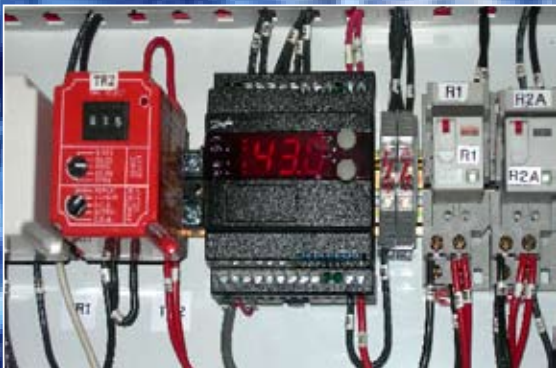


DESIGN/BUILD FIRM MIXES UP



The Danfoss EKC331T, electronic controller, loads and unloads the reciprocating compressor and allows the cranberry juice to be maintained at a 1° temperature differential.

“We couldn’t afford to sacrifice anything. Cranberry juice is like red gold—a drum is worth thousands of dollars,” said Tom DeThomas, director of engineering for Clement Pappas, a leading producer of fruit juice, fruit drinks and cranberry sauce, as he explained why the facility installed a new process chiller: “Precise temperature control is essential to production, so we needed to upgrade our 1930s chilling technology to guarantee reliability. We also knew our facility was consuming too much energy.”

EFFICIENT SOLUTION FOR JUICE MAKER

Clement Pappas, a large producer of bottled juice and cranberry sauce, is located in Seabrook in southern New Jersey. The facility, a 400,000-plus square-foot plant, is not only a processing plant, but also a cold storage and bottling facility that produces millions of gallons of juice per year.

Time to convert traditional system

When Clement Pappas decided to upgrade their existing facility, they turned to Devault Refrigeration, a Design/Build contractor located in Colmar, Pennsylvania. The plant was a pre-World War II vegetable processing facility that was converted into a juice and cranberry sauce processing facility and cold storage warehouse.

Until recently, the operation used an ammonia system with three Frick HDI reciprocating compressors and cooled salt brine solution to remove heat from the processing plant. There were three heat exchangers between the product and the refrigerant – and three cooling mediums - R-717 to a salt-brine solution, and the salt-brine solution to propylene glycol, and the propylene glycol to the product. The brine solution was piped underground to the processing plant. The evaporators were located in the processing and storage rooms.

This was not an optimum control strategy for several reasons. Fifty-five hundred pounds of ammonia were used to cool 30,000 gallons of brine, which cooled the glycol, and glycol then cooled the cranberry juice. Clement Pappas wanted to eliminate ammonia from the system because the plant is in a residential area and an ammonia leak can be dangerous to employees or surrounding neighbors. Also the system was highly inefficient. Prior to the upgrade, the system was consuming approximately 250,000 kWh per month.



Tom DeThomas of Clement Pappas stands in front on the production line where cranberry juice is produced.



The mobile skid package system was delivered to Clement Pappas on a flat bed truck. The system was designed so it could be moved if the facility is expanded or relocated.

“We had some very interesting challenges with this project,” explains Bil Sauer of Devault. “Juice plants are unique because shelf-life considerations, design changes and many of the parameters are variable.” The customer runs three lines, and in 8 hours they can produce 50 different labels and 15 different formulas of juice or cranberry sauce. Accurate temperature control is paramount in processing juices. The juice must be held at 34°F. The product is batched, then it is pasteurized and bottled. Pasteurization is a critical control point where the product needs to be heated, filled and cooled immediately. The bottle temperature must be brought down from 182°F to 100°F very quickly in order to preserve juice quality.



Design/build Firm Drums Up Unique Solution

Bil Sauer, sales engineer and project manager at Devault Refrigeration, a UGI company that has provided a full range of HVAC and refrigeration solutions for over 100 years, worked with DeThomas and his engineering staff to design a solution for replacing the system with a new propylene glycol, R-22, process chiller.

Devault designed and built a customized package chiller on a skid that contained a Frick screw compressor and a Vilter reciprocating compressor. An evaporative condenser was located remotely, and a plate-frame heat exchanger was used to chill the cranberry juice to precise temperature with propylene glycol. By eliminating the brine and its associated heat exchanger, the system has less pumping loss and less leak potential, and less energy is consumed. “This system is basically a mini-engine room on skid. It can be moved relatively easily if the customer expands his operation or moves location,” Sauer points out.

Under Control

Because it is batch processing, the raw juice processing plant can be idle or it can be producing at a rate of 35gpm (gallons per minute). “We essentially used two different manufacturers’ compressors to handle the load,” explains Sauer. In order to design the system within the budget specifications, a screw and a reciprocating compressor were both used on the package. The Frick screw compressor is the lead compressor on the job. When the glycol pump turns on, it activates the screw compressor. If the screw compressor is in anti-recycle delay mode and unavailable to turn on, or if additional cooling capacity is required to achieve the target temperature, a Danfoss EKC331T electronic controller will signal the Vilter reciprocating compressor to turn on.

Tom DeThomas, corporate engineer of Clement Pappas; Bil Sauer, project engineer of Devault Refrigeration; Bill Carrington, installation technician for Devault; and Brian Davis, vice president of Industrial Refrigeration for Danfoss, in front of the skid package system.

The EKC331T will then load and unload the reciprocating compressor in steps of 100%, 75%, 50%, and 25%.

A Danfoss AKC21W temperature sensor monitors the glycol's leaving temperature to determine when the compressors need to run. "The system was designed with no flywheel effect, which means the entire volume of glycol is turned over in 8 minutes," remarks Sauer. "There is very little reserve glycol in the system, so tight refrigerant control is crucial. There was only one other compressor sequencing with the screw, and it was a reciprocating—a microprocessor sequencing panel did not fit within our project budget, so the Danfoss EKC was an ideal solution. For a fraction of the cost, we were able to achieve the same result."

According to Brian Davis, vice president of Danfoss Industrial Refrigeration, this application was ideal for the Danfoss EKC331T. "We were able to provide the link between the screw and the reciprocating compressors to achieve stable control and system efficiency." The controller works harmoniously with the other Danfoss valves and sensors that were also installed on the package.

Smooth Startup

The mobile skid package system was delivered to the Clement Pappas facility on the back of a flatbed trailer and started up on March 22, 2005. Bill Carrington and Tim Schrauger were part of the start-up team who were onsite when the system arrived.

"I can put it on paper, but they're the ones who make it work," says Sauer of his installation and startup team at Devault. This was the first project Devault had done using Danfoss controls, and they were very pleased with the results. "The 'blackbox' (EKC331T) was a very cost-effective solution and it works," says Schrauger. Bill Carrington, who was instrumental in carrying out the

design, commented further that the EKC331T allowed them to maintain a 1° temperature differential on the product with the reciprocating compressor – a critical factor since the application requires such precise control.

Dramatic Payback For Business And The Environment

According to DeThomas, once the skid package was started up, Clement Pappas noticed efficiency improvements immediately. "We are using 25% less energy in the processing than with the old reciprocating units that had been in place. The energy cost of cooling the juice was reduced to approximately 1 cent per gallon."

Significant energy reduction is a benefit to both Clement Pappas and the environment. But the ecological impact goes beyond energy consumption. Eliminating the external water-cooled condenser means Clement Pappas was able to reduce water consumption by approximately 20% as a result of the new skid package design. Along with the savings in water consumption is the reduction in waste water purging. "Our disposal of waste-water is reduced by approximately 300 gallons per minute," stated DeThomas.

A Solution That Protects The Red Gold

"We always strive to stay current on the latest technology so we can help solve our customers' unique challenges," said Bill Sauer. "And that's exactly what we were able to do on this project by working with Danfoss. Their controller allowed us to provide a unique control strategy and they provided excellent support during the entire process."

DeThomas was very pleased with results of the project. "Devault was able to design a system that met my budget and our specific needs. I was able to save money with the reciprocating compressor and the controller, but I didn't sacrifice anything in the control processing side," says DeThomas. Since installing the new system, Clement Pappas' overall energy consumption dropped by 25% and they no longer require 5500 pounds of ammonia or 30,000 gallons of salt brine solution. Best of all, the customer has compressor redundancy to protect the red gold! ■

