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CHILLIWACK CURLING CLUB LEADS THE WAY WITH A NEW AND INNOVATIVE REFRIGERATION SYSTEM

Accent Refrigeration Engineering of Victoria, B.C., has recently completed the design of a next generation eight sheet curling club refrigeration system for the City of Chilliwack, which is the first of its kind in North America.

The installation was carried out with a great deal of pride by the good folks at Fraser Valley Refrigeration.

Art Sutherland, the president of Accent Refrigeration Engineering explains how this very innovative system solves so many problems from so many different angles.

The configuration is a split-header ultra-low charge indirect system with ammonia as the primary refrigerant and aqua ammonia as the secondary refrigerant. There are significant advancements in every aspect of the system that improve safety, electrical efficiency, heat recovery, redundancy, sustainability, and longevity.

The Floor Piping System

The differences begin with the refrigerated floor. For many years curling club refrigerated piping grids were constructed with Low Density Polyethylene pipe (LDPE) and secured by clamps. The Chilliwack Curling Club has been constructed with High Density Poly Ethelene pipe (HDPE) which is fusion welded. This style of piping system is almost indestructible and will last the life of the building without any leaks.

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The Secondary Coolant

One major change is that the secondary coolant is 12% aqua ammonia which has several advantages. The aqua ammonia is just slightly stronger than the 10% cleaning solution you would buy at the hardware store. The viscosity (resistance to pumping) is significantly lower than glycol or calcium chloride, which results in much lower pump horsepower. The propensity to cause corrosion is much less than calcium chloride, which means the plate chillers are much less expensive. Unlike Calcium Chloride and Glycol, no ongoing corrosion treatment is required. The cost of aqua ammonia is a fraction of Ethelene Glycol.

The Chiller

The chiller is a high-efficient, Vahterus sealed plate and shell which operates at very close approach temperatures to keep the suction pressure and efficiency at the highest possible levels. With an inspection port, it will never have to be disassembled for inspection as a shell and tube would require and it does not have gaskets requiring replacing such as a plate and frame would require. The floating plate stack is constructed like an accordion and is not affected by freezing, offering a significant advantage. When combined with aqua ammonia, long term corrosion poses much less of a problem in comparison to traditional chillers. Being smaller than a half an oil drum means that space is not an issue. Best of all, the refrigerant charge is less than 50 pounds so in the unlikely event that the chiller ever leaked the entire ammonia charge into the secondary side, it would just increase the aqua-ammonia concentration by less than ¼%, which would not require any expensive remediation whatsoever.

The Pumps

The low viscosity of the aqua ammonia combined with a low chiller pressure drop and the reverse return header design all translates into a secondary pump with a very small 3 horsepower motor. This alone will result in approximately 5000 less kilowatts of energy being consumed per month in comparison to a traditional system.

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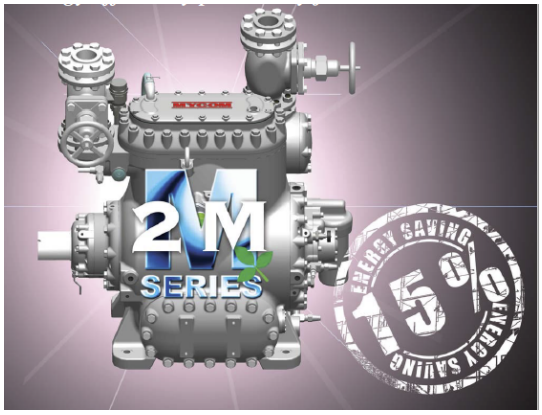
The Condensers

The system uses close approach fluid cooled plate style condensers that are mounted within feet of the compressors. This results in many advantages. The refrigerant charge is less than 1/10th of an evaporative condenser. The short piping run reduces the ammonia piping by 90% and the all welded construction eliminates leaks. The close approach fluid cooled condenser serves a double duty in that it provides 100% energy recovery with no need for a dedicated heat recovery condenser. Condensing temperatures can be maintained at 76°F while providing fluid temperatures of 70°F to heat the curling club ice house instead of fossil fuels.



The Compressors

The compressors are high-efficient Mycom 2M, which are the most efficient in the refrigeration industry. When combined with the close approach chillers and condensers, the result is phenomenal energy efficiency in comparison with any system used today. Operating at a low speed of 700 RPM with the very favorable compression ratios provided by the high-efficient condensers and evaporators, the compressors will provide many years of maintenance free service.

Split Refrigeration Header Design

The split refrigeration header design is one where there are two independent refrigeration systems connected to a common brine system rather than a typical common single system. This configuration offers some significant advantages. The split design has two chillers, two condensers, two compressors, and two pumps, which reduces the ammonia charge to half in each system plus provides 100% redundancy if there is a failure of any of the components. The condensers act as 100% energy recovery heat exchangers which can be used throughout the facility. The split header results in the system not having the mandatory staffing requirements of a common header system. There are very short all welded piping runs between the chiller, compressors, and condensers which minimizes any chance of piping leaks.

Heat Recovery

The Munters Desiccant Dehumidifier also functions as the ice house heating system through the harvesting of waste heat from the ice plant. When there is an opportunity to use low grade heat, an ammonia system operating at low condensing temperatures is far more efficient than any other refrigeration system used in the industry today. A curling club provides an ideal opportunity to use low grade heat for keeping the icehouse warm and comfortable for the curlers. The refrigeration system can operate at a very efficient 75°F condensing temperature, while providing a heating fluid of 72°F and a supply air temperature to the curling club of 65°F.

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Improved System Safety

In addition to the drastically reduced refrigerant charge and the split system design, there are several safety features not typically used in the past. Rather than having an open balance tank venting into the room, the system utilizes a pressurization tank which maintains a very small 3 psi pressure on the inlet of the pump. The secondary side of the system is protected with pressure relief valves so in the unlikely event of an over pressurization on either the primary or secondary sides the pressure is safely relieved away from operator or public exposure.

MYCOM 2-M COMPRESSOR PERFORMANCE	
REFRIGERANT	AMMONIA
CAPACITY	32.1 TONS
POWER	24.4 HP
SPEED	700 RPM
CONDENSING TEMP.	75.0 F
EVAPORATIVE TEMP.	18.0 F
REFRIGERATION COP	6.20
HEATING COP	7.17
TOTAL COP	13.4
HEATING CAPACITY	445,000 BTU's /Hr

Improved System Performance

The total system performance is realized at the design stage through optimizing the balance of the components into a harmonized system that is extremely efficient. When the chiller and condenser are selected for very close approach temperatures and combined with a slow operating Mycom M compressor, the refrigeration Coefficient of Performance (COP) is elevated to a phenomenal 6.2 (one watt of electricity consumed to do 6.2 watts of refrigeration). This is double the electrical efficiency of systems of 10 years ago and 50% better than leading CO_2 and synthetic refrigeration systems. When the low grade heat is used to warm the ice house the total COP increases to 13.4.

The outcome is a system that makes great ice with an exceptional level of electrical efficiency, thermal efficiency, reliability, redundancy, and the highest level of safety obtainable.

Facility Manager, Bruce Renwick, standing on his new sheet ice says that he is more than excited to have a plant that is using cutting edge technologies and a super-green brine not used in North America before. The curlers are loving the ice and the sheets are booked solid through to spring.

Accent Refrigeration Engineering specializes in the design of ultra-high efficient refrigeration systems, which they have deployed around the world for three decades.

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