

Manufacturing Innovation Insider Newsletter

Keeping Cooling Towers on Tap: How Today's Engineered-Plastic Cooling Towers Slash Downtime and Service Costs

Innovations in today's engineered-plastic cooling towers offer significant advantages over those of metal, providing optimum service with minimal maintenance and little or no water treatment costs.

Cooling towers are so critical to many industrial processes that if even one goes down unexpectedly, the consequences can reverberate throughout the organization's entire production line. Aside from unplanned emergencies, cooling towers that are overworked, out of service, or require periodic rebuilding or replacement also exact a severe toll in terms of lost production, labor and materials. Hence, the focus of any processing or manufacturing plant engineer is to ensure that when time comes to retrofit or expand, reliability and lack-of-downtime ranks first in the selection of cooling tower structures. Other factors include reduced maintenance, easy installation and lowered costs.

Given these considerations, and faced with a choice between metal or engineered-plastic, many engineers and plant managers are opting for the latter in light of new developments that increasingly tip the scales in favor of lightweight, high-capacity, energy efficient reduced-maintenance plastic cooling towers.

"My issues were really simple," says Glenn Burroughs, a test engineer with a major oilfield services firm. "I'm very busy running tests and don't have the time or personnel for cooling tower maintenance, so I went looking for a cooling tower that I was not going to have to do any maintenance on."

Burroughs chose engineered plastic.

The need for uninterrupted service

There is considerable science to the subject of cooling tower design and operation, of course, but fundamentally, three essential issues about performance are often considered by plant engineers: 1) is the cooling



Engineered-plastics' lighter weight makes it easier to place cooling towers on top of structures. An engineered-plastic cooling tower used for a forging application at Meadville Forging, Meadville, Pennsylvania.

capacity sufficient to the demands of the operation? 2) do the cooling towers require maintenance that is interrupting business? and 3) are the towers costing a fortune in water treatment?

Toward addressing these concerns, cooling towers have evolved significantly from the simple heat exchangers of the 1890s. Yet, only in recent years has the design of industrial cooling towers been fast-forwarded to prevent the need for expensive upkeep, repair and replacement; and the most significant ad-

Engineered-Plastic Cooling Towers Slash Downtime and Service Costs

vancement has come with the availability of corrosion-proof polyethylene-plastic cooling tower which will not rust, chip, flake, or peel — unlike metal. Nor does engineered plastic require the application and periodic re-application of paint or other protective coatings. High-density polyethylene also stands up better to harsh chemicals that eventually prove fatal to galvanized towers.

New-generation plastic towers are not only leak-proof and impervious to weather and chemicals, but they are now more applicable to the majority of commercial and industrial applications because of recently expanded cooling capacities that reach and exceed 2,000 tons. These gargantuan capacities are made possible by a new modular-construction design — where a group of smaller towers can be combined into one massive cooling unit.

The inherent and design advantages of the latest engineered-plastic cooling towers also allow easier installation (especially on rooftops) because a lightweight plastic shell weighs as much as 40% less than a steel tower. Additionally, the induced-draft, counter-flow design seen in some engineered-plastic towers allows improved cooling efficiency for the size, allowing a smaller footprint to fit where there are locating constraints. Some models incorporate innovative I-beam “pockets” to reinforce the tower bottom so that they can be easily mounted on standard I-beams or imperfect pads.

In conjunction with vastly enlarged capacities and improved structures, some plastic tower manufacturers have broken new ground by offering simpler cooling systems in the form of direct drive fan systems that require minimal maintenance because of less moving parts: no gear reducers, couplings, additional shafts, or extra bearings — furthering the goal of maintaining “up-time” within the plant.

Taken together, the design improvements of engineered-plastic towers offer several benefits over their metal counterparts for companies across a broad range of industries.



Built-in pockets reinforce the tower bottom so that the tower can be easily mounted on standard I-beams or imperfect pads. An engineered-plastic cooling tower used at the Conair plastics processing plant in Pittsburg, Pennsylvania.

A cleaner, more efficient quenching system

“The decision was to replace our galvanized steel cooling towers with the newer molded-plastic cooling tower design,” explains Matt Niemeyer, staff engineer for the brass division of Olin in East Alton, IL. “They were ten or twelve years old and had already rusted completely through in several areas. All of that was in terrible shape and had to be repaired several times.

“The cooling tower was a straight splash bar design,” continues Niemeyer, “and because the tower would fill with all the heavy junk that collected as the dirty water was cooled, the grid and fill within the tower eventually collapsed.”

Last year Olin changed its contact cooling method to a closed-loop, clean water configuration.

“We converted to a Delta Cooling Tower to overcome the inefficient, open loop system that had collapsed the fill under the weight of dirt and scale in the water,” continues Niemeyer. “The closed-loop clean water system made it possible to go with the different

Engineered-Plastic Cooling Towers Slash Downtime and Service Costs

cooling tower design. Instead of having a splash bar fill, which is about the best you can do for dirty water, we were able to go with a PVC film fill — what's in the Delta tower. That also allowed us to change from a crossflow tower to a counterflow tower, which gives us greater cooling capacity for its size. We had a limited footprint for the tower, so that has worked out great."

Founded in 1971, Delta Cooling Towers, Inc. of Rockaway, New Jersey, is one of the leading innovators of high-density, polyethylene plastic cooling towers. With sales representatives and distributors worldwide, Delta Cooling Towers offers a full line of factory assembled and modular plastic cooling towers in capacities up to 2,000 tons for a wide range of applications. Delta warrants the cooling tower casing or shell for 15 years.

"The new plastic tower is corrosion proof, and so we don't have to worry about rust," Niemeyer adds. "It was also the most economical price, and we were very pleased about that."

Keeping the presses going

In the capital intensive and fiercely competitive aluminum extrusion industry, the reliability of cooling towers is critical to maintaining sufficiently cool oil for the hydraulic presses to continue operating safely and accurately. This challenge can be exacerbated by hot ambient temperatures, such as the 85-degree average weather found in Puerto Rico.

"When you spend \$3 million on a piece of equipment, you have to be sure you can keep it working," says Hector Bas, Maintenance Director for Aluminio del Caribe in Humacaro, Puerto Rico. "We have two hydraulic extrusion presses, a 1,850-ton and a 1,670-ton model, which are cooled by copper loops in the presses that function as heat exchangers. We must keep the hydraulic oil temperature below 130 degrees F at all times. If the oil gets too hot, we have to shut down the press. That would mean losing four hours or possibly an entire shift. Not only would that be lost production, but it would make us push orders back, which would also mean delayed shipments. It's a domino effect."



Modularized engineered-plastic tower arrays increase cooling capacity up to 2,000 tons. An engineered-plastic cooling tower installed at Elan Chemical in Newark, New Jersey.

To meet these challenges, Aluminio del Caribe consulted with various industry representatives. Based on a compelling maintenance-free design, they installed a Delta 200-ton plastic cooling tower in January 2001. A second unit was installed when the second press became operational in April 2002.

"We just had to install a concrete pad, then place the cooling tower — which is relatively lightweight — on top of it with the anchor chains, and hook it up," says Bas. "It was easy. We had to install the motors and piping to get that cool water to the oil filter at each press location, but that was also relatively easy."

The reliability of the engineered-plastic cooling towers at Aluminio del Caribe has translated directly into ensured productivity.

"The basic improvements you get with a cooling tower like that are that you get cold water so that I can keep going all day long," explains Bas. "That means I can keep my production rate up. I can schedule orders without worrying about whether the damn press is going to overheat. The temperature never goes over 120-125 degrees [F]."

More power, less maintenance

"I needed a cooling tower with water-distribution power that is far from normal operating conditions," says Glenn Burroughs, a test engineer. "Secondly, I hate doing maintenance."

The cooling tower supports environmental testing that Burroughs carries out using electrodynamic shakers. The tests are run on equipment used in oil drilling and production operations. The electrodynamic shakers verify that the equipment in question is tough enough.

"These shakers emit a great deal of heat, and they're cooled by a closed distilled water system because distilled water doesn't conduct electricity," Burroughs explains. "Once heated, the distilled water flows through heat exchangers that are cooled by a chill water loop. A three-year-old, 100-ton Delta plastic tower is on the other end of the chill water loop. Another similar unit was also used to reject the heat created by two 1,000 horsepower drilling mud pumps. It has been working fine for over 13 years."

Saving on energy usage

In some cases an engineered-plastic cooling tower allows industrial or commercial users to completely re-vamp the technologies supporting their cooling systems, achieving greater productivity and savings in the process.

"The molded-plastic cooling tower is the only way for us to go, as I was able to eliminate double cooling — which was the case when we had metal cooling towers cooling down chillers for the process water," says Doug Henderson, Project Engineer for Cerro Wire & Cable in Hartselle, AL. "We switched over to plastic cooling towers and they give us enough cold water that we can do the job without any problems and we don't waste the energy."

Today Cerro Wire & Cable uses four 200-ton Delta cooling towers for four different process areas. Three go through heat exchangers to cool process water, while the fourth cools an open loop that runs through water troughs to cool wire as it is encased with plastic.

Plastic that pays for itself

"The Delta plastic tower cost a small percentage more than something else I could have bought, but any reasonable assumption of maintenance-savings offsets that pretty quickly," sums up Glenn Burroughs."

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