APPLICATION UPDATE

Thermoelectric cooler aids remote, hazardous spectroscopy

Truly new technologies are rare. So innovation usually means adapting familiar methods and equipment to improve quality and cut costs.

Thermoelectric cooling, for example, has long used dissimilar semiconductor materials and dc current to create temperature differentials without compressors, fluorocarbons, and piping. It's been refined over the decades and is now used in many applications, such as cooling electronic enclosures in hazardous locations, including NEC Class 1, Division 2. These environments are typical in oil and chemical refineries, foundries, and other places adjacent to gases or vapors.

To improve efficiency and reduce maintenance costs, Guided Wave Process Analytical Systems (El Dorado Hills, Calif.) recently installed an AHP-1200XP solid-state cooling system from ThermoElectric Cooling America Corp. (TECA, Chicago, Ill.) to cool its near-infrared (NIR) radiation remote spectroscopy system. A division of UOP LLC, Guided Wave's spectroscopy equipment collects real-time data from liquids, gases, slurries, and polymer-based films during on-line production processes. Its spectrophotometer transmits radiation through fiber-optic cables to a probe installed in a reactor or process line. Data are interpreted by the system's software to determine composition or physical characteristics of materials being processed.

Protection, maintenance

Though it sometimes can be installed further away from the probe, the spectrophotometer often must be installed in hazardous environments. Its electronics are protected in a sealed enclosure, which is purged with dry nitrogen to create positive pressure and a safe environment for the spectrophotometer's internal equipment. However, this sealed enclosure also traps heat from the electronics, which are now cooled with TECA's ThermoElectric system.

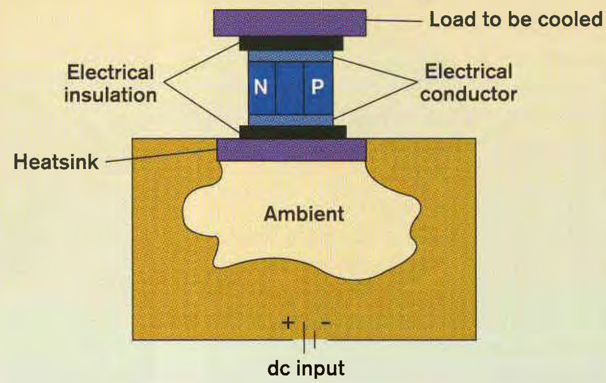
Because AHP-1200XP doesn't use air or water filters, Guided Wave's personnel are spared previously required maintenance. "Because the UOP system can be located in hazardous and frequently inaccessible locations in the facility, there had been a tendency to ignore the need for filter replacement. This affected efficiency and often the operation of conventional cooling systems," says Cal Reynolds, Guided Wave's project engineering group supervisor. "The thermoelectric cooling system's lack of moving parts also enabled us to minimize other maintenance concerns."

One AHP-1200XP unit operates at a standard capacity of up to 1,000 Btu/hr. However, added units can be installed to accommodate applications with higher heat loads.

For more information, Circle 499 or visit www.controleng.com/freeinfo.

Thermolelectric Cooling America Corp.'s AHP-1200XP solid-state thermoelectric cooling system weighs 40 lb and measures 18×12.65×9.69 in.

Thermoelectric cooling basics



Source: Control Engineering with data from ThermoElectric Cooling America Corp.

In thermoelectric cooling, semiconductor materials with dissimilar characteristics are connected electrically in series and thermally in parallel so two junctions are created.

Solid-state cooling shapes operating room mattress

Charleston, SC—Employing solid-state cooling instead of a conventional refrigeration system, engineers have designed a new thermal mattress that incorporates more features and uses less floor space in the operating room.

Designed by engineers at the Hill-Rom Co. Inc., a subsidiary of Hillenbrand Industries, the new mattress includes features that heat, cool, and help position a patient on the operating room table. In the past, hospitals have used two or three separate products to accomplish all that. At the same time, however, the new mattress's cooling system takes up less than half the floor space of conventional compressor-based refrigeration systems.

Known as the contOR™ table surface, the new product incorporates the features of a heating/cooling system, a vacuum bag, and polyurethane foam. The vacuum bag and foam help relieve pressure on anesthetized surgical patients, who, in some cases, do not move for more than three hours at a time. The heating/cooling system helps to keep patients warm during long operations, or cool in cases such as open heart surgery. Previously, all of those systems were independent and separate.

One of the keys to the creation of the new product was the development of a liquid chiller for the heating/cooling feature. To minimize the size of the liquid chiller and enhance its reliability, Hill-Rom engineers employed a novel approach: They used a solid-state cooling system.

Designed by engineers at Chicago-based ThermoElectric Cooling America (TECA), the system chills the coolant liquid in the channels of the mattress. It measures about 8 inches square by 10 inches deep.

Had it used a conventional compressor-based system instead of solid-state cooling, it would have been roughly the size of a window unit air conditioner, engineers say. "The solid-state cooler eliminates a lot of bulk and size," notes Karl Caldwell, senior project engineer specialist for Hill-Rom. "It also eliminates the potential risk of Freon leakage, which you don't want in the operating room." dn

—Charles J. Murray,
Senior Regional Editor

A new thermal mattress for operating rooms employs solid-state cooling instead of conventional refrigeration.

Solid-state cooling: How it works

Most engineers are familiar with the traditional forms of refrigeration: The refrigerator's condenser transmits heat; the evaporator cools.

But what's solid-state cooling? "Many engineers aren't familiar with it," notes Andy Brecklin, vice president of engineering for ThermoElectric Cooling America (TECA) Corp.

Solid state—also known as thermoelectric—cooling has much in common with traditional refrigeration. Only the means is different. Instead of a refrigerant, such as Freon, the thermoelectric cooler employs two dissimilar semiconductors. As electrons pass from one semiconductor to another, the junction between them grows cold. In that sense, the junction behaves like an evaporator. And a dc power source, which pumps electrons into the device, plays the same role as a conventional compressor, which pumps refrigerant.

Heat or cold is then transmitted to associated devices through a heat sink, instead of conventional condenser fins.

The result is largely the same as a traditional system—without the bulk and chemicals. "When you put current through them, you create a temperature differential, and then you transfer heat from one surface to another," Brecklin says. "In that sense, it's no different than a conventional refrigerator."