

Diode Controlled Cathodic Protection

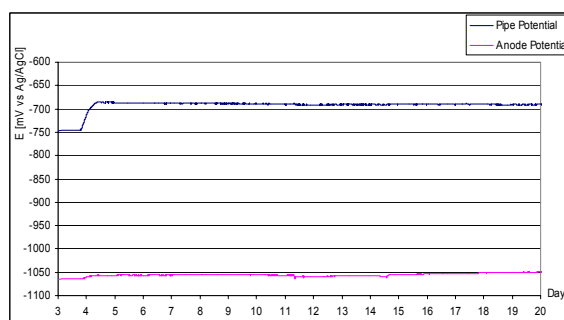


Applications

The diode-controlled cathodic protection system has been developed to prevent hydrogen embrittlement to high-strength stainless steels that require cathodic protection.

Typical applications for the product are 13% Cr, 22% Cr duplex and 25% Cr duplex pipelines, however, the system is also suitable for application to high-strength carbon steel materials where low potentials from the CP system may be a problem.

The system is installed as a part of the anode and no maintenance is required during the operational phase. For inspection of the system, FORCE Technology has also developed an inspection tool that is capable of measuring the potential of the buried pipeline.

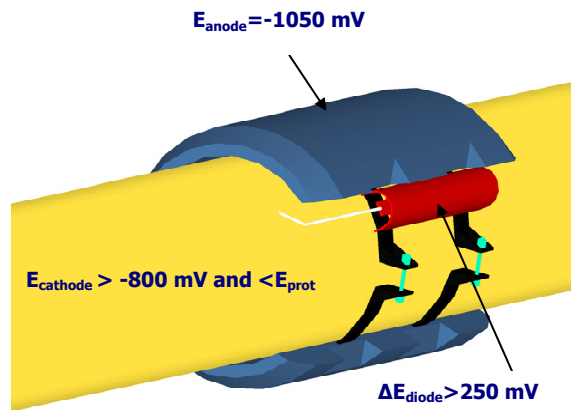


Measured anode and pipe potentials during qualification

Compared to a traditional design according to the NORSOK M-503 or the DNV-RP-B401 standards, the Diode-controlled Cathodic Protection system design will reduce the anode amount significantly.

System Description

The system is based on a diode installed in series with the anode and the cathode. The diode shall ensure a sufficient potential drop between the anode and the cathode to avoid any risk for hydrogen embrittlement of the pipe material. It shall also be ensured that the potential is sufficiently low to avoid corrosion on the material.



Installing an additional cathode close to the anode controls the potential drop over the diode. The area of the additional cathode is a design task based on the type of diode selected, material properties, coating type, pipeline design and operating parameters.

The diode package is a completely sealed unit that is designed for a maximum hydrostatic pressure of 260 bar. The materials in the unit have been selected to withstand corrosion at high seawater temperatures even without cathodic protection.

For the design of the system, pipeline attenuation calculations combined with sensitivity considerations is applied together with traditional cathodic protection calculations.

Design Data and Product Documentation

During the development of the system, extensive testing has been performed to find realistic current density data for buried pipelines operating at high temperatures. These tests were performed both in full-scale at the Trondheim harbour and in the laboratory. The results from this testing is applied in the design of the system to ensure an operating condition in accordance with the design calculation.

In addition to current density testing, extensive testing has been performed to find the protection potential for 13% Cr martensitic stainless steel for relevant pipeline environment.



The diode package installed to the sacrificial aluminum anode and the connection to the cathode plate



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