

# AMETEK and 3M team up to develop innovative heat exchanger technology

AMETEK, Inc. has developed a series of non-corroding fluoropolymer heat exchangers that are especially useful for industries such as metalworking, electroplating, steel pickling, chemical processing, and other applications employing harsh acids and highly corrosive materials.

Heat exchangers are traditionally constructed of metal and are just as traditionally challenged by corrosion. They depend on expensive special alloys or high-end metals, such as stainless steel or titanium, to resist fouling and scaling. To further complicate matters, prices for these materials have soared in recent years as demand has outstripped supply. Material shortages have also resulted in costly production delays. AMETEK and 3M, however, have collaborated to arrive at a novel solution: fluoroplastics.

## The fluoroplastic advantage

AMETEK shell and tube heat exchanger components are extruded from a special, high-thermoconductivity PFA fluoropolymer. This material's nonstick properties and chemical inertness help resist fouling, corrosion and scale buildup, while AMETEK's proprietary "Q" additive imparts additional durability and thermal efficiency.

These heat exchange units can be incredibly complex, with up to 1,000 tubes within the shell. A key advantage of the AMETEK units is that every component is made from the same fluoropolymer. This is significant, because the use of dissimilar materials can make parts of the unit cycle from hot to cold at different rates, jeopardizing unit integrity. AMETEK heat exchangers are entirely cohesive and firmly bonded to ensure efficiency and long life.



AMETEK heat exchangers feature acid- and corrosion-resistant fluoropolymer resins

## The challenge of compounding

Although AMETEK began by compounding standard PFA pellets in-house, it was very difficult to disperse additives into the fluoropolymer. The relatively large pellets melted into a thick, stiff sludge, making it extremely difficult to mix in the powdery additive evenly. This was highly problematic, for an almost particle-to-particle dispersion of the additive into the fluoropolymer is critical for this application. Without an even distribution, extrusion becomes difficult and inconsistent; the additive clumps and can degrade; and the resulting unit simply does not last as long.

In 2010 AMETEK approached 3M, in search of a fluoropolymer solution that would support the AMETEK additive and provide improved processing capabilities. The PFA fluoropolymer was available through 3M in smaller particles, increasing the opportunity for a better dispersion. 3M custom compounding facilities at Aston, PA, and Hebron, KY, had the desired compounding and pelletizing capabilities. AMETEK had a unique product concept and design in the fluoroplastic heat exchanger. Together, they turned the typical process on its head. Rather than distributing additives into the melt during the re-pelletizing process, they would instead take a cue from cookbooks and mix the "dry ingredients" together first.

## Material improvements

3M would use the intensive room-temperature milling and blending process at 3M Aston to obtain an excellent dispersion by starting with a fine powder grade of 3M™ Dyneon™ PFA Fluoroplastic and compounding it with the AMETEK additive. The 3M Hebron facility would pelletize the evenly dispersed mixture, and AMETEK could then extrude it into tubes for use in heat exchangers. The test run was more than promising. It met all the desired performance specifications while obtaining a good dispersion. "The results were so good, we went for it," said Ralph Reyes of AMETEK, Inc. That first test run quickly gave way to larger orders. The new process resulted in better yield, an extruded tube surface that is twice as smooth,



AMETEK Q Series heat exchangers incorporate a proprietary Q resin for added durability and thermal efficiency

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and a dramatic improvement in processability. “It’s night and day, the way the material extrudes,” said Reyes. “Less time, less labor. It has helped us immensely.”

Appreciation for this new technique extends well beyond the manufacturing floor. One of AMETEK’s major customers in Japan gave the product high praise. “They say it’s as good as or better than anything they have seen in Japan,” adds Reyes.

The inherent nonstick and chemically inert properties of fluoroplastics are ideal for applications where resistance to corrosion and fouling is vital. AMETEK heat exchangers are efficient and long-lasting, and their market continues to expand. Used by the metalworking and chemical processing industries for over 45 years, these heat exchangers now are available in ultra high-purity (UHP) constructions, for use in semiconductor and solar energy wet processing equipment. The demand for heat exchangers is on the rise as the global market demands higher energy efficiency. Thanks, in part, to 3M’s compounding capabilities and fluoroplastic products, AMETEK is uniquely poised to provide a cost-efficient, corrosion-resistant answer.

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