Industrial Flake Ice Makers

Liquid Ice Systems

Modular Ice Rake Systems

Ice Handling & Delivery Systems

North Star

TECHNICAL BULLETIN

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CORROSION AND WATER QUALITY

North Star has chosen to address the issues of corrosion and water quality, and their effects on steel in our first Technical Bulletin. We will be posting these Bulletins periodically with information we hope you will find useful and informative.

Corrosion - All steels, including commercial grades of stainless steel, chrome-plated steel and carbon steel are susceptible to rusting and corrosion. It is imperative that ice maker owners or maintenance personnel properly care for the freezing surfaces of their ice makers. Regular, visual inspection of the ice maker components, including the freezing surface, is the simplest way to discover and determine corrosion at an early stage. The corrosion types described here are the most common found on ice maker components.

Rust - Rust will form on carbon steel freezing surfaces whenever the temperature is above 32dF (0dC). If the ice maker is going to be shut down for long periods of time such as in a seasonal operation, it is recommended that the carbon steel freezing surface be coated with medium weight oil suitable for the application. In some cases this may require food compatible oil.

If the ice maker is going to be shut down frequently for short periods of time, it is recommended that the evaporator freezing surface be kept below 32dF (0dC). This can be done with the refrigeration system.

Some rust on a carbon steel freezing surface is normal; however, excessive rust on the freezing surface can be removed using steel wool as described in our service manual.

Stainless steel normally does not exhibit rust. However, rust may appear if stainless steel surfaces or components were contaminated during transit and installation, or if corrosive agents are present in the ice maker incoming water or used during cleaning operations.

Pitting - Pitting is a localized form of corrosion where cavities or "holes" are produced in metal surfaces, including stainless steel. Pitting usually indicates the presence of a corrosive solution and is an accelerated form of chemical attack on the metal surface in which the rate of corrosion is greater in some areas than others. The number and size of pits may vary greatly between one area to another.

Pitting may first appear and concentrate on the freezing surface directly under the tips of ice removal tools forming concentric grooves. If some traces of grooves appear on the freezing surface, shift the ice removal tools up or down by approximately ¼" (6.25mm).This periodic adjustment of ice removal tools will extend the life of an ice maker freezing surface. Small concentric grooves around the freezing surface should have no negative effect on ice production and ice maker lifetime.

Water Quality - The quality of ice and the longevity of the ice maker depend on the quality of the water supplied to the unit. North Star recommends that only drinking water fit for human consumption be used for making flake ice. The water used in ice production for all food applications must be sanitary and drawn from an approved public or private water supply system that is in compliance with local, federal and/or international regulations. Water treatment may be required to insure that ice maker water meets drinking water requirements. Water containing corrosive agents or water that does not meet drinking water standards may harm the ice maker and void the warranty.

Good quality water will produce high quality sub-cooled flake ice that provides excellent cooling capacity. Poor quality water will result in poor ice removal from the freezing surface and poor quality ice, which often contains fractured bits of ice, commonly referred to as "fines" (snow). Poor quality ice will result in ice bridging in transition chutes and hoppers, and the formation of lumps of ice in conveyors and storage bins.

Chlorides - Chlorides are normally present in water and common chlorides include sodium chloride (NaCl or salt), potassium chloride (KCl) and calcium chloride (CaCl2). Chlorides increase water corrosiveness and can also increase the rate of pitting corrosion on steel.

A low level of dissolved salt in ice making water will almost always result in smoother ice maker operation and improved ice quality. North Star recommends 100 to 400 parts per million (ppm) of salt in ice maker water to optimize ice maker performance. Salt content in ice making water should not exceed 500 ppm for water used in North Star carbon steel freezing surface ice makers. If salt concentration in ice making water exceeds 500 ppm, the use of ice makers with stainless steel freezing surface are recommended.

Seawater salinity varies in the range of 33,000 to 38,000 ppm with an average of 35,000 ppm (3.5%). North Star recommends thoroughly flushing all seawater ice makers with fresh water upon shut down, after the refrigerant is pumped out and the freezing surface is brought to ambient temperature.

Langelier Saturation Index or Saturation Index - The Langelier Saturation Index (LSI) or Saturation Index (SI) indicates the corrosiveness of water and is used to determine if the water has a tendency to be corrosive or scale forming. The LSI (SI) is typically either negative or positive. A Saturation Index of zero indicates that the water is "balanced" and is neither scale forming nor corrosive. A negative LSI (SI) suggests that the water is corrosive. Water with LSI (SI) from minus 0.5 down to minus 2 may result in mild to moderate corrosion and treatment of ice making water is recommended. Water with LSI (SI) below minus 2 may result in moderate to severe corrosion.

A positive LSI (SI) indicates that water may be scale forming. The scale, typically a carbonate residue, causes buildup on an ice maker freezing surface and reduces ice production. It is strongly recommended that the owner of the ice maker or maintenance personnel test the ice making water since corrosive or aggressive water could result in damage to the ice maker freezing surface.

Chlorine - Chlorine is often added to drinking water in very small concentrations for disinfection purposes. However, chlorine in water can contribute to pitting corrosion and deterioration even for stainless steel materials. Normally treated drinking water should contain from 0.2 to 3 parts per million (ppm) of chlorine. This level of chlorine is considered safe for ice maker operation.

If you have questions about water quality, please contact North Star.

Best regards,

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This Technical Bulletin is published periodically for the benefit of North Star's customers.