File: SERVICE MANUAL - Section 240
Replaces: S240-66 SB/J69
Dist: 3, 3b, 3c

S240–502SB/JUN 81

FRICK®

Installation - Operation - Maintenance - Service

FRICK SHELL - ICE® MAKERS

MODELS: SA150 and SA300

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This manual has been prepared to acquaint the serviceman with the installation, operation, maintenance and service procedures recommended by Frick Company for the SA Shell-Ice Makers.

DESCRIPTION – The Frick Shell-Ice Makers are automatic ice making units designed to economically produce clear, solid fragmented ice in large quantities – 13 thru 43 tons per 24 hours.

The two models of Frick Shell-Ice Makers are similiar in construction and consist basically of a freezing section; harvesting section and control panel. Each section is factory assembled for easy installation.

The freezing section includes supporting frame, stainless steel freezing tubes with liquid and gas headers, accumulator with float switch level control, stainless steel drip pan, oil and liquid traps, water distribution system, automatically operated suction, liquid and hot gas valves, necessary solenoids and stop valves.

The harvesting section consists of supporting base, ice breaker assembly and motor; ice sizer, water drain pan with float valve, recirculating pump and motor, baffle plates and water grid.

The control panel is factory wired and includes timer, terminal board, relay restarter mechanism, ice selector switch and pressure gauges.

To facilitate handling, the freezing and harvesting sections are shipped separately.

Optional features, available at extra cost, include oversize ice breaker motor for ice thickness over 3/8 inch and ice handling equipment.

MODEL NO. EXPLANATION

TABLE 1 – SHELL-ICE MAKER DESIGN DATA

Model Number	No. of Tubes	Pumps Motor HP	Breaker Motor HP		Nominal Operating Wts.
			Std Motor	Oversize Motor	
SA150	15	1/3	2	3	9000
SA300	30	1	5	7-1/2	16000

INSTALLATION

INSPECTION

Frick Shell-Ice Makers are shipped in two sections – base assembly with ice breaker mechanism and water pan; freezing section with tubes and accumulator. The control panel and other hardware will be shipped in a separate carton.

Carefully inspect the shipment for damages on arrival. Make a note of any damages on the carrier's bill of lading before signing and file all claims for damages against the carrier immediately. Frick Company should also be notified as to the nature and extent of any damages found.

HANDLING

When the Shell-Ice Maker arrives on the job site precautions must be taken to prevent damage to the machine during unloading and erection. Do not attach hoists or slings to the freezing tubes. These tubes constructed of No. 16 gauge material are easily damaged. Protect the tubes at all times during unloading and erection and keep the wooden supporting frame and clamps in position until the unit is in a vertical position in its final location. Lifting lugs have been provided to facilitate handling of the freezing section. Do not attach hoists to other points when transporting the unit.

LOCATION AND FOUNDATIONS

The Shell-Ice Maker should be located in a convenient area and as close as possible to the place where the ice will be used. If possible, the machine should be mounted directly over the ice storage room. This eliminates complicated and expensive conveyor equipment needed to transport the ice from the Shell-Ice Maker to the storage area. An opening in the roof of the storage area will allow the ice to fall directly from the machine into the ice storage. If the room is square and the ice slide is located in the center of the ceiling, the ice will distribute itself evenly in the room.

If it it decided to mount the Shell-Ice Maker in this fashion, the storage area must be constructed so that it will support the weight of the machine. A steel framework on a concrete foundation is recommended. Nominal operating weight for your Shell-Ice Maker is listed in Table 1.

If it is necessary to place the Shell-Ice Maker on the same level with the storage room a suitable conveyor must be used to raise the ice to the proper height for dropping it into the storage. An enclosed screw type conveyor is satisfactory for this purpose.

ICE STORAGE

It is not practical to store large quantities of fragmentary ice for long periods of time. "Shell-Ice" is no exception; however, due to the curved surface there is less tendency for Shell-Ice to stick together in storage. A storage of sufficient size to hold not more than 3 days supply is recommended. Since "Shell-Ice" weighs approximately 34 lbs. per cubic foot, the storage should be constructed accordingly. Be sure to insulate the storage with urethane or insulation equivalent to retard melting and sticking of the ice.

It is not recommended to store "Shell-Ice" in a bin with sides sloping toward a smaller opening in the bottom. After several harvests the ice will bridge over making removal difficult. Storages with vertical sides are the most satisfactory.

ERECTION

All erection and other assembly work should be carried out by qualified riggers and erectors who are familiar with refrigeration and ice making equipment. It is highly recommended that this work be done by a Frick Factor to insure satisfactory installation and adjustment of your new Frick Shell-Ice Maker.

Frick Shell-Ice Makers are shipped in two sections – base assembly with ice breaker and water box; freezing section with tubes and accumulator. Erection drawings are furnished with each machine and should be followed carefully. It is necessary to mount the base assembly first. If the Shell-Ice Maker is to be located over the storage area, steel rails or plate should be placed under the mounting legs at right angles to the roof members to distribute the weight of the machine and prevent the mounting legs from damaging the roofing materials. The steel rails should at least be 6 inches wide and extend the entire length of the Shell-Ice Maker base so that two of the four mounting legs rest on each rail. Be sure to level the machine before anchoring or securing with suitable anchor bolts.

If the Shell-Ice Maker is to be located on the same level as the storage area, it is recommended that the base be mounted and leveled on a concrete foundation. Elevate the Ice Maker to allow sufficient room for a hopper and screw conveyor with suitable drain piping. The steel rails may be omitted when mounting in this manner.

Attach the hoisting equipment securely to the lifting lugs on the accumulator and raise the freezing section to its proper position over the base. Carefully remove the wooden supporting frame and clamps and lower the freezing section into the base. Bolt in place at the four points shown on the assembly drawings.

The ice and water splash sheets should be installed next. These sheets are in sections and will be shipped in a separate crate with the machine. Install the end water sheets with the slotted end down and the flanges facing each other as shown on the assembly drawings. Fasten the sheets to the frame at points shown using the round head screws and nuts provided. Do not omit the lock washers. Draw the bolts finger tight only. The end ice sheets are bent at an angle of approximately 10° and should be attached to the flanged end sheets so that they extend inward towards the ice breaker.

Now install the ice breaker side sheets. Fasten them along their bottom edge to the top ice breaker stationary bar using the U-bolts provided. Tighten the U-bolts, keeping the ice side plates inside the flange on the end water sheets.

Insert the flat water side sheets keeping them outside the ice side sheets and inside the flange on the end water sheets. Tighten all bolts on the ice and water splash sheets.

Install the ice breaker motor, pulleys and belt guard. Carefully align pulleys and adjust the belt for proper tension.

Install the electrical control panel as shown on the drawings. Be sure to install the spacing washers between the frame and the panel.

RE-STARTING SHAFT

Now install the restarting device (Fig. 1) in its proper position on the frame as shown on the drawing. Insert the long end of the shaft (Fig. 2) through the opening in the back of the control panel. Be sure the water deflecting rubber washers are in place.

Bolt the bearing brackets in place and tighten all bolts. Adjust the thrust clamps on each end of the restarting shaft (Fig 2) for minimum end movement of this shaft. A 1/16" movement is desirable. Check after adjusting to insure that there is no binding of this shaft.

Adjust the feeler arms on the re-starter shaft so that all feelers touch the tubes at the same time. This is best accomplished by adjusting two end feeler arms first. Tighten all clamping bolts securely.

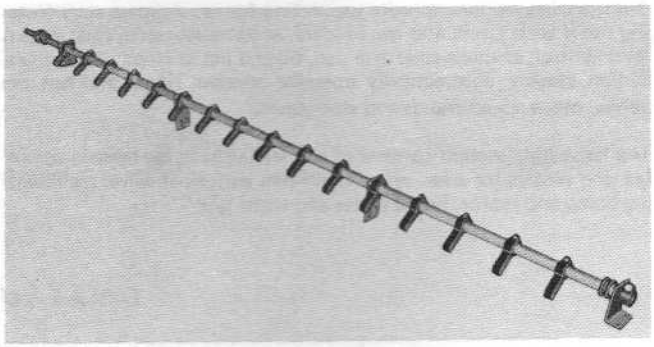


Fig. 1 – Restarting Device

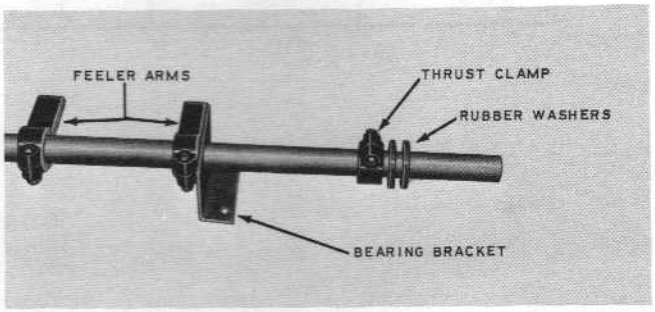


Fig. 2 – Control Box End of Restarting Device

ADJUSTMENT OF CONTROL ARM AND MICRO–SWITCH

Now install the counterweighted control arm on the end of the re-starter shaft which extends through the control box. (See Fig. 3). Position the control arm on the restarter shaft so that it will not bind on the magnet housing. Rotate the restarter shaft so that the feeler arms rest against the tubes. Manually lift the half moon weight so that it is in the "UP" or energize position. Clamp the control arm to the re-starter shaft, allowing 1/16" to 1/8" clearance between the control arm and the half moon weight. (See Fig. 4). Be sure the feeler arms are against the tubes and that the half moon weight is all the way up when the clamping operation is done.

Adjust the circuit breaking screw next. (See Fig. 4). With the half moon weight held manually in the "up" position, insert a 1/16" spacer between one of the feeler arms and one of the tubes. Adjust the circuit breaking screw so that the micro-switch button de-

presses sufficiently to operate the switch – listen for a light click. Be sure that the spacer remains between the feeler arm and the tube and that the half moon weight is completely raised when the circuit breaking screw is adjusted.

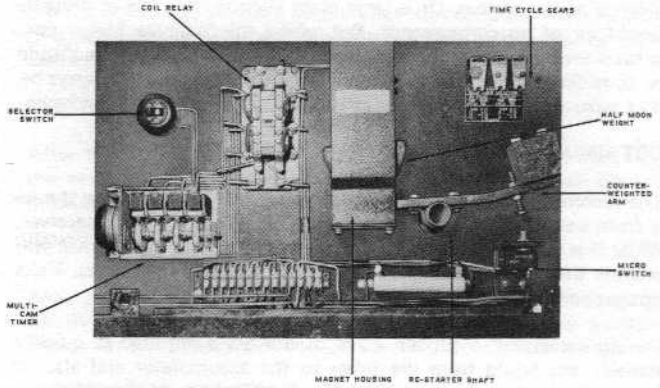


Fig. 3 – Control Box and Components

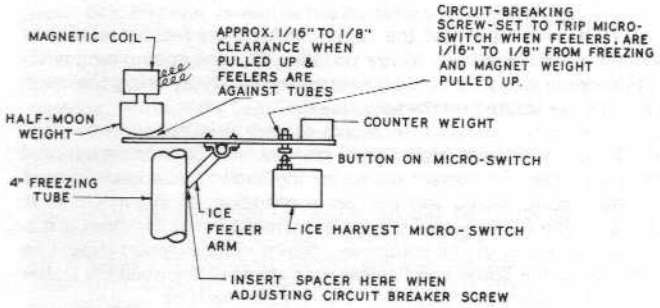


Fig. 4 – Adjustments of Restarter Controls

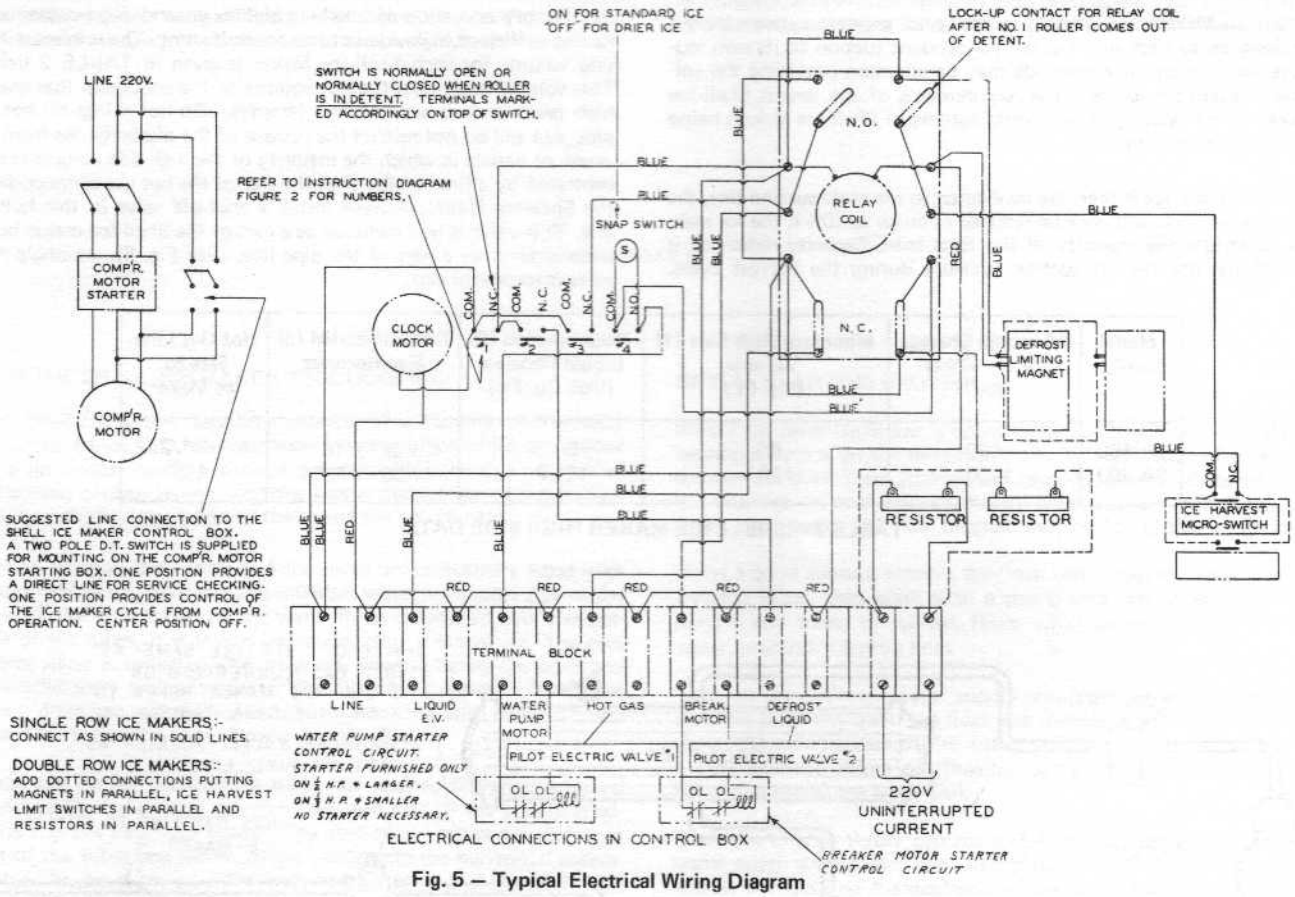


Fig. 5 – Typical Electrical Wiring Diagram

ELECTRICAL CONNECTIONS

NOTE: All wiring must comply with all existing national and local codes.

Control wiring has been made at the factory and should not be changed. Wire only from the power source to the terminal strip and from the terminal strip to the solenoid valves, water pump, and ice breaker motor. (See Fig. 5).

WATER CONNECTIONS

Water connections to the recirculating pump, water pan, water make-up source and drains should be made at this time.

REFRIGERANT PIPING

CAUTION: All models of the Shell-Ice Maker are factory sealed and contain a holding charge of dry nitrogen. Do not open piping without bleeding off this holding charge by slowly opening the main suction valve located on the accumulator.

NOTE: All refrigerant piping must comply with all existing national and local codes. Refrigerant piping for the Shell-Ice Maker consists of making suction, liquid and hot gas connections to the machine. A discharge line oil separator should be installed in the compressor discharge line ahead of the condenser. Appropriate strainers should be installed on the liquid and hot gas lines ahead of the Shell-Ice Maker to prevent foreign particles from entering the machine.

A shut-off valve should always be installed in the hot gas line to the Shell-Ice Maker.

Do not restrict the passage of hot gas to the Shell-Ice Maker by a pipe line smaller than the hot gas connection on the machine.

MULTIPLE ICE MAKERS

Where Ice Makers are installed in multiples, separate systems should be designed so each unit has an independent suction to its own separate compressor. The high-side may be common providing the volume is adequate to meet the requirements of the largest Shell-Ice Maker in the system, or any combinations of Shell-Ice Makers being harvested at one time.

If two or more Ice Makers are connected to the same suction line, the capacity of each unit may be reduced as much as 10% if the ice makers constitute the majority of the total load. Capacity reduction is caused by the rise in suction pressure during the harvest cycle.

OTHER EVAPORATORS IN SYSTEM

If an Ice Maker is connected to the suction line common to other evaporators, consideration should be given to what effect the momentary rise in suction pressure during the harvest cycle will have on the balance of the system. On a large plant suction, this rise in pressure would be of no consequence. But where the Shell-Ice Maker constitutes the majority of the total load, the suction pressure rise should be considered. For this reason, each Shell-Ice Maker should always be on a separate suction line when practical.

OBTAINING HOT GAS FOR HARVESTING

The recommended point for obtaining hot gas for harvesting the ice is from a separate connection at the top of the system liquid receiver. While it is possible to take hot gas from other points, the receiver will provide the largest volume of oil free gas for rapid ice harvest. Make hot gas connections as shown in Fig. 6

During harvesting, a sudden surge of hot gas is required to quickly transfer the liquid from the tubes to the accumulator and also to loosen the ice in a matter of seconds. Equally important as adequate high side volume is the line size from the receiver to the Shell-Ice Maker. This line must never be smaller than the size of the hot gas connection on the Ice Maker. Table 2 gives high side data.

HIGH SIDE VOLUME AND RECEIVER OVERSIZING

Satisfactory operation of Shell-Ice Makers depends a great deal upon having sufficient high-side volume for defrosting. The minimum high side volume for each Shell-Ice Maker is given in TABLE 2 below. This volume represents the net volume of the condenser (gas space), high pressure trap and receiver (empty). Do not skimp on hot gas pipe size and do not restrict the passage of the discharge gas from the vessel or vessels in which the majority of the high-side volume is concentrated by a line smaller than the size of the hot gas connection on the Shell-Ice Maker. Always install a shut-off valve in this hot gas line. This valve is not included as a part of the Shell-Ice maker but it is considered as a part of the pipe line. (See Fig. 5). An angle type valve is recommended.

Model Number	Ammonia Charges for Ice Maker (lbs.)	Minimum High Side (1) Volume (Cu. Ft.)	Recommened (2) Liquid Receiver (Vol. Cu. Ft.)	Recommended (3) Size Reciever	Hot Gas Line Size to Ice Maker
SA 150 SA 300	650 1200	60 128	54.3 121.7	24" x 18' 36" x 18'	2-1/2 4

TABLE 2 – SHELL-ICE MAKER HIGH SIDE DATA

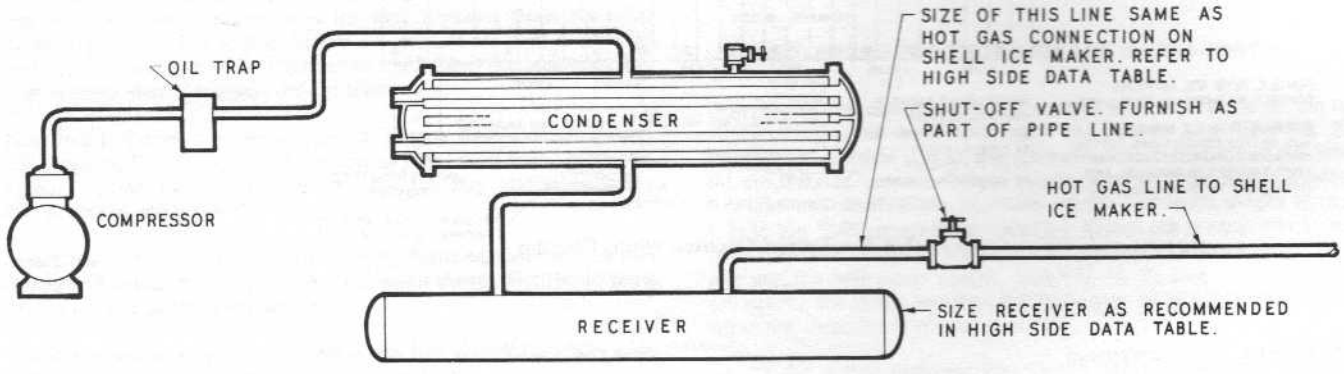


Fig. 6 – Hot Gas Connections for Shell - Ice Makers

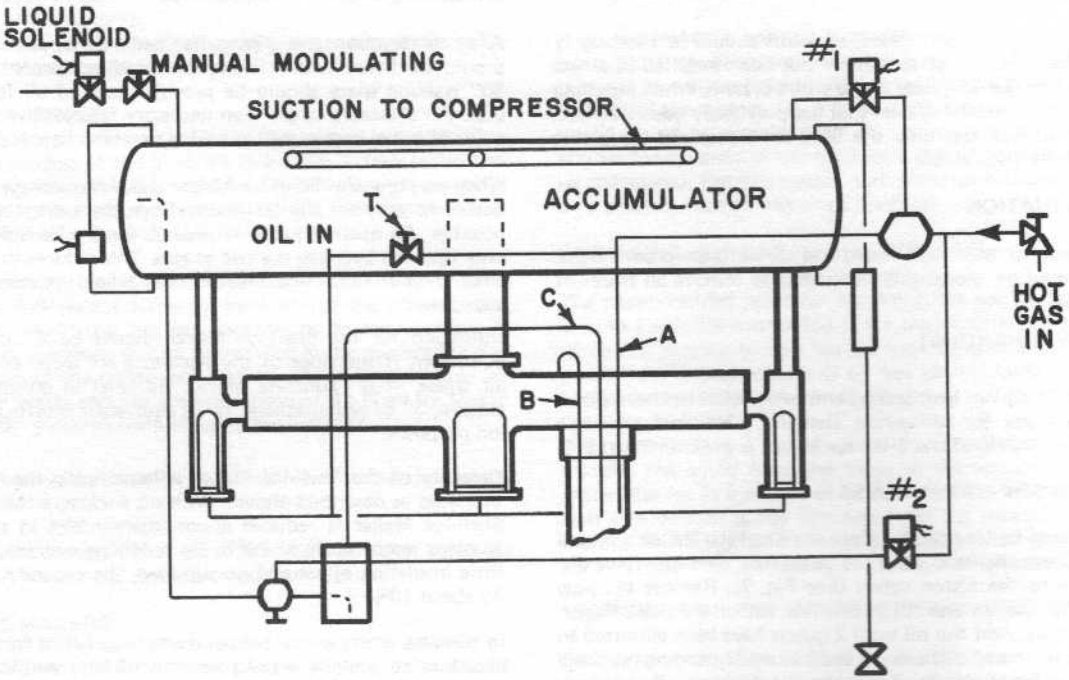


Fig. 7 – Schematic Diagram Arrangement of Typical Shell - Ice Maker

Now adjust hand valve (T) in the hot gas line which brings discharge pressure to bear on the piston valves (Fig 7). Normal setting for this valve is 1-1/2 turns open. Piston valves should close with a light thud at the start of the harvest cycle. Do not allow these valves to close in a violent manner; this will result in serious valve seat damage.

Within 30 seconds after the piston valve closes, ice will begin to harvest from the freezing tubes and drop into the ice breaker. When the ice slides from the last tube, the circuit breaking adjusting screw (Fig. 4) will trip the ice harvest micro-switch. This breaks the circuit to the relay coil, top contacts of relay open and bottom contacts close. The main pilot operated hot has valve (Fig. 7), will close, solenoid valve in liquid line to float will open, and the pump will start. Water will flow over the tubes and a new freezing cycle will begin.

The first harvest may be slow in leaving the freezing tubes. The second harvest will leave the tubes somewhat sooner, and the third harvest should be normal. Normal harvest time is 30 to 60 seconds. **NOTE**– Keep a close watch on the compressor oil level during the first several hours of operation.

MULTI-CAM TIMER

Operation of the Shell-Ice Maker is controlled by the Multi-cam timer located in the control box (Fig. 3). The time clock is normally geared for a single revolution of the cams in 12 minutes, which is usually best for normal ice requirements. Additional gears for 8, 10 and 15 minute cycles are furnished for use when thicker ice is required or the application requires a different time cycle. Ice should never be frozen over 1/2" thick on the tubes.

Cam No. 1 is next to the clock motor. As the roller resting on Cam No. 1 drops into the cam detent, switch No. 1 located next to Cam No. 1 makes contact. This energizes the relay coil which closes the solenoid valve in the liquid line. (See Fig. 7). Switch No. 1 also stops the water recirculating pump, opens solenoid valve No. 1 which pilot operates the main hot gas valve causing it to open, starts the ice breaker motor and energizes the magnet in the control box (Fig. 3). The energized magnet lifts the half moon weight, allowing the re-starter shaft to rotate until the feelers rest against the ice on the freezing tubes. The circuit to the relay coil is maintained through the ice harvest micro-swtich and one of the relay cont:cts after the roller on Cam No. 1 comes out of the detent and disconnects switch No. 1. The only thing which will return the control to the freezing cycle is to deenergize the relay coil by breaking the circuit through the ice harvest micro-switch.

As the main hot gas valve opens, hot discharge gas flows through the hot gas piping to immediately close the gas operated piston valves in the liquid down legs and gas return leg. (Fig.7). At the same time hot gas passes into pipe "A" which is inside the 4" stainless steel freezing tube. Pipe "A" carries hot gas to a pocket in the bottom of the freezing tube and up out of the pocket through pipe "B", bringing discharge pressure to bear on the liquid in the header. This pressure forces liquid ammonia out of the header and freezing tube up through pipe "C", which is open at the bottom.

This defrosts the tube and loosens the ice, causing it to drop into the ice breaker. The liquid forced out of the header and 4" freezing tubes through pipe "C" goes to the liquid blow out collecting pot, through the liquid return defrost valve, and into the accumulator. The time required to force liquid out of the tubes and into the accumulator is 15 to 25 seconds. A rise in suction pressure indicates that the tubes are free of liquid and to prevent excessive discharge gas from blowing into the suction line the rollers on Cam No. 2 drops into its detent, closing switch No. 2 to energize solenoid No. 2 which in return closes the liquid defrost valve, stopping discharge gas flow.

When the ice drops from the tubes, the feelers on the re-starter shaft come to rest against the bare tubes, tripping the ice harvest micro-switch. Ice remaining on any tube will prevent the shaft from rotating the last few degrees necessary to trip the switch. Until the ice slides from the last tube, there cannot be another freezing cycle. The ice harvest micro-switch must be tripped to de-energize the relay coil, which opens the solenoid valve in the liquid line, starts the water pump to recirculate water over the tubes and begin another freezing cycle. Pressures in the lines are equalized when the liquid defrost valve opens, causing the piston valve to open the valve port and flood

the tubes with liquid ammonia. Ice again forms on the outside of the tubes and the cycle is repeated.

Cam No. 3 keeps the ice breaker motor running for about 30 seconds after the harvest cycle to insure that all ice is broken into fragments which will pass through the sizer.

Cam No. 4 controls the operation of the water recirculating pump through the selector switch. (See Fig. 3). With the selector switch in the "ON" position, the action of Cam No. 4 has no control over the water recirculation pump. With the switch in the "off" position, Cam No. 4 takes control and stops the pump. The purpose of this is to dry the ice by turning off the water approximately 45 seconds to 1 minute before the harvest.

DRY ICE PRODUCTION

To produce dry ice before harvesting, move the selector switch in the control panel of the Shell-Ice Maker to the "off" position. (See Fig.3) This stops the water recriculation pump approximately 45 seconds before the harvest, permitting the ice to dry before it is placed in storage. Usually the ice must be 3/8" thick before drying is effective. To provide extra dry ice, the capacity of the Shell-Ice Maker is reduced approxitmately 5%.

QUALITY OF ICE

The quality of the ice made on Shell-Ice Makers depends largely upon the water and the suction pressure. Any water that will make a good grade of can ice will make clear "Shell-Ice" providing the suction pressure is not too low. The higher the suction pressure the better the quality of ice can be made.

If the water does not make clear ice, try draining the pan at frequent intervals. Often a constant bleed on the pan will help, particularly necessary where well water is used to prevent mineral build up.

If clear ice is of primary importance and the suggestions mentioned above are not effective in correcting the problem, contact a reputable water treatment service for their recommendations.

STORAGE AND HANDLING OF SHELL ICE

Outlined below are basic methods for storing and handling Shell-Ice. However, Ice Maker layouts and Frick recommendations for storage and handling of ice will necessarily vary according to specific job requirements, customer specifications, space availability, building construction details, operational convenience, etc. Therefore, the procedures and design data included in this publication are of general nature only.

For most applications, a storage room designed to hold not more than a three day supply is recommended. Shell-Ice weighs approximately34 pounds per cubic foot and when dropped in a pile, forms an angle of repose or a cone of approximately 30° with horizontal.

As with any fragmented ice, prolonged storage of large quantities is not recommended. "Sticking-together" or "chunking" during prolonged storage is a common characteristic of all fragmentary ice. Even extra dry Shell-Ice with its specially curved surfaces which limit the area of contact between pieces may "chunk" during a long storage period.

Shell-Ice storage rooms are seldom refrigerated since, in most cases, ice is used nearly as fast as it is produced. When the storage room is refrigerated, the room temperature should be 22°F or lower, and the Ice Maker should be operated on the "drying cycle" with the control panel selector switch in the "off" or extra dry ice position.

Storage rooms should be insulated with urethane and cold storage type doors used.

Shell-Ice storage bins should never be designed like a hopper with sides sloping toward a smaller opening in the bottom. This design always encourages ice bridging after several harvests. Storages with vertical or nearly vertical sides are the most statisfactory.

HANDLING OF SHELL-ICE

When ice is stored in a conventional type storage room it may be removed by a screw type conveyor level with the floor. A 12 inch screw conveyor with trough is arranged so the top of the screw is just slightly below the floor. The conveyor must always be covered with iron grating. Grating openings should be as long as possible, but must always provide protection against a workman's foot slipping through.

When filling the storage, the gratings should be covered with pieces of plywood or sheet metal about 4 feet long. This will prevent ice from packing around the screw and making it impossible to start the conveyor motor. By limiting the length of grate covers to approximately 4 feet, a workman may remove each cover, one at a time, as he gradually works to the end of the bin. This arrangement permits simplified feeding of the conveyor. If the storage room is wide, two conveyors are recommended.

OVERNIGHT SHUTDOWN PROCEDURE

When sufficient ice has been made, or it is necessary to stop the Shell-Ice Maker for overnight shut-down, proceed as follows:

(a) Manually close the shut-off valve ahead of the solenoid valve in the liquid line so that no more liquid can be admitted to the accumulator.

(b) Allow the Shell-Ice Maker to complete two cycles of operation.

(c) Place the electric control switch in the "off" position.

(d) Close compressor suction manifold valve and stop compressor. (If the Shell-Ice Maker is in a system common to other evaporators, close the suction valve at the accumulator of the Ice Maker and close the shut-off valve in the hot gas line instead of stopping the compressor).

(e) Close the shut-off valve in the hot gas line to the Shell-Ice maker.

LONG SHUTDOWN PERIOD

When it is necessary to shut-down the Shell-Ice Maker for long periods of time, proceed as follows:

(a) Follow the procedure for OVERNIGHT SHUTDOWN

(b) After compressor is stopped, close the suction valve at the compressor manifold.

(c) Shut off water make-up supply and drain compressor water jackets, condenser, Shell-Ice Maker water pan, pump and all piping which maybe exposed to freezing temperatures.

(d) Coat water pan, float freezing tubes and re-starting shaft with rust veto or heavy grease.

(e) Padlock control box and de-fuse power source.

CONDITIONS OF NORMAL OPERATION

The term NORMAL OPERATION Means that a Shell-Ice Maker is operating normally, within the limits of its design. The following chart is designed to illustrate normal and proper conditions of operation.

SYSTEM COMPONENT	NORMAL CONDITION
Water level and float.	Water level should be approximately 1 inch from the top of the wa-pan and should be maintained constantly by the float.
Water pump.	Should operate and circulate water over the freezing tubes only dur-ing the freezing cycle.
Piston Valves.	Open during freezing cycle, close with a light thud at the beginning of the harvest cycle.
Liquid line solenoid.	Open during freezing cycle — Closed during harvest cycle.
Liquid return defrost valve.	Closed during freezing cycle. Open during harvest cycle.
Ice breaker	Should operate during harvest cycle and for approximately 45 sec. onds after the harvest cycle ends.
Suction R-717	Should read approximately 30 psig at start of freezing cycle, dropping gradually to 17 psig just before harvest cycle.

Assurance of receiving trouble-free service from a Frick Shell-Ice Maker depends on PROPER AND DEFINITE PERIODIC MAINTENANCE PROCEDURES, performed by a qualified service/maintenance mechanic trained in the field of refrigeration and air conditioning.

When other than routine problems arise, or if the correctional procedure requires pumping down and opening the system, or other complicated functions, it is strongly suggested that the nearest Frick Factor be contacted for authorized service and assistance. This will ensure reliability and quick attention to the problem and a savings to you, the owner.

Close attention to, and faithful use of the following "ROUTINE MAINTENANCE CHART" will largely eliminate any need for further service.

**PREVENTIVE MAINTENANCE
FOR
FRICK SHELL-ICE MAKER**

Maintenance Procedure	Daily	Every Three (3) Months	As Required
Lubricate bearings on end of ice breaker shaft.		X	
Lubricate bearing supports on re-starter shaft.			As required to prevent sticking
Lubricate pump and ice breaker motors			Follow manufacturers instructions
Drain oil pot.	X		X
Drain and flush water pan.	X		X
Clean nozzle at top of freezing tubes.			X
Defrost pan at top of freezing tubes			X

OIL COLLECTING POT

The oil collecting pot, located on the accumulator, must be drained daily, particularly if the Shell-Ice Maker is operated continuously or for several hours every day.

WATER NOZZLES

Mineral deposits from the water may gradually build up around the nozzles at the top of the freezing tubes. Eventually this will restrict the flow of water and warrant cleaning of the nozzles.

WATER PAN

The water pan must be drained frequently if a high quality of ice is to be maintained. Frequency of the draining operation depends largely on the condition of the water supply; usually twice a week is sufficient.

DEFROSTING PAN AT TOP OF TUBES

If the Shell-Ice Maker is operated in low ambient temperatures and the humidity is high, ice may build up on the underside of the sheet metal pan at the top of the freezing tubes. This build up may gradually extend down far enough to freeze into the ice on the tubes and prevent the ice from dropping into the ice breaker mechanism. To correct this condition, stop the ice maker and allow the ice to defrost. Reduce the amount of water being circulated over the freezing tubes and bend the nozzles down slightly so that they extend away from the pan.

SERVICE

PUMPING DOWN FOR REPAIRS

Before opening any Shell-Ice Maker refrigerant lines for repairs, the machine must be pumped down to avoid loss of refrigerant and to relieve pressures within the piping. Follow the procedure outlined below to pump down Shell-Ice Maker.

(a) Close the hand shut-off valve in the liquid line

(b) Operate the Shell-Ice Maker through several cycles of operation until a steady suction pressure reading of 0 psi is obtained. If the liquid receiver becomes more than 85% full, refrigerant will have to be withdrawn and stored insuitable containers.

(c) Close the hand shut-off valves in the suction and hot gas lines and place the Ice Maker electric control switch in the "off" postion. Stop the compressor if no evaporators are common to the system.

(d) Observe the suction pressure after a short period of time. Any rise above 2 psi is an idication that some refrigerant remains in the Ice Maker. Open the suction and hot gas hand shut-off valves and repeat Steps (a), (b), and (c) until the suction pressure does not rise above 2 psi.

(e) Open the oil drain valve and bleed the remaining pressure to the atmosphere.

SERVICING PISTON VALVES

Before pumping down to remove possible stuck piston valves in the gas and liquid legs to the accumulator, first determine if piston valves are actually stuck by trying to operate with the liquid return defrost valve held manually open. Turn the stem of the valve clockwise as far as it will go. If liquid does not flood the freezing tubes, either one or both piston valves are stuck. If this trouble develops, it is usually right after the Shell-Ice Maker is placed in operation. When the main hot has valve opens, high gas velocities in the discharge lines carry dirt into the Shell-Ice Maker. A filter will help eliminate this condition and should be installed before the machine is operated.

If it is determined that a piston valve is sticking, it is best to remove all the piston valves for cleaning. Care should be taken when removing these valves from the larger machines as they may weigh from 100 to 200 lbs. Drawings showing construction of the piston valves are shown in Figs. 8,9, and 10.

CHANGING THE TIME CYCLE IN MULTI-CAM TIMER

The time clock is normally geared for a single revolution of the cams in 12 minutes. Normally a 12 minute cycle is best for average ice requirements. When thicker ice is required or when a small compressor is made to operate a relatively large ice maker, a longer time cycle may be required. Gears for 8, 10, 12, and 15 minute cycles are furnished as standard equipment with each Shell-Ice Maker.

The gears are attached to the control panel above the chart which identifies each gear with its corresponding time cycle. (Fig. 3). Use a shorter time cycle for thinner ice and a longer time cycle when thicker ice is required, but ice should never be made more than 1/2" thick: To change gears proceed as follows.

(a) Select the proper gear using the chart on the control panel for the desired time cycle.

(b) Remove the setscrew next to the clock motor and install the new gear. (Fig.11). Be sure to replace the screw.

(c) Turn the timer mechanism by hand to insure that there is no binding of the gears.

FREEZING TUBE REPAIRS

Freezing tubes which have become dented or otherwise damaged will not permit the ice to drop into the ice brea er during the harvest cycle. Although small dents can be filled with solder and smoothed with fine emery paper, large dents or serious damage will warrant freezing tube replacement. Contact the factory in Waynesboro, Pa. for a replacement tube and recommended repair procedures as freezing tube replacement is not a simple operation and should be attempted only under factory supervision.

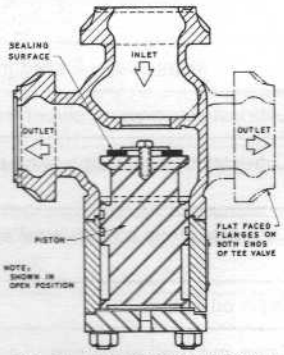


Fig. 8 – Gas Operated Piston Valve

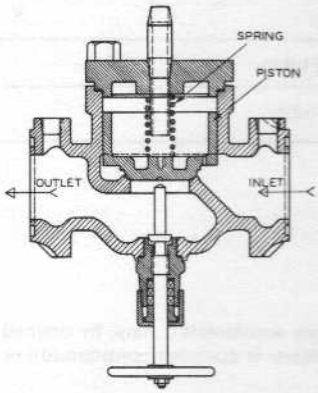


Fig. 9 – Pilot Operated Main Hot Gas Valve

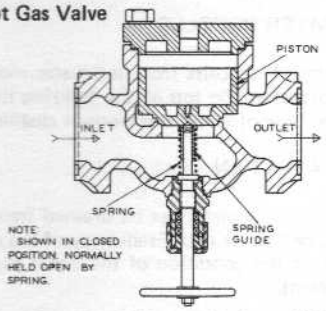


Fig. 10 – Liquid Return Defrost Valve

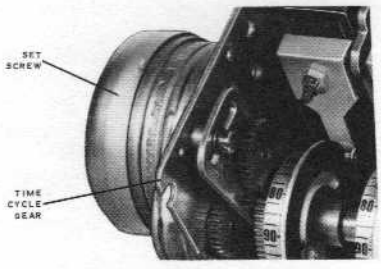


Fig. 11 – Multi-Cam Timer Showing Time Cycle Gear

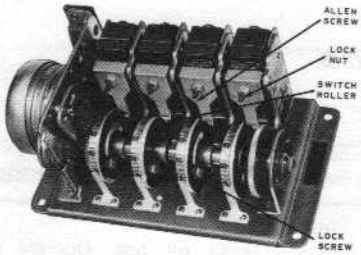
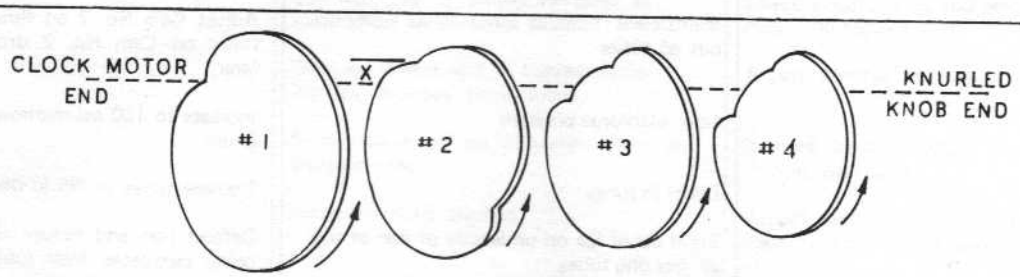


Fig. 12 — Timer Screw Adjustments and Cam Lock Screw



Cam No. 1 — Initiates defrost cycle by energizing coil relay.

Cam No. 2 — Controls solenoid valve No. 2 which pilot operates liquid return defrost valve.

Cam No. 3 — Controls operation of the ice breaker motor.

Cam No. 4 — Controls water pump — but only if selector switch is in "off" position.

Roller riding on Cam No. 3 must drop into detent approximately 30 seconds before roller riding on Cam No. 1.

The distance "x" on Cam No. 2 represents the time required to blow all the liquid out of the tubes. A sudden rise in suction pressure as the ice starts to slide from the tubes indicate all the liquid has been blown out. If distance "x" is too small then ice will hang up on some of the tubes indicating incomplete liquid blow-out. Increase distance "x" slightly to correct.

Fig. 13 — Cam Adjustments for Multi-Cam Timer

ADJUSTMENT OF MULTI-CAM TIMER

Each of the 4 cams in the timer can be adjusted by loosening the lock screw (Fig. 12) on the side of each cam assembly. The cams are in two sections, and are constructed so that detent openings and closings are individually adjustable. When adjusting cams, be sure the switch corresponding to each cam makes contact when its respective roller drops into the cam detent. If the switch does not make contact with the roller in the bottom of the detent, adjust the switch by loosening the lock nut on the switch arm counter-clockwise 1/8 turn. Repeat the operation as often as necessary until the switch makes contact. Be sure to retighten the lock nut after adjusting the screw.

The cam openings may be adjusted by following the instructions given below. (Also see Fig. 13). The cam next to the clockmotor is Cam No. 1 Place the control switch in the "off" position before making adjustments.

Cam No. 1 — Initiates defrost cycle by energzing coil relay.

(a) Rotate the cam assembly by hand in a clockwise direction until the roller riding on Cam No. 1 drops into the bottom of the detent.

(b) Check switch No. 1 to be sure that it has made contact as the roller on Cam No. 1 drops into the detent. Adjust if necessary.

(c) Adjust cam detent opening so that the roller on Cam No. 1 will immediately climb out of the detent after tripping switch No. 1.

Cam No. 2 — Controls solenoid No. 2 which pilot operates liquid return defrost valve.

(a) Energize the clock motor by placing the control switch in the manual position.

(b) Using a stop watch or a standard watch with a sweep second hand, observe the time interval between roller No. 1 and roller No. 2 dropping into their respective cam detents. This time interval should be 15 to 30 seconds to assure a complete liquid removal from the tubes and should never exceed 35 to 40 seconds. A slow harvest usually indicates an inadequate liquid removal. The pressure at harvest will be approximately 47.6 psig corresponding to 32°F ammonia. Adjust Cam No. 2 if necessary so that roller No. 2 drops at proper suction pressure.

(c) Be sure switch no. 2 makes contact when roller on Cam No. 2 drops into its detent. Adjust if necessary.

(d) Adjust Cam No. 2 so that roller stays in detent for 180° (6 min. on 12 min. cycle.)

Cam No. 3 — Controls operation of ice breaker

(a) Adjust Cam No. 3 so that roller No. 3 drops into the detent 30 seconds before roller on Cam No. 1 drops into its detent.

(b) Be sure switch No. 3 makes contact when roller on Cam No. 3 drops into its detent. Adjust if necessary.

(c) Adjust Cam No. 3 so that roller No. 3 stays in detent for approximately 2-3 minutes. (45 seconds after ice drops from last tube.)

Cam No. 4 — Controls water pump — But only if selector switch in control box is in the "off" position.

(a) Adjust Cam No. 4 so that roller on Cam No. 4 drops into its detent one minute before roller No. 1 drops into detent of Cam, No. 1.

(b) Be sure switch No. 4 makes contact when roller No. 4 drops into its detent. Adjust switch No. 4 if necessary

(c) Adjust Cam No. 4 so that the roller on Cam No. 4 comes out of its detent at the same time as roller No. 1 comes out of the detent on Cam No. 1.

DANGER SIGNAL	POSSIBLE CAUSE	SUGGESTED REMEDY
No refrigerant enters tubes after harvest machine will not freeze ice.	Piston valve in the liquid leg stuck in the closed position.	Remove all piston valves and clean thoroughly.
	Piston in liquid return defrost valve stuck in closed position.	Remove valve and clean thoroughly.
	Solenoid No. 2 failing to close to mechanical or electrical failure.	Check circuit, fuses and power source. Remove and replace valve.
	Shell-Ice Maker still in harvest cycle ice has dropped from tubes.	Adjust control arm to trip micro-switch.
	Small piece of ice between feeler and freezing tube.	Remove ice and reduce amount of water flowing over tubes.
	Re-starter shaft binding.	Adjust shaft and bearing supports to relieve binding. Check control arm.
	Faulty ice harvest micro-switch	Check switch and circuit
	Roller on Cam No. 1 came out of detent without breaking circuit.	Adjust roller by turning very small set screw on roller arm. Loosen lock nut and turn screw clockwise 1/8 turn. Repeat operation if necessary.
	Small piece of ice between feeler and freezing tube. Happens consistently to one particular tube.	Reduce amount of water to freezing tubes. Bend nozzle to give different flow pattern over tube.
Water pump loses suction.	Water level in pan too low due to insufficient water supply	Check water supply for sufficient water quantity and pressure.
	Water level too low in water pan.	Reduce amount of water flowing over tubes. Bend float arm to carry higher water level in pan. Install larger float valve to admit more water to pan.
	Faulty pump.	Repair or replace pump.
Ice collecting in water pan.	Ice falling past edge of ice slide into water pan.	Adjust ice slide.
	Low ambient temperature.	Heat Shell-Ice Maker enclosure.
	Broken or bent wires in ice slide.	Repair or replace ice slide.
Ice forming on ice slide.	Low ambient temperature	Heat Shell-Ice Maker enclosure.