



Provide lasting pipe performance

**aquatherm**

# POLYPROPYLENE PRESSURE PIPING SYSTEM IMPROVES SERVER RELIABILITY

PROJECT INFORMATION

PROJECT	PRODUCTS USED	LOCATION / DATE
Utah State University Data Center	Climatherm®	Logan, UT Winter 2007

## AQUATHERM ADVANTAGES

- No welding fumes in the data center
- No condensation on the chilled water lines thanks to PP-R's natural insulation value
- Saved significant floor space



## THE CHALLENGE

Officials sought a leak-free, insulated pipe option that would allow the data center to remain operational during repairs

## THE SOLUTION

PP-R met all of the USU staff's needs, with no leaks, easy expandability, and many other benefits

When Utah State University first planned to upgrade its data center, improving the server cooling system was a top priority. USU engineers considered using welded steel but had concerns regarding condensation as well as the difficulty of installing and repairing the system in an occupied space.

"Our problem with the data center was using a piping system that was reliable," said Lorin Mortensen, a mechanical engineer at USU. "We originally spec'd stainless steel, but the environment of the data center was not suitable for welding, so we looked at alternatives."

Another option they explored was running single lines of flexible PEX tubing from a main line outside the data center to and from each cooling unit, but it quickly became clear that with the insulation needed to prevent condensation, there would not be enough room to run all the lines cleanly.

## WELDED PIPE WITHOUT THE FUMES

Fortunately, Jon Burrows from Colvin Engineering suggested an alternative system.

"We were working with an existing system. We had to maintain the fire protection and the air quality," Burrows said. "[USU] wanted welded pipe, but without the welding fumes. The Aquatherm system seemed like a good way to give them that."



No insulation is needed for pipes carrying 40°F chilled water, because polypropylene is a natural insulator.

Aquatherm, a German-based pipe manufacturer, produces a fusible polypropylene system called Climatherm, a system specially designed for heating and cooling applications. While only recently available in North America, Climatherm, and its sister-system Aquatherm Greenpipe (for potable water applications) have enjoyed decades of success in over 70 countries around the world.

Climatherm uses heat-fusion to form connections, a process often used in natural gas piping because of its exceptional reliability. Heat fusion bonds both sides of a joint into a single, homogenous material, without the use of chemicals or mechanical connections. This tends to eliminate systematic weaknesses and fail-points in the pipe. The heat

fusion connections, combined with polypropylene's resistance to corrosion and abrasion, eliminated the concerns of pipe leaking.

The engineers at USU took the innovation a step further by installing the system without additional insulation. Polypropylene has a natural insulation value, and Climatherm is made from over 97% pure polypropylene. Based on the minimum operating temperatures of the system and the maximum humidity levels in the data center, the engineers determined that no condensation would form on the uninsulated pipes during normal operation.

Steve Clark, P.E. and president of Aquatherm Inc., stated that, "Based on the temperature of the water in the pipes and the air around it, and the relative humidity of the room, the bare pipe will not sweat, even under extreme conditions. Ironically, if they do insulate it, and someone damages the vapor barrier, then you'll almost definitely see condensation."

## RE-PURPOSING THE ELEVATED FLOOR

USU's central energy plant provides the chilled water, which is carried through steel mains up to the server room. From there, six-inch Climatherm lines are flanged directly into the steel and carry the water securely into the data center.

The first phase of the remodeled cooling system supplies 22 APC modular cooling units, with threaded outlets taken from three four-inch Climatherm branch loops. A second phase, still in planning, will add at least 15 more units on an

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additional branch line. All the piping is installed inside an elevated floor, previously used to circulate chilled air underneath the data center.

"We've been running the system for about a month now," Mortensen said, assessing the system's early performance. "We basically have to run the system 24/7. We can't afford to have any shut-down time. We can isolate zones and units if we need to. It's allowed us to plan for future expansions."

By integrating Aquatherm's polypropylene pressure piping systems into their design, the engineers at USU were able to avoid many of the major pitfalls sometimes associated with other systems. Corrosion and impact resistant pipes, combined with leak-proof fusion connections, allow for more pounds of cooling to be brought into the data center without jeopardizing the delicate equipment. The result is improved server performance and reliability.

"This system saves the owner a lot of floor space," Mortensen added. "If we'd installed [flexible tubing] it would have been spaghetti in there. The Aquatherm cleaned it up very nicely."



*Case study originally published in the June 2008 issue of Engineered Systems magazine. Reprinted with permission.*



The German-manufactured pipe has been one of the world's most durable and greenest piping systems for nearly four decades and proven successful in 70-plus countries. Aquatherm piping systems offer many performance and environmental benefits, such as:

- Eliminating toxic materials, glues and resins, and open flames from the piping installation equation
- An R-value of 1 or greater depending on pipe size and SDR
- The fusion welding process, which creates seamless connections that last a lifetime without leaking or failing
- An optional fiber-composite layer in the pipe reduces linear expansion of the pipe by up to 75% compared to plastic piping

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