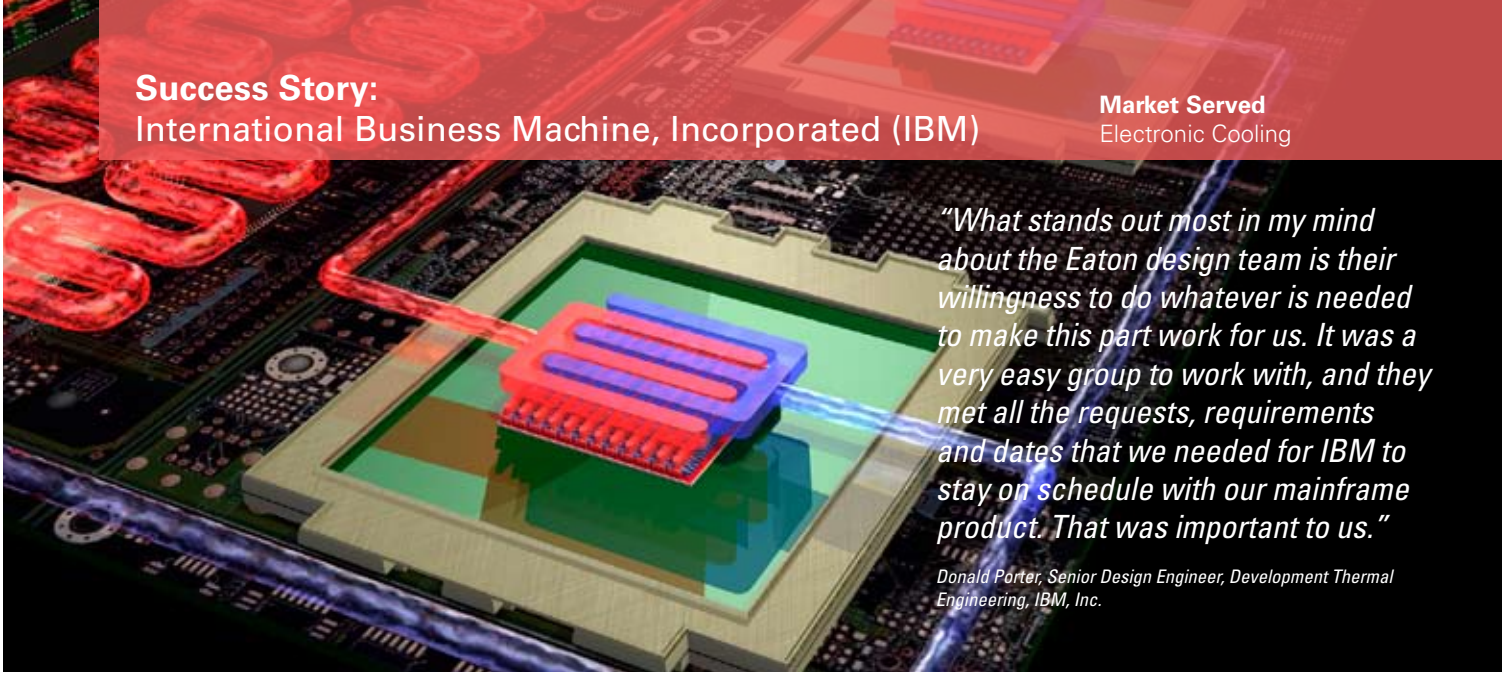
Success Story:
International Business Machine, Incorporated (IBM)

Market Served
Electronic Cooling



"What stands out most in my mind about the Eaton design team is their willingness to do whatever is needed to make this part work for us. It was a very easy group to work with, and they met all the requests, requirements and dates that we needed for IBM to stay on schedule with our mainframe product. That was important to us."

Donald Porter, Senior Design Engineer, Development Thermal Engineering, IBM, Inc.

Eaton® FD83 Coupling Integral to Liquid Cooling System on New IBM Supercomputer

Location:
Poughkeepsie, NY

Segment:
Commercial Electronics Cooling

Problem:
IBM required a highly-reliable, full-flow style coupling with interlock features to control and channel coolant through sophisticated electronics.

Solution:
Eaton's FD83 quick-disconnect coupling

Results:
Design of coupling provides reliable performance and minimal spillage when processing unit requires inspection of service.

Background

The prospect of finding Eaton components in one of the world's most powerful supercomputing platforms would seem, well … far fetched. Yet, enduring elements of Eaton's brand heritage are innovation, problem solving and a commitment to ecological issues, including conservation of global resources. The latter has come to even greater prominence as Eaton attempts to permeate its worldwide culture with the concept of "sustainability."

It is an encompassing business strategy that it applies to itself in terms of production but also to the products, service and counsel it provides to customers. Perhaps it should be no surprise, then, when an equally venerable icon of American business and one with the same interest in sustainability, called on Eaton's engineering team to solve a problem that figured prominently in the successful introduction of a powerful, new supercomputer — a supercomputer incorporating a novel and highly energy-efficient means of cooling. That customer is International Business Machine (IBM).

Challenges

Computational output and power consumption generate a significant amount of heat that must be addressed. The processors radiate considerable heat which has to be disbursed to avoid operational and durability issues. Supercomputers are typically housed in climate-controlled rooms that are filtered and air-conditioned. Consequently, computer designers have to consider the energy required to keep the unit cool as well as the amount of power it draws.

One design challenge IBM faced was finding an effective and energy-efficient means of cooling its new POWER 575 supercomputer. The POWER 575 incorporates the IBM POWER6 processor — one of the fastest if not the fastest processor in the world. With speed, however, comes the issue of disbursing heat. In the supercomputer arena, companies like IBM typically rely on chilled air to cool the processors. Yet, knowing that liquid-based cooling concepts have advantages, IBM chose to make liquid cooling central to the POWER 575's cooling design. IBM scientists estimate water can be 4,000-times more effective at cooling than air.

Interestingly, many machines use water or combinations of fluids to help reduce heat. Often, the water is channeled through air-cooled fins or vanes (like a car radiator) to enhance the effect. Thus, the concept of liquid cooling is not new. Mixing water and electricity, however, has always been problematic. The more pressing design challenge for IBM was to design a liquid

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cooling conveyance system comprised of components that would not leak and that could be readily sourced.

Solution

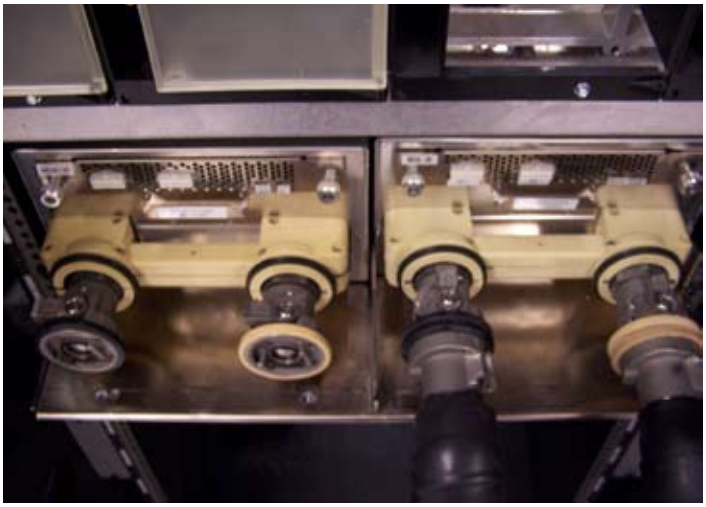
In any conveyance system, the connection points are often the source of problems. The Eaton solution is the FD83 quick-disconnect coupling. The couplings are used on the IBM POWER 575 coolant pump's supply and return lines, all of which reside within the processing rack itself. Important features designed into the FD83 coupling include minimal spillage upon disconnection, an unobstructed full-flow path, a special locking pin and lever handle to prevent accidental disconnects, and color coded bumpers to avoid cross connections. Yet, its robust engineering also makes it decidedly reliable. The one-inch coupling features 303 stainless steel construction, EPDM O-ring seals with 150 and 300 PSI operating and burst pressures respectively. The coupling is an integral part of a conveyance system that chills copper plates mounted directly above a POWER6 microprocessor's core to remove heat from the electronics.

Results

The FD83 coupling proved to be the correct solution for the IBM POWER 575. It helped IBM realize an effective and energy-efficient departure from conventional cooling to liquid cooling. It provides Eaton with another testament to its ability to innovate and to its penchant for going outside its customary markets to provide solutions by leveraging its engineering and production expertise. More important, its success with IBM points to the efficacy of its sustainability strategy which will undoubtedly distinguish its value proposition from that of competition.

In recounting the success of the project, Don Porter Design Engineer, Development Thermal Engineering, IBM, Inc. commended the Eaton team: "What stands out most in my mind about the Eaton design team is their willingness to do whatever was needed to make this part work for us. It was a very easy group to work with and they met all the requests, requirements and dates that we needed for IBM to stay on schedule with our product. That was important to us."

The POWER 575 began shipping this past April. One of the current customers



is the Max Planck Institute for Plasma Physics in Garching, Germany. Other customers scheduled to use the new POWER 575 include the National Center for Atmospheric Research and the European Centre for Medium-Range Weather Forecasts in Reading, England. The IBM cooling technology is referred to as Hydro Cluster cooling. IBM estimates that the energy consumption associated with cooling a data center containing the new supercomputer is reduced by 40 percent. Another metric used by IBM is the new supercomputer will require 80% fewer air conditioning units for cooling purposes. The combination of fast processing speed and liquid cooling make the POWER 575 three times more energy efficient per rack — there are 448 processor cores per rack.

The IBM Corporation continues to order the FD83 couplings for the POWER 575 and is seeking additional product and design support from Eaton for design enhancements that will allow use of the coupling on additional platforms. Eaton hopes the relationship will extend beyond the POWER 575 to the next generation of water-cooled technology in which water actually comes in closer contact with or flows through the processor chip itself instead of through the copper cooling plates.

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