
CASE STUDY

Two plus two equals one efficient, dependable and quiet chiller for Chicago luxury high-rise

As facility manager of Harbor Point Condominiums, a luxury high-rise on Chicago's Gold Coast, Bill Herring is responsible for providing smooth, uninterrupted service to over 1,300 residents. When the building's 30-year-old centrifugal chiller became too expensive to maintain, he had one specific requirement for its replacement: a machine that would operate quietly and dependably under low loads. The noise level from the old chiller had become unacceptable. But energy efficiency and redundancy were also top of the list, and at first he assumed he could only achieve these somewhat diverse requirements by installing two chillers, with one primarily for backup in case the other failed.

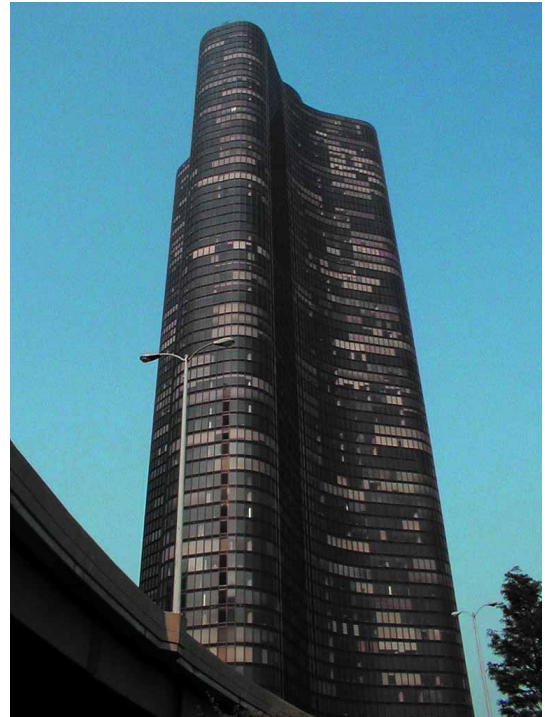
Working with representatives of McGuire Engineering and Thermosystems, two Chicago firms, Herring learned that a McQuay dual compressor water-cooled chiller would provide the low load operation and redundancy he required. And now, after two cooling seasons, he just needs to look at the electric bills for a reading on energy efficiency. The 575-ton dual centrifugal chiller from McQuay has exceeded the 30% savings on electric usage estimated by the engineering firms. "I've been pleasantly surprised ever since the new chiller was installed," said Herring, "with how the machine meets all three criteria,

and I'm especially pleased with our energy savings."

Chiller designed for 60 percent of capacity on a single operating compressor

Herring knows from personal experience why he needed a low load machine. "I live on the concourse level," he said. "Even though I was two floors above it, I could tell when the old machine went to low loads; it rattled and vibrated and the condenser tubes were shaken up so badly we were concerned about losing them. We were lucky we didn't have a catastrophic failure, because we were due anytime. The new machine is unbelievably quiet and smooth—it's a pleasure to work in the mechanical room—and it provides the low load operation we need, particularly for the spring and fall."

To achieve efficient low load operation, the McQuay dual compressor centrifugal chiller utilizes the same evaporator and condenser heat transfer surface as a single compressor chiller; but instead of one, it is equipped with two efficient compressors. The two compressors can be individually balanced for optimum operation at 60 percent of capacity with one



compressor fully loaded, providing true full load efficiency at part load operation.

The ARI-certified integrated part load value (IPLV) for the dual centrifugal chiller with variable frequency drive is 0.3 kW per ton, compared to .6 kW per ton for full load efficiency. One compressor of the chiller operates with the full heat transfer surface of the entire unit. For example, a 500-ton (1,750 kW) compressor on a 1,000-ton (3,500 kW) chiller utilizes 1,000 tons (3,500 kW) of evaporator and condenser surface. This increases its capacity and also results in high efficiency.



Redundancy carries the day—and the load

Although the building's 742 units are individually heated and cooled with fan coil units, Herring is responsible for cooling the commercial space: 55 floors of corridors, plus a concourse, lobby, shops and party rooms. That's over 235,000 square feet in all, and Herring couldn't afford to lose service due to a maintenance shutdown or failure. Installing a dual compressor chiller not only saved significantly in installed costs, it also gave him the backup he needed when a bearing had to be unexpectedly replaced. "This happened in July, and again I was surprised that one compressor could do what it did. I was able to keep the corridors and rooms comfortable and dry, and I had no complaints. I never would have tested this in July, but I was more than happy with the results."

Herring was able to maintain normal operating conditions because the chiller is equipped with two compressors; two lubrication systems, two control systems and two starters, all connected to a common evaporator and condenser. Should a component fail, it can be removed or repaired while the second compressor continues to operate, providing 60 percent of the chiller design capacity available.

Additional redundancy includes the design of the compressor motor. The compressor motor is isolated from the main refrigerant flow circuit so that, in the unlikely event of a motor burnout, the chiller

refrigerant charge will not be contaminated. Any contaminants generated by a motor fault will not pass into the main refrigerant circuit. Moisture, acid and/or carbon particles would be automatically trapped within the dedicated coolant feed and exit lines.

The chiller's positive pressure design offers greater sustainable performance over its life cycle. Positive pressure eliminates the intrusion of noncondensable gases that can "rob" efficiency. These foreign gases compete with refrigerant for heat exchanger surface and can reduce efficiency by as much as 14 percent at full load. Environmentally friendly HFC-134a refrigerant operates above atmospheric pressure in the entire refrigerant circuit.

Though the chiller performance has exceeded Herring's expectations over the past two years, he is still most impressed with the day it was delivered and installed. The compact HFC-134a compressor design and shell configuration, plus the chiller's bolt-together construction, simplify delivery and assembly. "The mechanical room was designed for a bigger, clunkier chiller, but we had no trouble getting the new one in," said Herring. "In fact, the millwrights



didn't have to back up once, even though they had to turn several corners and negotiate their way around the boilers. It was fascinating to watch."

From his 10 years working in the building, Herring knows first-hand the importance of keeping equipment up and running. "It's a high maintenance building, but that's because of our extensive preventive maintenance program" he said. "We have 60 McQuay air handlers, most of which are still in good condition even though they are over 25 years old. Plus we do our own boiler waterside and all the plumbing and electrical maintenance in the units. With a crew of five, we're busy all the time."

And now with a new chiller installed, Herring expects that routine, scheduled maintenance will keep the chiller up and running to his expectations. The machine's redundancy, plus its quiet operation, allow him to sleep much better at night.