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Heatcraft Helps Travelers Keep Their Cool

Coils used in new terminal at Detroit Metropolitan Airport

HEATCRAFT COILS WILL HELP KEEP NORTHWEST AIRLINES TRAVELERS COMFORTABLE IN THE DETROIT METROPOLITAN AIRPORT'S NEW TERMINAL, WHICH IS CURRENTLY UNDER CONSTRUCTION.

Heatcraft coils will help cool the new Northwest Airlines terminal at the Detroit Metropolitan Airport when it opens in late 2001. The state-of-the-art facility, which is over a mile long, will feature 97 gates, 18 luggage carousels, an 11,500-space parking garage, an Express Tram system, and more than 80 shops and restaurants in an open and spacious environment. And thanks to the combined efforts of three companies, the terminal's air handling system will be ready to keep Northwest's travelers comfortable on opening day.

Nearly a year and a half ago, CPG Tri-Venture Contractors of Detroit contracted with Heat Transfer Specialties of Jeffersonville, Indiana to build 45 custom air handlers for the terminal's HVAC system. Heat Transfer Specialties, a long-time Heatcraft customer, contacted Jim Nester, a Heatcraft senior field sales engineer with Nestek Sales of Columbus, Ohio, regarding designing and manufacturing the coils. Jim worked with both companies to finalize a design, and Heatcraft's Commercial Coil facility in Grenada, Mississippi manufactured over 100 custom chilled water coils to be used in the units.

This was one of the largest projects Heatcraft has done in several years, according to Mark Lien, sales manager for Heatcraft's Commercial Products group. "It's a high-profile job, and it's a high-tech terminal. There were lots of issues and lots of dollars involved for all three parties. As expected, the entire job went off without a hitch."

Dick Rademaker, president of Heat Transfer Specialties, is pleased with the end product. "Everything was smooth. We had no problems. Heatcraft does what it says it will. We deal with Heatcraft because of the assurance of quality and predictable performance. The price was fair, and the equipment has exceptionally high performance."

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Out With the Old

by Lane Murphy & Matt Kiley

Since the signing of the Montreal Protocol over 10 years ago, there has been a continuous expenditure of political and commercial resources into phasing out the use of ozone-depleting substances. Many conventional refrigerants have already been banned, and others are scheduled to be phased out in the near future. As a result, identifying and testing ozone friendly replacement refrigerants have been exhaustively pursued.

In a paper published in 1974, it was shown that CFCs could cause significant ozone depletion. Ozone depletion potential (ODP) is a measure of the negative impact each substance can have on the atmosphere. ODP is an index that compares the relative destructive power of a chemical. The CFC refrigerant R-11 has an ODP of one. Other CFC refrigerants include R-12 and R-502.

Replacement refrigerants are different for mobile, stationary, large, and small systems. R-12 was used in small refrigeration and air conditioning systems including refrigerators, window air conditioners, and automotive air conditioners. The HCFC refrigerant R-22 was used in stationary air conditioning and high to medium temperature refrigeration systems.

A short-term solution for stationary air conditioning and refrigeration was to continue to use HCFCs. R-22 has an ODP of 0.055 that serves as its own short-term replacement. Nevertheless, all ozone depleting refrigerants will be phased out. The production of R-22 has reached the maximum level and will be phased out by 2010 for new equipment. The production of R-22 will cease in 2020 and will be completely phased out in 2030. The longer-term strategy is to use HFCs including R-134A, R-407C, and R-410A.

In addition to ODP, global warming has become an important issue. Global warming happens when energy that should radiate into space is inadvertently captured in the earth's upper atmosphere. Burning of hydrocarbon fuels and the release of harmful chemicals have raised the threat of global warming. The warming of the atmosphere could have potentially severe effects on the climate. Global warming potential (GWP) compares the warming effect of a substance to that of carbon dioxide over a 100 year period.

HCFCs such as R-22 have a significantly high GWP, but lower ODP factors than CFCs. HFCs

LENNOX' ELITE 13 IS DESIGNED TO TAKE ADVANTAGE OF NEW REFRIGERANT TECHNOLOGY.

have zero ODP. However, they have significant GWPs. The search for zero ODP and low GWP refrigerants continues. Some of these potential refrigerants include ammonia, propane, butane, air, and carbon dioxide. These natural refrigerants are the next frontier, but they have their own set of challenges, such as very high pressure for CO_2, flammability for propane, and toxicity for ammonia.

The dilemma with identifying a single substitute for R-22 is that there is no replacement that covers such a wide range of applications while maintaining the same operating characteristics. Various industries throughout North America are now facing the design and production issues that surround these market-wide refrigerant replacements.

One of the proposed replacements for comfort air conditioning applications is the near azeotropic mixture R-410A with an ODP of 0 and a GWP of 1725. This refrigerant is a 50-50 mixture of R-32 and R-125. The mixture creates a vapor pressure increase of almost 50 percent over R-22. Air condition and refrigeration systems designed for R-22 may not be able to handle the increased pressure. Another problem is that R-410A requires polyalkylene glycol or poylol ester oils. These oils are not compatible with seals and gaskets used in R-22 systems. In addition, they absorb water (hygroscopic) which can cause these oils to break down and create acids. In fact, these oils are good solvents and will clean debris and process fluids used in manufacturing from the refrigeration system. Unfortunately, these materials will deposit in areas such as expansion valves or capillary tubes. Thorough system cleaning and evacuation is required prior to refrigerant charging. Current systems must be redesigned to accommodate R-410A. An advantage to re-engineering is that the new systems should prove to be more compact and efficient.

The system performance is somewhat different for each refrigerant. R-410A has a 1 percent to 3 percent lower heating capacity than R-22. The system EER of R-410A ranges from 4.3 percent to 21.4 percent higher than R-22. “R-410A in particular would benefit from a heat exchanger’s optimization because of its small change in saturation temperature for a given pressure drop and a postulated improved compressor efficiency due to the low pressure ratio” (Powell). It is this optimization potential that is of key interest to our engineering staff.

Heatcraft has been studying several new fin surfaces and tube patterns to take advantage of the benefits of R-410A. Since the R-410A operating pressure is significantly higher than R-22, concessions must be made to withstand the significant pressure increase. Two choices for pressure capability are thicker tube walls or smaller diameter tubing. R-410A’s characteristics are conducive to better performance with smaller diameter tubing.

The pressure criterion currently used is the Underwriters Laboratories (UL) standard 207 for refrigerant containing vessels. This standard requires the heat exchanger to withstand a pressure of five times the design pressure. This means, for example, a condenser for R-410A would have to be designed to withstand a 3500 psi burst test. Even with small diameter tubes, the tube wall may have to increase to withstand this pressure.

A few years ago, the industry proposed that UL change the five times working pressure requirement for burst testing. The resulting solution is to rate the pressure capability under a fatigue cycling criteria combined with a three times burst pressure requirement. The fatigue cycling criteria requires that the heat exchanger undergo a pressure cycle test of 250,000 cycles from normal working pressure to below the vapor pressure at 40˚F. After the cycle test, the heat exchanger is pressurized to two times the cycle pressure or one and a half times maximum working pressure for one minute. An identical second heat exchanger is pressure tested to three times the

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New Product News

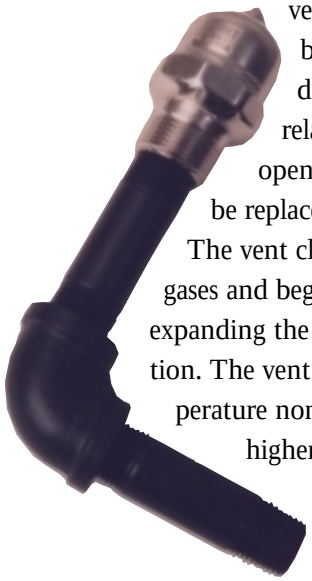
Heatcraft now offers vacuum breakers and/or thermostatic air vents as standard options on all steam coils. Both devices are delivered partially assembled and are shipped in the coil's crate(s). We will be adding both of these options to the next version of the Coil Calc selection software program. Both options are available in Heatcraft's standard lead-time. One exception could be those systems operating >125psig.

There will be two thermostatic air vents available(one for <=25psig and one for >25 <=125psig. Another vent is available for coils operating above 125psig. However, the factory should be consulted for lead-time. The vacuum breaker is applicable to <=300psig systems.

Important: if steam pressure is modulated from a pressure >25psig to a pressure <=25psig, the higher pressure vent should be requested.

Thermostatic Air Vent

The thermostatic air vent allows the system to purge itself of non-condensables. As non-condensables gather at the high point in the system, the vent's thermostatic mechanism becomes insulated by the non-condensables and begins to cool and relaxes to its open position. The vent opens allowing the gases to escape and be replaced by the higher temperature steam. The vent closes as steam replaces the escaped gases and begins the process of heating or expanding the mechanism back to its closed position. The vent remains closed until the lower temperature non-condensables again replace the higher temperature steam.

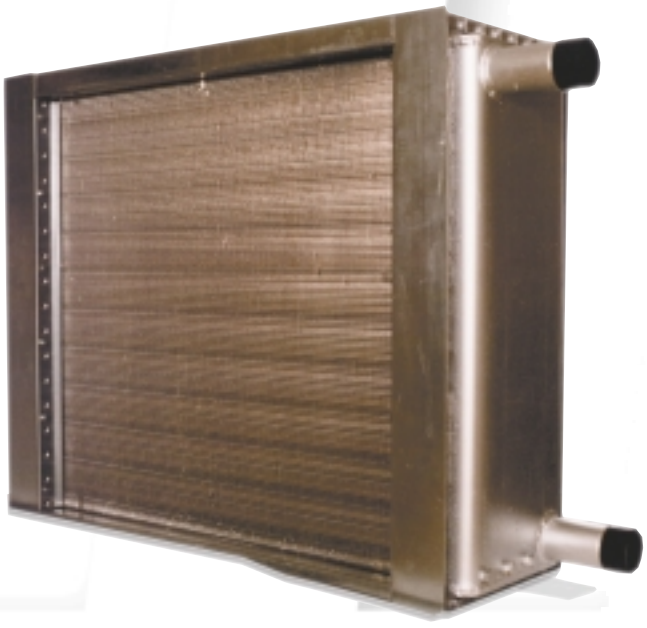


Vacuum Breaker

The vacuum breaker allows the coil to purge itself of an internal vacuum, typically caused by a modulating control valve. When the control valve throttles back the steam pressure due to reduced load demand, it inherently creates a vacuum in the coil as the existing steam inside the coil begins to condense. If left to its own design, condensing steam, which is allowed to pull a vacuum, can cause catastrophic damage to any coil or pressurized vessel. The presence of vacuum conditions activates the vacuum breaker and allows air to enter the coil, thus breaking the vacuum and allowing condensation to flow freely from the coil.

High Pressure Cleanable Coil

The high pressure cleanable coil is designed for high-pressure fluid applications up to 300psig operating pressure. The coil's removable heads on both ends allow for internal tube cleaning without clogging the ends of the coil.



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CE Mark

What is it, and can Heatcraft provide it?

CE marking is a system used in the European Community (EC) to identify products that meet certain safety standards. It is analogous to UL (United Laboratories) and CSA marking in North America. The mark was introduced to replace each individual country's own system with a unified system for EC members. As with UL and CSA, the mark is intended to be applied to products available for sale to the general public or products that will be used by or exposed to the general public.

In North America UL and CSA have a component marking system, "recognized component", which carries the cRUus mark. Products can bear this mark if they have been approved and registered by the agencies. The mark does not allow purchasers of the components to apply the UL or CSA mark to the units using the coils. In those cases, additional testing is required. The EC does not have a similar marking system for components, so there is no mark we can apply that would help customers get a CE mark for their units.

Whether a coil should carry a CE mark will depend upon its design and application. Coils that carry fluid in the tubes and are used to heat or cool air passing over the tubes can be categorized under the Safe Engineering Practice (SEP) of the country where they will be used. Coils that fall into the SEP category do not carry the CE mark. In order to make the determination, it is necessary to plot internal volume against maximum pressure on one of the charts detailed in the directive.

Refrigerant coils will not come under the SEP category because the system contains vapor. Our product will normally fall in category III in view of the internal volume and pressures involved. In this category, we can choose from several modules available, which detail the criteria used to evaluate the product. All of the criteria involve examination of the design and the manufacturing control and test systems by a third party. The third parties, notified bodies, must be on file with the EC. Several European countries have notified bodies in the U.S.

Heat exchangers, in general, are covered by the Pressure Equipment Directive (PED) 97/23/EC. The directive becomes law on May 29, 2002. After this date, all applicable products will have to comply with the directive to carry a CE mark. We are corresponding with some notified bodies to try to determine if one category and module can be used for all our products, but it is possible that the actual certification process will depend on the size, type, and application of the coils in question. More information about CE marking and requirements of customers who are intending to use the mark will be announced when it is available. If you have any specific questions, please contact the Product Engineering Department in Grenada.

maximum working pressure. The fatigue test and three times burst test must be successfully passed to qualify the heat exchanger.

Heatcraft had been performing these tests for our customers on a limited basis. As this need is growing, we saw the need to universally qualify all our heat exchangers. We have completed a project that would certify all heat exchangers with up to 1/2" tubing.

In conclusion, R-22 systems must be redesigned by the year 2010 for other refrigerants. A good candidate for new system design is R-410A because it offers potential efficiency gains and more compact designs. New system requirements that will have to be met include capability of handling higher pressures, multiple oil compatibility, and redesigned geometry that takes advantage of R-410A's properties.

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