

ICE RINK RISK REDUCTION

Ice skating combines both recreational activity and competitive sports, and is enjoyed by millions of people every year, indoors and outdoors, year-round, and seasonally. Ice rinks serve as a training ground for hockey teams, skaters, dancers, and of course the recreational skaters. Ice hockey and skating arenas occasionally experience unplanned outages due to the malfunction of key equipment. During peak seasons, ice rink cooling and ancillary systems are in continuous use and can be unattended during off hours. Some venues suspend ice activities entirely during summer months. In either scenario it is critical that equipment is properly maintained with predictive and preventive measures to ensure the readiness of ice rink equipment. Failure to properly maintain the ice layer and supporting equipment **can result in hundreds of thousands of dollars in lost revenue and restoration costs.**

Ice Rinks: Key Considerations

Commonly used mechanical and electrical equipment is used to make and maintain ice. Ice rink systems rely on chillers or refrigeration compressors, piping to provide cooling to build/maintain the ice layer and heating to the subfloor, and electrical distribution equipment to power the facility and equipment.

It is beneficial to identify the installed equipment and become familiar with the operation. Knowing system characteristics including equipment type, manufacturer, refrigeration capacity, refrigerant type, total system charge, and physical layout will enable repair efforts to be streamlined. Even functional and easily replaced equipment can result in unexpected downtime, increased operating expenses, and reduced business income if not properly maintained.

Preventive maintenance can increase the life expectancy of your equipment and help to prevent downtime and expensive repairs, increasing profitability and customer satisfaction. Preventive maintenance, inspections, and testing should be scheduled in accordance with the manufacturer's recommendations for the specific equipment and should be completed by qualified personnel. Keeping a detailed record of equipment maintenance and tests can help identify and prevent potential issues that can develop over the life of the equipment.

Chillers and Compression Systems:

Chillers play an essential role in maintaining business operations. A breakdown of this equipment will result in downtime or business interruption. The best practice to help ensure that equipment is reliable and reduce the risk of equipment breakdowns is to establish a preventive and predictive maintenance program.

Major Servicing may include:

- Annual refrigerant and lubricating oil analysis for contamination/degradation.
- 5-year Eddy Current on chiller/evaporator tubes.
- Annual motor/compressor preventative maintenance, including but not limited to:
 - Oil analysis for indications of excessive wear.
 - Vibration analysis of rotating equipment to detect impending failure.
 - Greasing and inspection of bearings.

Systems, especially those utilizing ammonia refrigerant present several unique considerations. For more information on chiller maintenance and ammonia refrigerant systems, please see Related Resources.

Brine System and Substrate:

The ice layer is formed and maintained by circulation of either a refrigerant or a cooling medium, such as glycol or calcium chloride brine, through piping that is installed beneath the ice layer. Heating piping may be installed beneath the cooling piping to prevent permafrost buildup. Sub-floor cooling/heating piping can fail due to thermal or physical stress, age, erosion, and corrosion. Buildup of permafrost beneath the ice layer can result in additional stress and damage to the ice rink subsurface and cause mounds in the ice surface. Loss of

efficiency, therefore increased operating costs can result from improper ice thickness, dirty or improperly mixed brine, improper refrigerant charge, etc.

- Rinks utilizing concrete subsurface benefit from increased protection from physical damage for piping, allowing for multipurpose use when the ice layer is not present or is covered by a temporary flooring, but have a higher installation cost as well as those to repair or replace due to excavation and labor costs.
- Rinks utilizing sand subsurface benefit from lower installation costs and easier access for repairs and replacement, but glycol brine, paint, and other materials can compromise both the ice layer and the sand over time.
- Piping layout and arrangement should be clearly identified on as-built diagrams to aid in maintenance planning, contingency planning, and future repair efforts.
- Major services may include:
 - Periodic removal of the ice layer to remove buildup of solids, old paint, residues, etc. which can reduce efficiency and contaminate the substrate resulting in soft ice and thawing issues.
 - Annual subfloor heating/cooling system and piping inspections.
 - Annual brine analysis.

Electrical Distribution Equipment:

Switchgear, switchboards, and subpanels contain essential components which provide control, isolation, and protective functions. Failure to monitor and maintain this equipment may result in equipment damage and unscheduled downtime.

Major services may include:

- Annual maintenance, including casing cleanouts, tightness checks, and breaker exercise.
- Testing/exercising protective devices such as automatic break trips and ground fault protection.
- Infrared thermography. This predictive measure uses specialized equipment to detect and visualize infrared wavelengths emitted by heat. When used for scanning electrical distribution equipment, thermography can proactively identify potential electrical deficiencies so they can be addressed before they result in catastrophic failure.

Electrical equipment presents several unique considerations and can be unique to every installation. For more information, please see Related Resources.

Considerations During Normal Operations:

- Operating logs for refrigeration equipment and brine systems should be kept for trend analysis and identification of issues as they develop, including but not limited to temperature monitoring, refrigerant leak detection, balance tank level, etc.
- Alarms, alerts, and automatic safety functions should be tested regularly.
- Glycol/brine filters should be checked regularly.
- Ice layer leveling/shaping: In addition to ongoing visual inspections and equipment maintenance, there should be a formal system for monitoring and correcting ice related quality issues such as thickness, bulging, uneven freezing, partial thawing (soft ice), etc.
- Water chemistry analysis and treatment should be utilized to minimize corrosion and maintain efficiency.
- Make-up water supply for sustaining or building the ice layer.
- Barriers and access control protecting key equipment should be kept in good condition.
- Property insulation should be maintained to prevent humidity or temperature issues.

Starting Back Up After the Off-Season:

Depending on how long equipment has been idle, precautions and additional monitoring may be needed before, during, and after the restart process to protect the equipment and ensure safety of personnel. Whether after a maintenance period or after the off-season, it

is important that equipment is operated by qualified personnel and in accordance with the manufacturer's guidelines. Some startup activities/considerations are:

- Ensure system valve positions are correct.
- Verify refrigerant charge and compressor oil level.
- Inspect refrigerant lines for leaks/corrosion.
- Test safety devices.
- Conduct vibration analysis.
- Once the system is back in operation, compare operating logs to pre-shutdown logs.

Contingency Planning:

Many locations are simply not prepared for an unexpected loss of equipment or services. Rental equipment may not be available without prior planning and a lack of preparedness might add thousands of dollars to the installation and lease. The following may reduce the cost, effort, and time needed to return to operation in the event of an equipment breakdown.

- Create a formal response plan for Key Equipment.
- Obtain contracts with vendors for rental equipment with defined lead times.
- Verify rental connections to facilitate hookup of rental equipment.
- Establish an inventory of spare refrigerant, oil, etc.
- Establish a critical spares program.

Related Resources

[Electrical Switchgear and Switchboards](#)

[Electrical Predictive Maintenance Using Infrared Thermography](#)

[Maintenance Guidelines for Chillers](#)

[Air Conditioning and Refrigeration Service Contracts](#)

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