

Thermal solutions for the cutting edge

*Fuel Cell
Products Group*





Modine has designed and developed modular cooling technology that integrates plant and fuel processing ventilation systems into compact, efficient modules. For instance, Modine stack coolers are used in stationary prime power generation systems. These balance of plant systems have been produced for PEM FC power plants extending into the 150 kW class.



Fuel cells are the most promising alternative power technology presently in development.

Modine supplies the air and hydrogen humidifiers as well as the cathode condenser for advanced automotive power plants such as the Ballard HY-80 used in the DaimlerChrysler F-Cell.

Managing the heat and mass transfer challenges of the emerging fuel cell environment

With more than 88 years of global experience in thermal management – in everything from trucks and automobiles to heaters and computers – Modine Manufacturing Company is uniquely positioned to meet the thermal requirements of fuel cell and hydrogen generation technologies.

Modine's Fuel Cell Products Group, created in 2000, focuses on these emerging markets through engineering solutions that address the specific challenges presented by the practical application and implementation of fuel cell systems and the hydrogen infrastructure.

Already at work in 30 buses in the CUTE (Clean Urban Transport for Europe) demonstration program throughout Europe, several automotive test programs, and a variety of stationary programs, Modine heat and mass transfer solutions are proving to be effective and reliable solutions for these challenging applications.



Manufacturers of today's most advanced fuel reformers rely on Modine to bring solutions and value to their products. The auto thermal reactor (ATR) recuperator pictured here incorporates Modine's patent-pending thermal pinch technology to achieve passive temperature control under wide turndown conditions.

The Modine edge

What value can Modine add to your business?

- **Engineers experienced in solving thermal management problems.**

At Modine, we meet heat transfer challenges every day ... it's all we do. By concentrating on our core competencies, we've become the world's leading thermal management solution resource for a wide range of industries.

- **Innovation and economy.** By partnering with Modine, you tap into a history of experience from which possibilities and innovations grow. Because our engineers understand the potentials and limitations of materials and designs, they bring an experienced point of view to your thermal management challenges. Modine engineers are up to speed on fuel cell technology, so we're able to hit the ground running on your behalf. You save time. You save money. And you get a superior solution in the end.

- **Manufacturing expertise.** Our engineers look at fuel cell thermal management from two perspectives. First, the problem itself ... how to provide an effective, efficient and practical solution. Second, the production aspect ... how to devise a solution that can be cost-effectively manufactured in volume to support your commercialization efforts.

We manufacture what our engineers design. Our capabilities ... from prototyping through testing and final manufacturing ... are among the industry's most advanced. When you're ready to bring a system to market, you can rest assured that with Modine, you are partnered with a global, technical leader ... ready to perform.

- **Teamwork.** Let our engineers serve as the thermal management experts on your team. Bringing our knowledgeable engineers into your processes early will result in more elegant, efficient and cost-effective designs.

- **Dedication to the future.** We believe fuel cells are among the most promising alternative energy sources under development today. That's why we've devoted substantial resources to helping fuel cell pioneers realize their promise.



The Clean Urban Transport for Europe (CUTE) program has placed three fuel cell-powered buses into service in each of ten cities across Europe. The Modine cooling module on these buses (pictured on top of the bus in photo above) integrates several hydraulic cooling and control functions along with the coolant surge tank, thermostat, and the most compact stack coolers available on the market.



Modine's micro-channel heat exchangers for the APU market meet the necessary compact, stable, steam generation requirements.

Modine is actively pursuing the development of heat exchangers and reactors for deployment in fuel processing systems. The integration of features such as catalyst coatings, advanced materials, manufacturable micro-channel architectures, and thermal pinch technology is key to ensuring that our advanced fuel processing systems are economical, durable and responsive.

Solving thermal management and heat transfer problems is our sole business. Our heat transfer solutions have set industry standards for efficiency, economy and durability. With more than 1,500 patents, we remain the leading innovator in the field.

As proof of our commitment to research, development and product testing, we've invested more than \$80 million in two new technical centers ... in Racine, Wisconsin and Bonlanden, Germany. These centers house the latest in virtual engineering equipment and physical testing technology.

Contact Modine today to find out how our applied thermal innovations can help you solve your heat transfer challenges.



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