Ontario Recreation Facilities Association

Building Community Since 1947

A Guide to Artificial Ice Skating Upkeep and Maintenance

VERSION 1.0

ISSUE DATE: MARCH 2018

orfa.com

Building Community Since 1947

ONTARIO RECREATION FACILITIES ASSOCIATION INC.
1 Concorde Gate, Suite 102, Toronto, Ontario M3C 3N6, Canada
Tel: 416-426-7062 Fax: 416.426.7385
info@orfa.com www.orfa.com

30 Years After The John Stein Skating Accident - How Has The Industry Changed?

Disclaimer

It is important to note that this resource is designed for practitioners with a strong understanding of the scientific and mechanical principles of ice making and maintenance. At times, the resource will speak to information that only a Certified Ice Technician (CIT) might comprehend. Many of these same principles are contained in other ORFA resources beyond those identified in the document. All information is available as a benefit of membership can be found at: http://www.orfa.com/Ice-Arena-Operations

1.0 Introduction

"The three stages of artificial skating ice are creation, maintaining and removal"

What amount of operational resources that must be invested in maintaining the sheet throughout its life-cycle will be driven by the methods of creation and the environment in which the ice sheet "lives". The word "live" is used as it qualifies that every ice sheet is in fact "alive". The sheet and the building will warm, cool, expand, contract, drip, fog, fracture, crack, shed, heal and at times - fail. Understanding its existence and what variables impact its quality of life is an essential ice technician skill.

A CIT understands that the less air and foreign matter that is trapped during the creation phase - the less ice maintenance that will be required. The next step in the process is water application. Applying the water in small sprays that quickly freezes will eliminate air entrapment creating a more durable sheet of ice. An additional variable is ice resurfacer operator competency. If those who are responsible for resurfacing the sheet understand the equipment and ensure it is functioning as designed, the result will once again less ice maintenance.

Post ice installation and painting, the objective of every ice rink manager is to maintain the same level of optical brightness and ice quality that is presented before the first skater uses it. This may or may not be attainable, as at times, the uncontrolled environment of the facility may continually erode ice conditions regardless of the best efforts of the ice crew. Facilities that experience such challenges must invest more time and resources into maintaining ice. This guideline will explore both the positive and negative aspects of ice maintenance. Each stage of ice will identify specific factors that must be considered or be in place to succeed. As with any set process, having one or more of the required pieces unattainable will impact the outcome. Each stage of the process can be analyzed and applied to determine what might be undertaken to improve ice condition, durability and appearance.

Ice managers must understand that there are two (2) totally different objectives 1. controlling ice thickness and, 2. ice maintenance.

Both are intertwined but separated. Understanding each separate issue and applying corrective measures according to the exact and current conditions is the role and responsibility of the on-site ice technician.

2.0 Ice Depth Measurements – Defendant or Plaintiff Tool

"Conducting regular ice depth measurements today is a Stein v. Sandwhich West (Township) court case industry legacy"

In October 1988, John Stein was participating in a Minor Hockey League Association game in the Town of LaSalle. During the game he either skated into a hole in the ice or created a hole in the ice which resulted in him coming into forceful contact with the arena boards. As a result, he suffered a severe injury to his vertebrae and spinal cord, rendering him quadriplegic. Stein and his family brought a suit against the Town of LaSalle alleging that they failed to maintain an ice surface of a sufficient strength and quality for playing hockey. In the end the *municipality was Issue liable for the plaintiff's injury as it was determined that they had breached their duty of care.* Source: Frank Cowan Co. Claim Case

Refer to:
http://www.orfa.com/Resources/Documents/librarydocs/guides_bp/Claim_Case_Study_LaSalle_Mun_0612.pdf

Today's ORFA members may not appreciate the role the Association played in this court case. Senior ORFA Board members were called to witness at the trial. The courts wanted to know what the Association was doing proactively to assist their membership in avoiding the circumstances outlined by the plaintiff's legal counsel. ORFA's industry leading refrigeration and ice making manual was entered as an exhibit in the court proceedings. ORFA staff and Board members now realized that the silent role being offered in good faith by the Association by providing industry best practice as guidance to safe operations could be used in litigation to benefit or regrettably help determine a member's failure to meet minimum industry best practices. This court case set the tone from that day forward on how the Association would and must conduct itself in the capacity of industry leader. Since 1988, the Association has been referenced in other court proceedings, the most notable was the coroner's inquest to the Tim Hickman tragedy.

Refer to:
http://www.orfa.com/resources/IMEO_%201%20Coroners%20Inquest%20Handout_RR.pdf .

In this court proceeding the Association was singled out for their role in educating rink owners and operators of the risks of working in these environments. Further, the ORFA offices are regularly contacted by both plaintiff's and defendant lawyers to gain an understanding to industry best practice. These events have resulted in the Association's commitment to provide industry leading professional development, accreditation and resources. Adoption or acceptance of any of these directives are currently self-governed by the industry but it must be recognized that failing to meet the Association's minimum operational recommendations may one-day be called into question.

It must be noted that the Town of Lasalle was doing nothing different than most other rink operations – the attitude and operational challenges was considered "industry acceptable" for the time. But when called into question, the courts evaluated industry behaviour and determined that the conduct of rink owners and operators did not meet "a reasonable standard of care" for the user. The Stein court case outcome shifted attitudes toward providing safer ice conditions and significantly lent to the creation of the Certified Ice Technician (CIT) designation program. Thirty years later, conducting regular ice depth measurements continues to be considered operational best practice. Many ice technicians find the task of measuring ice repetitive with no real value – any maybe they are correct. The mere collection of data is not a "silver bullet" to proving safe operations. In fact, the ice depth log book may be a plaintiffs most significant proof of unsafe conditions being present. Consider a log book that consistently identifies ice issues that need correcting without any change in operational activities to address the root of the problem. As much as the taking of ice thickness measurements are considered legally diligent what they must truly be embraced as is a weekly report of operational competency that self-evaluates operations that allows for proven adjustment to improve conditions.

3.0 Key Elements to Quality Ice

"Home ice advantage is often directly related to the variables found in each building"

As shared in the ORFA Ice Making and Painting Technologies course, an ice maker requires three (3) key elements to be in place for success. 1. Quality water. 2. Cold/dry environment. 3. Quality paint and application techniques. If the facility has poor water – high Total Dissolved Solid's or poor water application techniques that allows air to become entrapped, then the ice maintenance task will become more difficult. If the building struggles to control heat load or ambient air temperature, then ice maintenance becomes a greater challenge. And, if the ice paint quality and application processes are sub-standard keeping the lines and logos bright will be out of reach.

Proven water application for ice creation is one of the most overlooked steps in ice maintenance. To some, continually applying small layers of water that freeze quickly in a cold environment is an unwanted task. However, the commitment by dedicated ice makers to this process will result in a higher quality ice sheet that will require less ice maintenance throughout the year. The final piece to the ice maintenance puzzle is ice resurfacer operator ability and ice resurfacer capability through ongoing maintenance and upkeep. If the operator does not understand how the equipment is designed to function, or if they do not know how to set the blade and make slight adjustments or, if the equipment has worn parts - the capability of maintaining a smooth flat surface will be unattainable. Each of the identified key elements are discussed in length in other ORFA resources or training courses and as such will not be repeated in this document. The focus will be how best to address ice maintenance issues.

4.0 Gauging Safe Ice Thickness

"Measuring and recording ice thickness is no guarantee of operational diligence"

There was a time that the industry recommended singular optimum ice thickness levels. Although there continues to be industry best practices that provide guiding principles to safe ice thickness, the actual set points for each facility must be determined by facility management based on their understanding of the environment, mechanical capability, staff competency and use schedule. The current minimum gauge markers include the provision of an ice thickness that meets the type of users. High calibre skating or specialty sports such as sledge hockey need different consideration then a typical community rink. An additional way-point is to ensure an adequate amount of ice covers all paint and logos. There should be no less than 1/2 inch of ice covering these substances and materials at all times. What is important to understand is that once ice thickness levels are set then this is the target to be met at the end of each shift - not the beginning.

Aging infrastructure, staff changeover and environmental shifts requires an ice maker to continually evaluate all variables to determine what ice thickness is best.

Although there may be some low scheduled rinks that may be able to operate a full season with little adjustment, the reality is that most ice rinks should be regularly reviewing, and if so required, adjusting operations to meet facility demand. If ice continually builds in certain areas of the rink it should be evaluated. In the ORFA Safe Edging resource, the use of a standard permanent marker to identify the start and end of a high spot to assist in "spot edging" is described. Should these areas be chronic, facility management must determine what is contributing to the problem. Is it facility design, poor tire traction on the ice resurfacer that causes an operator to slow for safety reasons, is it environmentally caused as high humidity causes water to form and drip or is it user habit of emptying water containers onto the surface. Can the problem be addressed by the operator controlling flood water amount in these areas? It is facility managements responsibility to correct building issues to solve chronic problems. Setting an ice thickness that is slowly eroded to an unsafe level and then attacked to rebuild is a sign of derisory operations. Facility management should be keeping detailed records of their ongoing ice thickness analysis to confirm diligent operations if ever called into question. The importance of recording both pre- ice work tests as well as any work and or repairs undertaken must be stressed. Proving that issues were discovered and corrected are essential operational obligations.

5.0 Ice Resurfacer Operator Competency

"Ice resurfacer operation is as only as good as its operator"

There are thousands of ice resurfacer drivers but there are only a few real operators. Many embrace the fact of longevity in the business as being a confirmation of ability. At times, a new driver is in fact, a much better operator then senior staff member. Too often senior staff merely repeat the exact same resurfacing preparation and patterns – almost in a robotic state while a new driver approaches the task with an open mind and a fresh outlook. The perfect ice resurfacer operator is a person who has and maintains an equal balance of these two attributes.

There are those who work in an ice rink and then there are ice arena professionals. To determine personal assessment to which of these categories a worker may best align – if they have worked in the same facility for 2+years and have done the exact same resurfacing process without change then a categorization is simplified. For those who will rely on the adage of "why fix something that is not broke" most would be unable to identify, if in fact, it is broke or not. Realizing that these comments may not be palatable too many in the industry, it must be stated that in a court setting, compliancy or repetitive work habits, that have no substance to support the application will be easily called into question. High corners, low spots, lost paint or thick ice are simply signs of inadequate or incompetent operations. When compared with the 1988 Stein case, we know that today's ice rinks can maintain ice thickness and ice quality by applying proven techniques and scientific principles. Ice maintenance is no longer "a day" but an attitude toward the professional operations. If a rink is spending hours each week maintaining ice it is a waste of resources caused by a lack of understanding or commitment to the objective. The objectives are to have operators that understand their equipment's function, who can adjust cutting and water applications as required while removing ice that is replaced with an equal amount of water. If rinks are setting aside time to cut ice out of corners, or reduce ice thickness or build lost ice there are reasons for this – its either equipment capability or operator competency with the rare cases of dasherboard design, building shift or ice pad unevenness contributing to the challenge. If a facility manager cannot define what is contributing to ice maintenance challenges they cannot defend the shift away from industry best practice.

6.0 If the Ice Sheet is Not Flat There Is a Reason for That

"Ice sheets that have valleys or high spots are most often created by the operators"

In extreme cases, the ice pad may contribute to the issue but most often ice pad imperfection through low or high spots can be addressed. Scientifically, water will always self-level when applied. The ice resurfacer if properly functioning and set correctly will naturally cut-off high spots. Low spots are always created with the ice resurfacer blade. As suggested, 95% of fluctuations in ice depth are operator made. The other 5% are building factors (high humidity causing drips) or user poor habits (pouring of water onto the ice).

Key contributing factors to operator impact to ice depth include failing to understand blade control, the need to drive at the recommended speed and water control. Too many operators fail to understand how to set the blade to properly perform. An operator who is constantly adjusting the blade most often does not know what they are doing – rather they are pretending to be in control. Any person who can identify changing ice conditions at 9mph while looking over 15ft. of ice resurfacer and adjust the blade depth to meet their upcoming ice correction need observation is truly skilled. But like the unicorn, they just don't exist.

Chronic high ice thickness experienced along the dasherboards and in the corners, are created by a lack of edging. The ice resurfacer in its natural design cannot cut up to the dasherboard or completely into the corner but it can and will deposit water that freezes and builds. This layering must be mechanically removed with an edger. The industry best practice is one edging after every 12-resurfacings, but lighter edgings can be conducted more often if so desired. Reducing the floodwater bar flow amount along the boards can assist in reducing ice build-up but water flow must be calculated based on ice condition created by previous user load. Ice resurfacers with board brushes will remove snow build-up along the board. This will not reduce the need for regular edging but will reduce ice build-up as user snow along the boards if not removed will contribute to ice build-up which leads to more edging requirements.

It is recommended that the ORFA Safe Edging Guideline be reviewed as part of this document.

Refer to:
http://www.orfa.com/resources/Documents/librarydocs/guides_bp/Safe%20Edging%20Guidelines

%20and%20Industry%20Best%20Practice%20July2017.pdf

Once edging is complete, it is critical that the operator perform what is referred to as **"edging ice resurfacing finishing laps"**. This technique will guarantee the ice edge will be feathered from the boards edge for approximately 10-12ft. The process follows the following steps:

1. To start the process, begin by pulling up the blade as to not cut any ice. Begin scraping the ice from two or three conditioner widths away from the boards and come in toward the boards a 1/2 of a conditioner width as this will allow the ice clipping and snow pick up to be easier on the ice resurfacer's auger systems and to counter clogging the augers by taking too much snow and ice on the pass against the boards.
2. Once the edger snow has been collected, set the blade to its standard cutting depth.
3. If the ice resurfacer has a board brush – use it to remove excess snow along the dasherboard with the conditioner in the "up" position. If the ice resurfacer does not have a board brush the edge should be hand swept with a clean, stiff corn broom.
4. Once complete, detract the board brush into the stored position and bring the conditioner as close to the boards without touching them and begin the dry cutting of the surface for 1 full lap.
5. Once the first lap is complete, move the ice resurfacer out ½ of a conditioner width as to overlap the first cut by 50%. Complete a full second lap.
6. Repeat the moving of the conditioner out ½ of a conditioner width as to once again overlap the second cut 50% and repeat the process 2 additional times for a total of 4 laps that would equal 2 conditioner widths total once complete.
7. For a final 5th lap, once again drive the ice resurfacer as close to the boards without touching the dasherboard and complete a 5th and final full lap.

This completes the ice edging process.

Regardless of ice resurfacer operator ability the corners of the rink are natural ice maintenance problem areas. The curvature of the corner must be no less than 26ft for a current model ice resurfacer to be able to perform. However, it is mechanically impossible to cut tight to the dasherboard regardless of ability which then requires regular edging. Operators will create larger challenges when they fail to regularly edge the sheet. Ice that is allowed to build is time consuming to correct while wasting other resources such as fuel, blade life and life-cycle of the ice resurfacer.

The chronic low spot in the center of the ice or in the crease area is always operator caused. Contributing factors may be facility and ice resurfacer design. The actual cutting capability of an ice resurfacer is predetermined at the factory based on blade length. Typically, a 77in. blade or 84in. blade can only cut 71in. or 78in. if properly set but will cover 80in. and 87in. of water application. The speed of the ice resurfacer makes a natural wave like effect that spreads the water to at least the outer edge of the conditioner. This leaves approximately 3-inches of "feathered" ice on both sides of the conditioner so that the laps can be married to each other resulting in no ridge being created during the resurfacing process. Operators must take the conditioner length and divide it into the actual rinks width to determine the number of laps required to conduct the flood. What is hoped for is an equal number of laps – in a typical community rink it is seven (7). When the math is complete, an operator will know, if in fact, there is a conditioner length issue that will need to be addressed. For example, if the math determines that there are slightly more than seven laps then this creates an overlap situation that may contribute to low ice on the last lap as it is being cut twice. Some blade adjustment by the operator may assist in reducing the lost ice but in the end the natural operational issue must be addressed in the ice maintenance plan. More common, is the operator's inability to marry the cut edges together on each lap. Each lap is either a viewed lap or blind lap. The viewed lap is a cut on the left-hand side of the machine that allows the operator to gauge the overlap visually as they can easily see the two cuts. The right-hand side of the machine is the blind side of the unit and requires skill by the operator to correctly marry up the two cuts without being able to see. This is a teachable skill that can be learned. Some operations will place a mark on the hood of the machine to assist with operator alignment. Operators must be taught that all cuts are to be straight from end to end. The objective is to leave the same amount of uncut ice to be refinished on both sides of the final lap. The question is if current operations are spending several hours each week focused on the same types of ice maintenance or required corrective action – is what is the root cause to these problems?

7.0 Ice Maintenance

"Ice maintenance is an attitude not a day"

Throughout each shift, the operator is focused on maintaining a safe ice thickness. To create a durable sheet of ice that meets the demands of all users will require ice maintenance. Ice maintenance will focus on destressing the ice sheet while refurbishing its condition. An analogy would be the same as maintaining a waxed floor. How often ice maintenance must be performed will be based on the same factors shared at the beginning of the resource: water quality, equipment capability, ice paint. user load and ice resurfacer operator ability. Each building will have different demands throughout the year, so the ice maintenance plan cannot be militant. It must adjust to weather conditions and demand.

Destressing the ice is often accomplished by adjusting refrigerant temperature. Warming the ice allows air and dirt to easily migrate while reducing ice strength allowing the ice resurfacer to more easily perform its function. Destressing is often accompanied with non-traditional ice cutting patterns. Cross cutting will assist in keeping ice even. Unlike ice resurfacing, ice maintenance has no set rules for ice resurfacer speed or conditioner touch point. If the machine is not under stress, it can be driven as quickly or slowly as required, while the conditioner blade can be lifted by using the blade adjustment crank or the conditioner lift/lowering lever while in motion. Proven figure 8 patterns in the corners or directly across the ice in the figure 8 pattern can help focus on trouble areas. Conducting an ice depth check is essential to understanding the ice actual ice maintenance need. Just getting off the usual flood pattern and focusing on the identified ice depth areas is the best approach.

8.0 Outside Dumping

"Dumping the ice shavings outside the building is one of the highest risk factors to dirty and unsafe ice conditions"

The tracking of soil, small rocks and other foreign matter onto the ice must be controlled at the source. Thoroughly cleaning the ice resurfacer tires every time the equipment returns from outside is essential but just as critical is the cleaning of the ice resurfacer storage area to remove the washed off debris to eliminate its movement from this area onto the ice. Failing to control this dirt increases the need for ice maintenance while reducing ice resurfacer blade life resulting in increased operational costs and poor ice conditions that are very hard to defend legally.

9.0 Ice Resurfacer Levelling Equipment

"Technology should always enhance operator competency – not replace it"

The introduction of laser technology to assist facility managers in maintaining level ice has improved some operations. The question becomes is the expense achieving the projected return on investment. Reality is the almost the same amount of training on how to properly use this equipment as on how to properly maintain ice manually.

Laser technology does nothing more than what a properly trained team can produce through planning, application and commitment of the simple principles already shared. At times, the investment is made as it allows a smaller team to accomplish more within the operation – a reasonable expense. However, if the investment is being considered to rectify operator shortcomings that are causing ice issues it may need more thought. If operators cannot grasp basic ice maintenance activities what other inabilities exist within the operation. As with any technology, it is only as useful as those that know how to use it. It will require regular confirmation of calibration as well as operator ability to enter the computer and reset or adjust limits. It is vital that these adjustments, calibrations and confirmations be logged as proof of the equipment's ability and accuracy. Additionally, a plan on how the facility will operate if the technology fails must be in place. The reliance on computerization to accomplish standard operating practices can be a slippery slope. Facility management must clearly understand that it will be their responsibility to be able to explain the technology, its use and ongoing maintenance if ice conditions are ever called into question. Manufacturer marketing claims must be confirmed in a real-time working environment. Claims of less water application, snow removal, edging requirements are easily stated but not necessarily applicable in every environment. Finding the balance between the human factor and technology is challenging today's facility manager.

10.0 Refreshing the Ice Sheet

"The principal product you have to sell is the ice itself." Frank Zamboni

High use facilities or buildings with poor water quality will benefit from refreshing the ice sheet. There are two different "refreshing" processes. The first process is referred to **"ice skimming"** which merely has the operator remove 2-3 full loads of ice using whatever patterns the wish. These loads equal 4 resurfacing as the full buckets hold 25% more snow load then a traditional resurfacing that involves fresh water application. The removal of these loads requires them to be replaced so 3 full tanks of hot water should be reapplied, at ½ flood water valve setting to build ice thickness. This will remove all skate cut scars and provide a fresh appearance of the surface.

The second process of rejuvenating ice is referred to as a **"deep cut"** and involves the removal of at least the top ½ inch of the ice sheet and replacing it with fresh ice applied in small layers as described in the Ice Making and Painting Technologies materials. This will give a fresh skating surface that brightens lines and logos. It is important to schedule ample time for these processes to occur as they cannot be rushed.

It is recommended that the **ORFA Logo Installation, Removal and Storage Guideline** be reviewed as part of this document. See:

http://www.orfa.com/resources/Documents/librarydocs/guides_bp/Ice%20Logo%20Installation%20Removal%20%20Storage%20Oct2015.pdf

11.0 Correcting Damaged Ice – Takes Time

"Damaged ice is a wound that can only be corrected with time – there are few quick fixes"

Large patches of ice that has been damaged through excessive skating cannot be corrected with mass amounts of water being applied. This ice must be slowly cut away and rebuilt with small applications of water that freeze quickly. Small areas of damaged ice can be filled with clean slush that is packed into the hole and allowed to freeze. This can be expediated with C02 that is swept across the top of the slush and tempered with warm sprayed water to climatize the area. Filling any hole with slush and not allowing it to properly freeze is the equivalent of placing branches over a hole hoping no one steps on it.

12.0 Post Task Clean-up

"Professional ice operators leave the equipment and work areas cleaner then they found it."

It is important that all equipment and tools be cleaned and stored safely away after the ice maintenance task is complete. The ice maintenance log should be filled out with any issues being identified in the book as well as being passed along verbally to supervisory staff. Equipment refueling, or recharging must also be performed.

13.0 Cancelling Unsafe Ice

"Within the industry, there is a reluctance to cancel unsafe ice – this mindset must change".

It is unacceptable to allow other renters to access substandard ice. These conditions are often caused by over use of ice by elite coaching staff or at times mechanical problems that creates poor ice conditions. Rink staff must be empowered to cancel rentals and take corrective action as required. Failing to support such policy is negligence and difficult to legally defend. The ORFA resource, the Changing Dynamics of Artificial Ice that was released in 2011 recommended significant operational best practices change that have been slow to be adopted by the industry.

Refer to:
http://www.orfa.com/resources/documents/libraryd ocs/guides_bp/ChangingDynamicsofArtifcialIceFinal2011.pdf

Reluctance toward change is most likely based on not wanting to shift away from historical operations as it may result in user outcry. Facility management must accept that the same people who resist change will be the same people who will seek legal counsel should there be injury. People change for two reasons: either their minds open or their hearts have been broken.

14.0 Ice Removal

"The final stage of ice life-cycle".

Removing ice efficiently and environmentally friendly is responsible rink stewardship. The ice removal schedule provides the perfect opportunity for facility staff to better understand their equipment and environment and as such should be used as a training ground. The challenges and risks associated with ice removal are outlined in the **ORFA Artificial Ice Out Guideline.** See: (to be released this month)

15.0 Conclusion

"A skilled ice technician knows their environment"

To be successful, the chronic operational area issues, the buildings flaws and, the mechanical capability or limitations of the equipment must all be assessed and understood. Once complete, a visual inspection of the ice surface will often result in an immediate identification of trouble areas. The kicker plate being an equal distance from the ice to the top of the plate completely around the surface is a quick and easy evaluation of ice thickness while consistent paint colour brightness is also a clue to ice quality and thickness. All learnable skills that can be easily applied by any level of operator.

If not already obtained, consider the ORFA Certified Ice Technician (CIT) professional designation program – where understanding the principles of ice first is considered critical to understanding the practical application.

Refer to: http://www.orfa.com/designations/cit