

ALUMA-ZORB



Low Emissivity
Ceiling Curtain for Ice Rinks



In any covered rink a wide temperature difference exists between the warmer ceiling above and the colder ice surface below. The ceiling is warmed by the sun and the outdoor temperature, by lights, body heat, and the normal heat rise in an enclosed arena. Since heat always transfers from a warmer to a cooler surface, this ceiling heat, in the form of infrared energy, continuously radiates down to the ice below. Because this infrared radiation is invisible and cannot be felt, its importance is easy to ignore. The fact is, however, that the amount of heat radiated to the ice is substantial and can account for 35 to 45 percent of the daily refrigeration load of an indoor ice rink.

The only practical way to reduce the amount of heat radiated from the ceiling to the ice is to change the emissivity of the ceiling. Emissivity is the measure of a material's ability to radiate heat. The most desirable ceiling for an ice rink



would be one whose surface has zero emissivity. Common ceiling surface materials, such as wood, paint, varnish, insulation, glass and brick, however, have emissivities between 85 and 95 percent.

An ALUMA-ZORB Ceiling Curtain, with an emissivity of 4 to 5 percent, will stop 95 percent of this energy-robbing heat radiation to the ice surface. It consists of a tough laminate of bright aluminum foil, fiberglass scrim, and vinyl backing which is suspended from the ice rink ceiling on lightweight wire cables. The curtain and cables are run at right angles to each other, and the curtain is simply draped over the cables and secured at each end by an adjustable "snap-in" system. Experienced installation crews are available or it can be done by rink personnel or volunteer help. Slits may be cut in the curtain to accommodate lights, sprinklers and other obstacles.

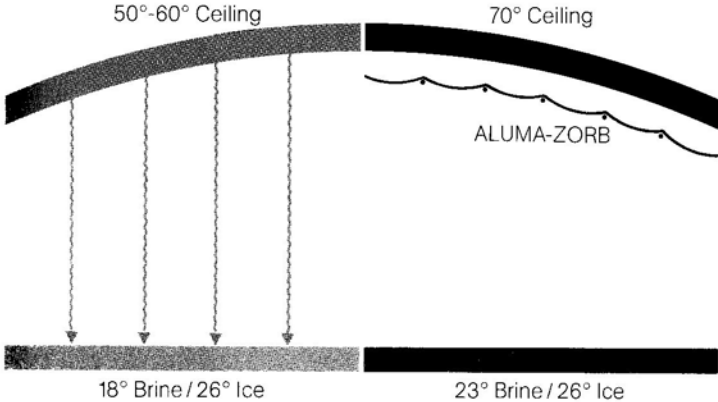
Only the ALUMA-ZORB Ceiling Curtain can offer these exceptional design features:

1. Stops infrared heat radiation

The aluminum foil used in ALUMA-ZORB curtains has an emissivity of only 5 percent at 70F. This effectively blocks virtually all heat radiation to the ice surface. As a result, brine or evaporator temperatures can be raised as much as 5 degrees and the compressor operated fewer hours per day to maintain desired ice temperature and hardness.

2. Reduces refrigeration energy requirements by 25 to 40 percent

The actual savings from an ALUMA-ZORB Low Emissivity Ceiling Curtain will vary with each installation. Refrigeration capacity, location and season of the year all have a bearing on its effectiveness. However, the savings from drastically reducing the radiant heat problem, coupled with the additional advantages that the curtain provides, have resulted in *total rink* energy cost savings from 20 to 33 percent annually for past users—enough to pay for the cost of the curtain, including installation, in one or two years for most rinks.



3. Eliminates moisture condensation

The heat that is no longer radiated to the ice stays above the curtain, keeping the ceiling temperature around 70F. Conversely, a rink ceiling without the ALUMA-ZORB Curtain has a temperature of approximately 50F, which is near the dew point.

Thus, if the air inside the arena becomes humid, water will condense on the cool unprotected ceiling and dripping and wet ice will occur. This condition cannot be solved by ventilation because the introduction of outside air only aggravates the problem when the weather outside is mild and humid. Eliminating wetness also prevents rust and rot and helps preserve the rink structure.

4. No ceiling painting

The periodic painting and cleaning of unprotected ceilings to improve appearance and prevent deterioration is completely eliminated. This can be a substantial saving in material and labor costs and rink down time. Once installed, the ALUMA-ZORB curtain requires no maintenance.

5. Reduces lighting requirements

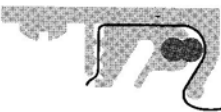
The highly reflective surface of the ALUMA-ZORB curtain also reduces the number of lighting fixtures required. Light bounces back and forth between the painted ice and the metallized curtain in a reflective action which minimizes glare and shadows and improves the overall appearance of the rink.

6. Improves acoustics

The nature of the ALUMA-ZORB Ceiling Curtain material results in a substantial acoustical improvement in rinks where the volume or quality of the sound in the arena are objectionable.

7. Withstands puck impact

Because of the material's high tensile strength and the curtain's slightly draped method of installation to absorb impact, an ALUMA-ZORB ceiling is highly resistant to hockey puck damage. The ceiling's modular design and tension bar method of securing curtain ends simplify replacement and/or repair of any section.



The tension bar consists of an 8-foot extruded aluminum base and four 2-foot snap-in aluminum inserts. A protective rubber strip in the insert holds the ALUMA-ZORB Curtain securely in place.

The engineering basis for our product

The radiant heat flow from the ceiling to the ice sheet can be calculated by the application of the *Stefan-Boltzmann* equation:

$$R = [0.1713Ae(T_c^4 - T_i^4)10^{-8}] / C \text{ (tons)}$$

$$= 0.005663Ae(T_c^4 - T_i^4)10^{-8} \text{ (kW)}$$

$$= [0.1713Ae[(T_c/100)^4 - (T_i/100)^4]] / C \text{ (tons)}$$

where: R = radiant heat load, tons (kW)
 A = area, ft² (m²)
 e = emissivity
 T_c = ceiling temperature, deg R (K) (deg R = 460 + deg F)
 T_i = ice temperature, deg R (K)
 C = 12,000 × Btu/h per ton

For example, for an 85 × 200 ft rink with 25F (485° R) ice and 60F (520° R) ceiling temperature: R = 0.1713Ae[(T_c/100)⁴ - (T_i/100)⁴]/C (tons)
 = 0.1713(17,000)(0.9) × (5.20⁴ - 4.85⁴)/12,000
 = 38.8 tons (136.6 kW)

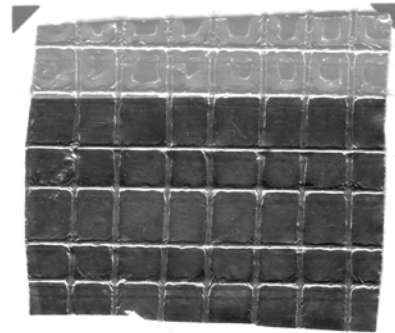
Specifications

Material: Fiberglass scrim, vinyl backing, aluminum foil facing.
Color/Finish: Silver/Mottled. Weight/Linear Foot: 1.6 oz.
Thickness: 0.007" ± 0.001" Length: Up to 300 feet per roll.
Tensile Strength: 30 lbs./inch average. Emissivity: 5% at 70F.
Width: 54"

Fire Resistance: Underwriters' Laboratories Class 1 Fire Rated product.
UL Registration Number R-6240. Tunnel test ASTM-E-84 results:

Flame Spread Index	Fuel Contribution	Smoke Density
Face 25	Face 0	Face 35
Back 10	Back 0	Back 0

Also meets NFPA-701.

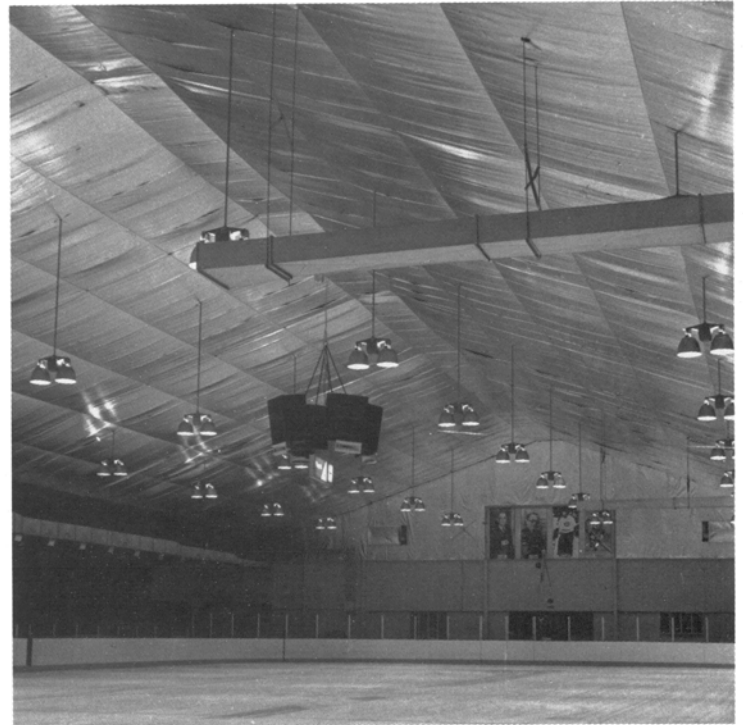


ALUMA-ZORB Installations

Some of the many installations of ALUMA-ZORB Ceiling Curtains have been made at the following rinks:

Grundy Recreation Center Bristol, Pennsylvania	Zion Leisure Center Zion, Illinois
Rockford Park District Rockford, Illinois	John F. Kennedy Arena Rome, New York
Kennebec Ice Arena Hallowell, Maine	Aspen Ice Garden Aspen, Colorado
Skating Club of Wilmington Wilmington, Delaware	Haverford Township Skadium Havertown, Pennsylvania
Low Tor Ice Center Garnerville, New York	Rink In The Park Waterloo, Ontario, Canada
Mt. Lebanon Recreation Center Pittsburgh, Pennsylvania	Lawfield Arena Hamilton, Ontario, Canada
Nashoba Valley Olympia Boxboro, Massachusetts	Bakerview Ice Arena Bellingham, Washington
Foxhill Ice Arena Overland Park, Kansas	The Sky Rink New York, New York
Enfield Twin Rinks Enfield, Connecticut	Canton Memorial Ice Rink Canton, Massachusetts

Calmac Manufacturing Corporation is a leading name in the ice skating rink industry. Calmac manufactures both the ICEMAT Ice Rink Floor Grid System and the HEATMAT Sub-Floor Heating System. These patented products, which Calmac developed, helped pioneer the substitution of plastic for steel piping in the ice rink industry. Calmac also developed and manufactures the ICE-LOCK Dasher Board System and ALUMA-ZORB Low Emissivity Ceiling Curtain—all proven products designed to help rink owners run efficient, profitable rinks.





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