



# Process Applications for Small Absorption Chillers

**AT A GLANCE**

**SMALL ABSORPTION CHILLERS IN PROCESS APPLICATION**

- This technology getting a second look
- Industrial application not confined to large units
- Equipment as small as 5 tons playing roles
- Advantages include avoided demand charges, long unit life, ability to recover process heat
- Units being used successfully in wide range of commercial, industrial applications

**A**bsorption chillers make sense in many applications for process water cooling. Instead of mechanically compressing a refrigerant gas, as in the familiar vapor compression process, absorption cooling uses a thermo-chemical process. Two different fluids are used, a refrigerant and an absorbent.

Heat directly from natural gas combustion, or indirectly from a boiler, or other waste-heat source drives the process. The high affinity of the refrigerant, water, for the absorbent (usually lithium bromide or ammonia) causes the refrigerant to boil at a lower temperature and pressure than it normally would and transfers heat from one place to another.

Lithium bromide-water systems are used for larger tonnages in process applications. Ammonia-water systems are more common for small tonnages and for lower temperature applications, with achievable temperatures as low as -40° F (-40 C). Ammonia-water systems

are usually air-cooled, while lithium bromide-water systems require condenser water-cooling, usually from a cooling tower.

**MINIMAL ELECTRIC REQUIREMENT**

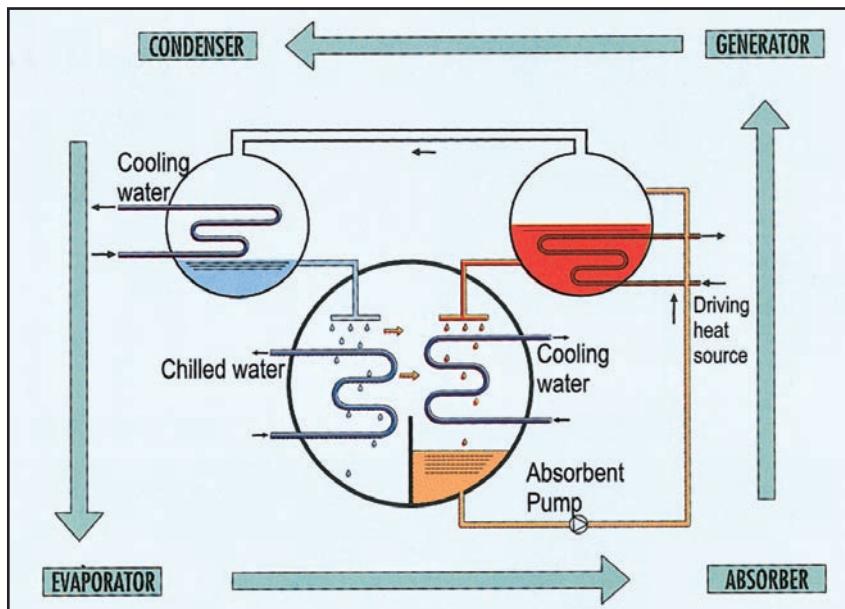
In either cycle electric energy is needed only for pumps, fans and controls. Absorption chillers can be direct-fired or indirect-fired, and they can be single-effect or double-effect. Double-effect absorption machines recycle some of the internal heat to provide part of the energy required in the generator to create the high-pressure refrigerant vapor. Natural gas is an attractive primary fuel for direct-fired machines. With gas firing, emissions are low, and can be

further reduced by the application of low-NO<sub>x</sub> burners. Absorption cooling equipment has very few moving parts and usually has a long service life.

**RECENT EQUIPMENT IMPROVEMENTS**

Important improvements in absorption equipment in the last 10 years have included improved heat exchange materials, more reliable pumps and motors, and controls that permit precise process management. Many energy observers feel that a new age of process absorption cooling is coming. Opportunities are being explored for application of small absorption units for a variety of applications. Is it possible that small-

*The basic operation cycle of the single-effect absorption chiller*



scale absorption units may lead the way into the future?

Use of the absorption principle for smaller units is not a recent development. The Robur Corporation, with U.S. headquarters in Evansville, Indiana, manufactures and sells Servel gas-fired central air conditioners and small commercial chillers in sizes from 3 to 25 tons. The Servel units are air-cooled and use the ammonia-water cycle. These units are commonly installed to cool commercial buildings, but the same chiller unit can be used for small process applications. For example, at Bryan's Cleaners and Laundry in Pasadena, California, three 5-ton Servel units are used to cool dry-cleaning chemicals.

According to Robur spokesman Rick Halbig, there is growing interest in spot industrial applications. Halbig says, "We see this as a real growth opportunity." Robur's 5-ton units are also sold in modules of up to 50 tons, delivered factory-mounted on a rail system with all interconnecting gas and water piping in place.

At the Bayview Medical Center in Newport Beach, California, a 3-unit Servel system is used to cool X-ray equipment and for comfort cooling. Another brand is the Cooltec5 unit from Cooling Technologies, Inc. of Toledo, Ohio. Both the Robur (Servel) and the Cooltec5 units utilize an advanced absorption cycle called GAX.

### GAX CYCLE ENHANCES EFFICIENCY

This approach, developed with support from gas utilities and the DOE, improves unit efficiency and reduces fuel consumption. The GAX cycle makes small absorption systems even more competitive with electric cooling.

Larger absorption units are available from Broad USA, with U.S. headquarters in Hackensack, New Jersey. Its smaller units range from 50 to 100 tons in size and are available both as direct-fired and as indirect-fired types. These use the lithium bromide water cycle.

According to applications engineer Nitin Pathakji from Broad USA, the firm has had success marketing small

absorbers for process applications in other countries, including pharmaceutical processing plants, bottling plants, and in the food industry. He feels that similar opportunities exist in the U.S.

Also available are units from Yazaki Energy Systems, with headquarters in Dallas. The firm offers double-effect gas-fired chiller-heater packages in sizes from 10 to 100 tons, and single-effect hot water systems in the same size range.

Another important supplier of absorption equipment in the U.S. and Canada is Thermax-USA. Thermax absorption chillers include steam and hot water units up to 1400 tons, and direct-fired units as large as 1,100 tons. However Thermax offers a wide range of small chillers, in sizes down to 10 tons, using the lithium bromide water cycle.

Rajesh Dixit, an applications engineer from Thermax, suggests that there are numerous potential applications for process absorption in smaller scales. He says that industrial users are attracted by the absorption chiller's ability to reduce summer peak electric demand, plus avoiding problems with halogenated refrigerants. The Thermax direct-fired unit operates using natural gas to produce chilled water temperatures as low as 44°F.

An example of the application of hot water absorption is the use of an absorption chiller to provide process chilled water at Medway Plastics in Long Beach, California. Here three 375 kW DTE Energy Technology natural-gas fired engines provide a large part of the electric energy used on the site. The jacket water from the engines goes to a Thermax single-stage absorption chiller rated at 150 tons. This machine produces chilled water for cooling operations related to the injection molding process.

Hot water absorption chillers often use a heat byproduct from other industrial processes that might otherwise go unused. An example of this type application of hot-water absorption is the PSM Print Shop in Lake Forest, California, where a 40-ton absorption chiller is used to cool printing press components.

Yazaki gas-fired absorption unit



### A RENAISSANCE FOR ABSORPTION

Another example of industrial applications of absorption is the E.B. Manion Company in Manchester, Connecticut, where a 15-ton gas-fired absorption system is used for cooling water in a grinding shop serving the automotive and aerospace industry. At the Foster Company in Dayville, Connecticut, gas-fired absorbers provide cooling water for plastics processing operations, and at NE Electronics in Milford, Connecticut, over 100 tons of absorption units provide cooling for electronics manufacturing.

With rising electric costs, facility owners are beginning to consider absorption as a serious option. Because process and comfort cooling is the major part of many facility energy budgets, the word is getting out. Regardless of the size of the process cooling load, absorption needs a second look. **<GT>**

### For More Information

**Robur**

<http://www.robur.com/>

**Cooling Technologies, Inc.**

<http://www.coolingtechnologies.com/>

**Broad USA**

<http://www.broadusa.com>

**Yazaki Energy Systems**

<http://www.yazakienergy.com>

**Thermax**

<http://www.thermax-usa.com/abcoolingbottom.htm>

**York International**

<http://www.york.com/>

**Carrier Corporation**

<http://www.global.carrier.com/>

**Trane**

<http://www.trane.com>

**McQuay**

<http://www.mcquay.com>