

Pumping Solutions for Abrasive and Corrosive Slurries

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SULZER PUMPS

Zinc is the fourth most widely used metal in the world. Its electrolytic production process comprises several stages where corrosive and highly abrasive metal slurries and sludge have to be pumped. Sulzer Pumps offers custom-fit process pumps for metal refining applications whose lifetime by far exceeds that of standard rubber-lined pumps.

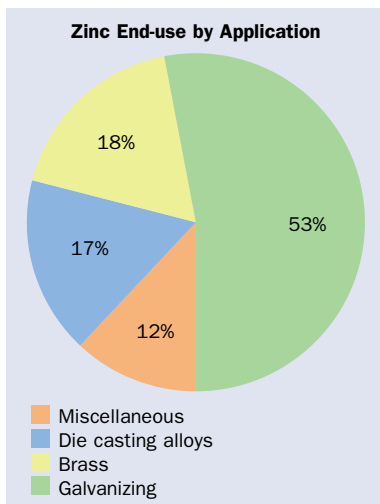
▶ Zinc occurs naturally in the environment – in rock, soil, freshwater and seawater. The mineralizations where zinc occurs in amounts that allow for profitable mining often contain other commercially attractive metals such as lead, copper and precious metals. The main application of zinc today is galvanic corrosion protection of steel (Fig. 1).

The pure metal can be produced in a thermic process by distillation or in a hydrometallurgic process from zinc sulfate solution. The lat-

ter comprises roasting of the solution to calcine; precipitation of iron as jarosite in the leaching of the calcine; production of cadmium by melt refining and a low contaminant copper cake for copper smelting in the purification; conventional electrowinning (Fig. 2), melting and casting of zinc.

Longer Pump Lifetime

Because of combined corrosion and abrasion, jarosite slurry pumping is the most difficult pumping application in this



1 Worldwide more than 7 million tons of zinc are produced annually. Its metallurgical production requires pumping of hot, abrasive, and acidic metal slurry. Sulzer pumps are used successfully for these demanding applications.

process. The liquid is highly acidic – the pH is very low – and contains 300 g/l of solids. The lifetime of rubber-lined pumps used for this application varies between two weeks and two months. By contrast, a Sulzer Ahlstar™ wear-resistant WPP pump – operated without problems for two months – showed no apparent wear when it was opened for inspection.

There are exceptionally abrasive applications in metal refining processes, like in the leaching step in zinc and nickel refining, where the solids can destroy the volute casing of a pump within weeks. If only abrasion occurs, usually a hard material like chromium iron with a hardness of 600 HB (Brinell hardness) is chosen. The lifetime of an Ahlstar wear-resistant WPP pump with chromium iron material in non-acidic applications can be about three times longer than that of a normal process pump.

Resistant Against Corrosion

Corrosion is the reaction of a material with its environment. The basic reason for corrosion is the material's tendency towards a lower energy level. Chemical corrosion is a reaction of the material with a contacting liquid, gas, material, etc. As a result, a new chemical compound is generated. The most important reaction is oxidation, which results in an oxide layer on the surface of the material.

Electrochemical corrosion always takes place within electrochemical corrosion pairs. As a potential difference between process equipment is unacceptable, isolation from the ground has to be secured. This is very important in the electro-winning process of zinc, where the dissolved product is supposed to precipitate on the cathodes. To prevent electrochemical corrosion, all parts of a pump which are in contact with the pumped liquid, including bolts and nuts, must be made of the same material. The parts of the pump which are not in contact with the pumped liquid continuously should be corrosion-resistant, especially when leakage from other process equipment takes place due to operational failures. Baseplate, bearing unit, or other parts will be lost in a very short time if they are made from cast iron.

When corrosion and wear take place simultaneously, a metallic material is the best choice. Because of their hardness, the pump's metallic parts can withstand the abrasive solids. Austenitic cast steels resist both corrosion and abrasion very well. This material is successfully used in an Ahlstar wear-resistant WPP pump in a zinc leaching process (Fig. 3).



2 Electrowinning zinc metal from aqueous zinc sulfate/sulfuric acid solution is an important industrial process.

3 Pumps made entirely from stainless steel have longer lifetime and are more reliable than conventional devices partly made from cast iron. Ahlstar wear-resistant WPP Pumps are tailor-made for abrasive and corrosive conditions.



Zero-Leakage Seals

The shaft seal is one of the most important factors when attempting to minimize the lifetime costs of a pump, which include capital, operating, maintenance and downtime costs. Experience shows that at least 60% of all troubles with centrifugal pumps are caused by the shaft seal.

Double mechanical seals with externally pressurized non-flowing sealing liquid are the preferred solution for demanding applications such as impure, crystallizing or corroding liquids as well as slurries. The sealing liquid first flushes impurities such as dust off the seal, and then a valve located after the seal is closed. The sealing water network still feeds the seal, but

the sealing liquid stays in the seal. Because of the friction heat, the temperature of the sealing liquid rises, but due to the pressure inside the seal and internal circulation through the seal faces the liquid will not vaporize (Fig.4).

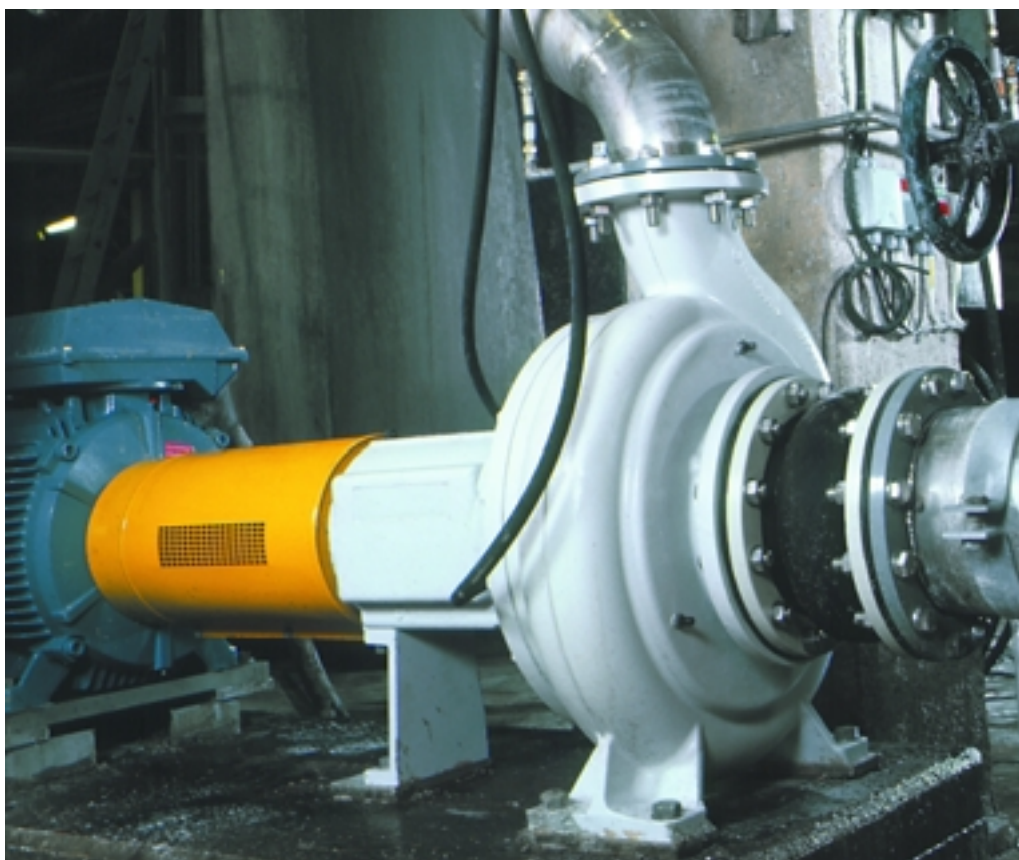
Customer-Fit Design

Sulzer designs Ahlstar process pumps to the customers needs, therefore good knowledge about the liquid to be pumped is essential. Ahlstar process pumps are designed for continuous operation in industrial processes. They can be used for pumping various kinds of liquids and slurries. Therefore, the selection of a pump for metal refining applications needs information on the pumped liquid like

density, temperature, pH, content of chemicals, contaminants, hardness, and proportion of solids in the liquid, as well as their size.

Ahlstar process pumps are designed for continuous operation not only in zinc production, but also in other industrial processes such as metal refining applications for copper, nickel, steel, alumina and aluminum. The Ahlstar process pump series offers a choice of standard, wear-resistant, non-clogging and hot-liquid hydraulic design, as well as two solutions for gas removal. ◀

4 The ready-fitted double mechanical seal – barrier non-flowing – in this Ahlstar APP process pump successfully prevents air bubbles from contaminating the electrolyte in the copper electrolysis process.



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