HOW INDOOR ICE RINKS WORK

Years before hockey or the Winter Olympics, ice skating was a means of getting across the frozen waterways in northern Europe. **It was only when ice became available year-round that sports such as hockey and figure skating took off.**

The success of modern ice rinks owes a lot to Lester and Joe Patrick, two brothers who created hockey leagues in Canada in the early 1900s. **On Christmas Day 1912, the brothers opened Canada's first indoor ice rink in Victoria, Canada.** The arena cost $110,000 to build and seated 4,000 people. Three days later, the Patrick brothers opened another arena in Vancouver, Canada. This was a more expensive arena — $210,000 to build — and it could hold more than 10,000 people. Underneath the ice was the world's then-largest refrigeration and ice-making system.

Over the next few decades, the Patricks were responsible for creating arenas all across the northwest United States and throughout western Canada. **Today, the United States has more than 1,700 ice rinks.** New arenas today can cost hundreds of millions of dollars to build.

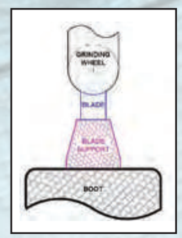
The underlying technology behind indoor ice rinks is the same technology at work in refrigerators and air conditioners.

The main difference in an ice rink, other than sheer size, is that the refrigerant doesn't cool the ice directly. Instead, it cools brinewater, a calcium-chloride solution, which is pumped through an intricate system of pipes underneath the ice. In most rinks, the pipes are embedded in a concrete or sand base.

SKATE SHARPENING

The blade of a hockey skate is 0.120" thick and the bottom is cupped inward. This inward cup is called a hollow. The hollow actually creates two edges on the ice skate blade — an inside edge and an outside edge.

Hollow - The bottom of your skate blade is not flat. The "hollow" is described in terms of the radius of the circle that is cut into the blade. Having a hollow allows the blade to "grip" the ice. A typical hollow for hockey skates might fall in the range of 1/4" to 3/4". The smaller the number, the "sharper" the blade. A "sharper" blade allows the skater to make better turns and hold edges, but may make the skater slower because the blade is digging deeper into the ice and it also makes it more difficult to stop.



Radius and rocker - The bottom of a hockey skate blade is curved at the front and back, and the center is mostly flat. The radius is specified in feet and it is usually selected based on the skater's height. The process of putting a radius on a skate blade is called profiling. In addition to the radius another important aspect of profiling is where the tangent line intersects the blade. This is called the rocker and will define the high point of the blade.

How often - Some people get their skates sharpened after every four skating sessions. Others wait 40 sessions before sharpening. If your skates feel like they are sliding sideways, it's probably time to get them sharpened. Also, if you just bought a new pair of skates they will need to be sharpened because they are not sharpened at the factory.

How it's done - Sharpening is usually done in two passes. The first pass is a coarse pass where rust and nicks are removed. On the second and final pass the blade is treated with a lube stick to create a polished finish. The second pass is slower. Sharpening is done equally on both blades.

A two-pass sharpening removes about 0.005 inch from the blade. 100 sharpenings will remove about 1/2 inch. Newer skates have a line in the blade that marks the point below which the blade should not be sharpened - if you reach this line it is time for new blades.

Burned blade - A burned blade will be discolored - a metallic blue.

Flat spots - You can spot a blade with flat spots by rocking it on a flat surface. Rock it from heel to toe - it should rock freely like a rocking chair. If there is a flat spot it will tend to stop on the flat.

Uneven Edges -The thickness of a skate blade varies based on the type of skate. To detect uneven edges, place a straight edge on the bottom of the blade. It should be perpendicular to the blade. If it is sloped to one side or the other you need to get it sharpened properly.

Bent blade -Place a straight edge along the side of your blade and look for gaps. A bent blade will have uneven edges at the point where the blade is not centered on the grinding wheel. Replace both blades.

HOW RINKS WORK

zamboni's, ice rinks & other fun facts

Greenville Rec
GREENVILLE COUNTY RECREATION DISTRICT

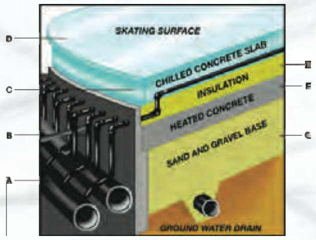
www.greenvillerec.com

THE ICE FLOOR

At the Pavilion, we use two large water filtration systems to produce deionized water, which is essential for making clear ice.

Underneath the floor of our rink, you'll find a refrigeration system like the one shown below. This system consists of three main pieces:

* **Chillers** * **Steel pipes with 2,800 pipe welds**
* **Brinewater (an antifreeze agent)**



Five miles (8 km) of steel pipe wind under the ice rink **(A).** The chillers cool the brinewater to 16 F (-9 C) and provide up to 270 tons of cooling. The brinewater's chemical makeup keeps it from freezing.

The refrigeration system's temperature is based on indoor and outdoor temperatures. To freeze the rink surface, the system pumps 9,000 gallons (34,000 L) of freezing brinewater through the pipes and then onto the ice-bearing concrete slab.

Brinewater is pumped **(B)** *into the pipes embedded in the ice-bearing concrete slab* **(C).** *The slab sits between the skating surface* **(D)** *and a layer of insulation* **(E)**, which allows the ice to expand and shrink as temperatures and time demand. Brinewater helps keep the slab's temperature below 32 F so that the water spread onto it can freeze.

Underneath the layer of insulation, a heated concrete layer **(F)** keeps the ground below the ice from freezing, expanding and cracking the rink structure. *The entire rink sits on a base layer of gravel and sand* **(G)** which has a groundwater drain at the bottom.

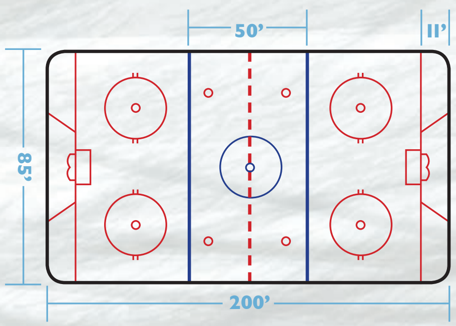
To defrost the surface, the brinewater is heated and pumped through concrete slab. This heats the under layer of the ice, making it easier to break up and remove with front-end loaders.

RINK LOGISTICS

RINK SIZE & SHAPE

An official NHL rink measures 200' in length and 85' in width, with corners rounded to a 28' radius. The end zone width is 11', and the zone between the center blue lines is 50'.

For hockey purposes, the rink has various painted markings. These images include the goal lines and creases, blue lines, red center line, face-off circles, and face-off spots — each of these must be carefully measured to fit within that 200-foot by 85-foot space. The goal net is 4" high and 6' wide, and is only 44" deep.



RINK SURROUNDS

The boards are a continuous wooden or fiberglass wall, often used as advertising space. The boards sit on top of the ice surface and are ideally 42" high. Except for the official league and team markings, the entire playing surface and the boards are painted white. The kickplate at the bottom of the boards is light yellow. The boards are constructed so that the surface facing the ice is smooth and free of any obstruction or any object that could cause injury to players. The doors in front of each team's bench and the penalty box open inward, away from the playing surface, to prevent injury to players.

The glass that surrounds the rink for hockey games is very important because it protects the fans from line-drive pucks, and it protects the players from the fans. In addition to protecting the fans, players, and playing surface, keeping the glass up around the rink while the floor is being flooded helps it set up faster.

There are two types of glass:

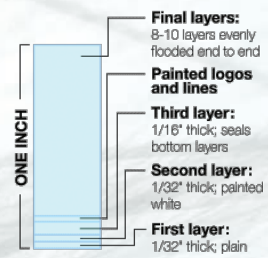
* **Tempered glass** - The sides of the rink are lined with seamless, tempered glass. The primary purpose of the tempered glass is to provide an unobstructed view for the fans, it can also better withstand the force of a player or a slap shot slamming into it. Tempering involves successive heating and cooling, which makes glass harder and less brittle. The pieces of side glass, each 6' tall and 5/8" thick, fit together smoothly.

* **Plexiglas** - The ends of the rink are lined with Plexiglas — acrylic plastic sheets. The end glass is 8' tall and a 1/2" thick. The Plexiglas sheets are fitted together with supports that are mounted on the outside edge of the boards.

THE ICE

Making an ice rink isn't as simple as flooding the floor with gallons of water. Water must be applied carefully and slowly, in order to insure ideal thickness. An ice surface that is too thick requires more energy to keep frozen and is prone to getting soft on the top. A surface that is too thin is also dangerous because skaters risk cutting straight through the ice.

It takes between 12,000 and 15,000 gallons of water to form a hockey rink surface. It takes several different layers, and many steps:

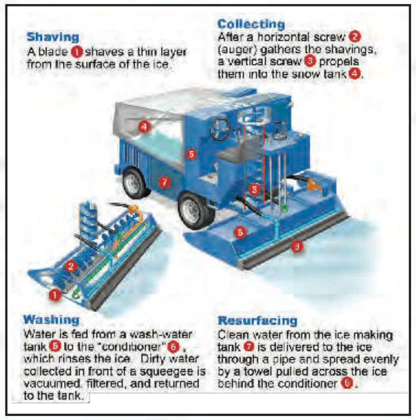


1. *A paint truck creates a fine mist of water to create the first two layers, each only 1/32" thick.*
2. *Once the first layer is frozen, the second layer is sprayed.*
3. *The frozen second layer is painted white, allowing for a strong contrast between the black hockey puck and the ice.*
4. *The third layer, which is only 1/16" thick, is sprayed on and acts as a sealer for the white paint. The hockey markings (the lines, creases, face-off spots and circles) and team and sponsor logos are painted on top of this layer.*
5. *Once the markings and logos dry, the final layers are applied.*

The remaining 10,000 gallons are applied with a flooding hose.
It takes 15 to 20 hours (1 hour/500-600 gallons) for the final layer.
Each of those layers is allowed to freeze before the next 500 to 600 gallons on.

THE ZAMBONI

FUN FACTS ABOUT THE ZAMBONI



1. On average, a Zamboni machine "travels" close to 2,000 miles each year in the course of resurfacing.
2. In 2001, a Zamboni machine was driven from the East Coast of Canada to the West Coast. At about nine miles per hour, and took four months.
3. More than 7,000 Zamboni machines have been delivered around the world.
4. 20 Zamboni machines were on hand to resurface the various ice sheets during the 2002 Salt Lake Winter Games.
5. Prior to the invention of the Zamboni machine, the manual resurfacing of the ice sheet required three or four workers and took over one hour to complete.
6. Why does the Zamboni machine have headlights? Machines may be required to travel over the road at night and many have to leave the arena to dump the snow collection tank.
7. "Not very scientific" facts and figures:
   * Average number of resurfacings a day: 9.7
   * Time in operation per day (12 min/resurfacing): 116.40 minutes
   * Miles traveled per day (9.7 resurf. X .75 mile) 7.3
8. When the machine resurfaces the ice, it picks up approximately 1500 pounds' worth of snow, but leaves behind approximately 1200 pounds of water.
9. The shape of the Zamboni ice resurfacing machine is a federally registered trademark.
10. Zamboni machines have a top speed of about 9 miles an hour.
11. Each Zamboni machine is hand-assembled, one at a time, and lead-time can be as long as eight months.
12. A Zamboni machine may provide about 10 to 20 years' worth of service.