

EM Coupons

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Coupon - Installation

- Installation –
 - Locations of coupons
 - Typically near any potentially corrosive inputs to the system or where liquids can collect
 - Critical angle of inclination
 - NACE SP0602, indicates within the region for ICDA
 - DOT code 49 CFR Part 192 Subpart O, indicates of performing ICDA in the cover segment
 - Best practice for determining Internal Corrosion, recommend at the POD (Point of Delivery) to the first critical angle of inclination

Coupon - Installation

- Installation –
 - Design of the coupons
 - Can be made from the actual pipe from the system
 - At least the same grade and vintage
 - Flat surface coupons are recommended
 - Do not make contact with pipeline, holder installed

Coupon – Advantages

- Coupons will determine if corrosion environment exist from the point of placement into the system
- Two types of coupons can be used for internal corrosion evaluation
 - Weight loss
 - Chemical analysis (also known as EM coupons)
- Cost is mainly accumulated in the installation

Coupons – Weight Loss

- Weight Loss Coupon –
 - Advantages
 - Determines if corrosion environment exist internally
 - Cost in the range of \$160.00 per coupon
 - Rate of corrosion can be determined
 - Disadvantages
 - To indicate corrosion activity based on weight loss of the coupon, takes a very long time
 - In most cases over a year
 - Some of the chemical analysis perform after corrosion has taken place, makes it difficult for thorough analysis due to the corrosion products left behind

Chemical Analysis – EM Coupons

- Chemical Analysis Coupon – (EM Coupons)
 - Advantages
 - Coupon retravel a lot sooner than weight loss coupons, chemical analysis will indicate if a corrosion environment exist
 - The laboratory will indicate the corrosion element (establishes the root cause for corrosion).
 - H₂S, CO₂
 - Bacteria – SRB & SPB
 - Rate of corrosion can be determined base on the PPM of the corrosion elements found
 - Cost
 - \$160.00 per coupon
 - Laboratory expense – approximately in the range of \$600.00 per coupon
 - Information can be obtained normally less than 100 hours

Chemical Analysis – EM Coupons

- Disadvantages
 - The cost is more for the chemical analysis EM vs. Weight loss type due to the expense for the lab analysis for the chemical residue on the coupon surface done on a microscopic level
 - Care must be taken on the handling
 - Must not contact the surface of the EM coupon
 - Need to minimize exposure to air as much as possible
 - Must be shipped with in 24 hours
 - Packed with cold packs to slow down the bacteria reaction for accurate data collection
 - Must be stored in vial with a special preservative solution

EM vs. Weight loss Coupons

- If corrosion is visible,
 - The attack is in an advanced stage and our program becomes *reactive* instead of *proactive*
 - EM will determine corrosion elements in the early stages so we can be proactive
 - Weight loss coupons will determine corrosion after significant corrosion has taken place in the system so we are more in the remediation stage (Re-active)



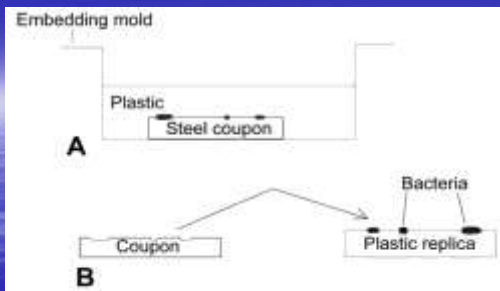
Coupons



Surface preparation of EM coupon



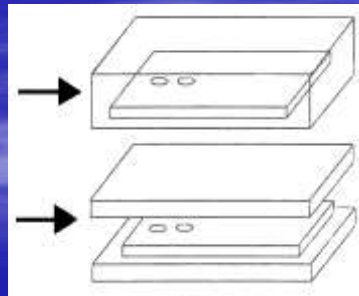
Surface preparation of weight loss coupon



Coupons received at the lab are immediately fixed, run through rinsing and ethanol dehydration series and embedded in an acrylic embedding material.

The acrylic "replica" is then removed with the biofilm/corrosion product embedded in it.

Methods





Testing Instruments Used

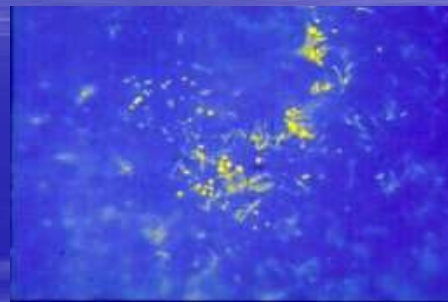
- The expected data to be obtained from the EM coupons are the following
 - Corrosion Rate
 - Pit Rate
 - Presence of MIC
 - Presence of bacteria/colonies on coupon surface
 - Presence of scale on coupon surface

Testing Instruments Used

- The coupon is weighed to determine the amount of possible metal loss to calculate the corrosion rate.
- The next step is to examine the coupon under the microscope (SEM – Scanning Electron Microscopy - 1000X) to rank the severity of the corrosion and classification (generalized or localized pitting).
- The corrosion depth can be measured to help determine pit rate with a Stereoscope.
- A Epifluorescent microscopy used to determine if any bacteria exist (replica and embedment process used).
- Some other types of equipment used for the testing process is EDS – Energy Dispersive X-Ray Spectroscopy and TEM – Transmission Electron Microscopy.



Testing Instruments Used



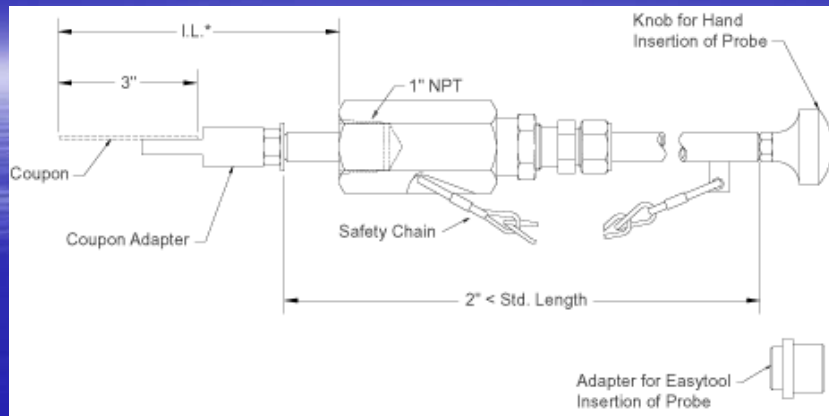
Epifluorescent microscopy process

Installing Coupon

1. Once the welding process is completed and the pipeline has been tapped, one has to measure depth from the insertion device to the bottom of the pipeline for coupon installation.
2. The coupon must be positioned within 1/8" to the bottom of the inside pipe wall
3. Insert coupon onto retrieval device with great care in avoiding contamination
4. Insert coupon retrieval device onto the top of the valve
5. Open 2" ball valve slowly, once fully open, insert the coupon until designated mark of depth is reached
6. Lock the retrieval rod into place and attach the safety chains

Model RT4000

- **Model RT4000** coupon insertion system is a retractable unit commonly used in field and plant applications.
 - A specially designed packing gland is used to insert or retract a coupon from a pressurized system without a process shutdown.
 - The insertion system is designed to mount onto a 1" piping system, but can easily be adapted to fit your specific requirements.
 - The system consists of an insertion rod with a coupon adapter, and a packing gland.
 - A safety chain and safety nut are also provided to prevent blowout.



Model RT4000

Cost of unit in the range- \$295.00 for 24"

Coupon Insertion System

Cost of unit in the range – \$335.00 for 48"

Retractable with Packing Gland

Unit is left into the system until coupon is ready to be retrieved

Retrieval can done above ground on buried pipeline.

Insertion



- Without the coupon attached, push the rod down to make contact with the bottom of the internal wall of the pipeline.
- Mark the location with some tape at the top of the retrieval device.

Insertion



- Attach the coupon,
- Insulate the bolts on the retrieval device connecting the coupon

Insertion



- Mark the direction of the coupon to allow it to stay parallel within the pipeline (flat side of the coupon position as to not to get impinged by substance in the pipeline, flow of gas does not go against the flat surface.

Insertion



- Pull the retrieval device out.
- Attach the coupon and measure from the bottom of the rod to the length of the coupon

Insertion



- Pull the retrieval device out, measure 1/8" plus the previous measurement of the coupon length from the tape to position
- Mark this location and re-insert the device with the coupon attached to the set mark to keep the coupon position at 1/8" from the bottom of the internal wall of the pipeline.

Insertion



Open bleed off valve

Insertion



Open top valve, insert the rod to the designated marked location.



Insertion



Tighten the locking nut on the retrieval device to lock the rod in place, once the desired measurement are met with the coupon placement.

Insertion

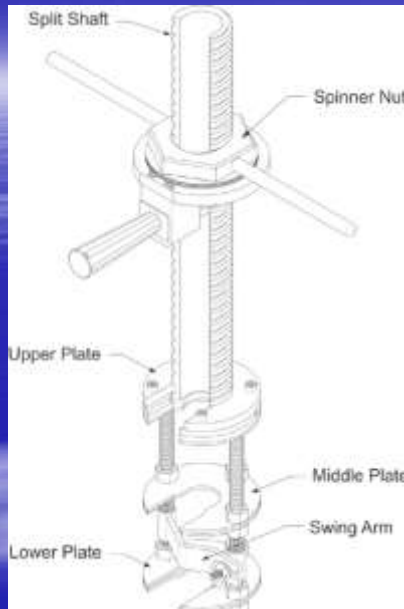


Apply safety chains in case of blow out.

Once coupon is locked and inserted, close off the bleed off valve.

Retrieval Process

1. Un-tighten lock down nuts
2. Loosen safety chains
3. Slowly pull retrieval rod back through the 2" valve
4. Shut down valve
5. Bleed off retrieval device
6. Un-screw the device
7. Use extreme care to remove the coupon from the retrieval device with out contaminating it
8. Place coupon into neutralize solution with vials
9. Place ice packs into container
10. Deliver with in 24 hours to lab



For higher pressure systems, there may be a need for the easy tool to get the coupon position.

Cost in the range of \$1685.00 for up to 24"

Cost in the range \$495.00 additional for clamp to be used on lengths greater than 44"

The unit can be reused at other locations, it is not left in place, so therefore one unit can be used for multiple applications.



Fixed Coupon Holders

Metal Samples Corrosion Monitoring Systems carries a variety of standard pipe plug coupon holder assemblies for flat and round specimens.

Retrieval Process

- Documentation is a critical point of the testing process.
- Some important points to considered such as,
 - The identification number of coupon,
 - Date of installation/retrieval,
 - Any noticeable anomalies,
 - Temperature of the pipeline & ambient air,
 - Date and time of drop off for laboratory testing

Recommend to pack coupon in Dry Ice and deliver with in 24 hours to the laboratory for testing.

Any Questions?

Thank You