Corrosion Coupons

A brief introduction

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A corrosion coupon is a bare metal device designed to provide a means of evaluating cathodic protection system performance and compliance with industry-standardized corrosion control criteria. Coupons are installed in native soil backfill near the pipe and usually at centerline elevation. The most basic models are made of metal having similar properties to that of the steel pipeline, with two wires extending from the coupon that terminate in a test station – one wire is connected to the pipe above grade (current-carrying lead), the other is used as a test lead. The surface area of exposed metal is known and may be used to calculate cathodic (or anodic) current density. A basic coupon is shown in Figure 1, below.

Figure 1: The MCMiller model COU075 is shown

Corrosion coupons are commercially available in many configurations, including those with integrated permanent reference electrodes as shown in Figure 2, below. This example has two coupons that facilitate additional measurements and provide redundancy in field applications.

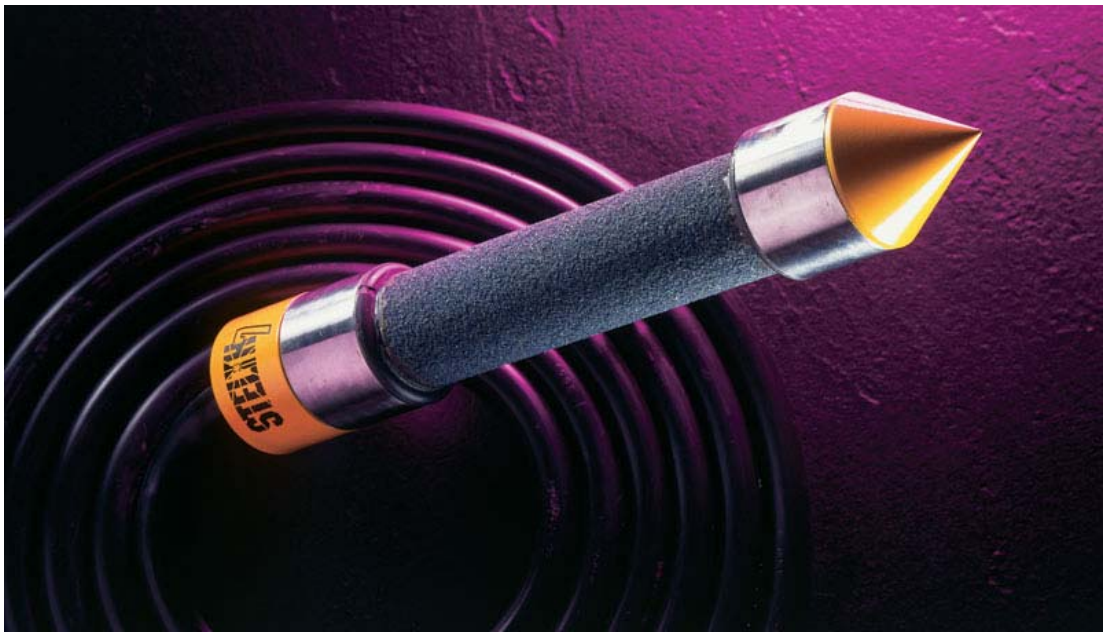

Figure 2: The STELTH7 by Borin Manufacturing has an integrated reference electrode

Key Functions of Coupons:

1. Measurement of an instant-off potential where cathodic protection systems are impractical or impossible to completely interrupt
    a. The coupon acts as a surrogate coating fault that can be controlled from a test station installed above

2. Measurement of instant-off potentials where interference is present
    a. Since the coupon can be momentarily isolated from complicated piping and cathodic protection system networks, measurements can be made that represent true polarization conditions in the absence of many current sources

3. Confirmation of the presence of interference and uninterrupted current sources
    a. A difference between the pipeline instant-off and coupon instant-disconnect potentials may indicate whether interference exists. If no interference is present, the two measurements will be very similar.

4. Provide a means of measuring current density and direction
    a. When installed with an appropriate calibrated shunt or used with an appropriately precise ammeter, current magnitude and direction may be measured. The data may be used to infer current density along the pipeline surface and identify current discharge due to interference.

5. Facilitates the calibration of DCVG %IR and ACVG dB measurements
    a. Engineers are often concerned with the relationship between indirect fault size measurements reported from coating holiday surveys and the

physical area of damaged coating on the pipe surface. The %IR or dB may be measured at the coupon. The data recorded provide a reasonable indication of that relationship for holidays of similar depth, soil conditions and physical size.

Key Limitations:

1. The length of pipe accurately represented by the coupon is generally limited in the same ways as standard 2-wire test stations. Coupons may be strategically placed along a pipeline and in locations that present a worst-case representation of corrosion conditions. Coupons, just as standard test stations, are not a substitute for high-resolution over-the-line surveys.

2. Potential measurements recorded from the ground surface above a coupon are subject to IR errors, just the same as conventional pipe-to-soil potentials.
    a. Remedy:
    Some of these errors are eliminated by measuring the instant-disconnect potential. The best way to minimize or eliminate these errors is to install a permanent reference electrode with the coupon. Alternatively, a soil access tube may be installed that allows the technician to extend the reference cell tip from the surface to soil in close proximity to the corrosion coupon.

3. Reference electrodes installed with coupons have limited life and maybe costly to replace if defective.

4. Soil access tubes may be impossible to locate over time.

Reference Standards:

NACE Recommended Practice (RP-0104-2004) “The Use of Coupons for Cathodic Protection Monitoring Applications” (Houston, TX: NACE).

NACE Test Method TM-0497-2002 “Measurement Techniques Related to Criteria for CP on Underground or Submerged Metallic Piping Systems” (Houston, TX: NACE).