San Diego County Facility Chooses Danfoss Turbocor Oil-Free Compressor Technology

Exterior of Juvenile Hall campus

Turbocor compressor installation on existing chiller in Juvenile Hall.

"They were having real problems with the existing chillers, both from the standpoint of efficiency and staying on the line." Speaking is Ben Erpelding from the San Diego Regional Energy Office (SDREO). His organization is an independent, public-benefit, non-profit 501(c)(3) corporation that provides objective information, research, analysis, and long-term planning on energy issues for the San Diego region.

The application to which he refers is Juvenile Hall, a complex of three buildings operated by San Diego County totaling approximately 250,000 square feet. A central chiller plant is located in the Juvenile Probation Center Building. As a result of a recent facility upgrade, the existing chiller compressors were replaced with Danfoss Turbocor oil-free centrifugal units, dramatically improving operating efficiency.

Originally a Primary–Secondary Design

The central plant had been constructed in 1998, using a primary–secondary design with a tertiary pump in each building. The chiller plant used two centrifugal chillers, a 450-ton constant-speed unit and a 350-ton variable-speed unit. Erpelding notes, *"They were supposed to be really efficient machines, but were not. Our office was tasked with evaluating the facility and improving performance."*

SDREO performed an energy audit on the facility in 2003 and recommended reconfiguring it as an all variable-speed system, with VFDs on the second chiller as well as on condenser pumps. They suggested converting the entire campus to an all variable-speed primary/booster chilled-water design to be controlled by Hartmann demand-based controls. But when conversion was completed, Erpelding notes, other problems appeared. *"The chillers' performance was terrible," says Erpelding. "They were operating in the 0.77 to 1.3 kW/ton range with the VFDs."*

Recommended Compressor Replacement

Tom Shaw from Alpha Mechanical reviewed the situation and recommended replacing the 300-ton existing chiller's compressor with three 90-ton Turbocor oil-free centrifugal machines, Model TT300. He and Erpelding convinced the county that this solution would improve plant efficiency dramatically, especially at part load.

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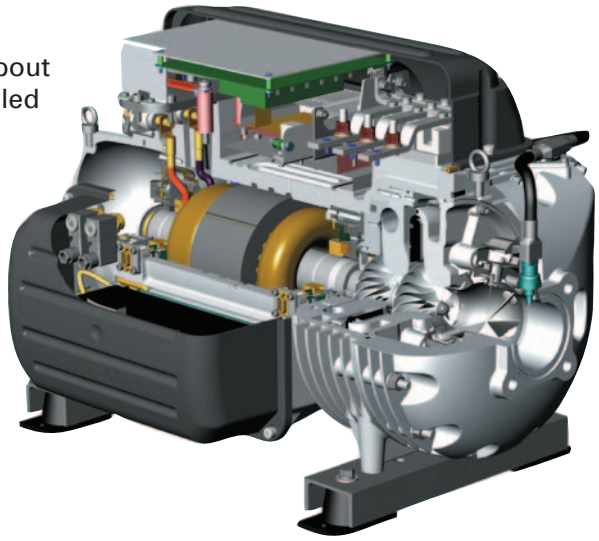
The retrofit of the first unit was completed in 2004 and the facility immediately showed a dramatic improvement in efficiency. Following this upgrade, Shaw and SDREO recommended completing the project by installing three 150-ton Turbocor Model TT400 compressors on the second 450-ton unit. Erpelding did the calculations on potential energy savings and projected chiller loads that showed the payback would be short. This final upgrade was completed in October, 2005. With this second machine, the operating savings have increased.

Oil-Free Compressors Show Advantages

Tom Shaw from Alpha Mechanical is also enthusiastic about the oil-free centrifugal chiller concept. His firm has installed similar machines in other facilities, and he has been impressed with the operating efficiency and reliability of the technology. According to Shaw, the conversion of each chiller took about two weeks, and the work was done by good mechanical plant technicians with experience working on chillers, piping, and controls.



New Turbocor Oil-Free Compressor technology has high efficiency, low acoustic signature.

Could be Attractive for Many Applications

According to both Erpelding and Shaw, there are many chiller applications out there that would benefit from this type of conversion. Erpelding points out, *"These solutions save energy, eliminate oil problems, and are very quiet. They are light in weight, use environmentally acceptable R-134a, and the multiple compressors improve system redundancy. Another advantage is their low amps at startup. We think they are particularly attractive in applications with a lot of part-load hours."*

Part-Load Performance Especially Impressive

Erpelding notes that the calculated payback from the plant improvement project is less than four years, with annual savings of $109,000. He stresses that although the new compressor out-performs the previous unit across the board, it's at load levels less than 50% where the new units really shine.

Here, chiller performance ranges from 0.2 to 0.4 kW/ton, compared with rates of 0.6 kW/ton to as high as 1.8 kW/ton at the lowest load levels for the older units. *"This is important," he says, "because in so many installations the chillers are operating most of the year and most of the day at part-load, often levels of 20% to 40% of the design load."*

He adds, *"All of these benefits came into play at Juvenile Hall. It's an ideal installation to show the benefits of this oil-free compressor technology. Based on our experiences elsewhere, we were comfortable recommending the oil-free centrifugal machines. As a result of this chiller replacement, the performance of the plant has been drastically improved, and here we have the numbers to show it."*

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