

Ice Making Equipment

by Danamark Watercare

This Ice Application module will cover:

- Commercial Ice Makers and how they work
- How water quality impacts ice





Part One

Commercial Ice Makers

Commercial Ice Makers

There are almost 150,000 ice machines sold each year, and industry studies indicate that they have an average life span of 5-7 years.

This means that there are almost one million (1,000,000) commercial ice makers in use today.





Ice is required in all foodservice operations to chill beverages, blend cocktails and maintain safe temperatures in salad bars.

Grocery and wholesale food outlets also need icemakers for bag ice sales, the chilling of fish, meat and produce displays.



Hospitals and other medical facilities require ice for a wide variety of applications.

Most hospital floors have at least one ice/water dispenser and flaked ice is still the preferred choice for hospital therapeutic applications.

Types of Ice Machines - Flakers

During the first half of the twentieth century, Flake ice machines were the most common type of icemaker.

The Flake ice machine produces fine particles of irregular shaped ice, which melt quickly and offer rapid cooling.

Because flake ice melts rapidly, it is not usually recommended for fountain drinks.

To address this limitation, the industry introduced machines which compress the flakes into small, cylindrical, randomly sized bits of ice.

Known as nugget or chiplet ice, the compressed flakes have rapid cooling power but melt more slowly than traditional flake ice.

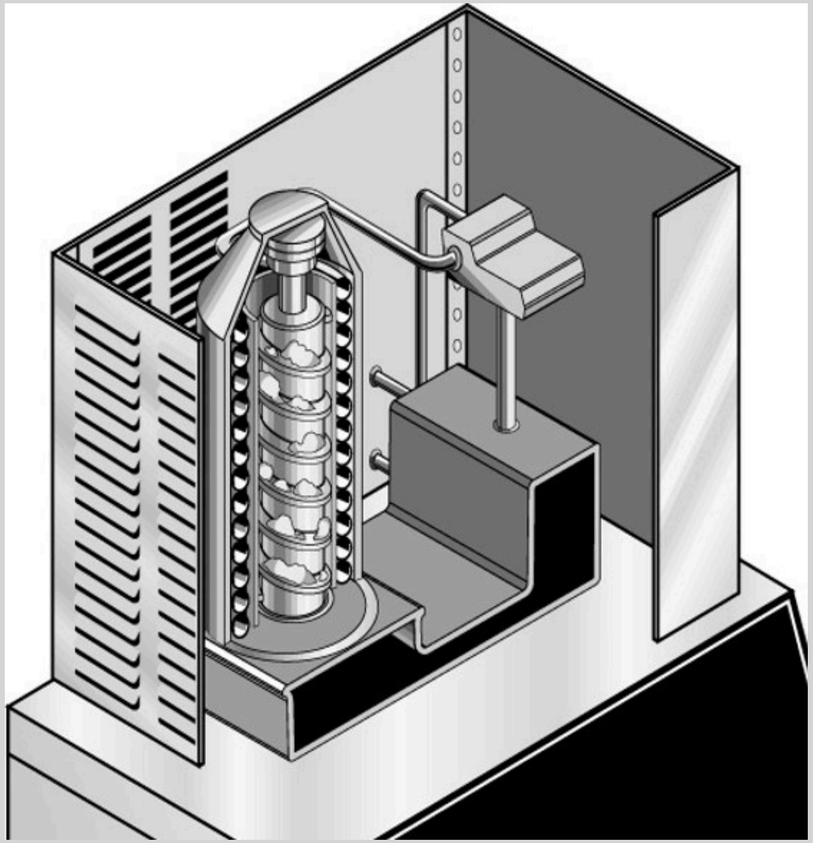


These types of ice cubes are often referred to as 'chewable'.

Nuggets are preferred by some theatres because they are soft enough to eat quietly, and do not leave chunks of hard ice on the floor or in the empty cups.



How Flakers Make Ice



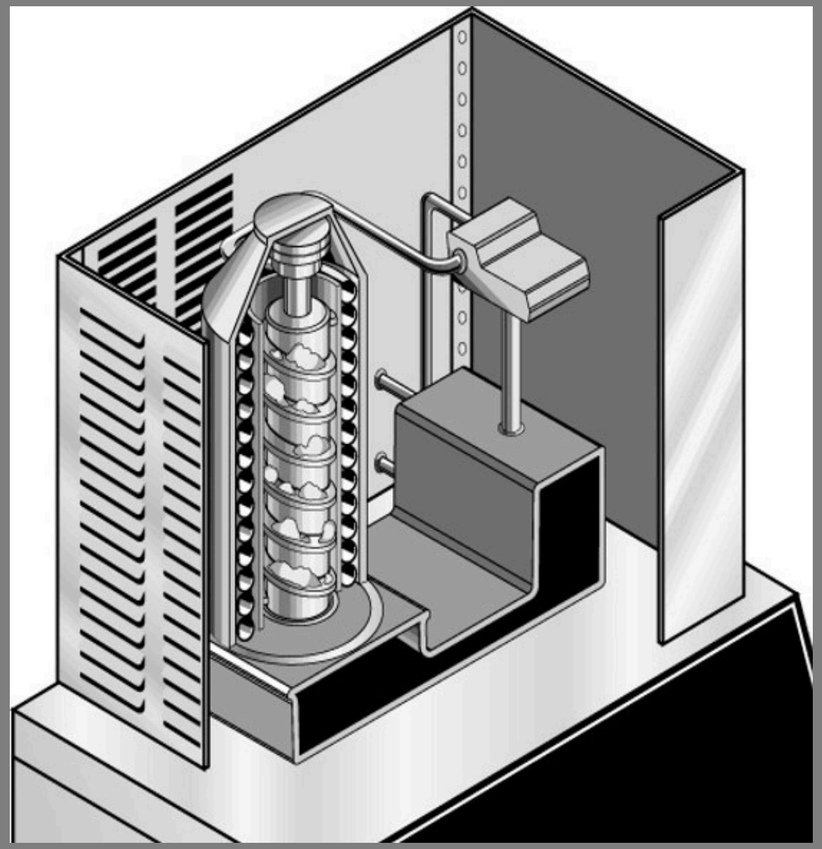
There are 6 basic steps:

1.Water flows through a float or mechanical solenoid into a small sump.

2.Water enters an evaporator chamber, which has refrigerated tubing embedded in the walls of the barrel. Cold refrigerant is pumped through the tubing to lower the temperature and create a freezing surface.

3.As the water cascades down the sides of the barrel, ice crystals form along the cold evaporator walls.

How Flakers Make Ice



4. The auger (shaped like a large metal screw) slowly rotates and draws the ice crystals up the sides of the evaporator. The upward motion allows the water to drain away, and turn the ice crystals to semi-dry flake ice.

5.The Flake ice is carried to the top of the evaporator and pushed into a delivery chute.

6.The Flake ice falls into an insulated storage bin.

Flake ice machine designs are available in a variety of models and sizes.

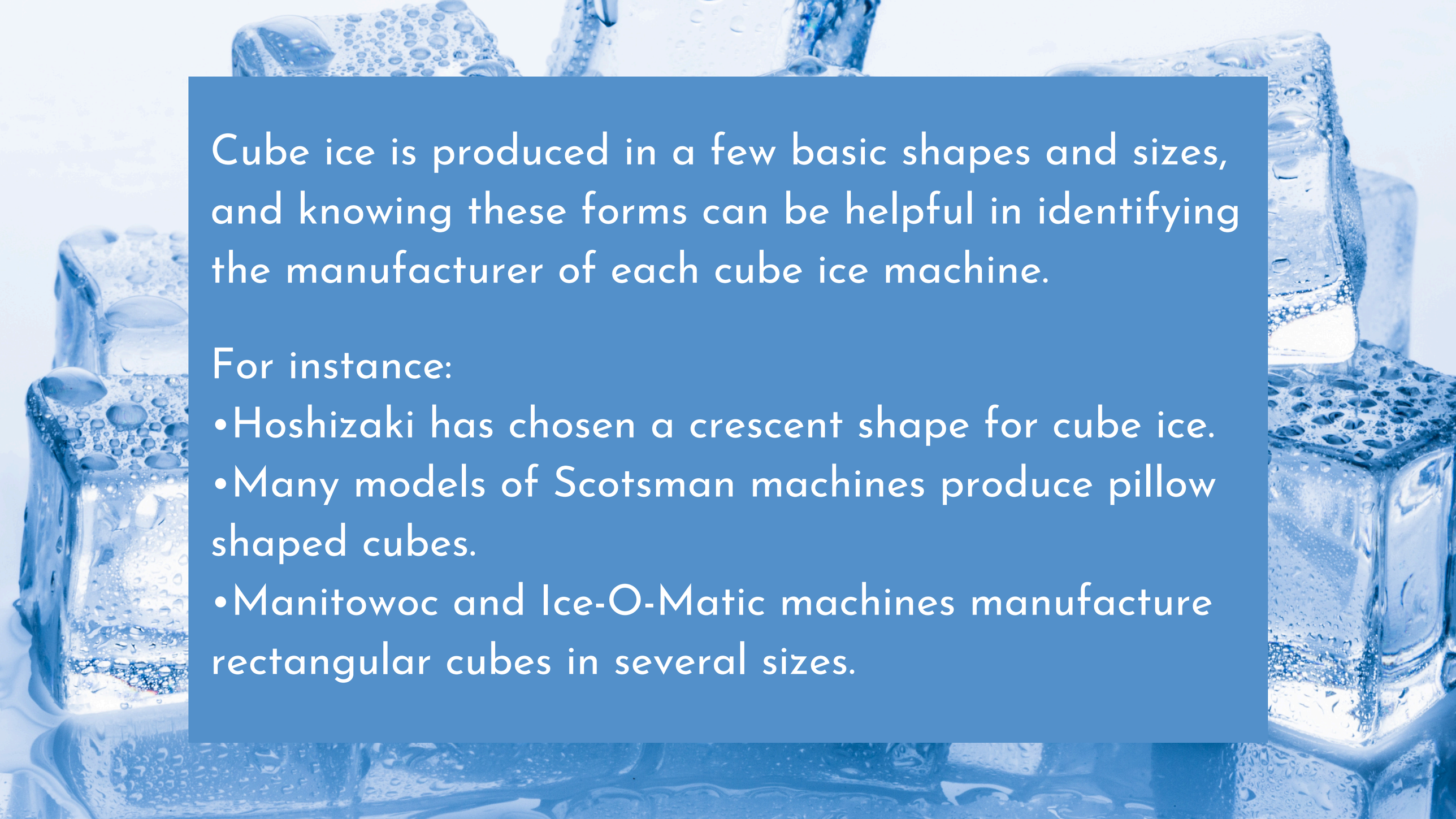
Small machines produce 200 pounds per day and the larger units can make over 2,000 pounds per day.



Types of Ice Machines - Cubers

In recent years, the Cube ice maker has become the industry standard for most foodservice applications.

Cubes have a specific, clear shape, and are harder than flake or nugget ice. Since the high density of cube ice results in a slower melt, it is recommended for most fountain and bar drinks.



Cube ice is produced in a few basic shapes and sizes, and knowing these forms can be helpful in identifying the manufacturer of each cube ice machine.

For instance:

- Hoshizaki has chosen a crescent shape for cube ice.
- Many models of Scotsman machines produce pillow shaped cubes.
- Manitowoc and Ice-O-Matic machines manufacture rectangular cubes in several sizes.

Types of Ice Makers – Cubers Continued

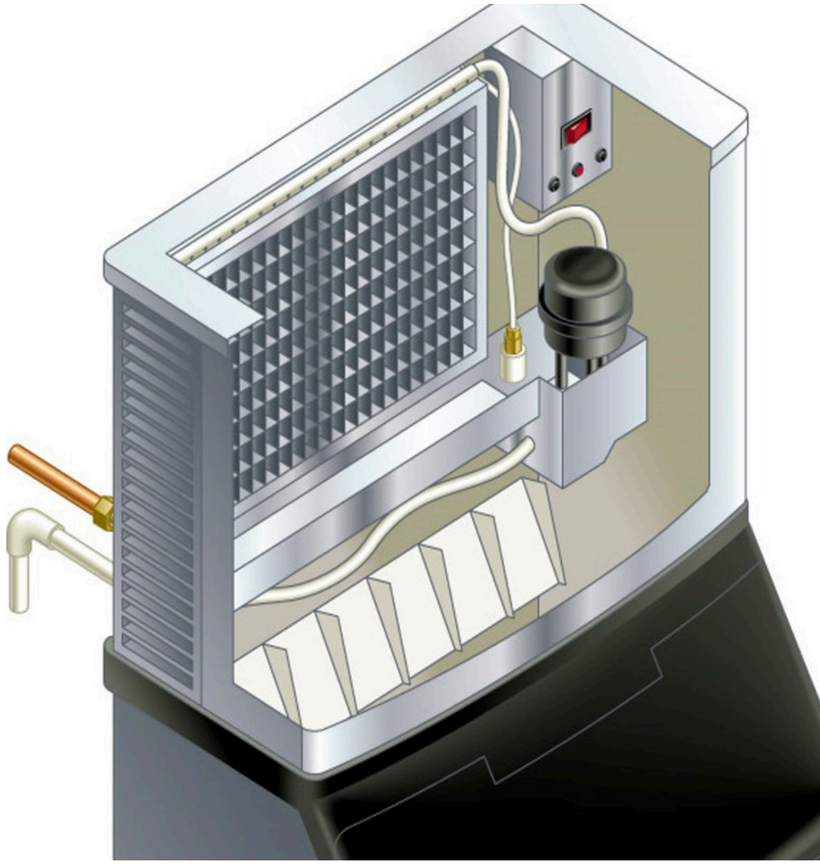
Cube ice makers are available in a variety of models and sizes. Small commercial machines produce less than 200 pounds per day and some larger units can make over 2,400 pounds each day.

To accommodate growth or space limitations, smaller machines can also be stacked on top of each other to produce a greater volume of ice in the same storage bin.

How Cubers Make Ice

There are five basic steps to producing the cubes, with a few variations between equipment brands:

1. Inlet water flows through a float or a time controlled solenoid into the sump.
2. Water is pumped out of the sump and through the distribution tubes at the top of the evaporator plate.



How Cubers Make Ice - continued

3. The small holes in the distribution tube allow the water to cascade slowly over the evaporator plate. This flowing motion releases some water vapour, which you will notice as a cool mist in the ice machine. The agitation also allows a few chemicals to be released in gas form, and they mix with the water vapour to become mild acids.

How Cubers Make Ice - continued

4. The evaporator plate is imbedded with refrigerant tubing, and cold refrigerant is pumped through the tubing to produce a freezing surface. Some of the water turns to ice on the surface of the small cube grids.



How Cubers Make Ice - continued

5. The remaining water, and most of the dissolved minerals, are pushed away from the freezing surface and return to the sump – to repeat the process until a full ice cycle is completed.



There are four more steps for harvesting the ice:

- When a timer or sensor indicate that ice cubes have reached their proper size, the compressor changes to the hot gas cycle and begins to warm the evaporator plate. At this point, more water may be added to help the cubes release from the grids (harvest assist).
- Cubes release and fall into the storage bin.
- The sump is flushed to discard the solids and mineral impurities.
- The sump is then refilled with fresh water.



Ice-Over Set Ups

Today, you may find separate icemakers over each fountain dispensing system in fast food and convenience store locations.

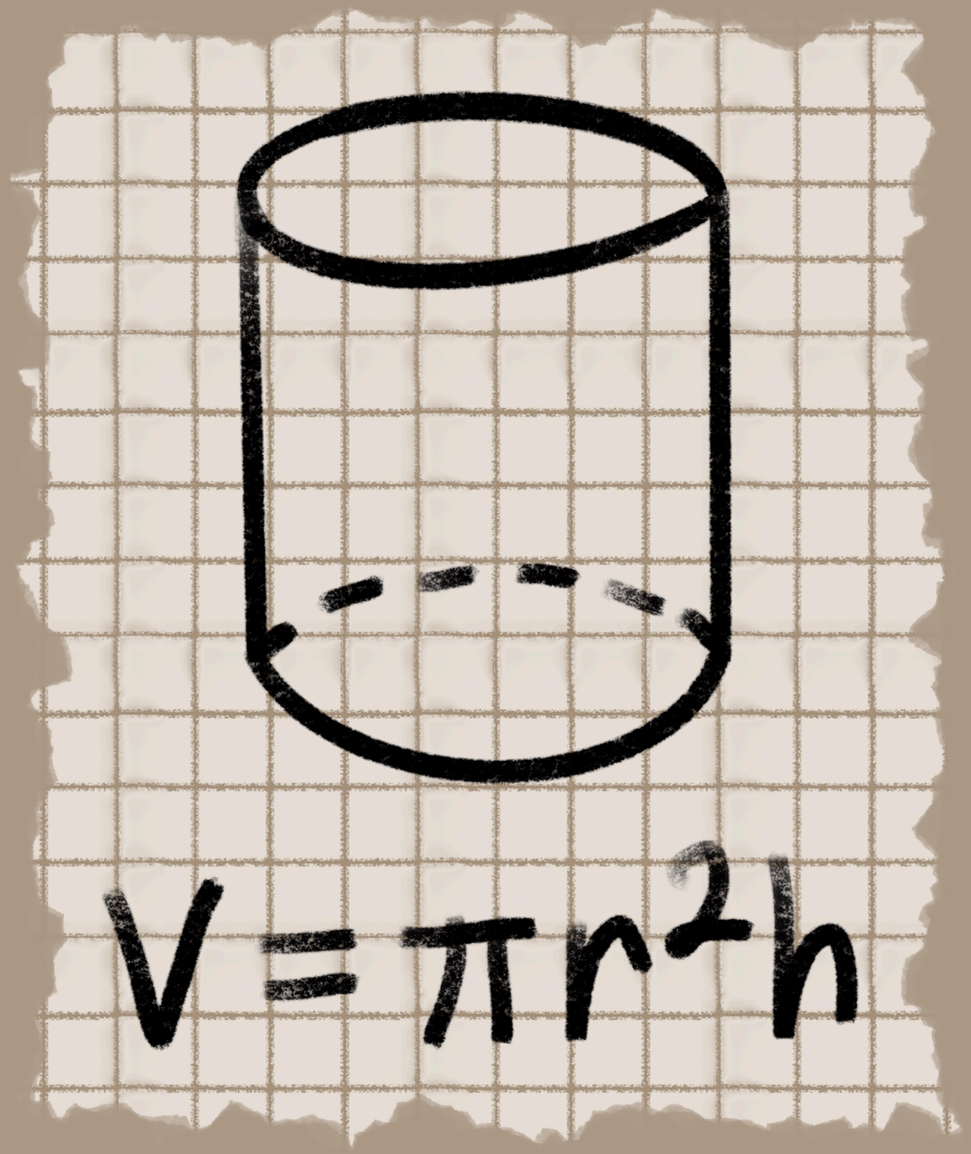
These units have limited storage, and are sized to the peak demand during each day.

The large, back room icemaker may only be used as an emergency supply.



From a water volume perspective, there are two types of Cube Ice Machines

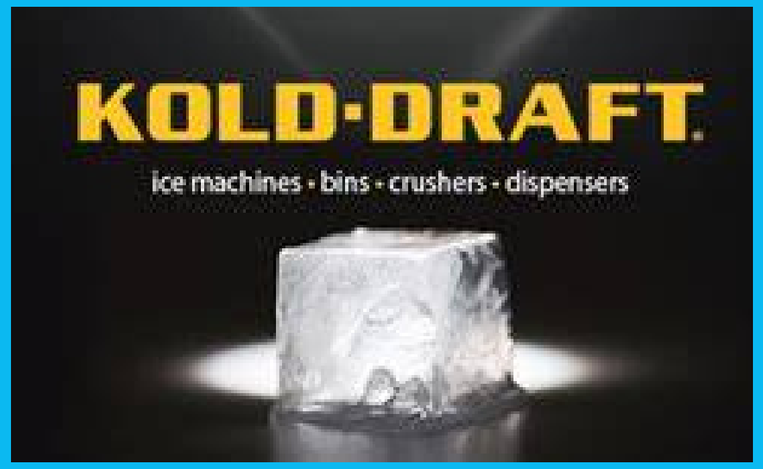
Low flow machines, which draw less than 1.5 gallons per minute during fill, and send a limited amount of water to drain. This flushing action is designed to rinse the solids and mineral concentrations from the machine after each batch of ice is made.



From a water volume perspective, there are two types of Cube Ice Machines - continued...

High flow machines, such as Hoshizaki and Kold Draft, with a minimum draw greater than 2.0 gpm, based on their belief that aggressive fill and flushing will produce better quality ice, and lower maintenance.

HOSHIZAKI



Ice machines need to cool down...

Freezing can be viewed as the process of removing heat from water [Ice = H20 less BTU].

All machines must have a method of releasing this transferred heat into the environment.



There are two common methods of Ice Machine Cooling

Water cooled condensers - water coils run along the condenser coils. The condenser coils release heat into the water, and then the hot water drains out of the unit, removing heat from the system and allowing it to maintain a cool temperature.

Air cooled condensers - Internal fans and vents inside the machine circulate the air. When air flows through the condenser coils, it removes the internal heat, which is then let out through vents in the rear or sides of the ice machine.



Part Two

How Water Quality Impacts Ice

How Water Quality Impacts Flakers

With this design all contaminants that travel with the water into the machine will be trapped in the ice. There is no flush or waste water in the basic flake icemaker. In other words, junk (water) in – junk (ice) out.

Machine operation and efficiency can be affected by many of the same contaminants, along with the issues of mineral scale.

How Water Quality Impacts Cubers

Water contaminants can create a variety of problems in Cube ice machines. Remember that the machine is designed to freeze water with the least amount of solids, chemicals, and mineral content, and to concentrate and flush those impurities in a controlled volume of waste water.

It is in this sorting, separating, and flushing process that we find the root causes of icemaker damage.

Naturally present suspended solids can create several issues:

- Large solids are abrasive and can scratch or score the metal surfaces inside the machine.
- Solids can clog small orifices in the float or solenoid assembly.
- Solids can create cloudy or dirty conditions in the ice.
- Small solids add considerable volume to the mineral scale deposits that form in the machine.
- Some water supplies can include potentially harmful cysts such as cryptosporidium.

Chemicals, such as chlorine, chloramine, organic taste, odour and colour, can create other issues:

- Chlorine and Chloramine can easily convert to gas vapours and combine with water molecules to form mild acids in the ice machine. These acids will corrode the metal surfaces over time.
- The disinfectant chemicals can also attack rubber gasket and seals, creating leaks and operational problems.



Mineral scale consists of precipitated minerals and small solids. It forms at a point of energy transfer, such as the freezing process in ice machines. Mineral scale is actually the 're-forming' of rock from its component minerals.



Reduced Energy Transfer

Scale is an insulator which causes reduced energy transfer & efficiency loss = increased energy demands for cooling & increased operating costs.

1/4” Scale = up to 39% loss of energy transfer.

Some interesting stats...

- There are 7,000 grains of mineral content in one pound of dissolved rock.
- There are approximately 15 grains per gallon in the average water supply
- 467 gallons of this water contains more than one pound of dissolved rock.
- A typical 600 pound cube ice machine can produce 1.5 pounds of limescale per week.

RECAP



Although every manufacturer of commercial icemakers recommends appropriate water treatment, ***most of the new machines are installed without a filter system.***

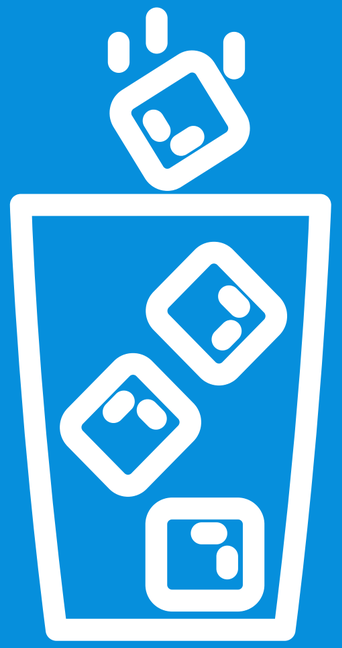
Commercial Icemakers present a significant opportunity for selling water treatment because ***at least 70% of all ice machine repairs are water related.***

The correct choice of watercare can address water problems, reduce maintenance costs and extend the life of an ice machine.

Ice is 100% Water!

Would you run your car without an oil filter?
Hmmm...probably not.

So why would you run an ice maker without a water filter?



This concludes this module. Thank you for your time.