REAL ICE AND SNOW FOR SPORTS AND ENTERTAINMENT

INDOOR REAL SNOW SOLUTIONS
COMPANY PROFILE

As a division of CTC Group Limited, since 1999, CTC Ice and Snow is a leading provider of world-class winter sports facilities: Ice Rinks and Snow Domes in Asia. We use ground-breaking technologies and engineering processes to provide energy efficiency and environmentally friendly solutions to our customers.

Founded in 1988, Acer Snowmec Limited is the world leader in the provision of designs and special engineering solutions for Indoor Real Snow centres. The company is at the leading edge for design excellence in order to provide Indoor Snow Resorts.

A STRATEGIC PARTNERSHIP TO PROVIDE THE BEST SNOW SOLUTIONS

CTC Ice and Snow and Acer Snowmec offer to you the best and most innovative solutions for your snow project. With 27 years of combined experience, both companies have developed more than 20 recognized indoor snow facilities around the world, from design to installation. This expertise gives us the capability to provide cost-efficient solutions, understanding the indoor snow operation from snow production to facility management.

PATENTED TECHNOLOGY

The Acer Snowmec indoor snowmaking system is patented in 28 countries and recognised by skiing and refrigeration experts alike as the most advanced technology in its field. Our patents can protect the licensed facility within an exclusive catchment from other Acer Snowmec centres and any similar competing technologies.

ENERGY EFFICIENT AND ENVIRONMENTALLY FRIENDLY

Our solution is the best on the market. We produce the best quality snow, with the lowest capital and running costs, thanks to the unique thermal storage system, which allows the load to spread over 24 hour period. Also, we use no harmful chemicals, which make it the safest and the most environmentally friendly system available.

Ski Dubai, the first indoor ski resort in the Middle East, is one of our most important realizations. The 22,500 square meters facility is covered with real snow all year round. Ski Dubai is part of the Mall of the Emirates.
OUR SOLUTION

We provide a full indoor snow facility package solution that covers all the stages of the project. From master planning, design and installation to commissioning and after sales service.

AN INDOOR SNOW FACILITY INCLUDES:

- Insulated walls, ceiling and floor
- Cooling and ventilation of cold area
- Snowmaking and retention
- Ski lifts and travellators
- Snow grooming and terrain forming equipment
- Snow melting
- Slope lighting and MEP Items in the cold environment
- FIS (Federation International de Ski) accreditation of individual runs
- Theming and interior design
- And many more...

WE MAKE IT POSSIBLE! REAL SNOW FOR YOUR FACILITY!
HOW DO WE PRODUCE REAL SNOW?

Methods of making snow indoors include using crushed ice, shaved ice, cryogenic snowmaking and hoar frost growth systems. However, none of these approach the look, the feel and the performance of real snow.

Our solution to produce real snow is based in the natural snowing process. To do so, we have designed an integrated snow making system composed of snowmakers, coolers, flooring and heat recovery that when working together produce the best quality snow with the highest cost-efficiency standards.

5 STEPS TO PRODUCE REAL SNOW

1. Every night, after the facility closing, before the production of new real snow, the surface is groomed. The new snow production process starts when pre-chilled water at +1°C and compressed air are pumped to the snowguns through hose systems.

2. Atomized water is sprayed to the environment through microholes in the snowgun nozzle. Ice particles of 10 microns become the nucleus around which the perfect crystals form, creating the real snow.

3. During the snow production process, a temperature of about -6°C is maintained inside the facility. This is achieved by using a series of coolers suspended from the ceiling.

To ensure the best real snow quality, the flow from the snow guns is carefully aligned with the coolers air steam. This ensures that the sprayed ice particles will be suspended for a longer time, creating bigger and more voluminous snowflakes.

4. Once the snow is produced, the floor cooling system plays and important role to maintain its quality and properties. Pex pipelines circulating glycol refrigerant, are installed beneath the snow surface, in order to keep the temperature below 0°C. A Chiller keeps the glycol at -16°C.

5. Within the 4-5 hours of snow production, small particles of snow adhere to the fins of the coolers, blocking the air stream. A heat recovery system supplies the energy to defrost the coolers, as well as to melt the removed snow and to heat the under floor, preventing the cooling of the structure of the building.
The ASI Snowmaker is the core component of our snow production system and it makes possible the production of real snow. This mechanical devise uses a mixture of compressed air and high-pressure water with a jacketed mixing chamber. The water jacket allows the snowmaker to operate in a below zero atmosphere without freezing internally, by circulating the snowmaking water around a chamber surrounding the snow gun.

This patented technology is by far the best in the market as it provides real snow at the lowest cost and without using any harmful chemicals.

We offer two snowmaker models adapted to you needs. The ASI-DLX-01 can produce snow for up to 5 hours before the need to defrost the ASI coolers or 4 hours for typical coolers. The ASI-PREM-01 can produce snow longer than 5 hours as it will adjust the density as required to maintain the snow quality.

<table>
<thead>
<tr>
<th>Model</th>
<th>ASI-DLX-01</th>
<th>ASI-PREM-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control System</td>
<td>Basic Controller</td>
<td>IntellSnow Controller</td>
</tr>
<tr>
<td>Time Before Defrost ASI Coolers</td>
<td>5 hours</td>
<td>More than 5 hours</td>
</tr>
<tr>
<td>Device Size</td>
<td>670 cm x 410 cm x 410 cm</td>
<td></td>
</tr>
<tr>
<td>Device Weight</td>
<td>25 Kg</td>
<td></td>
</tr>
<tr>
<td>Max. Flow rate</td>
<td>9 L of water per min</td>
<td></td>
</tr>
<tr>
<td>Snow Particles</td>
<td>10 - 50 microns (out of snowmaker)</td>
<td></td>
</tr>
<tr>
<td>Snow Density</td>
<td>100 - 500 Kg/m³</td>
<td></td>
</tr>
<tr>
<td>Snow Type</td>
<td>Powder to Spring Snow</td>
<td></td>
</tr>
<tr>
<td>Operating Time</td>
<td>20 hours</td>
<td></td>
</tr>
<tr>
<td>Snow Amount*</td>
<td>46 m³</td>
<td></td>
</tr>
<tr>
<td>Snow Coverage</td>
<td>~ 360&quot;</td>
<td></td>
</tr>
<tr>
<td>Flow</td>
<td>25-30 cfm** per snow gun</td>
<td></td>
</tr>
<tr>
<td>Snowing Grooming</td>
<td>~ 80% reduction vs. uni-directional</td>
<td></td>
</tr>
<tr>
<td>Chemicals</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Cryogenic Gases</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td>Ceiling void or Ceiling mount</td>
<td></td>
</tr>
</tbody>
</table>

* At a density of 100 Kg/m³
** Cubic Feet per Minute

The ASI Snowmaker is considerably smaller and lighter than the competitor’s. Also the Snowmaker and the coolers are separated facilitating the maintenance and the reparation of the whole system.
Real Snow is defined as ice particles that grow in flight through the air, forming snow crystal structures. Indeed, there exist over than 250 kinds of snow crystals.

Dense spring snow is slower and allows beginners more control, while densities such as dry champagne powder are used for other ski runs.

### Real Snow Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle size</td>
<td>$10 \mu m - 100 \mu m$</td>
</tr>
<tr>
<td>Density</td>
<td>$100 \text{ Kg/m}^3 - 500 \text{ Kg/m}^3$</td>
</tr>
</tbody>
</table>

The snow output of any snowgun is related to the snow density.

Basing on a similar system, the performance of snow production of the ASI Snowmaker is better than the competitor’s system.

The ASI Snowmaker output is 30% higher than the similar device in the market.
SNOW COVERAGE

The snow production consists of two stages. The first stage is the base layer that is complete prior to the snow center been opened. The second stage is performed every night to provide a new fresh snow layer.

For ASI-DLX-01 and ASI-PREM-01, under normal operating condition, each snowmaker is able to cover an area of 600 m² to 1200 m², depending upon the application and the snow type and quality needed.

In order to ensure an optimal coverage of the surface and optimize the investment, we calculate the right number of snow guns needed.

ENERGY-EFFICIENT SOLUTION

To provide the lowest energy consumption, our system is based on using the spare capacity in the main chillers at night when the room loads are reduced and there is no occupancy, ventilation, lights or lifts.

The main chillers and room coolers are used for the snowmaking period with no additional capital plant or pipe work. During the 5-hour snowmaking period, the room temperature needs to be lowered to -6°C. After this, the room temperature could be maintained at -1°C to -2°C.

When using our thermal store design, the chillers can be reduced as the thermal store can provide the cooling during the peak capacity requirement. The chart above shows peak cooling requirement of 6200 kwh, yet the cooling system can be sized for 4800 kwh due to the thermal store.

Based on a similar system, making the same amount of snow per day of the year, our system uses LESS energy than our competitors.
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