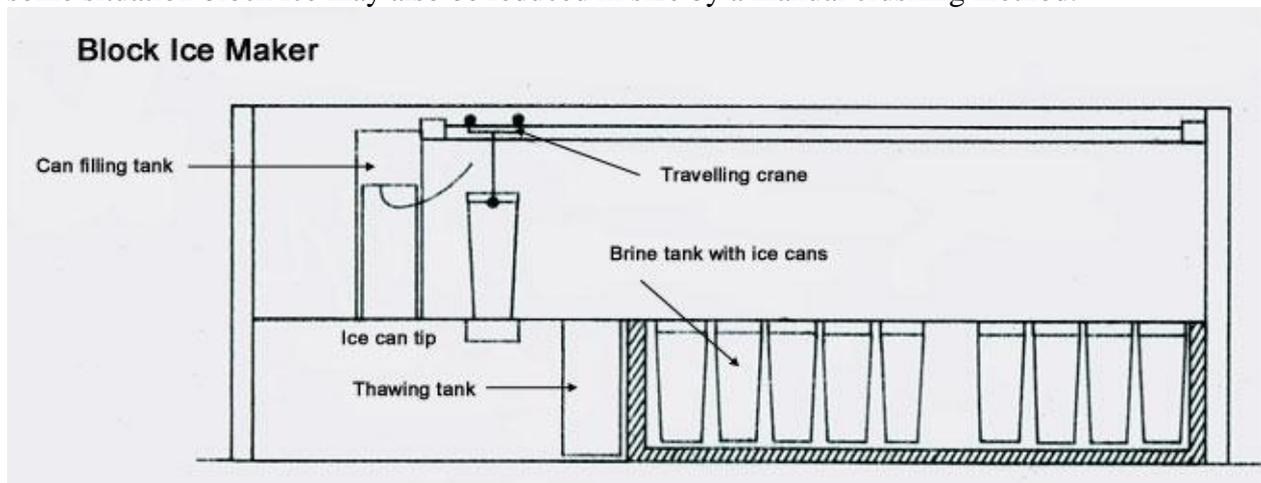


Type of ice

Type of ice

6.4.1. Block ice

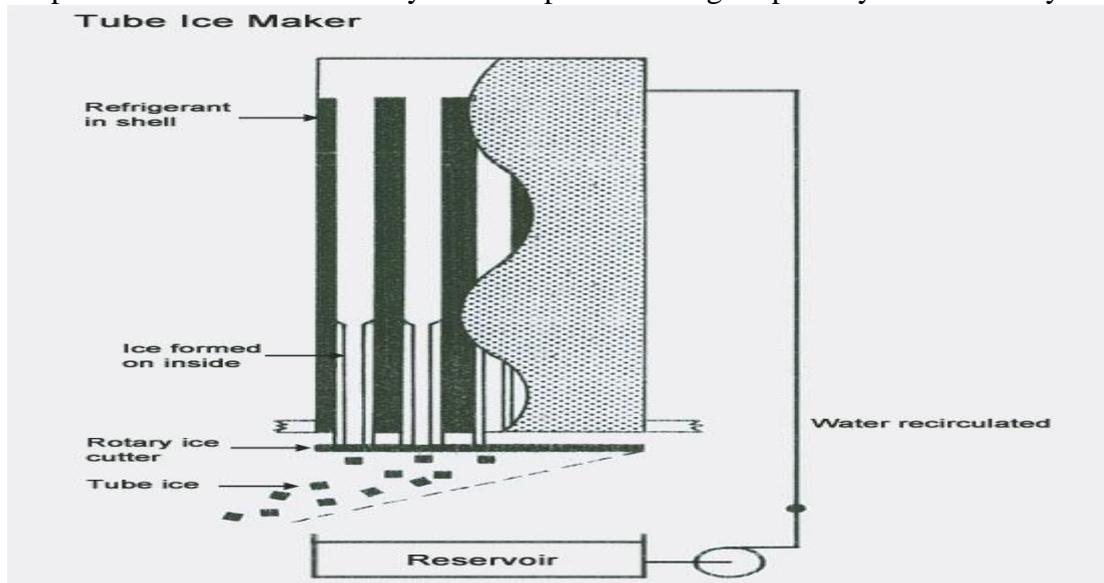
The traditional block ice maker forms the ice in cans which are submerged in a tank containing circulating sodium or calcium chloride brine. The dimension of the can to make block ice is usually selected to give a freezing period between 8 to 24 hours. Too rapid freezing result in brittle ice. The block weight can vary from 12 to 150 kg depending on the requirements, 150 kg is considered as the largest size of blocks one can conveniently handle. Thicker the block, longer is the freezing time. Blocks less than 150mm thick can easily be broken and a thickness of 150 to 170mm is preferable, to prevent the block toppling. The size of the tank required is related to the daily production. A travelling crane lifts a row of cans and transports them to thawing tanks at the end of the freezing tank. When they are submerged in water the ice release from the moulds. The cans are tipped to remove the blocks. Once ice is removed the cans are filled with fresh water and replaced in the brine tank for further cycle. This type of Plant often requires continuous attention and shift system is operated by the labor force which may be 10 to 15 workers for 100t/ day plant. Block ice plants require a good deal of space and labor for handling the ice. The later factor has been the main reason for the development of modern automatic ice making equipments. Blocks ice still has a use, and sometime an advantage, over other forms of ice in tropical countries, storage, handling and transport can all be simplified if the ice is in the forms of large blocks, simplification is often obligatory in small scale fisheries and in relativity remote situations. With an appropriate ice crushing machine block ice can be reduced to any particular size but the uniformity of size will not be as good as that achieved with some other toms of ice. In some situation block ice may also be reduced in size by a manual crushing method.



6.4.2. Tube ice

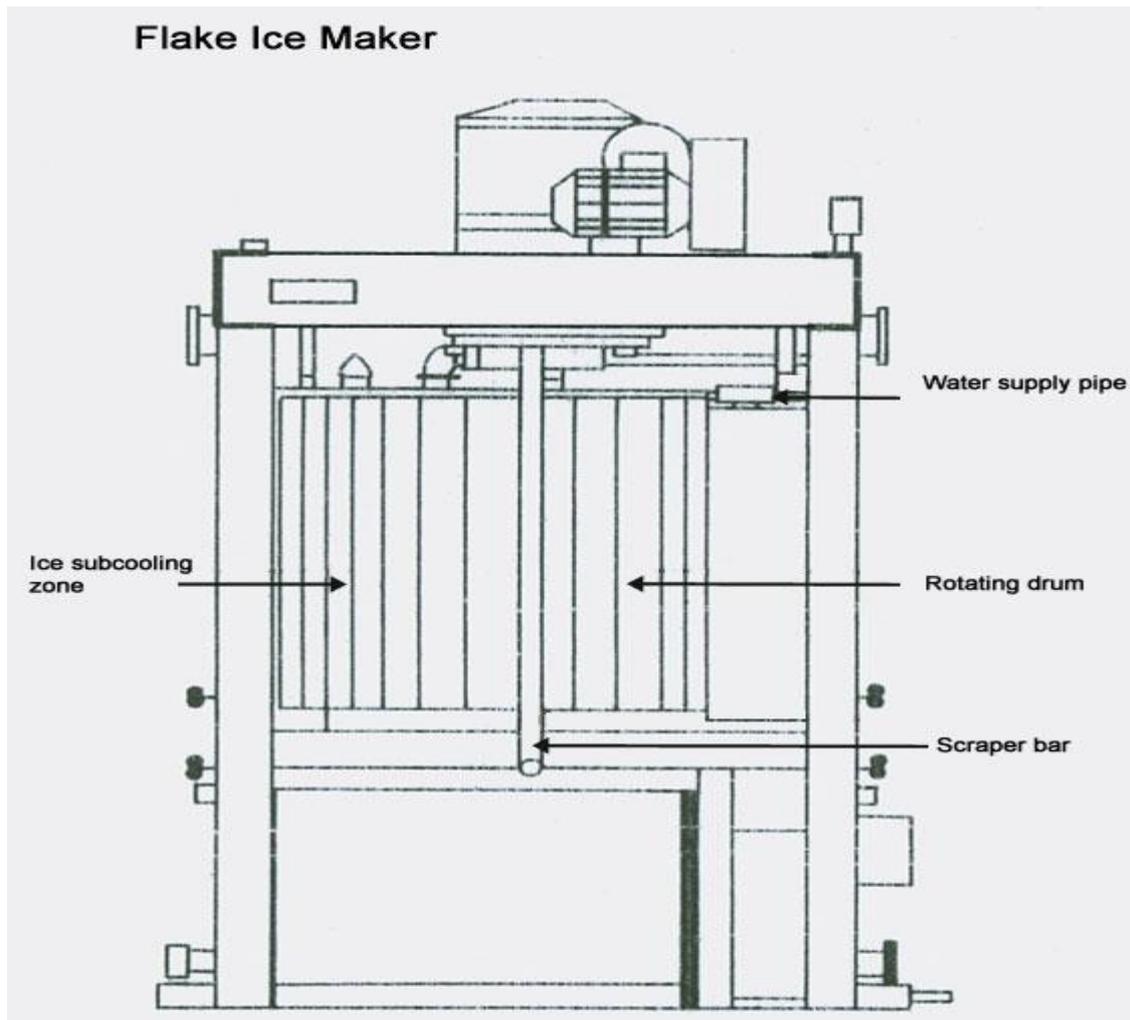
Tube ice is formed on the inner surface of vertical tubes and is produced in the form of small hollow cylinder of about 50x50 mm with a wall thickness of 10 to 12mm. The tube ice plant arrangement is similar to a shell and tube condenser with the water on the inside of the tubes and the refrigerant filling the space between the tubes. The machine is operated automatically as a time cycle and the tubes of ice are released by a hot gas defrost process. As the ice drops from the tubes a cutter chops the ice into suitable lengths, nominally 50mm but this is adjustable. Transport of the ice to the storage area is usually automatic. Thus as in the flake ice plant the harvesting and storage operation require no manual effort or operator attendance. Tube ice is usually stored to the form it is harvested, but the particular size is rather large and unsuitable for use with fish. The discharge system from the plant- therefore incorporates an

ice crusher which can be adjusted to give as ice particle size to suit customer requirements. The usual operating temperature of this type of plant is -8°C to -1°C . The ice will be subcooled as entering the store but it is usually possible to maintain the store at -5°C , since particle size and shape allow the ice to be readily broken up for discharge especially with a rake system.



6.4.3. Flake ice

This type of machine forms 2 to 3 mm thick on the surface of a cooled cylinder and the ice is harvested as dry sub cooled flakes. In some models, the cylinder or drum to rotates and the scrapper on the outer surface remains stationary. In others the scrapper rotates and removes the ice from the surface of a stationary drum, in this case built in the form of a double walled cylinder. It is usual for the drum to rotate in a vertical plane but in some models the drum rotates in a horizontal plane. One distinct advantage of rotating drum method is that the ice forming surfaces and the ice release mechanism are exposed and the operator can observe whether the plant is operating satisfactorily. The normal refrigerant temperature in a flake ice machine is -20°C to -25°C .



6.4.4. Dry ice

The frozen carbon dioxide or solid carbon dioxide is often referred to as dry ice. It is manufactured from carbon dioxide gas. The preservation of solid carbon dioxide is difficult because of its extreme low temperature. The manufacture of carbon dioxide gas is a chemical engineering problem in itself. The heating of limestone or its treatment with acid is their principal source of the gas. Large volumes are also obtained by the controlled combustion of coke even some carbon dioxide has been obtained commercially from the fermentation of organic substances.

Carbon dioxide gas may be liquified by a pressure of 900 to 1000 PSI, followed by condensation in coils, which are usually cooled by water. Compression is usually accomplished by three stage reciprocating compressor. Solidification of the liquid may be done in one of three ways.

- By removal of heat through auxiliary refrigeration
- By removal of heat through evaporation of a portion of the liquid carbon dioxide
- By expansion of the liquid carbon dioxide to a pressure below that of the triple point

The simplest form of equipment that could be used for the production of solid CO_2 by expansion of the liquid.

The apparatus necessary is practically identical with that of any vapour compression refrigeration system with the exceptions that –means must be provided for the introduction of- make-up carbon-dioxide gas and for the removal of- the carbon dioxide “snow”. As expansion reduces the pressure below that of the triple point the liquid flashes directly into

gas and CO₂ snow at the discharge of the expansion valve. This snow is quit porous and must be removed from the evaporator or snow chamber and compressed by mechanical means into cakes.