

Process thickener design for CORROSION PROTECTION

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A typical continuous gravity thickener consists of a tank, a means of introducing the feed with a minimum of turbulence, a drive-actuated rake mechanism for moving settled solids to a discharge point, a means of removing the thickened solids and a means of removing the clarified liquor.

There are four basic types of circular thickeners which differ primarily in the method of supporting and driving the mechanisms:

- a bridge-supported mechanism
- a centre-column-supported mechanism with a central drive
- a centre-column-supported mechanism with the driving arm at the tank periphery, normally called a traction thickener
- the tray type, which is really a variation of a bridge supported mechanism with several compartments on top of one another with a common driving mechanism

A unit thickener with a bridge-supported mechanism (see Figure 1) is discussed in this article.

Thickener corrosion

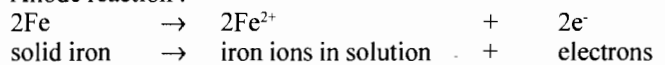
In most instances little or no long-term corrosion protection is considered at the design stages of a processing plant, with costly consequences.

A typical thickener mechanism may consist of two raking arms attached to a centre shaft through steel spiders. The long arms have sufficient blades to scrape the bottom twice per revolution, and when necessary, two additional short arms are provided to rake the inner area four times per revolution to remove large quantities of coarse particles settling out near the centre. Cone scrapers bolted to the centre shaft prevent plugging of the bottom discharge cone. These mechanisms are vulnerable to corrosion at different stages of their life cycles.

Factors affecting the corrosion rate in the thickener environment are typically the conductivity, dissolved oxygen levels, total dissolved solids, pH and certain microbial activity. The

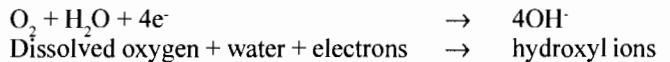
thickener is usually commissioned with a coating which under normal operating conditions would withstand most corrosion influences for a reasonable period of time. With time the original coating on the mechanisms will fail due to abrasion, pH, or other contributing factors, exposing the steel to a potentially corrosive environment. Anodic and cathodic sites typically form under these conditions with corrosion taking place at the former and protection at the latter. Typical reactions are:

Anode reaction :

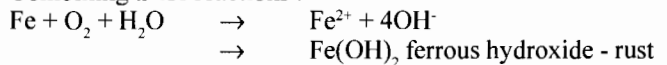


This reaction shows that corrosion is occurring as solid iron is converted into soluble ions that enter the water.

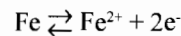
Cathodic reaction :



Combining these reactions :

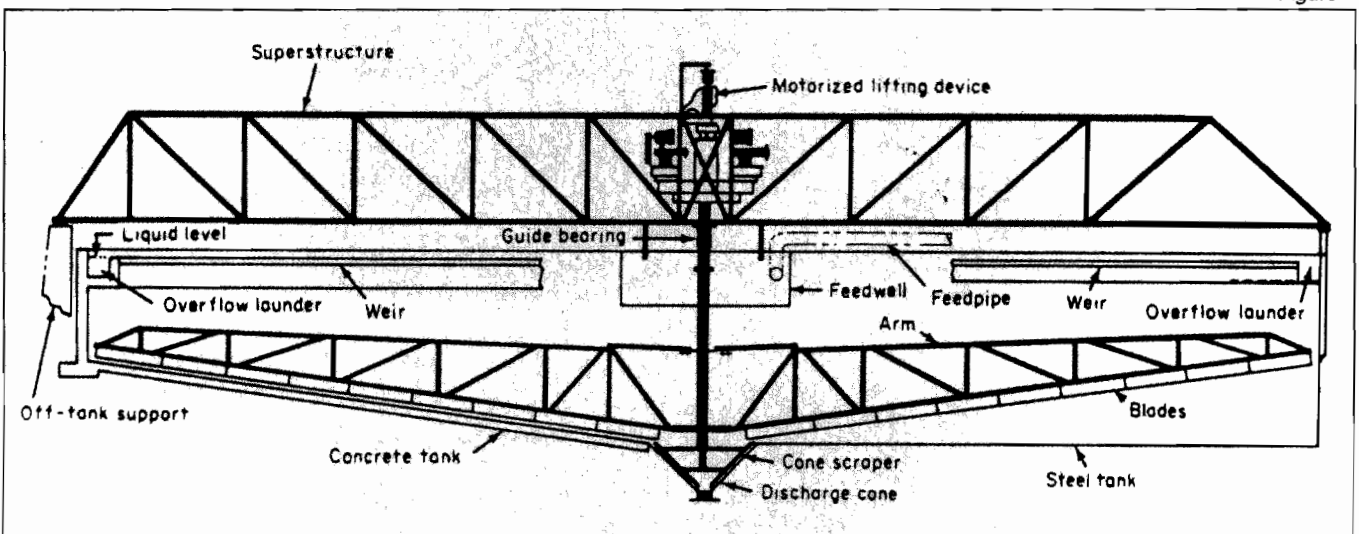


An equilibrium will best illustrate the cathodic and anodic reactions, for example the iron reaction may be represented as follows:



The above reaction is found to be at equilibrium at -0,85V with respect to a Cu/CuSO₄ reference electrode. More negative values would imply that the reaction proceeds from right to left and any iron ions in solution will deposit on the metal surface. Cathodic protection essentially enables the alteration of the metal surface potential to prevent corrosion.

Figure 1



Cathodic protection

Cathodic protection may be applied on a practical level to the mechanisms submerged in the liquid. This may be achieved by connecting the mechanisms to the negative terminal of a direct current (dc) source and connecting the positive terminal to a suitable anode in the same medium so that a current passes between the two.

Protection is achieved at the cathode (submerged thickener mechanisms) provided that the potential is more negative than -0,85V. The location of anodes relative to the mechanisms will be determined by the following variables:

- liquid conductivity
- mechanism geometry and spacing
- attachment requirements for cabling and anodes
- distributed anode approach using platinum metal oxide (PMO) anodes

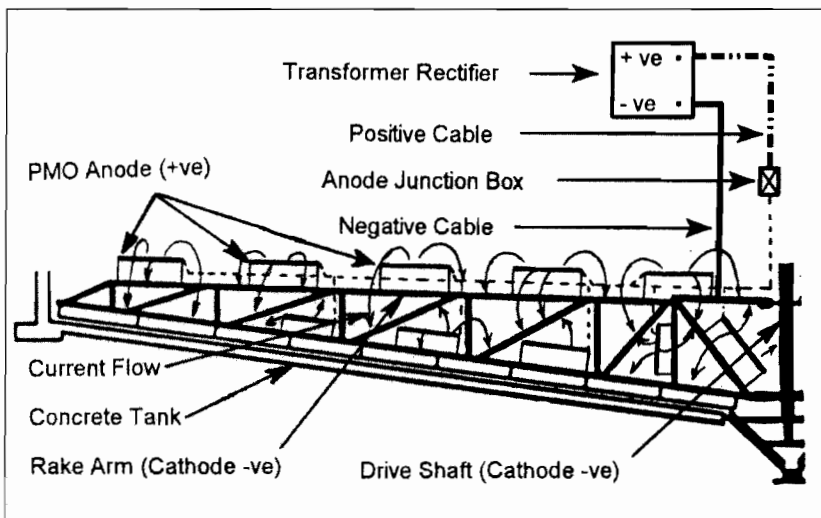


Figure 2

A schematic layout of a typical cathodic protection installation to submerged thickener mechanisms is shown in Figure 2.

New flotation plant for Impala

Outokumpu Mintec South Africa, the South African division of the Finnish international mining and metallurgical group Outokumpu, with joint venture partner Senet, has been awarded a contract to build a new flotation plant for Impala Platinum's Mineral Processes operation.

The plant will incorporate the latest flotation technology. Eighteen 130 m³ TankCells are to be installed in rougher and scavenger duties. These will be the largest flotation machines ever installed in Africa. State-of-the-art analysis, process control and a reagent plant have been included in the order.

Senet will be responsible for the project management, civil, structural and mechanical design and installation of the plant which is expected to be operational in February 1999.

Cylindrical cells have been part of Outokumpu's development work in flotation for twenty years. Flash flotation in circular Skim-Air

cells was introduced in the early 1980s after years of in-house testing in the company's concentrators.

Important elements include excellent mixing and air dispersion capabilities, particle-size based mechanism selection, patented froth crowding and froth surface area control, different launder designs, a unit reactor approach and integrated intelligent control.

Outokumpu has sold more than 500 TankCells worldwide of which 300 are 100 m³ or larger. TankCells now operate on every continent in applications ranging from the giant porphyry copper deposits of South America and the USA, nickel and zinc flotation in Australia, talc flotation in Finland, platinum, copper and nickel flotation in Southern Africa to copper, zinc, gold and coal operations in Canada.

A Courier 30XP on-stream analyser and Procon 2100 automation system with Floatcon advanced flotation control software will be incorporated into the new circuit for Impala Platinum.

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