LOW-E CEILINGS
Still Making A Difference

by Mark M. MacCracken

The patented Aluma-Zorb low-emissivity ceiling drastically reduces the energy consumption needed to maintain an ice surface and is heralded as one of the most important advancements in the last 50 years.

If you've ever watched or participated in any sport that takes place on an ice surface, then you know how important it is to have a pristine sheet of ice. When the ice starts to degrade, hockey pucks take unpredictable bounces, figure skaters have a harder time landing their jumps and even casual groups of skaters start to create ruts that wouldn't normally present themselves. The culprit for poor ice conditions is heat and a rink's ceiling plays a major role in the quality of the ice below it.

The temperature of indoor ice skating rinks varies greatly from the ceiling above to the ice below. The ceiling is being warmed daily by outdoor elements, such as the sun, in addition to indoor factors, such as lighting and body heat that rises in an enclosed arena. Since heat is always trying to reach equilibrium by transferring from high concentrations to lower concentrations (hot to cold), ceiling heat is continuously radiating down to the ice below. This heat is infrared energy, which is easy to ignore since infrared radiation is invisible and cannot be felt. The amount of heat radiated to the ice is substantial, as it can account for 35 to 45 percent of the daily refrigeration load of an indoor ice rink.

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So how do you slow down this transfer? The answer lies with the emissivity of the ceiling. Emissivity is the measure of a material's ability to radiate or disperse heat, with zero emissivity being ideal. Creating a low emissivity ceiling reduces the amount of heat radiated from the ceiling to the ice.

Traditionally, the ceilings of ice rinks were created with surface materials such as wood, paint, varnish, insulation, glass and brick. These materials have emissivities between 85 and 95 percent, resulting in energy-robbing heat radiation making it to the ice surface, thus compromising its integrity. In the 1970s, Cal MacCracken, a prolific inventor and founder of CALMAC, was working on a new way to freeze an ice surface, using stratified cold air instead of pipes in a floor, and discovered the major impact of radiation. During an experimental installation of his Air-Freeze idea inside of a Quonsit Hut on a hot summer day, Cal observed that even though the air temperature 1 foot above the rink was 20 F, the ice melted right before his eyes. When he looked up, he recognized the radiant heat beaming down from the 140-plus F metal ceiling which made him wonder what that load would be on a normal rink.

What may have looked like, to a non-inventor, as a failed attempt at a new air freeze rink, actually led to the discovery of the largest energy saving measure of any indoor rink. It was from this initial observation that Cal pioneered the low emissivity ceiling, creating an aluminum sheet curtain that would limit radiation from the ceiling down to the ice surface. This material would be suspended above the ceiling to cover the rink and had an emissivity of 4 to 5 percent, stopping 95 percent of the heat radiation from traveling to the ice surface. Using this invention, the heat that is no longer radiated to the ice stays at the ceiling level, keeping the ceiling temperatures warmer than before the installation (around 70 F compared to 50 F).

Low emissivity ceilings have many added benefits. Installing an aluminum curtain reduces refrigeration energy requirements resulting in total rink energy cost savings from 20 to 33 percent annually. In addition, as stated above, the ceiling temperatures actually go up thereby reducing the incidence of condensation forming on the ceiling and dripping to the rink surface. The rink is also brighter due to the reflection of visible light which translates into better illumination and less energy usage. CALMAC's Aluma-Zorb Ceiling consists of a tough laminate of bright aluminum foil, fiberglass scrim and vinyl backing, which improves acoustics, eliminates the need for regular ceiling painting and withstands puck impact. For his invention, Calvin MacCracken received the Frank J. Zamboni award, named after the inventor of the ubiquitous ice-resurfacing machine, for his contributions to the ice skating industry.

Today's low emissivity ceilings can be seen in thousands of rinks around the world, saving energy and reducing operating costs for rink owners and managers. The laws of thermal dynamics have and will not change, making this technology just as relevant today as it was more than 40 years ago.

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