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Cold and Calculated

Canadian grocery chain creates cold storage facility with zero global warming impact



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The warehouse holds nearly
600 varieties of fruits and vegetables

Keeping a 240,000-square-foot warehouse chilly without depleting the ozone layer or warming the planet may sound like a tall order, but Metro Inc. isn't sweating it.

Rapid growth can be a mixed blessing for an organization that takes its environmental responsibilities seriously, but growing pains aren't stopping Metro Inc. from staying the course. The company has been working continuously to improve its environmental record since 1998, most recently in the expansion of its main cold storage distribution warehouse.

With annual sales exceeding C\$11 billion and more than 65,000 employees, Montreal-based Metro Inc. is a leader in the food and pharmaceutical sectors in Québec and Ontario, where it operates a network of more than 600 food stores and over 250 drugstores.

As Metro's steadily increasing retail operations made it necessary to expand its primary facility for storing cold food and dairy products, the company considered the upgrade to an efficient and safe refrigeration system just as important as meeting its capacity needs. The end result was a win-win-win solution that also enabled significant savings of both capital and ongoing operational costs.

Balancing efficiency, safety and responsibility

To meet the diverse challenges of the expansion, Metro reached out to CIMCO, an international leader in industrial refrigeration, food and beverage cold storage; and Dessau, one of Canada's largest engineering and construction firms.

Metro takes its duty to respect and protect the environment very seriously, performing annual environmental audits of all their Québec and Ontario warehouses. With that in mind, the designers wanted to make sure this facility would be able to meet or exceed Metro's requirements for years to come.

It was clear from the outset that hydrofluorocarbon (HFC) refrigerants, known for their high global warming potential (GWP), would be out of the question. Instead, the project team developed a design incorporating a dual-temperature, low-charge ammonia package refrigeration system.

Natural ammonia is a non-ozone depleting refrigerant with zero global warming impact. Low-charge ammonia systems like the one applied for Metro are growing in popularity for large-capacity cooling applications in the 75–750 kW range. This is partly because of their efficiency, but also because the low ammonia refrigerant charge improves safety and reduces certification costs. Safety is further enhanced by completely isolating the ammonia from the warehouse. Only a secondary refrigerant—cooled CO₂ brine—is pumped into the cold storage space.

To maximize part-load efficiency and keep costs to a minimum, the team also made it a priority to find an efficient compressor system that would eliminate the need for costly variable frequency drives.



Saving energy — and operational costs

Another key benefit of the system is the ability of its single-screw slide valves to ensure optimum part-load performance, matching any fluctuations in refrigeration load. This combination eliminates the need for expensive inverter drives and their inherent electrical issues, improving part-load performance while saving energy and money.

In the case of the Metro project, dual-slide valve efficiency avoided C\$100,000 of capital cost for variable frequency drives. With an amount of ammonia of about 0.12 kg/kW, the secondary circuit met another of Metro's crucial requirements: to minimize the total amount of ammonia used on-site.

Optimized for performance

Fine-tuning the function of the entire unit are microprocessors with process temperature controls. These controls are designed to regulate starting, stopping and capacity control.

Combined with the dual-slide design on the screw compressors, this setup allows the system to function in a range of 20 to 100 percent of flow while continuously operating at the ideal compression ratio throughout the part-load range. This allows the compressor to match the system flow requirements to make cooling as low-cost and efficient as possible, operating at an estimated 15 percent higher efficiency than comparable technologies. ☼

The new Metro C\$50 million produce and dairy products distribution center

VSS 601 refrigeration compressor unit



