

Acid coolers

Sulphuric acid technology

Few developments in the manufacture of sulphuric acid can eclipse the Chemetics anodically protected sulphuric acid cooler introduced in the 1970's.

Developed out of the need to improve plant reliability and to free up valuable real estate, the CIL cooler, as it was once known, revolutionized the conventional methods of acid cooling. Gone were the frequent acid leaks; the plume of weak acid mist corroding away adjacent plant equipment and the all too frequent plant shutdowns to effect repair. In their place, were long periods of uninterrupted plant operation; compact plant layout; vastly reduced maintenance; greatly improved acid quality and the ability to recover sizeable quantities of valuable low grade energy.

Chemetics' success as the dominant supplier of sulphuric acid cooling technology can be attributed to two major factors:

- viewing the problems from the plant operators' perspective.
- close attention to every mechanical and material quality detail during fabrication.

Ongoing design and materials development coupled with improvements based on operating experience gained from the over 1600 acid coolers sold since 1971 have kept Chemetics Acid Coolers at the forefront of sulphuric acid cooling technology.

Design concepts: From the very beginning, Chemetics had the foresight to recognise the potential for problems to manifest themselves from the cooling water. This prompted the decision to design the coolers with water flowing through the tubes and the acid on the shell side.

Cooling water velocities are selected, based on water quality and extensive operating experience, to reduce the risk of tubeside fouling or scaling, thereby reducing operating problems and minimizing disruption of service.

The thermal and mechanical designs of the acid coolers are optimised using Chemetics proprietary design programmes. These programmes are constantly updated and refined incorporating the latest extensive field experience, producing coolers with maximum heat transfer capability and robust mechanical designs. Baffle arrangement and tubing layouts are carefully selected to provide maximum operating flexibility. Generous design allowances enable the coolers to cope with even the most severe plant fluctuations.

Sulphuric acid cooler. Large four cathode cooler

Multiple cooler installation



Design and fabrication: Design and fabrication of all Chemetics sulphuric acid coolers is carried out at its fabrication facility in Toronto, Canada. With its highly skilled work force, the key role within the company is to provide the consistent high quality fabrication required not only for acid coolers but the entire range of proprietary sulphuric acid plant equipment.

Within its fabrication facility, Chemetics possesses all the necessary skills and modern equipment required to produce acid coolers of the absolute highest quality. Fabrication procedures have been developed and refined over time to consistently exceed regulatory standards. The latest specialised computer controlled welding equipment is used for the critical tube to tubesheet joint. Plasma welding techniques are used extensively on all shell seams. At every step in the fabrication process, in-house Quality Control Inspectors ensure that every detail is checked.

Materials of construction: Each individual cooler is custom designed to meet the exact process requirements for the cooling duty.

Although several materials with good sulphuric acid corrosion resistance, including Chemetics' own SARAMETM material, have been developed since the introduction of the anodically protected acid cooler in the 1970's, no single material can offer a complete solution

to the diverse corrosion problems encountered in an acid cooler.

The most critical material selection is not the material to withstand the acid corrosion but the material which can safely and reliably handle the cooling water. The key parameter in this selection is the quality of the cooling water to be used and in particular its chloride content.

Chemetics has worked very closely with selected tube manufacturers to develop proprietary specifications and in some cases proprietary materials, e.g. CIRAMETM, to handle the complete cooling water spectrum from demineralized boiler feed water through fresh cooling tower applications to brackish and full seawater service.

Acid side corrosion: In designing an acid cooler to promote good heat transfer, it is essential that turbulent flow conditions be created with the shell of the cooler to increase the heat flux between the acid and the cooling medium. The turbulence created and associated high velocities, if left uncontrolled will promote both erosion and corrosion of the materials with which they come into contact. Fortunately, the stainless steels that provide the necessary resistance to cooling water corrosion can be protected from the hot sulphuric acid by anodic passivation of the metal surface.

Anodic passivation is achieved when the electro-chemical potential of the metal is increased to allow the formation of a stable oxide film on the acid wetted metal surfaces by passing an electrical current between a sacrificial Cathode and the Anode (the cooler). The film is the corrosion product created with the cooler is allowed to corrode under strictly controlled conditions. During the passivation cycle, the electrochemical potential of the cooler is constantly measured and the current flow adjusted to achieve and maintain the potentials required for optimum corrosion control within the individual cooler.

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Large cooler for Asian client.



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