National Grocery Chain Makes Transition to Transcritical Refrigeration

Phoenix-based grocery chain deploys its first CO₂ transcritical booster system in Atlanta store

Emerson Climate Technologies equipment portfolio

The pilot CO₂ transcritical booster system designed for Sprouts’ Atlanta store utilizes multiple Emerson Climate Technologies components, including:

1. Copeland Scroll Z0 compressors — for low-temperature refrigeration requirements (freezers)
2. Copeland semi-hermetic transcritical CO₂ compressors — for medium-temperature refrigeration requirements (dairy, produce and meat cases); includes variable frequency drives to prevent the compressors from cycling on and off too frequently
3. CoreSense™ technology for Copeland compressors — advanced compressor diagnostics, protection and communications technology that allows technicians to make faster, more accurate decisions, resulting in improved compressor performance and reliability; present on all store compressors
4. E2 Facility Management System — provides complete CO₂ transcritical booster system optimization and facility-wide energy management
5. High-pressure CO₂ controller — optimizes high side pressures and liquid quality to the cases
6. XM Series case controls (pulse-width modulated) — integrates with the E2 system to maximize operating efficiencies through tighter temperature controls; present on nearly 50 cases

Discharge air controller (not shown) — operates in unison with the E2 system and is capable of controlling heat and cool stages, fans, dehumidification devices and economizers using on-board I/O

Transcritical CO₂ booster system
**Going Green and Keeping It Fresh**

When you’re a grocery chain focusing on selling fresh foods, fresh is the fundamental ingredient. That means your refrigeration system design has to be—above all else—reliable. 

Like many food retailers, Sprouts has historically employed more traditional refrigeration systems based on common hydrofluorocarbon (HFC) refrigerants. These HFC systems operate with what’s traditionally seen as acceptable temperatures and pressures. CO₂’s low critical point temperature and high operating pressure (around 1,500 psig) are characteristics not found in traditional HFC-based refrigeration. These are the primary reasons for the reluctance to move toward CO₂. But, with advances in system technology and architecture, CO₂ can be a game changer for retailers seeking to improve energy efficiencies, achieve sustainability targets and cross the finish line on regulatory compliance.

Changing their refrigeration philosophy and moving to a CO₂ transcritical system architecture was a giant step for Sprouts, especially for this store in the hot, humid climate of Atlanta. To pull this off, they turned to OEM partner Hillphoenix, whom the company partnered with to earn an EPA GreenChill platinum certification in 2011. And Hillphoenix, seeing the challenge presented by installing a CO₂ transcritical booster system in a warm climate, turned to Emerson Climate Technologies.

**Transcritical Technology in Action**

Emerson Climate Technologies, Hillphoenix and Sprouts all shared the same goal: show the industry it’s possible to operate an efficient refrigeration system in higher ambient temperatures using CO₂ exclusively. A key enabling feature of the CO₂ transcritical booster system is an adiabatic condenser, which was designed to operate in high ambient temperatures. Adiabatic condenser cooling is the process of spraying water into the air supply of an air-cooled condenser to pre-cool the air and improve refrigeration efficiency. The goal of this condenser technology is to keep the CO₂ below its critical point, thus maximizing system efficiencies. Hillphoenix’s rack refrigeration system featured four Copeland™ semi-hermetic transcritical CO₂ compressors and three Copeland Scroll™ Z0 compressors. Both models were designed for CO₂’s high-pressure requirements and benefit from its thermal properties. Emerson’s E2 Facility Management System was installed to oversee the CO₂ transcritical booster system, manage nearly 50 electronic case control units and optimize the facility’s overall energy management profile. The E2 system helps improve performance in multiple ways:

1) Controls the variable speed of the fans on the adiabatic condenser in response to operating conditions
2) Optimizes compressor coefficient of performance by regulating system discharge pressures via Emerson’s high-pressure CO₂ controller
3) Provides complete oil management control of all CO₂ refrigeration compressors
4) Communicates with and captures information from individual case control units
5) Provides complete control of building HVAC and refrigeration systems, and supports the retailer’s energy and maintenance reduction strategies

The E2 system also allows Sprouts operators to run diagnostics, monitor the system remotely through Emerson’s ProAct™ Service Center and, if necessary, shut down the system components before failure.

The condenser manages both low- and medium-temperature refrigeration requirements on the same system using only CO₂ as the refrigerant, another unique aspect to the transcritical booster system. Running both requirements from the same condenser enhances the efficiency of the system across the store.

**Easing Concerns**

CO₂ transcritical booster systems have been used in Europe for nearly a decade. Adoption by the U.S. refrigeration industry has been slower due to a general apprehension about new (and, to many, unknown) technology. It’s understandable why state-side end users are hesitant to switch to CO₂ transcritical booster systems. Concerns over operating pressures, maintenance levels and energy have prompted careful and steady evaluations to understand the true cost of ownership for their enterprises. Emerson technology helped ease those concerns for Sprouts. Their Atlanta-area store is operating efficiently and effectively on the transcritical system.