Electrical Isolation

Period 6

Practical Applications
2017
Introduction

• Common isolating fittings & their installation
• Uses & locations of isolating fittings
COMMON ISOLATING FITTINGS AND THEIR INSTALLATION

• Unions
• Flanges
• Compression Couplings
• Monolithic Joints
• Meter Swivels and Meter Bars
Unions

• Frequently used in small diameter pipe, 2 to 3-inch
• Generally confined to above ground applications
  – most gas codes prohibit their use underground.
  – common location for isolating unions is on service risers just before the meter
• Do not over tighten the nut
  – Over-tightening can crack the sleeve and squash the gasket, causing a short and rendering the union useless

(example on next slide)
Isolating Union
Isolating Flanges (continued on next slide)

• Used wherever isolation is desired in a flanged connection
  – Can also be added in piping system where otherwise there would be no break
• Flange isolating kit consists of four components:
  – Isolating gasket - small gasket that just fits over the mating faces of the flange, or a full circle gasket that extends to the outside diameter of the flange and has holes in it for the bolts
  – Fiber or other non-metallic isolating washers; these go against the flange face
  – Steel bearing washers; these go outside of the fiber washers
  – Non metallic isolating sleeves that go over the bolts
• Some standard gaskets will also function as isolating gaskets so long as the gaskets contain no metallic particles or components
  – Many high-pressure gaskets do contain metal and cannot be used in an isolating flange
Isolating Flanges (continued on next slide)

• Installation
  – Cautions
    • fiber isolating and the steel bearing washers are put on in the right order and that they are put on every bolt
    • fiber washers go against the flange face and the steel ones go under the bolt head or nut
  – Flange bolts may be isolated on both sides of the flange or on only one side
  – Sleeve goes over the bolt
    • Do not jam a bolt through the sleeve; bolt threads will cut thorough the sleeve and cause a short
    • If bolts do not fit smoothly, use smaller diameter bolts of the same strength as the original ones
Isolating Flanges (continued from previous slide)

• Installation (continued)
  – Flange faces must line up
    • Forcing them into line will put a stain on the sleeves that will very likely crack them
  • Can protect flange from corrosion by filling the space with an inhibited grease or similar material to protect
  • Wrap outer edge with pipeline tape to prevent the entrance of water into the flange
  • Do not over tighten the bolts; can deform the isolating washers and cause shorts

(Isolating flange shown on next slide)
Isolating Flange

STEEL WASHER (TYP.)

INSULATING WASHER (TYP.)

FLANGE NUT

INSULATING GASKET

INSULATING SLEEVE

FLANGE BOLT

PIPELINE

FLANGE

ISOLATING FLANGE

FIGURE 5-2
Compression Couplings

• Plastic cap that fits over one end of the coupled pipe ends and extends an inch or so beyond the compression ring
  – cap separates the two pipe ends, thus proving isolation between them
  – don’t jam the two pipe ends together; a cracked plastic cap can cause a short

• Plastic separator placed between the pipe ends

Compression coupling shown on next slide
Compression Coupling
Monolithic Joints

• Self-contained units
  – isolating mechanism sealed within a steel container
  – entire fitting is welded into the pipeline
  – generally more expensive
  – less prone to damage or failure than other isolating fittings

Monolithic Joint shown on next slide
Monolithic Joints

ISOJOINT® MONOLITHIC ISOLATION JOINTS

Insulating Coating

Double Seal Gasket System

G-10 Isolating Ring

This cutaway illustrates the typical isolating properties of ISOJOINT®
Meter Swivels and Meter Bars

• Installed at a residential gas meter
• Swivels are equipped with an isolating washer and sleeve very similar to the those in an isolating union
  – do not over-tighten the swivel; may crack the isolation and cause a short
• Meter bar contains a built in isolating assembly
  – The larger of the two nuts contains the isolation

Meter bar shown on next slide
Typical Meter Bar

Isolated Union

Available Pressure Tap Locations

Inlet end front Position A

Outlet end front Position C

Inlet end back Position D

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USES AND LOCATIONS OF ISOLATING FITTINGS

• Above Grade Installation
• Cathodic Protection
• Sectionalizing
• Distribution Cathodic Protection
• Dissimilar Metal Separation
• Metering, Compressor and Town Border Stations
• Regulator Sites
• Casing Isolation
• Short Circuits
Above Grade Installation

• Best to isolate above grade
  – can be easily tested
  – can be easily repaired in the event of a failure

• Underground installation subjects the fitting to soil stress and the possibility of wet, low resistance soil reducing the isolating quality of the fitting
Cathodic Protection

• Isolated from other structures that are not part of the protection system

• Confines cathodic protection current to the piping to be protected, making smaller, less expensive cathodic protection systems possible

• Important when protecting coated structures with galvanic anodes, as anodes may not produce sufficient current to overcome the short
Sectionalizing

• Isolating fittings used to separate, or sectionalize
• Gas distribution systems may be broken up into families of piping, each family isolated from the others
  – Shorts or other malfunction in one family does not affect the other families
  – Facilitates troubleshooting in the family where the trouble occurred

See next slide for sectionalizing
Sectionalizing

Use of sectionalizing and service isolation
In a gas distribution system
Figure 5-4
Distribution Cathodic Protection

• Gas distribution piping electrically connected to steel service lines, is isolated at the meter
  – this isolation confines the cathodic protection to the gas piping, with no loss to water piping, telephone cable and the like
  – Residential services can usually be isolated at the meter with meter swivels, meter bars or unions
  – Commercial services, which usually have large meters, generally require flange or coupling isolation
Dissimilar Metal Separation

– Isolation is often used to separate dissimilar metals
  • In effect disconnecting the anode from the cathode
    – copper service line, for example, may be isolated from a steel or ductile iron main
– Past practices - pipe was replaced with coated and cathodically protected pipe
  • old, bare services were left in place and electrically isolated at the main
    – Note; services isolated at the main cannot be used as test points for the main
Metering, Compressor and Town Border Stations

• Transmission lines are nearly always isolated from metering and town border stations
  – usually represent points of ownership change
  – separates cathodic protection systems

• Compressor stations are complex systems and usually cathodically protected separately
  – isolation is used to prevent any problems in the compressor station from affecting the transmission line protection.
  – Some may prefer not to isolate compressor stations from the transmission line to avoid the maintenance that may be associated with isolating fittings
    • sufficient cathodic protection is used to overcome any undesirable effect on the transmission line
Regulator Sites

• Points where pressures change
  – Most companies isolate the higher-pressure piping from the lower pressure piping
  – Especially valuable where galvanic anodes are used on both systems, as the isolation acts like sectionalizing and separates the two systems electrically

• Telemetering and motor operated valves can cause shorts

• Next slide shows typical regulator site isolation
  – Notice the places where shorts can occur
Distribution Regulator Setting
Casing Isolation (continued on next slide)

- Casings must be isolated from carrier pipes
  - Many casings are bare
  - Protective current will flow to the casing and then to the pipe through the metallic contact, leaving the pipe within the casing unprotected

- Casing isolation consists of three major components
  - casing spacers
  - centering cradles
  - end seals
Casing Isolation (continued on next slide)

• Spacers are non-metallic runners that are bolted around the carrier pipe
• Spacers serve three purposes
  – electrically separate the carrier pipe from the casing
  – support the pipe within the casing
  – pipe pulled through the casing rests on the spacers; this prevents coating damage while the carrier pipe is being installed
Casing Isolation

• Centering cradle
  – Partial spacer that fits under the end of the carrier pipe and prevents it from bending down and contacting the casing
  – Most casing shorts occur at the ends
• End seals
  – Boot type is essentially a sealed rubber boot
  – Modular type secures the carrier pipe in place and seals the casing against intrusion of water and debris
• Carrier pipe must be well supported for several feet beyond the end of the casing
  – Sand bags or well-tamped earth can be used
  – Pipe should come out of the casing at exactly the elevation of the bottom of the ditch

See casing on next slide
Casing
Short Circuits

• Electrical isolation fittings can inadvertently be by-passed, or “shorted”
  – Any metallic path, such as a kick brace, regulator equalizing line or pipe supports attached to aluminum siding that goes around an isolator will render the isolator ineffective

• Above ground fittings such as block valves may have kick braces or other reinforcements that will provide a short circuit across the valve
  – braces need to be isolated in such a way that no short is created
Lab 8 – Flange Isolation Test

1. Hook leads up to meter set
2. Coated Steel (represents gas distribution system or other protected system)
3. Copper Pipe (represents water distribution system or other non-protected system)
4. Connect magnesium anode to the coated pipe
5. Take P/S reading of the coated pipe
6. Short the isolation flange
7. Take P/S reading of the coated pipe
Summary

• Common isolating fittings & their installation
• Uses & locations of isolating fittings
Questions??

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