRINCIPLE DIAGRAM

Ice machine with two generators and water precooler



FUNCTION OF AUTOMATIC CONTROLS - SIMPLIFIED DESCRIPTION

A detailed description of and instructions for the control panel will be found in separate manual sheets.

The production of ice takes place fully automatically and is governed by the ice generator controller (IGC) and by the ice machine sequencer (IMS).
The time for one ice freezing cycle (the time between commencement of two harvesting periods for one generator) is set on IMS.
Six different times are set on the IGC of each generator. These times together comprise the harvesting period. Apart from the harvesting period, the ice freezing cycle consists of the freezing period, which, then, is the time between the conclusion of one harvesting period and the commencement of the next one.

In plants incorporating a water precooler controller (PCC) to control the latter is also included.

Function of the various items of apparatus during a complete cycle (freezing plus harvesting):

SAFETY AND AUXILIARY APPARATUS

As evident from the circuit diagram, several items of safety and auxiliary apparatus are included in the automatic equipment. If one of these items trips, the ice machine will stop and, depending on the mode of connection, so will the compressor, the condenser and any transport device.

- Emergency stop. The entire plant is stopped by pressing in the button.
- The main switch is connected to all the electrical components in the tube ice machine.
- Overload protection, cutter motor and pump motor cut out in response to overloading of their respective motors.
- The float switch on the top of the generator cuts out if the water level in the upper water tank becomes too high (as a result of repeated freezing without harvesting).
- External interlock. Can be wired so that it cuts out in response to a fault in the compressor, condenser, transport device etc.
- Start and stop switch. Actuation starts or stops the ice machine.

When all the above mentioned items of apparatus have been switched on and the start swith is actuated, relay "R" pulls and the ice machine starts. Control of the generator ice freezing cycles is initiated by actuation of IMS "Control cycle on". Relay "R" also opens the solenoid valve for bottom heating. If the plant features a water precooler, this is started by pressing "ON" on PCC.

- External fault signal. If any of the items of safety apparatus connected to IGC cuts out, a signal is obtained which can be utilized to stop the entire plant or part of the plant
- Equipment for refrigerant supply to the ice machine.
- Change over switch for automatic or manual operation of the ice transport device. Included only in certain installations.
- Signal lamps and displays for monitoring of operations are always included.

Operation of the ice machine commences when the start switch and "Control cycle on" are actuated. If the 24-volt supply to IGC and IMS has not been interrupted between stopping and starting, operation continues where it was interrupted at stop. If, in contrast, the 24-volt supply has been cut out between stopping and starting, operating recommences right from the beginning, i.e. all generators commence their freezing periods and generator 1 is the first one to harvest.
The freezing and harvesting cycles in one generator are described below.

FREEZING PERIOD

The pump contactor is energized and the pump starts. When the pre-set time for cooling of the generator has elapsed, one of the pilot valves (20) – see piping diagram – is energized and the main valve (19) in the suction line opens.
Some of the water circulating in the tube ice generator is now frozen to ice.

HARVESTING PERIOD

When the pre-set ice freezing cycle time for the generator has elapsed, IGC receives an impulse from IMS, thereby starting the harvesting period which comprises a series of time-controlled operation stages.

- After-freezing, the circulation pump stands still and the main valve is open. No water is circulating in the tube ice generator and the ice is sub-cooled.
- The main valve closes. At the commencement of the period the pilot valves (20) switch and the main valve starts closing, becoming fully closed at the end of the period.
- The upper hot gas valve for emptying of the generator is energized and opens. Hot high-pressure gas now forces the liquid refrigerant out of the generator.
- Harvesting. The lower hot gas valve is energized and opens. The upper hot gas valve closes. At the same time, the contactor for the cutter motor is energized and the cutter starts. The ice transport device, if included, starts.

  Hot gas now flows into the generator and heats it, causing the ice to thaw loose, slide down, be cut off and ejected from the ice basket.
- Delayed pump start. The lower hot gas valve is de-energized and closes. The cutter stops.
- Generator cooling. The pump is energized and starts. Cold water is now circulated and cools down the generator. When the pre-set time for generator cooling has elapsed the main valve opens and a new freezing period has commenced.
- Depending on the plant configuration, there may be time for delayed stopping of the ice transport device. This time commences to run after cooling of the generator.

ADJUSTING THE TUBE ICE MACHINE

Ice thickness

The ice capacity and ice thickness are dependent both on each other and on the refrigerating capacity. Long freezing cycles give thick ice and the ice capacity decreases, albeit slowly. When the ice thickness is less than 6-7 mm, harvesting begins to deteriorate. Ice thickness in excess of 18-19 mm are not permitted in view of the risk of freeze-ups in the tubes.

NOTE! When the feed water is colder the ice will be thicker and consequently the requisite harvesting time will be longer. This means that there is a risk of the harvesting not being concluded because the set harvesting time is too short.

Condensing temperature
When adjusting the ice machine, the condensing temperature should be kept low, but not lower than 20°C. A recommended value is between 25° - 30°C. If this is not possible, e.g. owing to high temperature of the condenser cooling water, the adjustment must be checked on an occasion when the temperature falls.

IGC and IMS
No specific times for setting of IGC and IMS can be stated, since the time depends on factors such as ice thickness, condensing temperature and the temperature of the feed water. Some guide values and setting methods are described below.

It is appropriate to commence adjustment of the ice machine without precooled water. In the course of subsequent fine adjustments, the water precooler is used. The adjustment is not complete until the water precooler has been connected.

IMS
This unit, which is the impulse emitter for the automatic controls, determines the length of the ice freezing cycle. The cycle can be varied between 1 and 59 minutes. The actual harvesting time – which is included in the length of the cycle and determined by the IGC of the respective generator – varies between 1.5 and 3 minutes, depending on the capacity, but the setting of the optimal cycle length and the optimal harvesting time is performed individually for each tube ice plant. Initial setting 20 minutes.
Final setting . . . .

IGC
AFTER-FREEZING
If after-freezing of the ice is required, this is set at 10-15 seconds.
Final setting . . . .

CLOSING OF MAIN VALVE is set at 5 seconds.
Final setting . . . .

EMPTYING OF GENERATOR
Is set at a relatively long time, at least approx. 30 seconds. By listening to the gas trap valve during the emptying process a slight click will be heard as the gas trap valve closes. To be set at a time equivalent to 2-3 seconds after closing of the gas trap valve.
Final setting . . . .

HARVESTING
Set initially at a long time, at least approx. 300 seconds. This time is then successively reduced as the machine is running. The time must nevertheless be long enough to ensure that all the ice leaves the generator. The harvesting time is dependent on factors such as the ice thickness, implying that if the freezing period is increased it may also be necessary to prolong the harvesting period.
Final setting . . . .

DELAYED PUMP START
To be set so that the cutter just stops rotating when water starts circulating in the generator. Select 0 or 10 seconds.
Final setting . . . .

COOLING OF GENERATOR
In the beginning of the cooling period the temperature in the generator (as indicated on the pressure gauge on the machine) falls fairly rapidly and then approaches a final temperature increasingly slowly. To be set at a time corresponding to approx. 1°C higher temperature than the final temperature. Initial setting 15 seconds.
Final setting . . . .

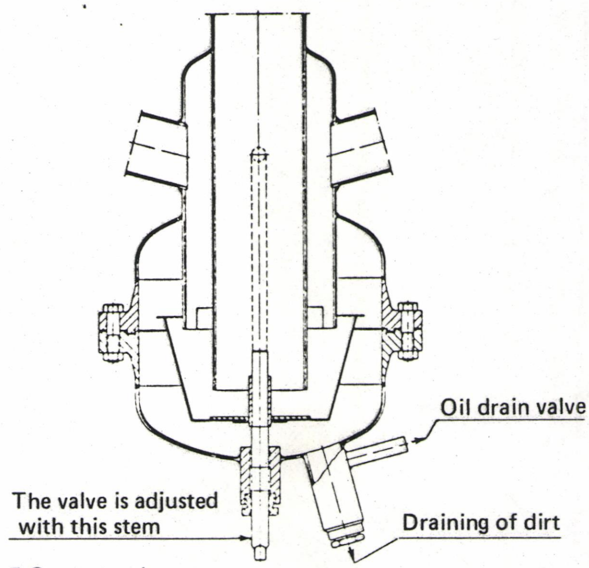


Fig. 5 Gas trap valve

Gas trap valve
The task of the gas trap valve is to admit liquid from the generator to the surge drum at the beginning of the harvesting cycle and after this to close and prevent gas from arriving. This setting must be adjusted to give a suitable opening. The valve is closed upon delivery. It is appropriate in the course of adjustment to screw the stem all the way out and then to adjust if necessary after running. If the valve closes before the generator is empty, this indicates that the valve is not open enough. If, on the other hand, it fails to close completely, then it is open to much. When altering the valve setting, adjust only a little bit at a time and wait for the result.

When closing, a slight click is heard and emptying of the generator can be verified by defrosting of the discharge pipes and trap valve. If it does not close completely, this is noticed in that the valve makes a noise and the pressure becomes unsteady for the other generators too. In the most unfavourable circumstances, the pressure in the generator fails to rise and harvesting does not take place.

When the gas trap valve has closed, the condensate formed during the harvesting – but not gas – must be able to pass to the surge drum. This takes place through valve (15) which must be adjusted so that no liquid remains in the bottom of the generator. If pure gas passes the valve the line after the valve will be relatively warm. This line should frost. In most cases the valve can be fully closed.

Adjustment of bottom heating
The bottom heating should be set so as to prevent the ice cutter knife from freezing up. Nevertheless, unnecessarily large amounts of hot gas should not be permitted to pass, since this heating results in losses. The adjustment is made with valve (6). The temperature of the bottom heating – as indicated on the pressure gauge (12) – should not be lower than +3°C.

Setting the water float
The water float (or float switch) should be set so that water does not flow out through the overflow at the highest water level in the tank.

Once properly adjusted, the items concerned should not be interfered with except in the event of a fault.