



Energy-saving technology for skating rinks

Location : Montreal, Quebec; Canada

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Project Description

General Description

Since 1989, the City of Montreal has experienced recurring steel corrosion problems with the brine header of its skating rink. Montreal owns 25 indoor skating rinks and had to replace six corroded brine headers between 1989 and 1995. Pipe corrosion did open a window of opportunity which was used to experiment a new design, now known as a 4-pass brine system with evaporators in series. First, they have updated the brine specification. Then, they took 2-pass brine distribution systems with evaporators connected in parallel and replaced them by building 4-pass brine distribution systems with evaporators in series. This new 4-pass design resolves the problems of corroding brine header pipes, while lowering construction costs and producing energy savings of 8 to 9%.

Technical Data

The original 2-pass rinks systems used brine with a specific gravity of 1.25 at 15.56 C (60F). The chiller evaporators were piped in parallel, and used 47.32 litres/second (750 USgpm) each. The pump was driven by a 50 hp electric motor (1800 rpm) and had a capacity of 94.64 litres/second (1,500 USgpm) of brine and a head of 43 psig.

The initial modifications were done between 1983 and 1986. The original motors (1800 rpm, 50 hp) were rewound to produce 1200 rpm, 25 hp. The brine flow produced was 56.97 litres/second (903 USgpm).

Towards the end of 1991 more modifications were made, first: the 2-pass design was changed to a 4-pass design. Then the specific gravity of the brine was reduced from 1.25 to 1.18, reducing the pump energy consumption. The two (or three) evaporators in their system are piped in series with a flow of 28.45 litres/second (451 USgpm) each. Brine is

circulated by a single pump sized for 28.45 litres/second and 64 ft of brine head, driven by a 15 hp high-efficiency (1200 rpm) motor.

Energy Data

The following results are for three skating rink: Arena Mont-Royal : Important features are:

- radiant electric heating system - electrical feed to a small urban park.

The electrical consumption has decrease by 16.7%. The energy cost for 8 months of operation is CAD 98,500, for 1.33 MWh/year, using the kWh rate of 1996.

Arena Saint-Donat : Important features are:

- radiant natural gas heating system - electrical feed to a medium urban park.

The electrical consumption has decrease by 14.0%. The energy cost for 8 months of operation is CAD 89,025, for 1,18MWh/year.

Arena Marcellin-Wilson : Important features are

- radiant natural gas heating system - electrical feed to a medium urban park.

The electrical consumption has decrease by 14.1%. The energy cost for 8 months of operation is CAD 99,210, for 1.27 MWh/year.

Economic Data

The total cost of the modifications(1992-1994) was CAD 77,000 per rink. The energy saving resulting from a four-pass system with evaporators in series are estimated at CAD 8,500 per year or 8-9 % of the energy cost. The replacement of a brine header using a 4-pass system is less costly than a 2-pass system. The payback period is either instantaneous or at most a few month since the modification cost was zero and the replacement cost was CAD 77,000 and had to be done regardless of the potential energy saving.

Environmental Data

Environmental protection regulations prohibit the use of sodium chromate to inhibit corrosion. The city of Montreal now use a biodegradable inhibitor.

KEYWORDS :corrosion, four-pass, brine, two-pass

Project Details

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| Project Number | CA-97-514 |
| Project Type | Result |
| Start date | October 01, 91 |
| End date | December 01, 94 |
| Country | Canada |
| CADDET Brochure | |
| Primary Sector | [3B] BUILDINGS: Commercial |
| Primary Technology | [F00] ENERGY SYSTEMS, EQUIPMENT & MATERIAL |
| Secondary Sectors | [] |
| Secondary Technologies | [] |

Organisation(s) and Contact(s)

| | |
|---------------------|--|
| Organisation | CADDET CANADA (Dept. of Natural Resources Canada) |
| Abbreviation | NRCan |
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Related Document(s)

[none]

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