Selection Guide

	ELECTRODES								
	$Cu/CuSO_4$ (liquid) soil	Zn 99.99% (solid) soil	Zn 99.99% (solid) water	Ag/AgCl (solid) water	MnO_2 steel in concrete	Polarization probe	Test coupon	Supporting structure	Weld-in flange
ONSHORE	■	■				■	■		
OFFSHORE			■	■				■	
INTERNAL			■	■					■
STEEL REBARS IN CONCRETE					■				

Supporting structures required for the installation of electrodes can be supplied as an optional item on request

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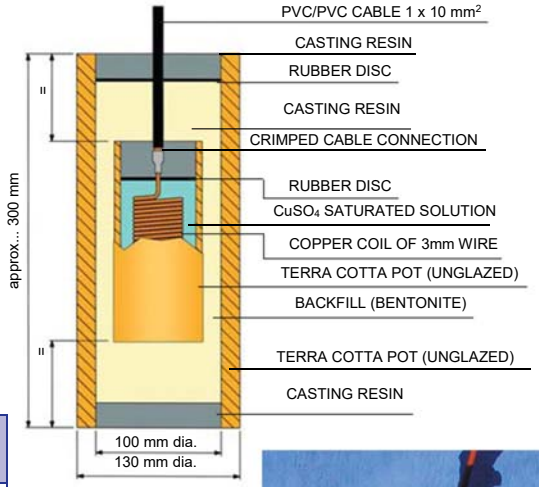
Type: Cu-PRE (Cu/$CuSO_4$)

Reference electrode CU-PRE consists of high purity copper spiral wire in a saturated sulphate solution contained in a pot of terra cotta material.

Model: Double chamber of terra cotta material. Reference electrode CU-PRE is prepacked in a cotton bag filled with non-polarizing bentonite backfill.



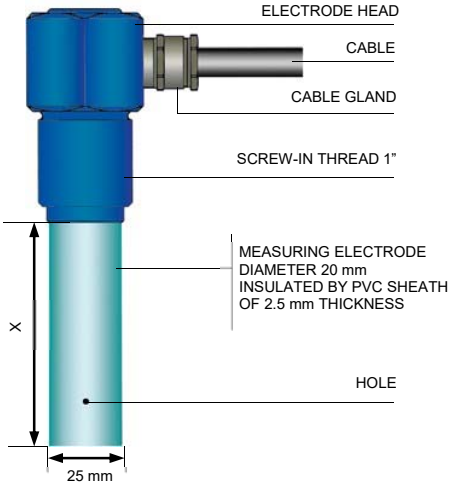
Potential referring to H_2 - electrode	+0.32 V
Temperature range	-10 - +55° C
Variation of potential, approx.	+0.9 mV / °C
Outside pot dimensions Weight, approx.	D=130, H=300 mm 12 kg
Composition of backfill	70 % Bentonite 20 % Sodium sulfate 10 % Kieselguhr
Cotton bag dimensions Cotton bag and backfill	Diameter: 260 mm Height: 560 mm Weight: 28 kg

Type: Ag-W (Ag/AgCl)

Application

Reference electrode Ag-W is used inside internally protected steel water containers, tanks, pipes etc. and is provided with a 1" screw-in thread for permanent fixture by using a weld-in flange.

The measuring cell is contained inside a plastic tube provided with 2 holes on the lower sides and 1 hole in the base for electrolytic contact to water.

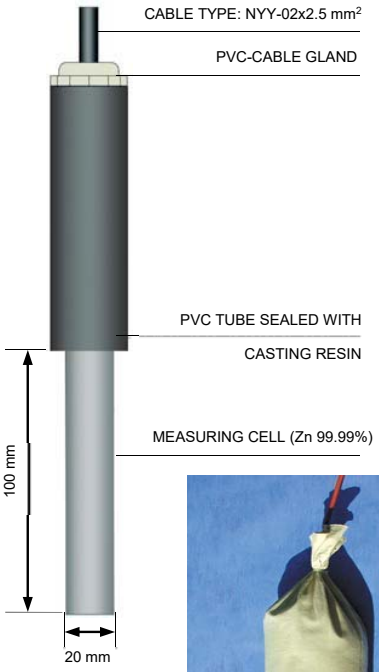


Potential referring to H_2 - electrode	+ 0.25 V
Temperature range	acc. to Purchaser requirements
Operational pressure	acc. to Purchaser requirements
Length of measuring electrode “X”	acc. to Purchaser requirements
Cable type and length	acc. to Purchaser requirements

Type: Zn-U (Zn 99.99 %)
or Permanent Underground Application

Reference electrode Zn-U is prepacked in a cotton bag filled with non-polarizing bentonite backfill.

Potential referring to H_2 - electrode	- 0.77 V
Temperature range	0 - 55° C
Composition of backfill	70 % Bentonite 20 % Sodium sulfate 10 % Kieselguhr
Cotton bag dimensions	Diameter: 250 mm Height: 560 mm Weight: 20 kg



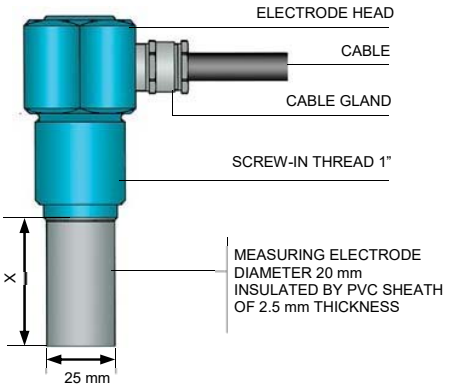
Type: Zn-W (Zn 99.99 %)

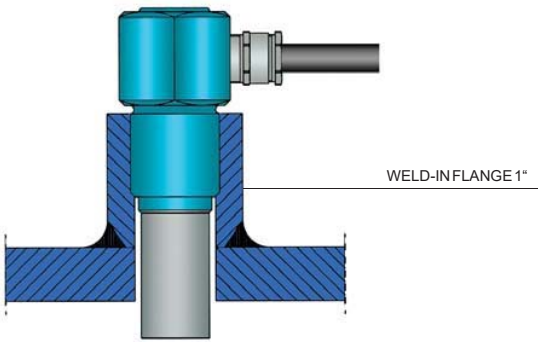
Application

Reference electrode Zn-W is used inside internally protected steel water containers, tanks, pipes etc. and is provided with a 1" screw-in thread for permanent fixture by using a weld-in flange.

The measuring cell is covered with insulating material so that the only exposed area is the circular base at the bottom.

Potential referring to H_2 - electrode	- 0.77 V
Temperature range	acc. to Purchaser requirements
Operational pressure	acc. to Purchaser requirements
Length of measuring electrode “X”	acc. to Purchaser requirements
Cable type and length	acc. to Purchaser requirements





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Polarisation Probes

General

The polarization probe is used where an appreciable voltage drops (IR - drop) in the soil is present. This is due to the flow of current in interconnected, protected pipelines or objects or due to galvanic currents or stray currents, because of contacts between steel/concrete and steel/soil in industrial plants.

The probe is buried close to a pipeline, in the same soil and connected to a test station.

Type: PSE-PB 1.0 Test surface area: 1.0 cm^2

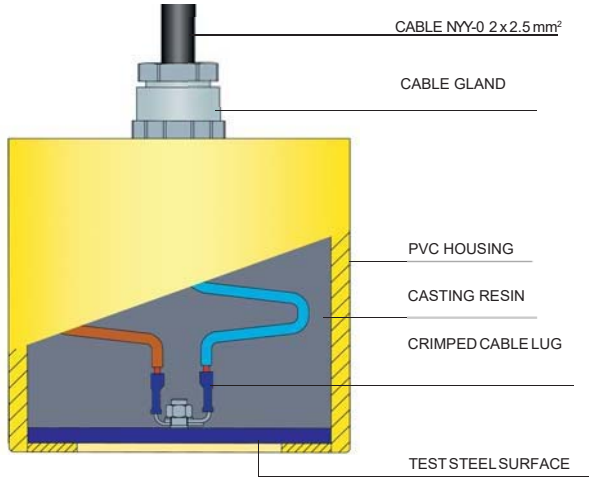
For protective objects with very small areas of coating damages like: well coated pipelines

Type: PSE-PB 10.0 Test surface area: 10.0 cm^2

For protective objects with small areas of coating damages like: bad coated pipelines or plant areas etc.

Type: PSE-PB 72.0 Test surface area: 72.0 cm^2

For protective objects with large areas of coating damages like: very bad coated pipelines or plant areas etc.



Housing	PVC
Temperature range	0° C to 55° C
Test surface material	Steel
Connecting cable	NYY-0 2 x 2.5 mm^2

Housing	PVC
Reference electrode	Zn 99.99 %
Potential referring to H_2 - electrode	-0.77 V
Temperature range	0° C to 55° C
Test surface material	Steel
Connecting cable	NYY-0 4 x 2.5 mm^2

Test Coupons

General

Coupons are one of a valuable tool in determining the effectiveness of cathodic protection. Cathodic protection adequacy can be obtained by using coupons of the same metal as that of the protected structure. These are electrically connected to the protected structure. The coupons should be placed where they can receive the same exposure to cathodic protection current as does the structure. In connection with a permanent reference electrode installed close to the test coupon the real polarisation potential of the defined test surface can be determined.

Type: PSE-TC 1.0Test surface area: 1.0 cm^2

For protective objects with very small areas of coating damages like: well coated pipelines

Type: PSE-TC 13.0 Test surface area: 13.0 cm^2

For protective objects with small areas of coating damages like: bad coated pipelines or plant areas etc.

Type: PSE-TC 75.0 Test surface area: 75.0 cm^2

For protective objects with large areas of coating damages like: very bad coated pipelines or plant areas etc.

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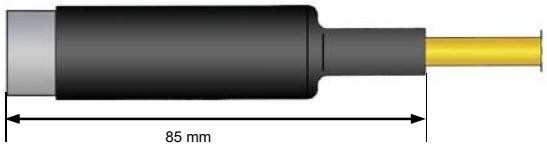
Embeddable reference electrode for potential reading (ERE 20)



The ERE 20 is a true, long life Reference Electrode, which can be cast into the cover concrete to check the cathodic protection and to monitor the corrosion state of reinforcing steel or predict corrosion.

Normally in newly cast concrete structures, but the electrode can also be installed in existing structures.

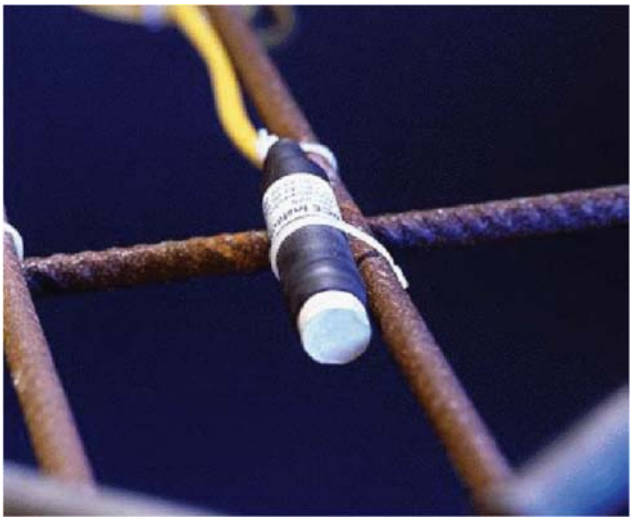
The potential of ERE 20 is virtually independent of changes in the chemical properties of the concrete. It can, therefore, be used in wet or dry concrete, whether exposed to chlorides or to carbonation.

Based on proven battery technology, the ERE 20 is a true half-cell using a manganese dioxide electrode in steel housing with an alkaline, chloride-free gel. The steel housing is made of a corrosion resistant material. The pH of the gel corresponds to that of pore water in normal concrete, so errors due to diffusion of ions through the porous plug are eliminated.

The ERE 20 can easily be attached to a logger in order to monitor data. Remote monitoring by modem is also possible.

Advantages

- Control of cathodic protection
- For potential measurement in wet and dry concrete
- Can be exposed to chloride or carbonation
- Does not induce corrosion in steel
- Does not change potential of steel
- Easy to install in new or old structures



Example

The ERE 20 is used to check the correct operation of the cathodic protection in structures. Figure 1 shows a typical curve found on checking a CP- system.

The reinforcing steel to be protected shall be polarised a minimum of 100 mV at anodic locations. When using the polarisation decay method, the decay is determined by interrupting the protective current and monitoring the reinforcement's potential measured relative to a stable reference electrode.

When the current is interrupted, an immediate voltage shift is the result of eliminating the IR-drop and is not to be included in the polarisation measurements.

According to EN 12696 the Polarisation Decay should be met within 24 hours.

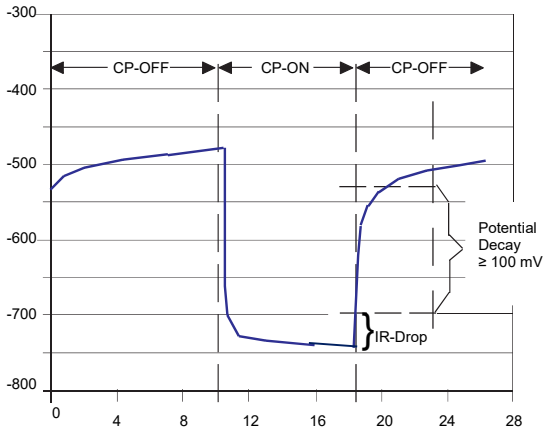


Figure 1: Polarisation Curve from CP-System

CorroWatch Multiprobe

The CorroWatch is a multiprobe, which in the standard version consists of four black steel anodes and one noble metal cathode. The anodes are placed in varying, but defined distances from the exposed concrete surface. The height of the anodes is flexib- le and can be adjusted according to the concrete cover thickness.

The CorroWatch acts as an early warning system to predict the initial stages of corrosion in concrete structures. It is cast into the cover concrete, normally in newly cast concrete structures. The probe can measure most of the relevant corrosion para-meters.

To predict when the reinforcement will start corroding, the current between the single anodes and the cathode is measured, either with a volt-meter or a specially designed data logger. When corrosion starts, the current will increase significantly.

Areas of use

- Areas difficult to access, e.g. tunnels.
- Bridges in marine environments.
- Splash zones, e.g. pillars in sea water.
- De-icing areas, e.g. parking floors/decks.
- Structures heavily affected by acid rain, e.g. chimneys.

Example

The adjacent picture shows a CorroWatch multi- probe which has been installed for monitoring of time to corrosion initiation in the immersed elements of a tunnel.

The CorroWatch were installed in such a way that the concrete cover on the highest electrode (anode) is approximately 25 mm.

Example

In Figure 1 an example from a laboratory test is shown indicating when the corrosion initiates at each of the 4 anodes.

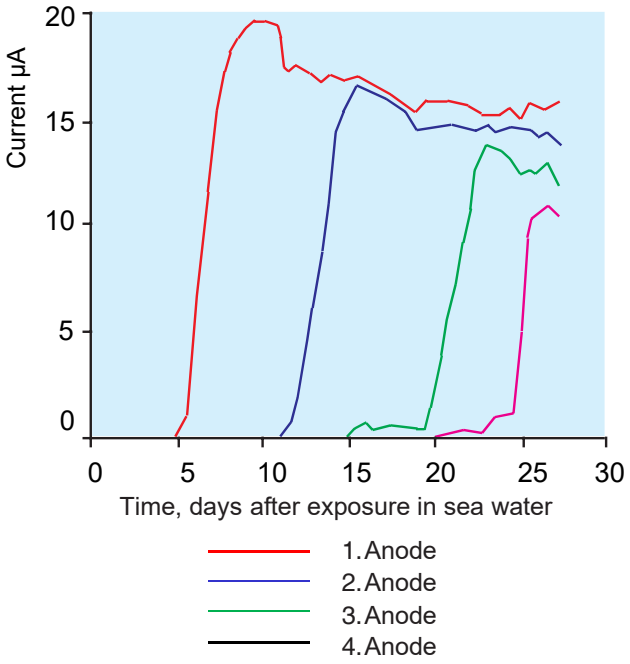


Figure 1. Increase in current in the 4 anodes