

April 17, 2001

Michael C. Kearney P.E.
326 Sugar Creek Road
Kirkwood, MO 63122

Subject: Gold Ribbon and Log Book of Time Award

Dear Mr. Kearney:

I am enclosing the La Crosse Area Chapter, 19th entry for the Gold Ribbon and Log Book of Time Award. The La Crosse Area Chapter, 115, is pleased to submit the history of a system, "Modular Chillers." This is a product of a West Salem, WI company, which practices many ASHRAE principles to provide world class cooling.

Thank you,



James M. Ritter, P.E.
Chapter Historian
La Crosse Area Chapter

HISTORY OF A SYSTEM

MODULAR CHILLERS

In the early 1900's the commercial segment of the business industry was interested in a system that could not only provide heating, but also some degree of cooling.

In the 20's and 30's the first experience with the cooling or air conditioning end of the business was through the use of larger sizes of extended surface fin and tube heating elements or coils with cold well water to cool theaters and department stores.

In 1938 a new type of water chiller with a centrifugal compressor was developed. This was the forerunner of today's equipment that combines a centrifugal compressor, condenser and evaporator and is a complete water chiller unit that can provide cooling capacity for the largest air conditioning jobs.

As the demand for air conditioning increased, models in both smaller – 80 to 550 tons and larger (620 to 1290 tons) became available.

Chiller operating data collected and evaluated by engineers' show that most existing centrifugal and screw type chiller installations are at least 30% oversized and that some are as much as 100% oversized. As a result these existing chillers and many others, are operating in the lower half of their capacity range for more than 40% of the time; and for much of the time they are operating in the surge region. Over-sizing results in higher than necessary power and energy consumption per ton of cooling delivered, increased maintenance cost and, ultimately, a shortened chiller operating life.

Modular chillers always operate at their best efficiency, even when for any extended period of time, the demand is below 40% of design capacity. At low loads, some of the module compressors are shut down while only the compressors needed to meet demand continue to run at optimum efficiency.

Modular chillers make an ideal low load, peak load, standby chiller and returns its investment in power cost savings within a very short time. Regardless of the load, modular chillers always operate at its best efficiency.

Other types of requirements demand special application. Research work reported by the medical profession indicates that patient recovery rates after surgery improve considerably when the operating room temperature is lowered from 68°F to 52°F. The lower temperature reduces bacteria growth and slows the body functions, thereby reducing stress on the patient's heart.

One of the problems encountered in the design of this application was supplying condenser water to the dedicated chiller which is located near the operating room. By using one or more 30 ton modular units equipped with condenser water regulating valves (head pressure control), a minimum amount of returned chilled water from the main chiller is diverted to the special purpose chiller condenser water.

The lower chilled water temperature and the size and convenience of the modular chiller made this system work with complete success in applications in Miami, Florida and Columbus, Ohio.

At 57th and Broadway in Midtown New York City stands the Ed Sullivan Theater where David Letterman televises his nightly "Late Show." Obtaining tickets for this performance is a bit of a feat...it sometimes requires standing in line for hours. While waiting outside in the summer heat, the "wanna-be" audience is unaware of the cool treat in store for them if they are lucky enough to get inside the theater. It is always cool inside...60°F or cooler.

Some folks say David Letterman doesn't want to break into a sweat during intense interviews under hot studio lights. The cool air makes the sound crisper and keeps the audience more alert. Crowd reaction is very important in this business and the comedy stays fresh in the cold.

Two 120 ton modular chillers, each comprised of four 30 ton modules, were installed in the Ed Sullivan Theater. They meet the customer's requirement and continue to perform flawlessly. The multiple components in the chiller make it simpler to operate and maintain. The modular design consists of two banks of four chiller modules each. The arrangement fits neatly into the space available without crowding.

The cooling load profile required a wide range of operation at high efficiency. At night, with no audience, no hot lights, and no equipment operating, the cooling load is small. A few hours before the show and during taping of the Late Night Show, the load hits its peak. The modular system must respond quickly and reliably to meet the large increase in demand.

The double redundant two bank system assures that the chiller has the capacity to cool the theater to the exceptional requirements of the performer, and is available on demand. There is one master control for each bank of chillers and a key-operated switch for each compressor in case of control failure.

At about 5 o'clock each week night, the building manager must make sure that the temperature of the Ed Sullivan Theater is pulled down to 50°F before the audience arrives. The modular chiller has never failed to cool things down.

A very good application of modular chillers occurred in La Crosse, W, when a local high school built a sizable addition to its existing building. As with most schools the cooling requirement fluctuates in spring, fall and summer. Three 30 ton modular units were installed in the electrical room. During the summer the maximum cooling demand reached 90 tons so all three units were in service. In spring and fall, the cooling demand was lowered to 30 tons, so one unit was in service. The flexibility of these units to meet a severely fluctuating cooling demand makes it an ideal, efficient system.

The concept of modular cooling was instigated by the concept of modular heating with modular boilers supplying hot water heating to hi-rise residential buildings where the upper and lowest floors had the maximum heat loss. The in-between floors had substantially lower heat loss. The modular boiler system was developed to meet the varying heating needs of these applications.

In 1985 Mr. Ron Conry, an Australian refrigeration engineer, developed a modular chiller system. He was later associated with Mr. Monte Holman, Mr.

Dick Campbell, and Mr. Bill Bast, former Trane executives, who made improvements to the design and manufactured and distributed the modular chiller in the US to replace older air conditioning systems. Many of these older air conditioning systems are hard to get at and space is at a premium which are ideal applications for the smaller, stackable, modular chiller. In many older buildings rooftop space is not readily available.

As the air conditioning market continues to grow globally, there are many applications that will be ideally suited to the "Modular Chiller" concept.

Respectfully submitted,

James M. Ritter, P.E.
Chapter Historian
La Crosse Area Chapter

A BRIEF HISTORY OF THE MODULAR CHILLER

The installation of the first modular chiller in the USA occurred in 1987. This project was the Nevada Palace Hotel and Casino in Las Vegas, Nevada. The 187.5-Ton modular chiller consisted of five interconnected 37.5-ton modules. It was a replacement for the original chiller, which had reached the end of its useful life. Since 1987, there have been thousands of modular chillers installed throughout the world.

The first modular chiller came from a patented design created by Mr. Ron Conry, a native of Australia. Mr. Conry patented a method for interconnecting the chiller modules water systems, electrical power and controls. Mr. Conry found enough financial backing for his invention to form a manufacturing company in Australia, which then began to produce his Modular Chiller design. This stackable, water-cooled, modular chiller, was sold under the trade name Multistack™. It received limited market acceptance at its introduction into North America in 1987.

The first US Manufacturing of the modular chiller came about in 1989 when three former Trane Company executives (Mr. Richard Campbell, Mr. Monte Holman, and Mr. Bill Bast) acquired the patent rights of Mr. Conry's invention through the creation of a partnership with the Australian patent holders. These US Investors quickly redesigned the product to better serve the US and Canadian Markets. The first US designed modules began to ship in 1990.

The Modular Chiller conceived by Mr. Conry and further developed by the US Investors had one inherent weakness. The extremely small footprint of the Modular Chiller (necessary to penetrate the replacement market for which it was designed) was made possible by the use of Compact Brazed Exchangers (CBE's). These CBE's were utilized for both the evaporator and condenser heat exchangers and allowed a 50-ton chiller module to fit through a standard 2' door. However, the extremely small passages of the CBE, unlike the large tubes of the more traditional shell and tube heat exchanger design, made these early modular chillers very susceptible to fouling. So much so, that the only US Modular Chiller manufacturing facility nearly closed its doors in 1991 because of the service expense associated with the fouling of its condenser heat exchangers.

As is generally the case though, "necessity is the mother of invention", and beginning in 1992 a new filtration system was developed for the incoming water systems of the Modular Chiller. This filtration system, later patented by the US Investors, finally made the Modular Chiller a viable product. Since 1992, there has been a steady stream of improvements to the debris handling systems employed in today's Modular Chiller. These improvements have made it possible to install a Modular Chiller virtually anywhere a conventional chiller can go.

Beginning in 1993, competing Modular Chiller designs were introduced throughout North America. This has helped to increase the market acceptance of this design concept and fueled the 20%+ growth rate of Modular Chiller sales in North America. There are currently at least six North American manufacturers of Modular Chillers.

The largest market for the Modular Chiller continues to be in older urban areas where access to building equipment rooms is the most limited. The installation cost saving of a Modular Chiller has been its greatest advantage. However, several other applications have proven to be ideal for this product. These applications are as follows:

- **REDUNDANCY AND RELIABILITY:** The Modular Chiller is applied extensively in applications, such as industrial process, where reliability and redundancy are important. Because of the modular design, a single component failure affects only one module. This allows for the design of a redundant chiller system without adding an entire redundant chiller.
- **SOUND SENSITIVE INSTALLATIONS:** Because of the smaller compressors used in the modular design, Modular Chillers are typically very quiet as compared to larger single compressor machines. In fact, a typical 50-ton chiller module can operate at an incredibly quiet 60 dB(A).
- **FUTURE EXPANSION OF THE SYSTEM:** Installing a Modular System makes it easy to expand the capacity of your chiller plant later. No other system provides such a simple upgrade path for the mechanical system.
- **SHORT LEAD-TIMES:** With a modular system, a manufacturer can significantly reduce the number of machine types it will produce, but still provide the flexibility of matching most system loads. This means very short lead-times are possible without requiring excessive component stocking.
- **SMALL FOOTPRINT:** The Modular Chiller typically requires half the footprint of a conventional system. This, coupled with the extremely quiet operation of these machines, means you can utilize the Modular Chiller to add an equipment room in an existing building in places which before were impractical or impossible.

Since the first installation the modular chiller in 1987, the market has grown to in excess of 1,000 modules per year. Modular Chillers are now available with Reciprocating, Scroll and Screw Compressors with module tonnages ranging from 10 to 90 tons. Modules are available water-cooled, air-cooled split-system, and air-cooled packaged. This product concept continues to expand into its niche. The Modular Chiller provides an important alternative to the conventional chiller system.