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Certificate

This is to certify that Mr. **Kazi Zaid Javed; Khan Abdul Rehman Ab. Salam ; Khan Saad Sameer** Roll No. *17126-17127-17128* of 6th Semester of Diploma in **Mechanical Engineering** of Institute, **Mohammed Haji Saboo Siddik Polytechnic (Code: 0002)** has completed Micro Project satisfactorily in the Subject **Refrigeration and Air Conditioning (RAC / 22660)** having title **A Report on Analysis on Advertisement** for the Academic year 2019-2020 as prescribed in the curriculum.

Place: ***Byculla, Mumbai*** Enrollment No: 1700020304

Date: ..... Exam. Seat No: .....

Course Teacher **Head of the Department** **Principal**

Anjuman-I-Islam's

M. H. Saboo Siddik Polytechnic

Refrigeration & Air Conditioning (22660)

Topic Name: ***A Project Report on Ice Skating Rink***

Subject: ***Refrigeration & Air Conditioning***

Subject Code: ***22660***

Course: ***Mechanical Engineering***

Course Code: ***ME – 6 – I***

Faculty: ***Professor Masood Shaikh***

Group Members:

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Academic Year: ***2019 – 2020***

Institute: ***M. H. Saboo Siddik Polytechnic, Byculla***

Institute Code: ***0002***

Ice Skating Rink

An **ice rink** (or **ice skating rink**) is a frozen body of water and/or hardened chemicals where people can ice skate or play winter sports. Besides recreational ice skating, some of its uses include ice hockey, bandy, rink bandy, ringette, broomball, speed skating, figure skating, ice stock sport and curling as well as exhibitions, contests and ice shows. There are two types of rinks in prevalent use today: natural, where freezing occurs from cold ambient temperatures, and artificial (or mechanically frozen), where a coolant produces cold temperatures in the surface below the water, causing the water to freeze. There are also synthetic ice rinks where skating surfaces are made out of plastics.

History

Early attempts at the construction of artificial ice rinks were first made in the 'rink mania' of 1841–44. As the technology for the maintenance of natural ice did not exist, these early rinks used a substitute consisting of a mixture of hog's lard and various salts. An item in the 8 May 1844 issue of Eliakim Littell's Living Age headed "The Glaciarium" reported that "This establishment, which has been removed to Grafton street East' Tottenham Court Road, was opened on Monday afternoon. The area of artificial ice is extremely convenient for such as may be desirous of engaging in the graceful and manly pastime of skating".[citation needed]

By 1844, these venues fell out of fashion, as customers grew tired of the 'smelly' ice substitute, and it was only thirty years later, that refrigeration technology developed to the point that natural ice could finally be feasibly used in the rink. The world's first mechanically frozen ice rink was the Glaciarium, opened by John Gamgee in a tent in a small building just off the Kings Road in Chelsea, London, on 7 January 1876. In March, it moved to a permanent venue at 379 Kings Road, where a rink measuring 40 by 24 feet (12.2 by 7.3 m) was established.

The rink was based on a concrete surface, with layers of earth, cow hair and timber planks. Atop these were laid oval copper pipes carrying a solution of glycerine with ether, nitrogen peroxide and water. The pipes were covered by water and the solution was pumped through, freezing the water into ice. Gamgee discovered the process while attempting to develop a method to freeze meat for import from Australia and New Zealand, and patented it as early as 1870.

Ice rink in Amsterdam c. 1900, from the Amsterdam City Archives

Gamgee operated the rink on a membership-only basis and attempted to attract a wealthy clientele, experienced in open-air ice skating during winters in the Alps. He installed an orchestra gallery, which could also be used by spectators, and decorated the walls with views of the Swiss Alps.

The rink initially proved a success, and Gamgee opened two further rinks later in the year: at Rusholme in Manchester and the "Floating Glaciarium" at Charing Cross in London, this last significantly larger at 115 by 25 feet (35.1 by 7.6 m). The Southport Glaciarium opened in 1879, using Gamgee's method.

In Germany, the first ice skating rink opened in 1882 in Frankfurt during a patent exhibition. It covered 520m^2 and operated for two months; the refrigeration system was designed by Linde, and it was probably the first skating rink where Ammonia was used as a refrigerant. Ten years later, a larger rink was permanently installed on the same site.

The oldest indoor artificial ice rink still in use (built 1909-10) is the one in Boston's Matthews Arena, on the campus of North-eastern University.

Types

Natural ice

Many ice rinks consist of, or are found on, open bodies of water such as lakes, ponds, canals, and sometimes rivers; these can only be used in the winter in climates where the surface would freeze thickly enough to support human weight. Rinks can also be made in cold climates by enclosing a level area of ground, filling it with water, and letting it freeze. Snow may even be packed to use as a containment material.

A famous example of this type of rink is the Rideau Canal Skateway in Ottawa, Ontario, Canada, estimated at 1,782,000 square feet (165,600 m^2) and 7.8 kilometres (4.8 mi) long, which is equivalent to 90 Olympic size skating rinks. The rink is prepared by lowering the canal's water level and letting the canal water freeze. The rink is then resurfaced nightly by cleaning the ice of snow and flooding it with water from below the ice. The rink is recognized as the "world's largest naturally frozen ice rink" by the Guinness Book of World Records because "its entire length receives daily maintenance such as sweeping, ice thickness checks and there are toilet and recreational facilities along its entire length".

The longest ice skating trail can be found in Invermere, British Columbia, Canada, on Lake Windermere Whiteway. The naturally frozen trail measures 29.98 kilometres (18.63 mi).

A portion of the Rideau Canal in Ottawa, Ontario, Canada, the world's largest naturally frozen ice rink

Types

Artificial Ice

In any climate, an arena ice surface can be installed in a properly built space. This consists of a bed of sand or occasionally a slab of concrete, through (or on top of) which pipes run. The pipes carry a chilled fluid (usually either a salt brine or water with antifreeze, or in the case of smaller rinks, refrigerant) which can lower the temperature of the slab so that water placed atop will freeze. This method is known as 'artificial ice' to differentiate from ice rinks made by simply freezing water in a cold climate, indoors or outdoors, although both types are of frozen water. A more proper technical term is 'mechanically frozen' ice.

A famous example of this type of rink is the outdoor rink at Rockefeller Center in New York.

A typical mobile ice skating rink near the Spanish Costa Brava

Types

Synthetic:

Synthetic rinks are constructed from a solid polymer material designed for skating using normal metal-bladed ice skates. High density poly-ethylene (HDPE) and ultra-high molecular weight polyethylene (UHMW) are the only materials that offer reasonable skating characteristics, with UHMW synthetic rinks offering the most ice-like skating but also being the most expensive. A typical synthetic rink will consist of many panels of thin surface material assembled on top of a sturdy, level and smooth sub-floor (anything from concrete to wood or even dirt or grass) to create a large skating area.

SM Skating Rink at Metro Manila's Megamall located in Ortigas

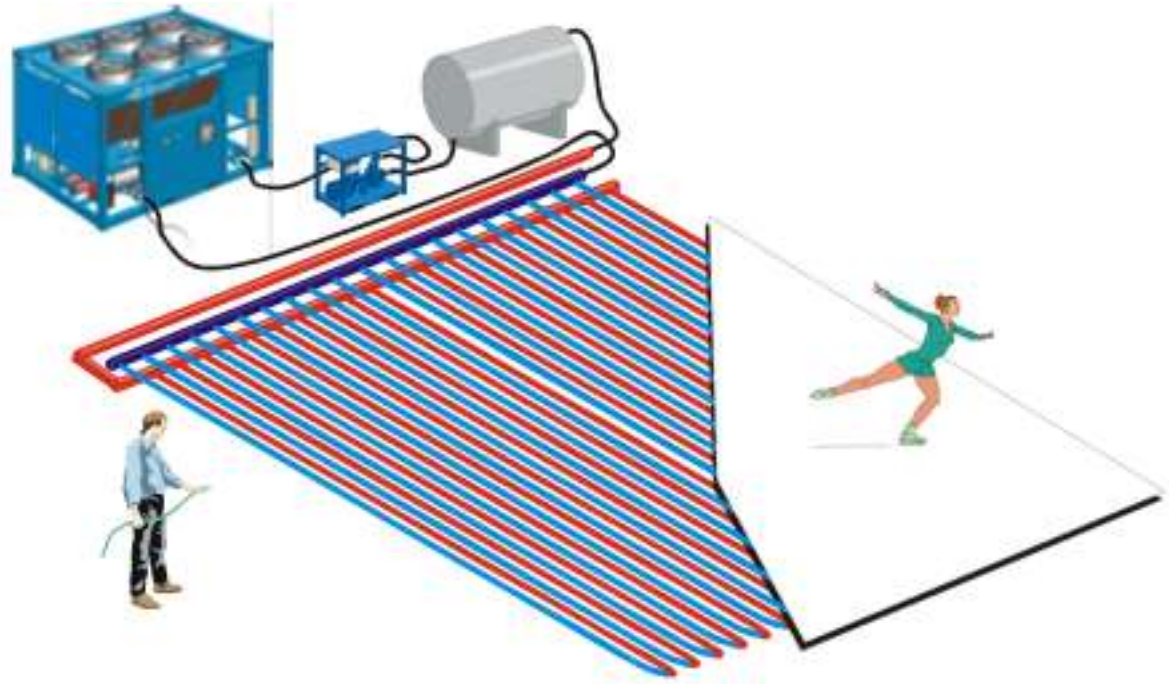
Operation

Periodically after the ice has been used, it is resurfaced using a machine called an ice re-surfacer (sometimes colloquially referred to as a Zamboni – referring to a major manufacturer of such machinery). For curling, the surface is 'pebbled' by allowing loose drops of cold water to fall onto the ice and freeze into rounded peaks.

Between events, especially if the arena is being used without need for the ice surface, it is either covered with a heavily insulated floor or melted by allowing the fluid in the pipes below the ice to warm.

A highly specialized form of rink is used for speed skating; this is a large oval (or ring) much like an athletic track. Because of their limited use, speed skating ovals are far less common than hockey or curling rinks.

Those skilled at preparing arena ice are often in demand for major events where ice quality is critical. The popularity of the sport of hockey in Canada has led its icemakers to be particularly sought after. One such team of professionals was responsible for placing a loonie coin under center ice at the 2002 Winter Olympics in Salt Lake City, Utah; as both Canadian teams (men's and women's) won their respective hockey gold medals, the coin was christened "lucky" and is now in the possession of the Hockey Hall of Fame after having been retrieved from beneath the ice.



Simple drawing of the main components of an ice skating rink

Working

At the Raleigh arena, Don MacMillan uses two large water filtration systems to produce deionized water, which is essential for making clear ice.

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

- **Chillers** (the Raleigh arena has three)
- **Steel pipes** with 2,800 pipe welds
- **Brine water** (an antifreeze agent)

Five miles (8 km) of steel pipe wind under the rink in the Raleigh arena (A). The three chillers cool the brine water to 16 F (-9 C) and provide up to 270 tons of cooling (see How Air Conditioning Works for the definition of a "cooling ton"). The brine water's chemical makeup keeps it from freezing.

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

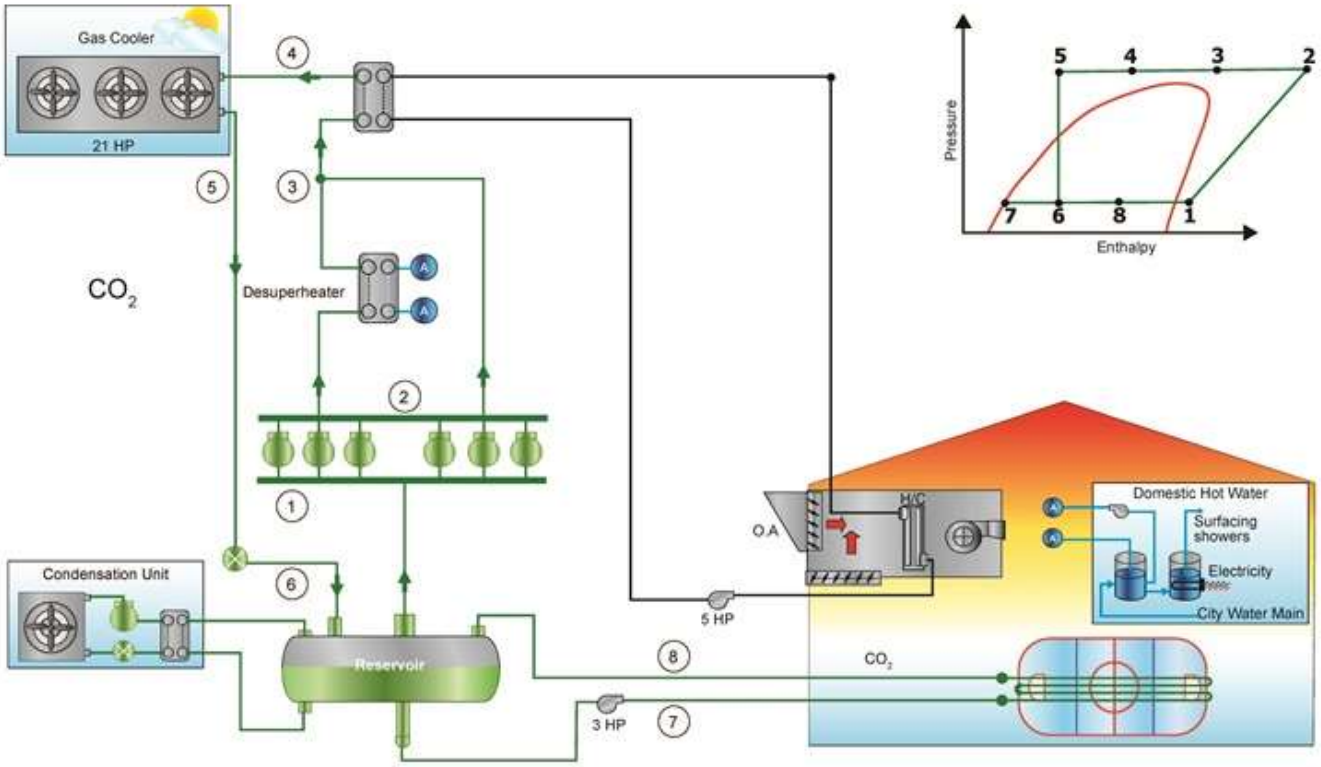
The brine water is pumped (B) into the pipes embedded in the ice-bearing concrete slab (C). The ice-bearing slab sits between the skating surface (D) and a layer of insulation (E), which allows the ice to expand and shrink as temperatures and time demand. The brine water helps keep the ice-bearing slab's temperature just 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.

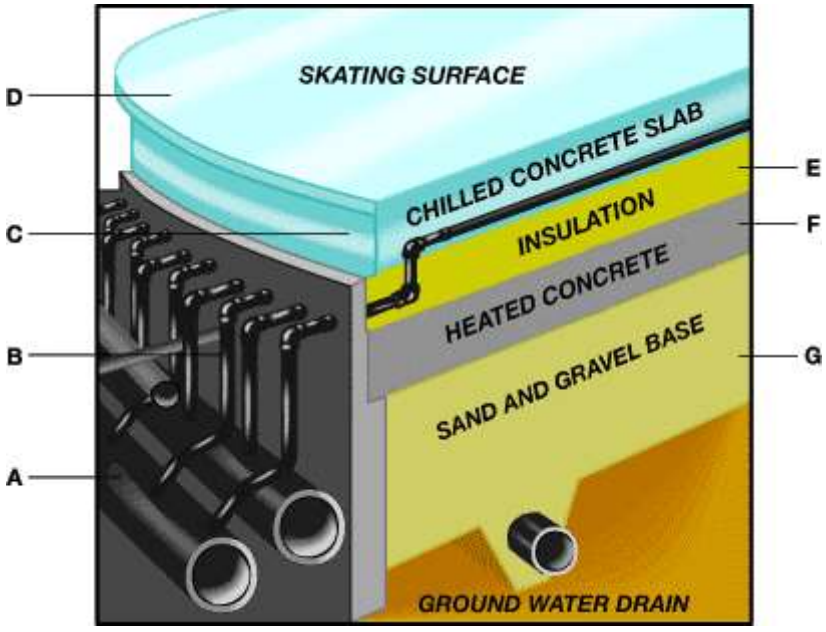
To defrost the skating surface, the brine water is heated and pumped through the ice-bearing concrete slab. This heats the under layer of the ice, making it easier to break up and remove with front-end loaders.

Since the Raleigh arena is home to the Carolina Hurricanes, the rink must meet all NHL regulations. This includes shape and size requirements, surround requirements, maintenance requirements and temperature requirements. Even during non-hockey events, the rink must be properly maintained.

Even during most non-skating events, the ice is always there. MacMillan explains that the conversion process is fairly complex. "For NC State basketball games, we make an ice deck using 4-by-8 sheets of plywood to cover the ice. Then we put the basketball floor over that. For non-hockey shows, we also take down the glass surrounding the rink. It takes six to eight hours to change from the ice rink to the basketball court." MacMillan says the ice is only broken up and hauled out "for the circus, because they make points in the floor to hold the trapeze and other things, or for a truck pull."



Circuit Diagram of an Ice Skating Rink



Path traced by the Refrigerant

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Standard rink sizes

Bandy:

In bandy, the rink size is 90–110 m (300–360 ft.) x 45–65 m (148–213 ft.). For internationals, the size must not be smaller than 100 metres (330 ft.) x 60 metres (200 ft.). The variety rink bandy is played on ice hockey rinks.

Figure skating:

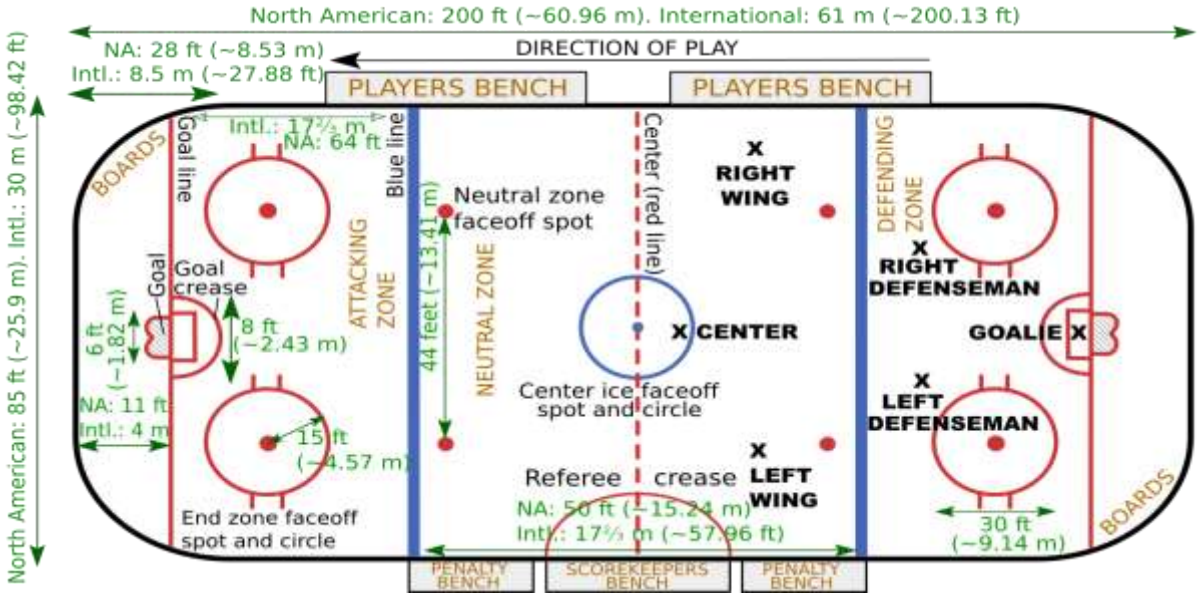
The size of figure skating rinks can be quite variable, but the International Skating Union prefers Olympic-sized rinks for figure skating competitions, particularly for major events. These are 60 meters by 30 meters. The ISU specifies that competition rinks must not be larger than this and not smaller than 56 meters by 26 meters.

Standard rink sizes

Ice hockey:

There are basically two rink sizes in use, although there is a great deal of variation in the dimensions of actual ice rinks. Historically, earlier ice rinks were smaller than today.

Official National Hockey League rinks are 26 m × 61 m (85 ft. × 200 ft.). The dimensions originate from the size of the Victoria Skating Rink in Montreal, Quebec, Canada. Official Olympic/International rinks have dimensions of 30 m × 60 m (98.4 ft. × 197 ft.).



Speed Skating:

In speed skating, for short track, the official Olympic rink size is 30 x 60 meters, with an oval ice track of 111.12 meters in circumference. In long track speed skating the oval ice track is usually 400 meters in circumference.

Ice skating in India

Ice skating is popular in North India in places like Ladakh, Kashmir and Shimla where cold weather occurs and it is possible to skate outdoors. Much of India has a tropical climate, hence in the rest of the country, ice skating is limited to the few artificial rinks available. An ice skating festival is organised in Shimla every year.

Ice skating in India

Indoor Ice Skating Rinks in India:

Indoor ice skating rinks are present in the following places:

- Doon Ice Skating Rink 60m x 30m Olympic size has a seating capacity of 3000. Located at Maharana Pratap Sports Complex, Raipur, Dehradun.
- Essel World, Mumbai (Near Borivali).
- iSKATE located on 6th floor of Ambience Mall, Gurgaon.
- Neptune Magnet Mall, Lower Powai, L.B.S. Marg, Bhandup (W), Mumbai.
- Atria the millennium mall, Dr Annie Besant Rd, Worli, Mumbai.
- Sparkys Ice Skating at Lulu international shopping mall, Edappally, Kochi.

Ice Skating Rink in Essel World

Ice skating in India

Outdoor Ice Skating Rinks in India:

- Shimla Ice Skating Rink, Circular Road, Shimla, Himachal Pradesh.
- Gulmarg under Ministry of Tourism, Jammu and Kashmir Government.
- Leh, Ladakh.
- Kargil, Jammu and Kashmir.

Shimla Ice Skating Rink