SMARDT Chiller Installed at University Medical Park

Case Study: Office Building

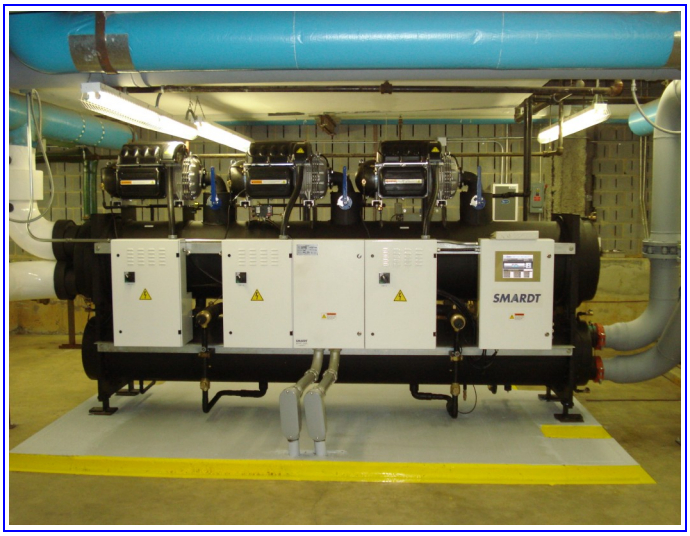
Benefits of SMARDT:

- Reduced Operating Costs
- Built In Redundancy
- Improved Energy Efficiency
- Continuous Monitoring
- Improved Sustainability
- Improved Serviceability
- Reduced Maintenance Costs
- Reduced Sound Levels

Location: University Medical Park, Charlotte, NC

University Medical Park is comprised of five medical office buildings. Affiliated with the Carolinas Medical Center, it is located adjacent to The University Hospital at the intersection of North Tryon Street and WT Harris Boulevard, in Charlotte, North Carolina.

Business Situation: The subject under study is the chilled water plant located in Building 5000 of the Medical Park. Maintaining a suitable environment within the office building was becoming more difficult because of the unreliable nature of the chilled water plant that was comprised of a single, 1991 vintage 250 ton chiller that utilized a rotary screw compressor. On two occasions, the slide valve mechanism in the compressor failed and there were indications that the slide valve would fail again. Having the



chilled water plant fail creates an untenable situation for the occupants of the building. Mechanical air conditioning is required in the building approximately ten months a year, due to local weather conditions. Failure of the chilled water system requires the installation of a rental chiller, and although the rental source is local, the delivery and set-up time causes inconvenience and discomfort to the occupants.

Technical Situation: The chiller's last failure resulted in a rental machine being brought to the site to maintain conditions in the building; the rental unit being on site for 13 days while the compressor was being repaired. The cost of the rental machine and its installation was $14,620. The cost to repair the Carrier screw compressor was in excess of $50,000. During the system repairs, the Lincoln Harris management team began looking for alternatives that would provide their customer with a more reliable system. One possible solution was to replace the single 250 ton screw compressor with three high efficiency centrifugal Turbocor compressors. The Turbocor compressor is one of the most energy efficient compressors on the market today, and its technology represents the most advanced compressor design in the air conditioning industry, by incorporating oil-free magnetic bearings, two stage centrifugal compressors, and a variable frequency drive.

A study of the electrical demand required for the original machine as compared to the Turbocor compressors, revealed that Turbocor presented several distinct advantages. Replacing one large compressor (250 tons) with three smaller compressors (80 tons each) would result in a major reduction in the electrical demand. Preliminary estimates indicated that the electrical savings could be as much as 253,890 kWh per year. Additionally, because the retrofit would reuse the existing heat exchangers, the demolition, installation, and piping costs would be eliminated. Another advantage to using the Turbocor compressor was that having three compressors instead of one, would provide redundancy that had never been available before.

Solution: The Lincoln Harris team, led by Mike Stiene, the Charlotte Division Director of Engineering, began investigating the feasibility of adapting the Turbocor technology to the UMP system. The team visited the Turbocor Plant in Canada in order to better understand its theory and application. After a thorough examination of the compressor and consulting with the Turbocor engineers, Lincoln Harris concluded that using Turbocor compressors was the solution to the problem. The only drawback to installing the compressors was the amount of time required to accomplish the retrofit. After discussing this problem with fellow engineers, Mike decided to visit the SMARDT factory in Canada, since the SMARDT chillers are built only using Turbocor compressors. After an extensive review, the SMARDT chiller was seen to be the best option, since it allowed the change over to be made on a weekend with no interruption in service. The factory would assemble and test the chiller package, and guarantee improved operation and a major reduction in electrical costs.

After presenting the owner with a detailed analysis of the system's options, including a replacement of the existing compressor with a similar item, a system retrofit using Turbocor compressors, or the installation of the SMARDT chiller, the obvious choice was deemed to be the installation of a new SMARDT chiller. This was agreed to by all concerned, the SMARDT chiller was ordered, received on schedule, and lowered into the basement equipment room. As much pre-fabrication as possible was done in order to ensure that the replacement chiller was ready and completed in an expeditious manner, at the close of business on January 19, 2007 work commenced, and on January 22, 2007 a SMARDT factory representative commissioned the new chiller.

The Benefits of using the SMARDT chiller are as follows:

1. **Redundancy.** The vast majority of the time, two compressors will be adequate to handle the cooling load. Having three compressors instead of one, allows for the third compressor to function as a backup, and would only be required during the hottest days of the year.

2. **Energy Efficiency:** The SMARDT chiller will operate with an estimated IPLV (integrated part load valve) of 0.37 ± kW per ton. Based on typical performance data for screw machines similar to the one that was removed, there will be a savings of approximately 253,890 ± kWh per year which translates into a reduction in operating costs of approximately $17,772 per year. At this time, the building does not require operating the chiller on auxiliary power; however, if this does become a requirement, the in-rush current to each Turbocor compressor, will only be 2 amps. If a backup generator becomes necessary, it will be dramatically smaller due to not having an in-rush of current associated with standard compressors.

3. **Continuous Monitoring:** The SMARDT chiller uses a Kiltech control panel featuring a touch screen display and user friendly graphics. The panel controls all three compressors, automatically rotating the lead to maintain equal run-time. Electricity consumption data is maintained and displayed in graphical form, and all data can be easily downloaded for detailed analysis.

4. **Sustainability:** The SMARDT chiller uses environmentally friendly R-134A refrigerant. The Turbocor compressor uses no oil, which means that the heat exchangers will always operate at peak efficiency without having the insulating effect that an oil film produces.

5. **Serviceability:** The compressor in the replaced chiller weighs over 2,000 lbs, requiring heavy rigging equipment for service, while the Turbocor compressors only weigh 265 lbs each. Each compressor has the capability to be isolated from the refrigerant system by means of service valves that are standard equipment on the SMARDT chiller.

6. **Reduced Maintenance Costs:** The Turbocor compressors run on magnetic bearings, essentially floating in a magnetic field. There is no metal-to-metal contact and virtually no vibration. By eliminating vibration, fittings and fasteners do not become loose; refrigerant leaks are not created so repair time is greatly reduced. Since there is no oil, there are no oil filters, pumps, regulators or any of the trappings associated with oil and oil management.

7. **Sound Levels:** Although sound levels were not a major concern in this facility, the SMARDT chiller operates at < 70 dB. The old chiller exceeded the decibel limit with those not using ear protection. This is a pleasant change for operation and maintenance personnel that work in the equipment room.