

Case study

Upgraded ice rinks in Canada

Upgraded ice rinks in Canada – reduced energy costs with environmentally friendly ammonia refrigerating systems



Photo credit: Alfa Laval

Canlan Ice Sports has taken a major step toward energy efficiency and sustainability of 22 ice rinks across Canada by upgrading their refrigeration systems with Alfa Laval's plate heat exchangers and U-Turn ammonia separators. This modernization has resulted in 10M kWh annual energy savings and a \$1.6M (€1.59M) yearly cost reduction since 2019. By lowering electricity consumption per ton of refrigeration by up to 20% and integrating waste heat recovery for showers, seating, and Zamboni water, the project increased sustainability. The ammonia-based system ensures enhanced safety while reducing environmental impact.

With optimized space utilization, lower maintenance costs, and advanced automation, this upgrade serves as a good example for cost-effective, eco-friendly ice rink operations.

Key information

Client: Canlan Ice Sports

Supplier: Alfa Laval

Type of facility: Ice rink

Refrigerant: Ammonia

System start-up: 2015

Requirements

Canlan Ice Sports sought to modernize its ice rink refrigeration systems to improve energy efficiency, reduce operational costs, and enhance environmental sustainability. Their goal was to replace outdated shell-and-tube chillers with a more efficient technology that would lower electricity consumption while maintaining optimal ice conditions.

Additionally, they aimed to maximize heat recovery for secondary applications, streamline equipment footprint, and improve overall system safety.

Solution

To achieve these objectives, Canlan Ice Sports implemented several key upgrades across seven facilities:

- **High-Efficiency Heat Exchangers:** Replacing shell-and-tube chillers with Alfa Laval's plate heat exchanger technology resulted in a more responsive system. The higher suction temperature reduced compressor load, leading to approximately 3% energy savings.
- **Compact Ammonia Separator:** The introduction of Alfa Laval's U-Turn ammonia separator optimized evaporation, further increasing suction temperature and ensuring liquid carry-over prevention, leading to an additional 1.5% energy reduction.
- **Advanced Reciprocating Compressors:** Upgrading to energy-efficient reciprocating compressors significantly cut energy consumption per ton of refrigeration, achieving up to 20% electricity savings compared to conventional models.

- **Heat Recovery Integration:** By replacing the evaporative air-cooled condenser with a liquid-cooled plate condenser the waste heat could be used for space heating, showers, and Zamboni water pre-heating. This further enhances the facility efficiency and reduces CO2 emissions.
- **Building Automation System:** A fully integrated control system optimized the operation of all mechanical equipment, ensuring continuous efficiency improvements and cost-effective ice maintenance.

Key benefits and features

Since 2015, upgrades of the first seven ice rinks have delivered substantial energy and cost savings, reducing electricity consumption by 3,500,000 kWh annually and cutting electricity expenses by \$600,000 (€529,600) per year. Canlan Ice Sports calculated that when additional facilities completed upgrades, at the end of 2019, the total electricity consumption was reduced by 10 million kWh annually, corresponding to 1,100 tonnes of CO2eq per year.

Beyond energy efficiency, the project achieved key environmental and operational benefits:

- **Lower Ammonia Charge:** Enhanced system safety with a reduced refrigerant charge (> 80% reduction).
- **Sustainability Gains:** Ammonia as refrigerant significantly lowers the system's global warming potential (GWP) compared to fluorocarbon alternatives.
- **Optimized Space Utilization:** Compact Alfa Laval plate heat exchangers with integrated U-Turn separators freed up valuable engine room space.
- **Reduced Maintenance Costs:** The upgraded system decreased the need for repairs and upkeep, further contributing to long-term operational efficiency.

Technical data

Cooling capacity: Ranges between 281 – 1266 kW per site.

Refrigerant charge: Reduced by more than 80%, now kept in the machine room only

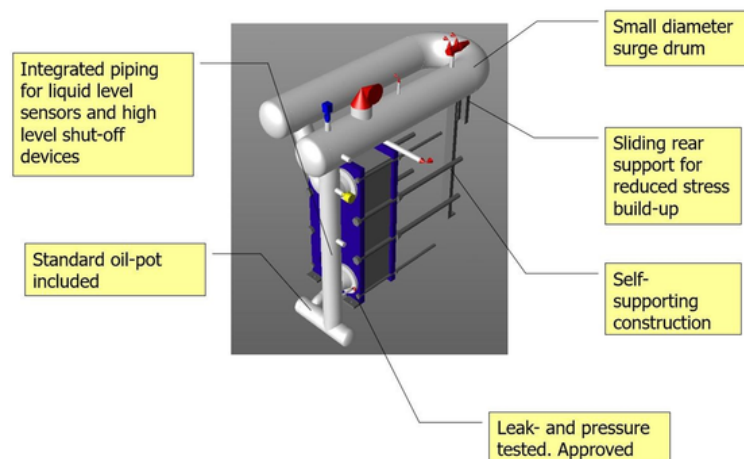
Evaporating temperature: Optimised for best efficiency at various loads.

Condensing temperature: Optimised for best efficiency at various loads.

Main components:

- Evaporator Semi Welded Plate heat exchanger with U-turn flooded separator
- Condenser: Liquid Cooled Semi Welded Plate heat exchanger
- Compressor: Reciprocating type

Figure 1: Description of the U-turn flooded ammonia separator



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