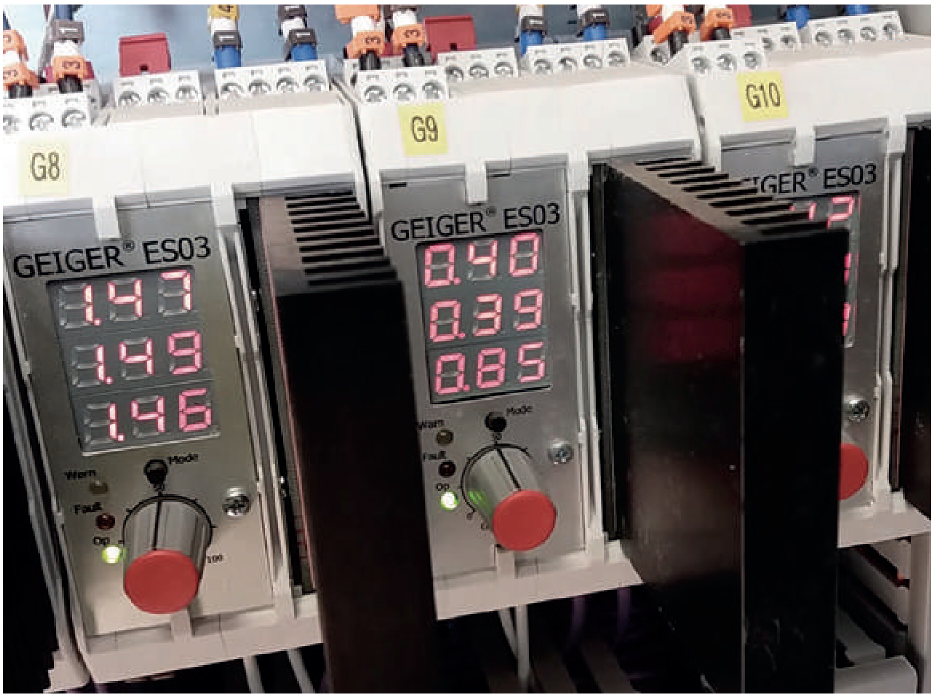
Geiger

A brand of
Aqseptence Group

Geiger® Cathodic Corrosion Protection Systems

Without a corrosion protection system in operation, it is virtually impossible to guarantee the sustainable functionality of sea water intake systems. Our plants based in Germany, are specialized in the production of water intake systems. Consequently, it boasts many decades of experience in the protection of water cleaning machines against corrosion caused by electrochemical reactions.



More than one hundred corrosion protection systems that have been designed and manufactured in Karlsruhe are in use around the world. Many of them have been installed in the Mediterranean and Gulf Region, where the machine technology to be protected is exposed to particularly corrosive sea water at high temperatures and salinity.

The Geiger® impressed current cathodic corrosion protection system (Geiger® ICCP) is a solution that is based on function and design principles for the protection of regular and stainless steel against electrochemical corrosion with a proven track record. Moreover, it is possible to reduce corrosion induced by microbes (MIC) through the operation of the Geiger® ICCP system.

The Cause of Corrosion

Corrosion of metal surfaces is the consequence of electrical currents in the metal in combination with electrochemical currents in the water, which is the surrounding conductive medium. According to Faraday's Laws of Electrolysis, the metal is consumed at the current emitting area of the metal surface (see Fig. 1). The driving voltage of these corrosion currents either comes from the inhomogeneity in the metal itself, which causes the formation of local elements, or from the formation of a galvanic element with another metal immerged in the same electrolyte.

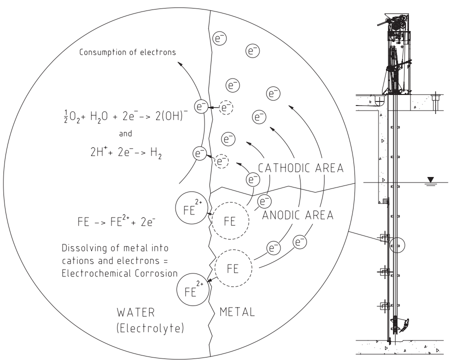


Fig. 1: The electrochemical corrosion mechanism

Corrosion Control

It is possible to prevent the electrochemical corrosion current and thus the consumption of the metal. One option is the application of an insulation coating; the other is the deployment of protective current of reverse flow direction (protective current principle).

Corrosion attacks occur rather quickly on coated steel components. It starts in small areas that have insufficient or damaged coating. As the corrosion process progresses, larger portions of the coating are removed from the metal. Ultimately, the corrosion protection provided by the coating is completely eliminated.

The protective current principle is a proven remedy, which has been successfully used for decades – not only to protect uncoated tread and gliding surfaces, but also to effectively prevent corrosion on bare spots without coating.

Without protection provisions even high-alloy steels are not completely free from corrosion. Nevertheless, with a professionally designed corrosion protection system it is possible to reliably protect even the large, exposed metal surfaces of protection objects made of stainless steel for many years against electrochemical corrosion.

Function of the Cathodic Corrosion Protection System with Impressed Current

One protective current principle implementation method is through the in-feeding of direct current "from the outside". This current is called impressed current (see Fig. 2).

To achieve this, the objects to be protected are connected to the negative terminal of a direct current source. In the case of the Geiger® ICCP, the positive terminal of the direct current source is connected to controllable DC supply devices ES03, which were developed specifically for corrosion protection applications.

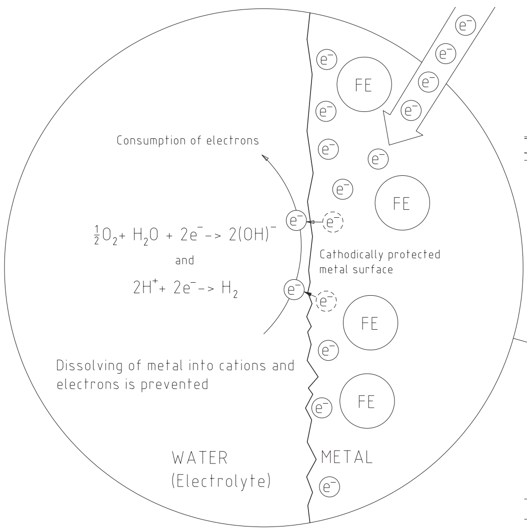
Impressed current anodes, which are set up in the environs of the objects to be protected in compliance with functional requirements, are connected to the DC supply devices (see Fig. 3).

The anodes emit the protective current into the conductive water.

In accordance with the rules of spreading current in wide spaces, the protective current reaches virtually all parts of the surface of the objects to be protected in the conductive medium, with the exception of small crevices.

The current in-feed causes a measurable change of the potential of the objects to be protected. The following effects occur:

- Suppression of the electrochemical corrosion as a result of the in-feed of protective current
- Reduction of oxygen, subsequent increase of the pH value on the surface of the objects to be protected; also supports the steel passivation
- Generation of protective cover layers thanks to the deposit of barely soluble reaction products



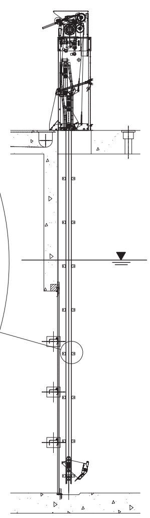


Fig. 2: The function principle of cathodic corrosion protection (protective current principle)

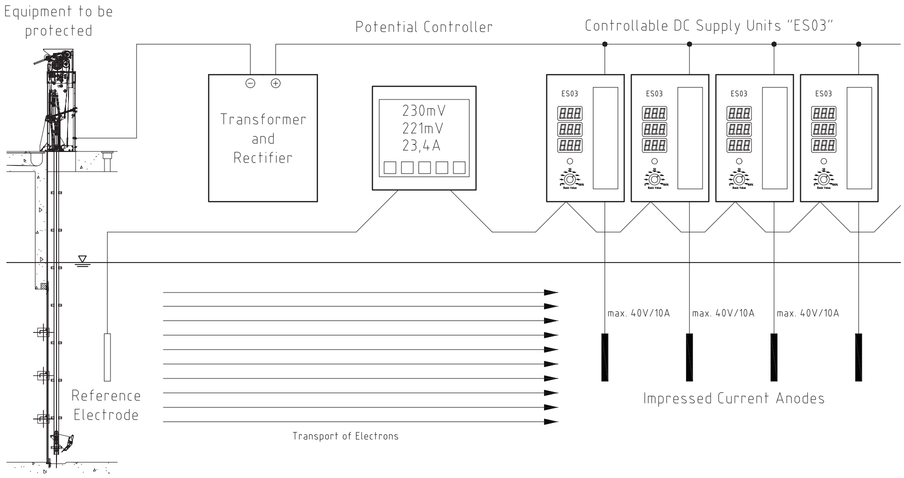


Fig. 3: Diagram of the Geiger® ICCP impressed current corrosion protection system

ES03, the controllable DC supply device, is the Aqseptence Group's latest corrosion protection technology innovation. The ES03's modern circuit technology enables the following functions:

- Maximum protective current emission of 10A paired with minimal power dissipation
- Separate measuring and display of the output current for each of the anode
- Digital controlling of the ES03 by a potential controller or also a PLC; implemented through RS-485/Modbus RTU
- A three-line 7-segment LED display that is easy to read even in bright sun light. It displays all device settings, parameters and measured values
- Realization of two reporting categories to ensure that it is possible to distinguish between warning and error signals

Fig. 4: Geiger® ICCP Corrosion protection cabinets at a power plant in Ghana

All relevant process and control parameters of the Geiger® ICCP are displayed in the operator's panel of the switching cabinet door on the touchscreen display of the potential controller. Moreover, up-to-date measuring and settings information of the individual ES03 power supply devices can be accessed on the touchscreen display.

Fig. 5: Potential controller with operating program start-up notification

As an option, the Geiger® ICCP can be equipped with a PLC, for instance enabling the system to transmit all operating data to the plant control system via a field bus system. This option can also be used to accommodate customer requests for large surface displays for convenient corrosion protection system operation via a HMI that is commonly used with a PLC.

The Geiger® ICCP ensures the provision of optimum corrosion protection for the installed machine technology thanks to:

- The fact that the number, dimensioning and positioning of the impressed current anodes is specifically customized for the plant
- The intricately distributed, needs-adequate and custom adjustable protection current in-feed
- The constant monitoring of the required protection potential
- The automatic adjustment of the protective current in-feed to corrosion affecting changes in the ambient conditions
- The modular basic concept. It makes it possible to design the system in a needs-adequate and cost effective manner
- The compact impressed current anodes, which are available in several sizes that are practical from a cost effectiveness and technical perspective (compact anodes)
- The wire anodes that are specifically installed in the guideways of travelling band screens to protect its chains
- The system's longevity: Depending on the plant-specific conditions and maintenance provided, the system can reach a service life time up to 30 years
- The minimal expenditures for maintenance and regular function checks

Corrosion Prevention with Sacrificial Anodes

It is also possible to implement the protective current principle by means of galvanic anodes, which are also referred to as sacrificial anodes. They are mounted to the objects to be protected with a conductive connection. Contributed by the electrolyte the less noble metal of the sacrificial anodes (usually aluminium or zinc) is dissolved. The thus generated surplus of electrons flows to the object to be protected as protective current.

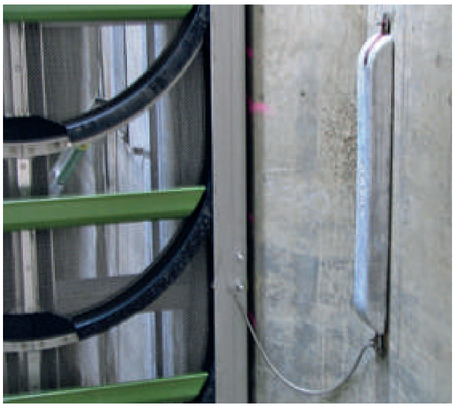


Fig. 6: Protection of a Geiger MultiDisc® Screen by means of sacrificial anodes

Sacrificial anode-based corrosion protection systems have one advantage: Relatively low material and installation costs. However, there are also some serious disadvantages. For instance, the protective effect is not directly measurable and only a relatively small amount of protective current can be delivered. This, among other things, means that a large number of anodes and a long start-up phase are required until the protective cover layers are formed. The short service life time of around 2-5 years is another disadvantage of sacrificial anode systems, which results in high operating costs and the risk of an undetected loss of protection.

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