Multi Channel Potentiostat for testing the resistance to cathodic disbonding

acc. ASTM G-8, ASTM G-42, DIN EN ISO 15711, DIN 30670

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Principle of testing cathodic disbonding

The CD Test Unit can be used to test the adhesion of a plastic coating on steel pipes.

Simulation of the corrosion processes

Plastic coatings are not absolutely diffusion-resistant against water vapour. For this reason, it must taken into account that after a longer time in a humid environment, water, even if only in traces, can be found between coating and steel surface. The hydrogen absorption simulates the status forming at a leak either by cathodic protective current or corrosion processes.

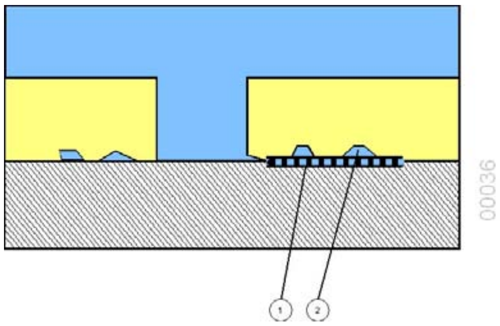

Figure 2: Water film between coating and steel surface

Pos.	Designation
1	Water film
2	Pore

Reaction of iron and water

Hydrogen develops at unprotected steel caused by the reaction between iron and water. When the cathodic protection is applied, hydrogen develops by the water electrolysis. Hydrogen ions absorb electrons from the water from the steel at the cathode (in this case: the protected object); hydrogen gas H2 develops.

This hydrogen not only develops at the free surface (the man made defect) but also within the environment insofar water was able to enter between the steel surface and the coating.

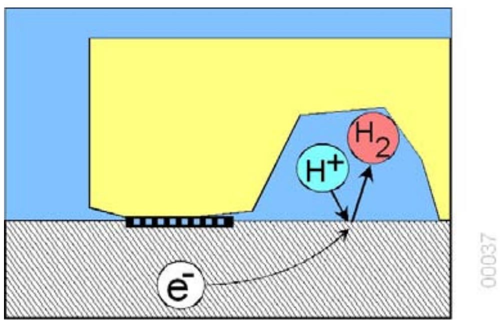

Figure 3: Hydrogen forming

Damage to the coating

Pores and blisters (locations where the coating insufficiently adheres to the metal surface) are filled with hydrogen gas. The hydrogen gas builds up a very high pressure. The result is that the coating is peeled off the surface. The water electrolysis is continued due to the water continuously permeating through.

Coating material of a good quality are less water vapour permeable than those of a poor quality. Good processing ensures that pores and blisters can hardly form. The CD test serves on the one hand to test the coating and on the other hand to check its correct processing.

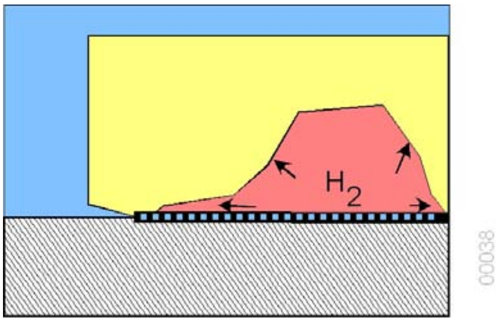

Figure 4: Delamination of the coating caused by hydrogen gas

Test installation and execution

Test installation

This chapter does not replace the contents of the corresponding standard. Refer to this standard. This chapter provides you with an example of how to apply the test cup to the part to be tested and to connect the electrodes to the CD Test Unit.

Preparation of the part to be tested

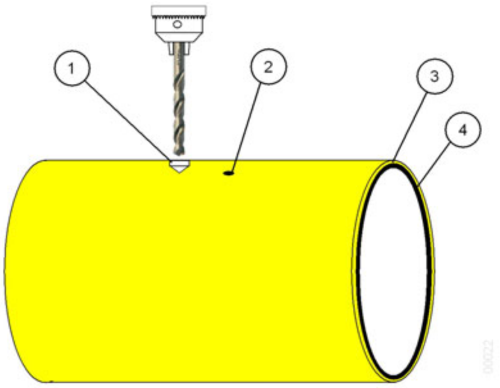

Figure 6: Preparation of the part to be tested

Pos	Designation
1	Setpoint defective point
2	Bore hole for the cathode connection
3	Pipe coating
4	Steel pipe

Table 5: Preparation of the part to be tested

- ➪ Use a metal drill to bore a setpoint defective point into the plastic coating of the part to be tested. Refer to the corresponding standard for the diameter and depth of the bore hole.
- ➪ For the cathode plug bore a hole with a diameter of 4 mm {0.16 inch} at a distance of 100 mm {3.94 inch} from the setpoint defect.
- ➪ Clean the part to be tested according to the attendant standard.

Applying the test cup

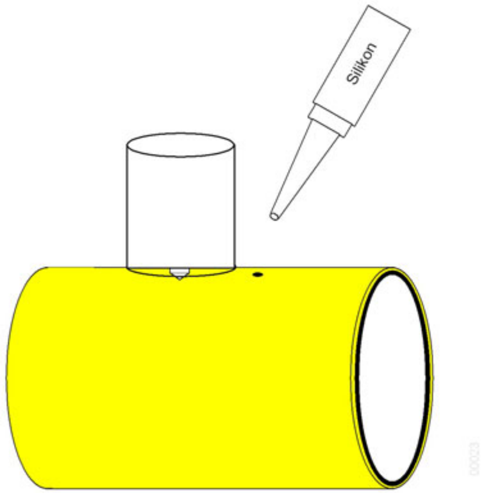

Figure 7: Applying the test cup

- ➪ Place the test cup centred above the setpoint defect.
- ➪ Use silicone to glue the test cup onto the part to be tested. The adhesive joint also serves as a sealing.

Filling with electrolyte

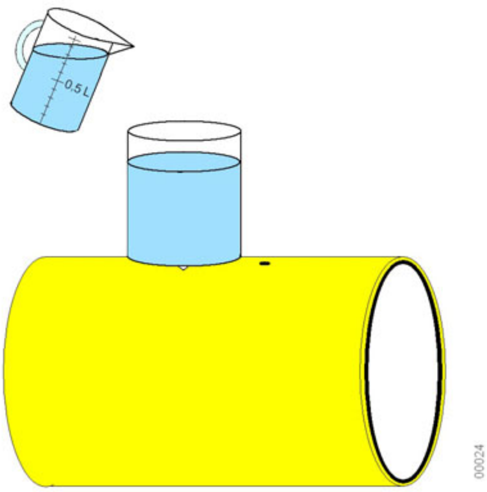

Figure 8: Filling with electrolyte

- ➪ Mix the electrolyte. Refer to the corresponding standard for the specification of quantity and concentration.
- ➪ Fill the electrolyte into the test cup.

Positioning the lid

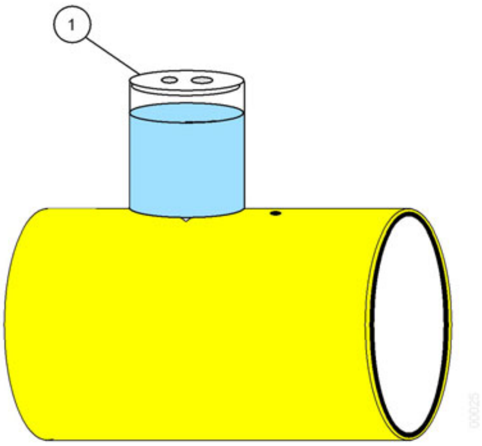

Figure 9: Positioning the lid

Pos.	Designation
1	Test cup lid

Table 6: Positioning the lid

➪ Place the lid onto the test cup. Ensure a tight seating.

Inserting the electrodes

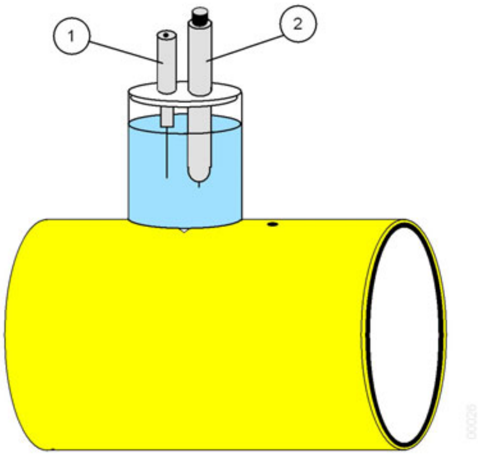

Figure 10: Inserting the electrodes

Pos.	Designation
1	Backplate electrode - Platinum wire electrode (platinized titanium electrode is also possible)
2	Reference electrode

Table 7: Inserting the electrodes

➪ Insert the backplate electrode into the smaller hole in the lid up to the stop. Use a platinized titanium electrode and the supplied O ring as a stop. Ensure that the electrode end has a spacing of approximately 10 mm {0.39 inch} from the part to the tested.

➪ Insert the reference electrode into the reamed, conical larger hole up to the stop.

Connecting the electrodes

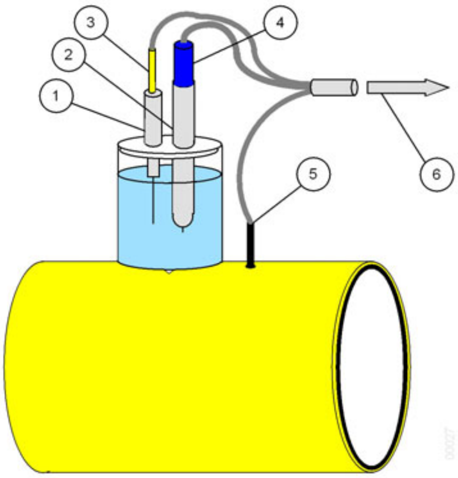

Figure 11: Connecting the electrodes to the connection cables

Pos.	Designation
1	Backplate electrode - Platinum wire electrode (platinized titanium electrode is also possible)
2	Reference electrode
3	Connector for backplate electrode
4	Connector for reference electrode
5	Connection plug for the part to be tested
6	Connector for potentiostat

Table 8: Positioning the lid

- ➪ Connect the backplate electrode to the yellow plug.
- ➪ Connect the reference electrode to the blue plug.
- ➪ Connect the part to be tested to the black plug. Insert the plug into the 3 mm {0.12 inch} hole of the part to be tested.

Connection of the connection cable to the CD test unit

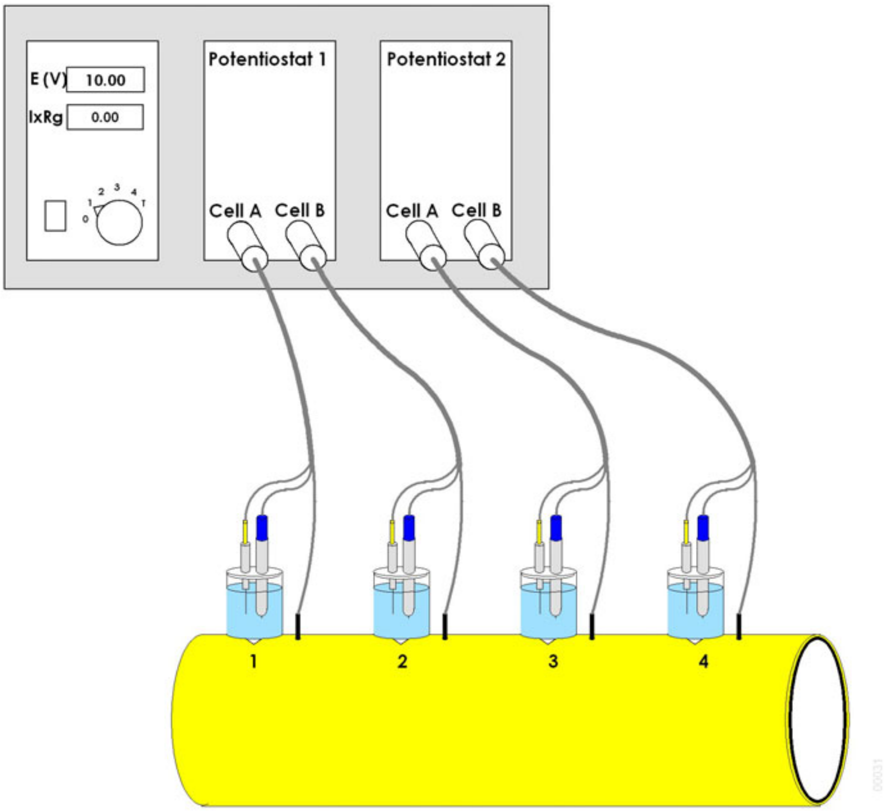

Figure 12: Connecting the connection cable to the CD test unit

➪ Connect the cable to the connection sockets of the CD test unit.

Repetition of the operating cycles

➪ Repeat the process until all desired test cups are positioned and connected.

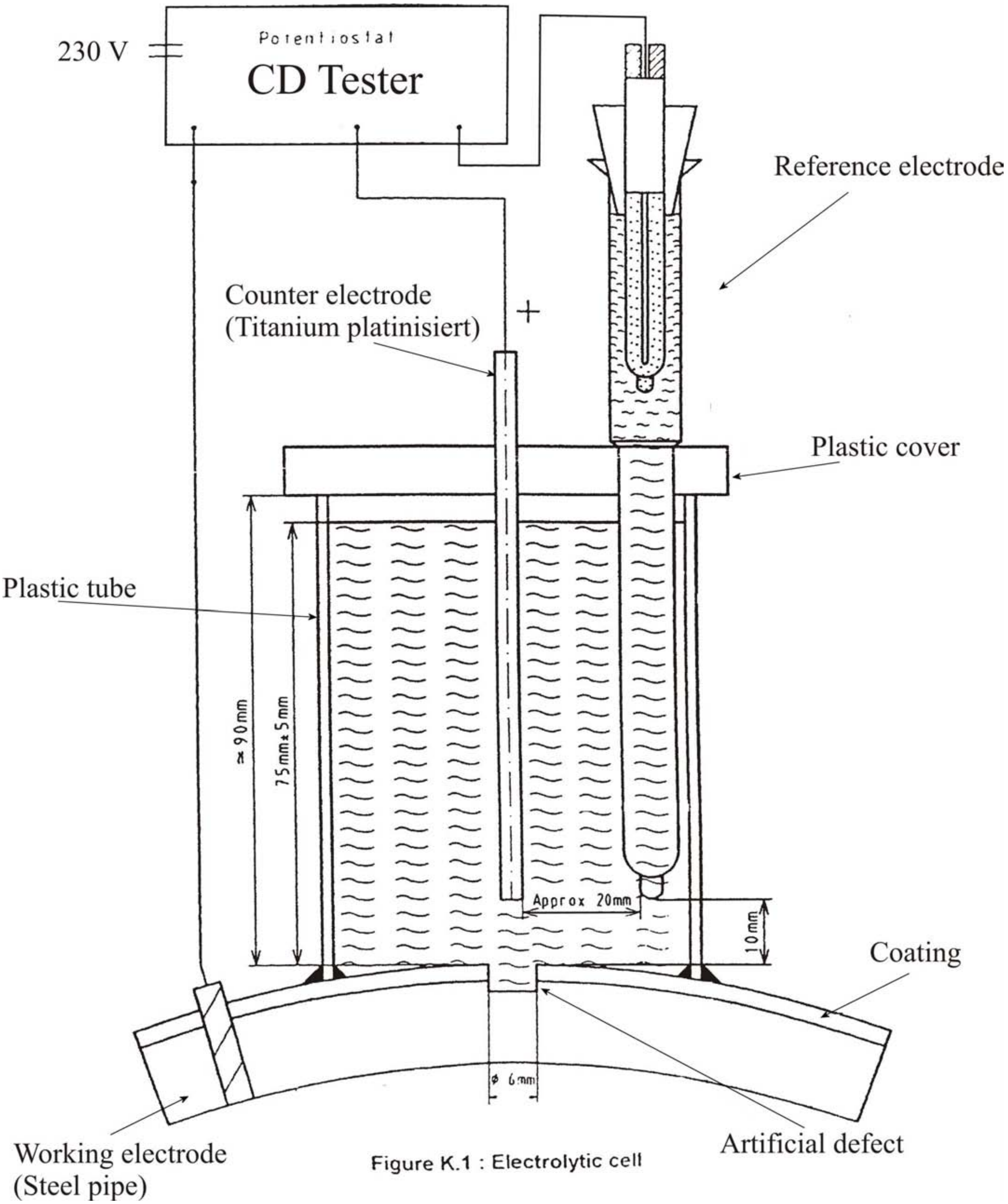

Figure K.1 : Electrolytic cell

DIN EN ISO 9001 DIN EN ISO IEC 17025

COESFELD
MATERIALTEST

HEIZPLATTEN
SANDBÄDER

für Dauerbetrieb

HOT PLATES
SAND BATHS

for continuous operation

- ✓ Robust
- ✓ Langlebig
- ✓ auch im Dauerbetrieb

- ✓ Robust
- ✓ Durable
- ✓ also in non-stop operation

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Sandbäder, elektrisch für Dauerbetrieb

Elektrische Sandbäder mit stufenloser Temperaturregelung mit oder ohne thermostatischer Regelung. Robuste Ausführung für Dauerbetrieb. Durch asymmetrische Langzeitheizung (Plattenecken und Ränder sind stärker beheizt) wird eine sehr gleichmäßige Temperaturverteilung auf der ganzen Heizfläche erzielt, wie es bisher bei konventionellen Sandbädern noch nicht erreicht wurde.

Die Sandbäder bestehen aus einer Heizplatte aus Aluminiumlegierung mit aufgeschraubtem und

abgedichtetem Edelstahlrahmen mit einer Nutzhöhe von 50 mm. Der Sand liegt daher direkt auf der Heizplatte.

Asbestfreie Isolierung, Gehäuseteile sind aus Edelstahl Werkstoff Nr. 1.4301 gefertigt, wobei das Mittelteil zusätzlich lackiert ist.

Vier Gehäusefüße, etwas höhenverstellbar. Anschlußkabel ca. 1,7 m. Bei 230 Volt bis 3300 Watt mit Schukostecker.

Sand baths, electric for continuous operation

Electrical sandbaths with variable temperature control, with or without a thermostatic regulator. Robust construction for continuous performance. Aluminium alloy hotplate. Because of the asymmetrical, long-term heating system (hotplate corners and edges are subjected to more heat) an even temperature is guaranteed over the entire heating surface. The sandbaths consist of an aluminium alloy hotplate with a screwed-on, sealed stainless steel frame with a usable height of 50 mm. The sand lays direct of the hotplate. The housing is constructed from high-grade, stainless steel No.1.4301, whereby the central section has been additionally sprayed in orange.

4 adjustable feet ensure extra stability. Connecting cable approx. 1,7 m long, 230 Volt/3200 Watt with Schuko plug.

Sandbäder mit Leistungssteller und thermostatischer Regelung							Sand baths with wattage power control and thermostaic control	
Technische Daten Best.-Nr. = Typ	**Watt**	***Volt***	***Temperatur temperature***	***A mm***	***B mm***	***C mm***	***D mm***	Gewicht weight
75-093	**4000**	**230**	**50...370 °C**	440	590	442	592	27 kg

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