R Arena Ice Making

Required Equipment

- Removable hack assemblies (2 per curling sheet)
- Pebbling can & appropriate sprinkler head (back-pack style containers are easiest)
- Zamboni or similar ice-resurfacing machine
- Circle-scribing tool
- Portable scoreboards (optional)

Ice Preparation

Hockey players and general skaters do not require the extremely flat ice surface that is necessary for curling. Therefore, the ice-resurfacing process must be slightly modified to accommodate the needs of curling. The edges of the ice surface (within 15 feet of the boards) tend to be the least flat due to normal skating patterns. Talk to your Zamboni driver about techniques he may know to shave the ice so that it can be made flatter before you start (a diagonal criss-cross pattern like on a baseball infield seems to work pretty well). After the ice is "leveled" to your satisfaction, have the ice re-surfaced with a normal Zamboni flood. After this flood freezes, use the Zamboni to do a dry-scrape along the length of all the sheets (not diagonally) as they normally would drive. Make sure they scrape the entire ice surface (not just the sheets) because it provides much better traction for people wearing shoes, and it tends not to sweat and accumulate humidity the way "shiny" ice does.

Sheet Location

Positioning your 1 to 4 curling sheets in the middle of the arena can avoid the major flatness problems found in any arena. An international-size arena is 100 ft x 200 ft. If you are playing in an arena of this type, the hack location (end-to-end) is easy to locate: it is approximately even with the outside hash-marks on the edges of the face-off circles. If you need more accuracy than that, it is best to measure.

Drawing the Houses

The easiest way to draw temporary houses is to make a scribe tool for drawing circles. This tool consists of a piece of 2x2 lumber, with large "Magnum-44 markers at 1-ft / 2-ft / 4-ft / 6-ft distance from a pivot screw. These scribe marks then become a template for using really large / fat permanent magic markers to mark the circles so that they are visible from the other end of the sheet. Remember to use a pesticide-spray container to apply a fine mist over the markings to ensure that the ink doesn't get all over people's pants when they slide through. If you are only doing 1 or 2 sheets, it sometimes makes more sense to put in the house at 1 end only. Then you don't have to worry about sliding through the house at all. You will also require fewer hacks to do it this way. If you can convince your arena employees to paint actual houses on the ice, all the better (use standard ice-painting techniques).

Pebbling

The ice can be pebbled as it would be in any curling facility. Fill your tank with hot Zamboni water (the hotter the better). Use a standard curling pebbling sprinkler head to ensure that you get the correct pebble size (these are available in catalogs, as are complete pebbling cans). The back-pack style are easier to hold, but are more expensive. It is helpful to pebble a large area of ice

behind the hacks so that new curlers get used to sliding on that surface before they step onto the sheet. If you are installing practice-hacks in the arena away from the actual curling sheets, pebble those areas also.

Hack Installation

So, how to install these things?? We typically lay the hacks out on the ice (rubber-side down) to get them good and cold during the Zamboni run so that only the metal plate will be heated and cooled during the installation process (if the rubber starts off at room temperature, it takes much longer to cool off).

If you are installing the hacks on the ice in a real curling rink, be careful to stay away from any painted areas of the ice because removal of the hack-rack often lifts a small chunk of ice (and paint) with it. So, if you want the hacks to freeze in quickly and solidly, do the following:

- find 2 large Rubbermaid / Tupperware containers (20 gallons) that allow the hack mount to sit flat in the bottom
- place one container inside the other container (nested / stacked). This produces an air gap and provides an insulation layer so this bucket of warm water doesn't make nasty marks on your ice.
- Fill the container 1/3 full with hot water
- Install the container lid so you don't spill on the sheet
- Take the container out to the hack location on sheet 1 (the hacks can be sitting rubber-side down near their intended location on each sheet, behind the house). Keep the water container off the actual sheet playing-surface to avoid the possibility of marring the ice where it really matters.
- Dip the first hack into the water (rubber-side up) with the rear metal edge deepest in the water. It's important to get the whole metal plate wet and hot while avoiding getting the top surface of the rubber hack wet at all (otherwise loose pieces of ice will break off the rubber during the game).
- Hold the unit in the water for 10-15 seconds, shake off the excess water, and quickly place it in position on the sheet.
- Stand on the hacks to squeeze water onto the sheet and make sure that the aluminum tabs have sunk all the way into the ice. Then place a curling stone on each rubber hack to hold it down as it freezes (since we had the hacks on the ice prior to this process, they will not warm up your stones at all).
- Wait 5-10 minutes (or until all water around the Hack-Rack has frozen) and curl on! Where to install the hacks: sheet / rink diagrams typically measure 6-feet from the back line to the beginning of the "ramp" on the rubber hack (the lowest portion of the ramp).Bonspiels & Competitions: easy removal of the Hack-Rack is less important in this application, so best results are achieved if the Hack-Rack is installed before the last or second-to-last flood (1/8"-thick flood is adequate).To remove the hacks, simply grip at the rear with both hands and pull straight up. It is very important to pull with both hands to avoid bending the Hack Rack. Some ice-chipping may be required to remove it after a flood.

Recommendations on curling arena equipment & design

The following outline contains the ideal construction of a new curling arena. The items will be prioritized from: **critical (A), ideal (B),** and **nice to have (C) but not absolutely necessary.** These recommendations are also taking into consideration preventive maintenance and the ability for year round use of the ice.

Scenario # 1 – Four sheet facility with ammonia as the coolant

Refrigeration

- a six cylinder compressor with 28 tons of capacity (A) and a 40hp motor (A) with a meter to track the hours of usage (B)
- 28 ton chiller (A)
- double oversize condenser (A)
- 7.5 hp two stage (C) brine pump (B) *(put probe in brine return line)*
- install security warning system on refrigeration plant *(protection against meltdowns)*
- system controlled by digital controller (B)
- install water re-circulating tank (B) (if paying for water)
- 6" header – schedule 86 PVC with welded joints (A)
- 40 gallon plastic brine expansion tank with lid (A)
- brine mixing tank for the calcium chloride (B)
- in-line filter system for the brine (B)

The Floor (concrete)

- two layers of 2" Styrofoam © SM with vapour barrier (A)
- plastic pipes with 3/4" inside diameter (A)
- chairs / sleepers 6' apart (A)
- lay pipes 4' outside of playing area (B)

Arena or Shed

- 8' fluorescent lights with proper starters and reflectors installed 12-14' above the ice surface (*and not blocking view from upper area if applicable).* (A)
- exterior block walls okay as long as the outside is insulated and there is insulation 3 to 4' below grade (A)
- 4" perforated "O" pipes all the way around the exterior of the building (B).
- seal off header ends to walkways to prevent airflow (B)
- 20' high ceiling is ideal (C)
- false ceiling with acoustical tiles (C)
- double-paned low E argon glass for the viewing area (C)
- minimum three foot walkways around the perimeter of the ice surface, carpeted with low pile indoor / outdoor (not Astroturf) (B)
- storage building for burner, vacuum, power scraper etc. insulated not heated (C)
- for use anytime during the calendar year install a de-humidifier in a far corner up high. Recommended tonnage is 10-12 (B)
- natural gas heaters - minimum three and maximum four (if gas is not available use propane as it is easily convertible. The heaters should have at least 175,000 BTU's of input and 135,000 of output (A)
- six ceiling fans (B)
- 220 and 110 service (A)
- 8' x 12' garage door insulated and sealed off in Winter (B)

Miscellaneous

- sample water to determine if purified water is necessary. If so, install in compressor room. Have 1" lines to tanks and a minimum of 3/4" from the tanks (B)
- have a 40 gallon glass lined hot water heater for pebbling (C)
- building should have two 60 gallon glass lined hot water heaters (C)

Scenario # 2 – Six sheet facility with ammonia as the coolant

Refrigeration

- a eight cylinder compressor with 42 tons of capacity (A) and a 50hp motor (A) with a meter to track the hours of usage (B)
- 42 ton chiller (A)
- double oversize condenser (A)
- 15 hp two stage (C) brine pump (B) *(put probe in brine return line)*
- install security warning system on refrigeration plant *(protection against meltdowns)*
- system controlled by digital controller (B)
- install water re-circulating tank (B) (if paying for water)
- 6" header – schedule 86 PVC with welded joints (A)
- 40 gallon plastic brine expansion tank with lid (A)
- brine mixing tank for the calcium chloride (B)
- in-line filter system for the brine (B)

The Floor (concrete)

- two layers of 2" Styrofoam © SM with vapour barrier (A)
- plastic pipes with 3/4" inside diameter (A)
- chairs / sleepers 6' apart (A)
- lay pipes 4' outside of playing area (B)

Arena or Shed

- 8' fluorescent lights with proper starters and reflectors installed 12-14' above the ice surface (*and not blocking view from upper area if applicable).* (A)
- exterior block walls okay as long as the outside is insulated and there is insulation 3 to 4' below grade (A)
- 4" perforated "O" pipes all the way around the exterior of the building (B).
- seal off header ends to walkways to prevent airflow (B)
- 20' high ceiling is ideal (C)
- false ceiling with acoustical tiles (C)
- double-paned low E argon glass for the viewing area (C)
- minimum three foot walkways around the perimeter of the ice surface, carpeted with low pile indoor / outdoor (not Astroturf) (B)
- storage building for burner, vacuum, power scraper etc. insulated not heated (C)
- for use anytime during the calendar year install a de-humidifier in a far corner up high. Recommended tonnage is 15 (B)
- four natural gas heaters (if gas is not available use propane as it is easily convertible. The heaters should have at least 175,000 BTU's of input and 135,000 of output (A)
- six ceiling fans (B)
- 220 and 110 service (A)
- 8' x 12' garage door insulated and sealed off in Winter (B)

Miscellaneous

- sample water to determine if purified water is necessary. If so, install in compressor room. Have 1" lines to tanks and a minimum of 3/4" from the tanks
- have a 60 gallon glass lined hot water heater for pebbling
- building should have two 60 gallon glass lined hot water heaters

Scenario # 3 – Eight sheet facility with ammonia as the coolant

Refrigeration

- two 6 cylinder compressors with 56 tons of capacity (A) and two - 40hp motors (A) with a meter to track the hours of usage (B)
- 56 ton chiller (A)
- triple oversize condenser (A)
- 20 hp two stage (C) brine pump (B) *(put probe in brine return line)*
- install security warning system on refrigeration plant *(protection against meltdowns)*
- system controlled by digital controller (B)
- install water re-circulating tank (B) (if paying for water)
- 8" header – schedule 86 PVC with welded joints (A)
- 60 gallon plastic brine expansion tank with lid (A)
- brine mixing tank for the calcium chloride (B)
- in-line filter system for the brine (B)

The Floor (concrete)

- two layers of 2" Styrofoam © SM with vapour barrier (A)
- plastic pipes with 3/4" inside diameter (A)
- chairs / sleepers 6' apart (A)
- lay pipes 4' outside of playing area (B)

Arena or Shed

- 8' fluorescent lights with proper starters and reflectors installed 12-14' above the ice surface (*and not blocking view from upper area if applicable).* (A)
- exterior block walls okay as long as the outside is insulated and there is insulation 3 to 4' below grade (A)
- 4" perforated "O" pipes all the way around the exterior of the building (B).
- seal off header ends to walkways to prevent airflow (B)
- 20' high ceiling is ideal (C)
- false ceiling with acoustical tiles (C)
- double-paned low E argon glass for the viewing area (C)
- minimum three foot walkways around the perimeter of the ice surface, carpeted with low pile indoor / outdoor (not Astroturf) (B)
- storage building for burner, vacuum, power scraper etc. insulated not heated (C)
- for use anytime during the calendar year install a de-humidifier in a far corner up high. Recommended tonnage is 20 (B)
- natural gas heaters - minimum three and maximum four (if gas is not available use propane as it is easily convertible. The heaters should have at least 175,000 BTU's of input and 135,000 of output (A)
- six ceiling fans (B)
- 220 and 110 service (A)
- 8' x 12' garage door insulated and sealed off in Winter (B)

Miscellaneous

- sample water to determine if purified water is necessary. If so, install in compressor room. Have 1" lines to tanks and a minimum of 3/4" from the tanks
- have a 40 gallon glass lined hot water heater for pebbling
- building should have two 60 gallon glass lined hot water heaters

Making and maintaining natural ice

Surface Preparation

For porous surfaces, ensure that the area to be flooded is as level as possible, eliminating any humps, low spots, or rocks. Dirt and sand bases are the easiest to float annually before the frost sets into the ground. A sloping or uneven surface will take much more time and water to make ice than would a relatively level surface. All porous surfaces should be loose to a depth of approximately 1 – 2 cm (1/2" – 1") to ensure a good bonding between the surface and the ice.

For all surfaces, before water is applied, any spaces under the rink boards should be sealed to prevent water from creeping under the boards onto adjacent areas. This can be accomplished by using wet paper towels, rags, plastic sheeting, canvas strips, foam strips, or even wet packed snow if it is allowed to freeze solidly before flooding. As the rink is flooded, a check should be made to ensure no water is escaping from the rink area.

Once cold weather is anticipated in the near future, some ice makers begin by soaking the ground with lawn sprinklers or with hose and nozzles. This soaking procedure is repeated every two or three days until it is time to make ice. The reason for this soaking is to provide maximum frost base which will help hold the ice through warm weather.

Ice Making

The open hose method of flooding an ice surface is generally considered to be the wrong approach to making good ice. While this method may free the worker to do other tasks, it inevitably results in problems. Firstly, the relatively warm water, i.e. +4c (40F) or warmer, will thaw the frozen surface and seep down into the soil where it may cause heaving and cracking problems later in the season. Secondly, the open hose method will likely cause shell (shale) ice as the water on the surface freezes while the water underneath runs away, leaving an air space under the surface. This shell (shale) ice will usually break or crack under normal use, resulting in a difficult and time consuming repair job.

The correct way to flood an area is to spray water in light amounts through a spray nozzle so that the water freezes on the surface and is built up slowly in thin layers. Once the surface of the ground is solidly frozen and the air temperature is regularly in the desired range, i.e. –18C to –7C (0F – 20F), the surface can be sealed by applying these fine sprays. It may be best to apply these sprays in the early morning or in the evening when the air temperature is around –12C (10F) or colder. Ice has the tendency to crack when flooding if you have a temperature of –25C (-12F) or colder. Start the flooding process at one end of the rink and work back to the other end. Walk back and forth across the rink spraying the area with a fan like motion covering a strip 1.5 – 2 metres (5 – 6') in width. Spaying into the air rather than directly onto the ice will help to cool the water before it hits the ground.

Several fine sprays should be applied before proceeding to a heavier spray. If the weather is cold enough, i.e. –18C - -12C (0F – 10F) spraying can likely be continuous, as the first coat will be frozen almost immediately. However, in warm weather, additional sprays should not be applied until the previous one is thoroughly frozen.

Once the ground has been completely sealed and the water will not run away, the leveling of the ice can begin. Using a heavier spray, repeat the previous procedure, applying as many coats as may be necessary to process to ensure the low spots are filled in gradually, as shell (shale) ice

may result if too much water is applied at once. If some spots are particularly low, it may be best to apply water only to those spots until they are built up close to level. Once this is done you can flood using the open hose method but make sure you do not use to much water. During the flooding process, a number of precautions must be taken with the hose:

- Keep the hose on dry ice. If the hose is dragged over wet ice, it will push ice and water with it and ridges will be formed.
- Keep the hose moving so that the warmer water running through the hose does not melt the hose into the ice.
- Ensure connections are tight and the hose does not leak.
- Do not leave a running hose unattended on the ice surface.

You should use hot water for the last couple of floods before you paint. This will give you a smoother surface. Once a base of 5 – 7 cm (2" – 3") is established, the ice surface is ready for painting.

Ice Painting

There are – Powder Paints and Paste Paints. What is the difference between powder and paste?

- Mixing: There is very little difference, because they are both comparatively easy. With the possible exception of the smaller amounts.
- Measuring: In the smaller amounts, it was felt that powders were easier to measure than the pastes. For the same reason that you find it easier to measure a cup of sugar or flour, than to measure a cup of butter. With paste you cannot tell how many air pockets there are in the bottom of the container. Powders score here.
- Application: They both are about the same. Once mixed they will both give an excellent finished job.
- Storage: While in the factory containers both are easy to store. However with paste, once it is opened, it will harden unless the lid is replaced tightly. Powders here have the edge. Also, less space is required to store powders, probably for the same reasons that it is easier to store frozen orange juice, than it is the equivalent amount of juice in actual oranges. Powders win again.
- Costs: It was the general consensus of opinion that it was more economical to use powder than paste. Again we go for powder.

Color in a curling rink is very important.

As far as mixing and quantities are concerned, there are suggested methods for mixing. One is for the first coat, and the other is for the re-paint and touch-up jobs. We suggest that the first coat should consist of 5lbs. of powder to about 1 gallon of water; whereas the re-painting coat can have up to 50% water added, say 5lbs. In up to 1 – ½ gallons of water. In real truth, however, these amounts are at best, just recommendations, and will have to be adjusted to suit each location, and indeed each applicator. It is important to remember that the more water added to the paint, then the more transparent the color becomes. One thick coat will give you better hiding than two thinner coats.

We estimate, generally, that 1lb of powder, when mixed; will cover an area of approximately 50sq. ft. The ft. rings will need about 5lbs., the 12 ft. rings about 10lbs.; buttons about 1lb. Just for your information, and here we do not want your Executives to listen too closely, we are told that it takes a real professional about two man-hours to paint the circles and lines on a sheet, and , that two men working together is the most efficient.

Brushing

We suggest that a good 5 or 6 inch nylon paint brush be used, this will give an excellent finish when used in conjunction with a small ½ inch striping brush. A good long handled paint roller can be also employed, short hair is better than long.

The other three methods of application – spraying, flooding and pouring all entail the use of well known pieces of, more or less, standard equipment. Our paint may be applied by any of these methods with very satisfactory results.

Each of the four methods seems to have its own merits, and is governed by the size of the area to be painted, primarily due to the cost in man hours and therefore in dollars and cents. Ideal painting temperatures range from between –7C - -14C (10F – 20F). Ice paint, when made hot (and we recommend that it should be) can be allowed to cool between 21C – 27C (70F – 80F) for the smoothest application.

Painting the ice surface white can be done by using a 45 gallon drum and a submersible pump. The white paint is mixed in the drum with hot water as described previously. Once the paint is mixed and allowed to cool it can be sprayed on to the ice using the same method as making the ice. The paint in the drum must be stirred constantly to help prevent the spray nozzle from plugging up.

Two coats of paint are recommended. Make sure that the first coat of paint is completely dry before putting on the second coat. Once the second coat is dry you once again spray the surface with water (as you did when you started to make the ice). Once you are sure that the paint is well covered you can put on more water using the open hose method.

When you have ¼" to 3/8" of ice over the paint you can again put on a hot flood and then mark out for the rings and start painting them. Once the rings are painted you can put down the center line, tee line, back line and hog line. After this is done you must go over the paint and lines with the pebble can to make sure everything is covered. Make sure that you cover them well as you do not want the paint to run or the lines to move.

Once you are sure that they are covered you can once again start flooding using the spray method. After a few floods using the spray method you can go to the open hose method. The hacks can then be put in using a power saw and a chisel. When you have ¼" of ice over the lines you can then flood using hot water. After 3 or 4 floods with hot water you should be able to start curling.

Tips

- Cold water builds up the ice thickness quicker than hot water.
- Hot water gives you a better surface and straighter ice.
- When using the open hose method tape the water hose to an old hockey stick. Flood 2 to 2 ½ ft at a time going across the ice; make sure the water runs into your last pass. Turn the water pressure down as you do not want to leave bubbles.
- When painting the ice white you can move the drum as you go if you put it on a little cart.

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