Pasadena Corporate Center

Pasadena, California

Pasadena Corporate Center Chooses Direct-Fired Absorption

Advanced absorption chillers have replaced 30-year-old machines at a Pasadena office complex, improving efficiency and reliability at all load levels. In the process, the chiller replacement also extends the life of an existing centrifugal chiller plant in an adjacent building. A major attribute of the new chillers is their ability to efficiently deliver chilled water at temperatures down to 40 F and at part-load levels down to 20 percent of capacity.

"Economy, flexibility, reliability – that's what we wanted." Armand Alvarado, chief engineer at the Corporate Center Pasadena, describes the goals of a recent air conditioning plant project involving two of the four buildings in the facility. The building owner, Aetna Life Insurance Company, is engaged in a complete renovation of the complex that was built in stages between 1965 and 1980.

The buildings are identified by their addresses in a prime business district in Pasadena: South Lake Avenue. In reviewing the 251 South Lake building during the acquisition process, the owner had identified a need for replacement chillers. This building dates to 1970 and was cooled by chilled water from the original chillers, steam-fired absorption machines. Because the building was in a general renovation program, the time seemed appropriate to replace the chillers.

Building renovation opened the opportunity to compare new chiller options.

The owners studied options for replacement chillers. Deeply involved in this evaluation was Jon Haviland, director of engineering for Marx/Okubo Associates Ltd., a consulting firm that represented the owners in the plans for renovation of the building, including the HVAC systems. Haviland indicates that a wide range of chiller plant options was considered. The options included engine-driven chillers, ice storage and electric machines.

Ultimately the decision was made to install direct-fired absorption chillers. Haviland says, "The owners thought that absorption made the most sense for this building and offered an additional opportunity." One of the adjacent buildings was built in 1980 and had been served by three 225-ton single-stage electric centrifugal machines. These machines were still in relatively good condition, but their operating costs were somewhat higher than those the owner expected with the new absorption equipment. This was, in part, because of the electric demand charge created by operation of the chillers at peak hours.

According to Haviland, the team began studying the concept of tying the chilled water systems for the two buildings together, thereby allowing the adjacent building to benefit from the economies of the absorption system. Thus the idea was advanced to size the 251 building chillers somewhat larger than the requirement for that building alone. The 251 building has a wide range in chilled water demand, from a peak of 700 tons on hot workday summer afternoons down to less than 70 tons during spring and fall evenings, when only small portions of the building are in use. The final decision was to install two 440-ton Trane Horizon® direct-fired absorption chillers.

By installing 880 tons of absorption capacity in the 251 building, and by coupling the chilled water systems of both buildings, the owners could reduce total operating costs, improve reliability and react to changing energy prices. Further, this interconnection would reduce the load and runtime on the centrifugal machines in the adjacent building, thereby extending their lives.

Another individual involved in the Corporate Center project was David Ellner from Engineered Automation Systems, Incorporated. His firm did much of the detailed mechanical-electrical-plumbing engineering on

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The buildings are piped together, allowing the adjacent building to benefit from the new absorption system.

the project. Ellner notes that previously the normal summer load in the 225 building could be carried by two of the centrifugal machines. Under the new arrangement, this load can be carried by one machine. Ellner notes, "This increases system redundancy and allows the one operating centrifugal chiller to operate in the best part of its range. Use of the absorption chillers also reduces the electric demand charge for the facility." Energy expenses are expected to decline as well. Ellner notes, "As a result of these upgrades, this should be one of the most energy efficient buildings in Southern California."

Another aspect of the project is that the Trane Horizon absorption machine can deliver chilled water at temperatures down to 40 F — significantly lower than the earlier generation absorption equipment and lower than the optimum temperatures from the centrifugal plant in the other building. This lower chilled water temperature improves the effectiveness of the existing airside equipment in both buildings.

The design challenges to the project included integrating the two central plants and redesigning the system to use a shared building automation system. This common system not only simplifies control but also allows shared dispatch of the chillers for energy cost optimization.

In addition to the new absorption chillers in the 251 building, a 110-ton electric screw compressor "pony" chiller was installed to meet cooling requirements during the minimum use hours. The unit selected for this application was a Trane Model RTWA. This unit was installed in the penthouse location near the absorption units.

Office spaces in the 251 building are being renovated. Part of the renovation involves updating the air distribution system. The original low-

pressure air distribution system is being converted from a constant volume to a variable air volume (VAV) system. The new system includes digitally controlled air volume diffusers and improved building comfort monitoring and control. The availability of 40 F water from the new chillers makes this system more responsive.

Because the Horizon chillers include combustion sources, system designers needed to be aware of the ultra-low nitrogen oxide (NO_x)

emission requirements of the South Coast Air Quality Management District (SCAQMD). The Trane chillers were able to meet the required NO_x emission limit of 20 ppm. Haviland notes that the Southern California Gas Company served as the company's agent in securing the necessary operating permits from the SCAQMD. The company had also participated in the feasibility and played an active role in the entire project. Haviland notes, "They are very supportive of gas cooling and were an important part of this project."

Brett Gaviglio, the sales engineer on the project from Trane's Los Angeles commercial sales office, notes that the original building was designed for absorption chillers. Therefore no major structural changes were needed. "That was an important consideration," he notes. The original chillers were lifted out of their penthouse location by crane and the new chillers installed at the same location.

The cooling towers were sized for absorption chillers, so only minimum modifications were necessary. The principal changes were to refit the tower fans with high-efficiency motors and variable-speed drives.

The climate in Pasadena is mild, so building heating requirements are now met with a group of packaged boilers. In the winter months, these boilers are primarily used for warming up the building in the morning.

Gaviglio indicates that the new absorption chillers are a key element in this strategy because of their efficiency at both full and part-load conditions. According to building engineer Alvarado, "With the absorbers on line, we expect our annual energy costs to drop dramatically most months of the year."

Additionally, according to Haviland, the overall objective of the project involving the two buildings was to give the building engineer the opportunity to run the buildings in an optimized condition, whether the chilled water systems were coupled or running separately. "We wanted a system that provided flexibility with changing conditions of load, weather and economics. We were fortunate to be working with an owner that took into consideration life-cycle costs, not just first costs. Actually, the savings from replacing the older chillers and interconnecting the two chiller plants show a reasonable payback."

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