Hypermarket achieves efficiency goals with digital modulation

Application

With a total sales area of approximately 55,000 square feet, this new hypermarket has installed three refrigeration racks for food quality and preservation. Two of these racks are indirect expansion systems utilizing Copeland® Discus Digital™ compressors, CPC Einstein™ electronic controllers and Emerson® electronic expansion valves. During a two-week testing period, the refrigeration system was operated with and without digital modulating to measure the impact on operating costs and environmental sustainability.

Customer

Large supermarket in Brazil

Challenge

Reducing energy costs while preserving perishable product integrity is an overriding priority. Typically, the cost to operate refrigeration equipment consumes 65% of a supermarket's total electricity usage. The imperative to manage the cold chain in order to increase food cooling temperature stability can also reduce energy, operating and maintenance costs. Among the keys to achieving these goals are reducing the number of compressor cycle counts as well as tightening suction pressure and temperature variabilities.

"In light of the results obtained in this facility, we are planning to transition to the use of Copeland digital compressors in both new projects and in existing store upgrades. We have concluded that Emerson's digital modulation significantly increases temperature stability, reduces both pressure and temperature variation, and leads directly to energy savings and reduced maintenance costs."

Industrial Sales Director
Plotter & Racks

EMERSON
Climate Technologies

Solution

Working in conjunction with Plotter & Racks, the OEM who designed the installation, Emerson Climate engineers specified a solution to provide the lowest operational cost with the highest system reliability. The Copeland Discus Digital semi-hermetic compressor features an infinitely adjustable 10% – 100% capacity modulation for temperature control without the need for frequency inverters. The modulation system allows the compressor to adapt its output to meet varying demand throughout the day, thereby making the equipment more efficient and allowing greater temperature precision while reducing the system's operating costs. A precision response electronic expansion valve ensures system accuracy by controlling the expansion of coolant at the heat exchanger's inlet. An electronic controller manages the store's energy usage systems by turning off non-critical loads during peak consumption periods, when electric rates are higher.

Result

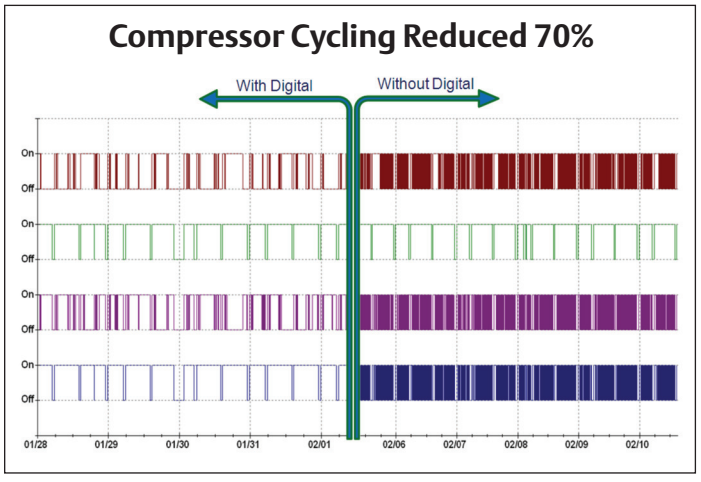
In-store testing of digital and conventional compressor modulation found that the Discus Digital compressor provided an:

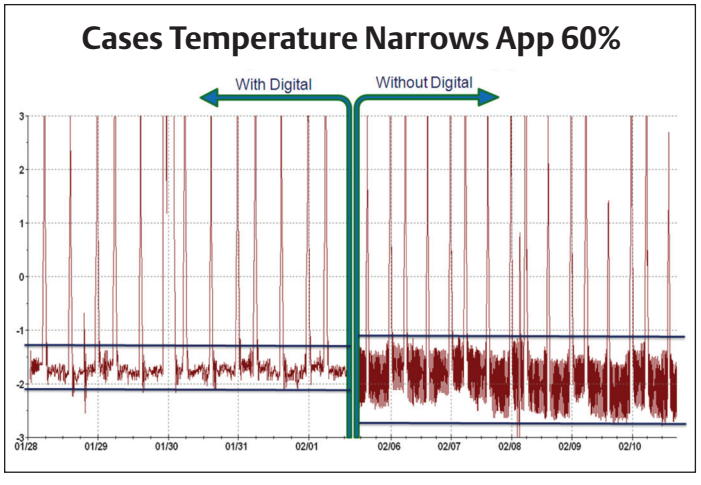
- Estimated annual energy savings of more than US$ 9,000
- Annual carbon footprint reduction of approximately 216 tons of carbon dioxide

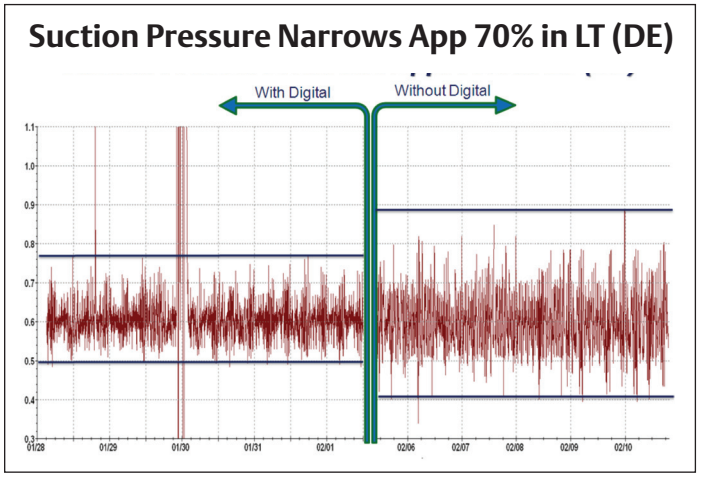
These results were achieved through:

- 70% reduction in compressor cycling
- 70% reduction in suction pressure variability (compared to direct expansion systems)
- 60% reduction in temperature variability
- 51% reduction in coolant temperature variability

Specifically, a 70% reduction in cycling is extending expected compressor life, minimizing service calls and reducing inrush current to decrease energy costs. Narrowing the suction pressure range by 70% has reduced case and cold storage temperature fluctuations, ensuring the freshest possible perishable products. And, due to reduced over/under shooting of target case temperatures, the end user was able to raise the suction pressure set point and improve overall system efficiency.







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