Electrical Isolation Applications

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Although this subject matter is so broad, and is present throughout so many various industries; I’m going to concentrate this presentation on the GAS industry, with the bulk of the information favoring the distribution networks.
The 5 ‘W’ s

- Why do we use it or Why do we need it
- What exactly is electric isolation
- When do we use it
- Where do we use it
- Woes’ (needed a 5th “W”)
Why

- Within the Gas Industry we find the need to electrically isolate segments of pipe.
- We want this isolation to stop/restrict the flow of current. We stop the flow of current, we stop (in theory) the loss of metal.
- This need especially becomes critical when the science of ‘cathodic protection’ (CP) is applied to our structures.
The Basic Corrosion Cell

Anode \[ \rightarrow \text{electrons} \rightarrow \text{Cathode} \]

Electrolyte
The Basic “D” type Battery

- Metal cap (+)
- Carbon rod (positive electrode)
- Zinc case (negative electrode)
- Manganese(IV) oxide
- Moist paste of ammonium chloride (electrolyte)
- Metal bottom (-)
Simple DC circuit
Simple DC circuit
Corrosion Cell

The Corrosion Cell:

Anodic Area Where Metal Dissolves

Fe⁺⁺ Fe⁺⁺ Fe⁺⁺

Iron Tuberculation

Corrosion

OH⁻

Water

Iron - or Steel Pipe Wall

Cathodic Area - of Dissolved Oxygen Reduction

O₂ O₂
Corrosion Cell

The Corrosion Cell:

- Anodic Area: Where metal dissolves
  - Fe++
  - Fe(OH)₂
- Corrosion
- Iron Tuberculation
- Cathodic Area: Dissolved oxygen reduction
  - Fe++
  - OH⁻
  - O₂
- Water
What exactly is electrical isolation: it’s a barrier/gap that exists within an electrical path. This barrier/gap restricts the flow of electrons or in electrical terms = NO current flow. But for our industry, we can’t have an open section of pipe.
What

- We create this barrier or gap, by a NON-conductive material or sometimes by air.
- This is usually incorporated in the form of a gasket into a union, coupling or flange.
- Or we may use a ‘monolithic’ type insulator that creates a gap between two sections of pipe, surrounded by a fiberglass shield.
Installing an Insulating Coupling

The Corrosion Cell:

- **Anodic Area Where Metal Dissolves**
- **Corrosion**
- **Fe(OH)₂ Iron Tuberculation**
- **Fe²⁺**
- **Fe³⁺**
- **OH⁻**
- **O₂**
- **Water**
- **Iron - or Steel Wall**
- **Cathodic Area - of Dissolved Oxygen Reduction**
Note

- Now although we create this barrier/ gap; we still, in most cases, have a mechanical connection. Or a continuous path for gas flow.
- So, in order to maintain a sealed connection for gas flow, our barrier/gap has to be quite thin.
Mechanical Insulating Coupling

Typical two-piece follower construction
Typical Insulated Flange Assembly
Typical Insulated Union
Some of the common materials for this gasket

- 1) neoprene faced (most common)
- 2) glass epoxy with a seal element
- 3) canvas cotton fabric (phenolic)
- 4) silicon glass with a sealed element
- 5) nylon
- 6) air (gap)
Examples of the Gaskets
Insulating Mechanical Couplings
Insulating Tee and Valve
Weld End-Monolithic Insulator
Cross section of a typical Monolithic Insulator
Internal snap shot of a ‘Kerotest’ Insulator
When do we use electrical isolation?

- To isolate bi-metallic structures (cast Iron/steel or steel/copper)
- To isolate new steel (coated) from old steel (bare)
- Isolate protected pipe from unprotected pipe.
When
When

NEW STEEL PIPE  OLD STEEL PIPE
Where do we use electrical isolation?

- Transition between transmission and distribution.
- Transition between below and above ground piping.
- Isolate carrier pipe from casings/sleeves.
- To isolate or create demarcation points within ‘CP’ systems
A typical casing set up
A cross sectional view of casing insulator
A carrier pipe inserting into a casing
A typical ‘CP’ schematic
Woes

When we don’t or loose electrically isolate segments

- It’s the **LAW** (DOT 192.467)
- The repercussions (when they fail)
- The cost
- Pros and Cons
The lost of Insulation
Adding an Insulator
Questions, comments or complaints?

Thank You