

# AN ACCURATE ISOLATION

Tim Hurley, GPT Industries, USA, explains the importance of the type and configuration of isolation gaskets for use in hydrotesting.

**H**ave you ever installed an isolating kit in a pipeline, successfully tested for electrical isolation, but later failed isolation following a hydrotest? You may have scratched your head and wondered how that could have happened. Very possibly it was not the hydrotest, but the type of isolation gasket or configuration of the gasket used in the hydrotest and the test method used to perform isolation testing. But before we dive into that, let us review the need for hydrotesting, some common practices that are used as a 'work-around'

for this common isolation issue, and then we will talk about a simple solution.

Not only is it common practice to hydrotest, it is a legal requirement in some areas and often a corporate policy for many companies.

Hydrotesting first became prevalent in the 1950s (in the US at least) for closed systems to ensure that operational pressures would be met by the system (typically a pipeline system) without leakage or catastrophic failure. A norm of 1.5× the maximum allowable operating pressure (MAOP) was used to give a 'safety factor' over the normal operating pressure maximum.

Due to the fact that a pipeline must be taken out of service, that large volumes of water must be used and disposed of in accordance with environmental regulations, and that hydrotesting could pose a risk to highly populated areas, inline inspection (ILI) is often used to replace hydrotesting. Although ILI has drawbacks (high cost, lengthy interpretation of data, and an inability to assess leaks), it is a tool that is growing in use for determination of pipe integrity. However, despite the popularity of ILI, there are many areas within pipelines that are deemed 'unpiggable.' This can be due to the radius of pipe turns/bends, small or changing diameter pipelines, low pressure media flow or barriers in the pipeline through which a pig cannot pass. For all of these reasons, hydrotesting will continue to be used as a means of determining integrity in oil and gas pipelines.

### Considering efficiency and safety

'Work-arounds' was mentioned earlier in this article. The most common work-around has been for installers who have experienced post-hydrotest isolation failures is to install a spiral wound or Kamprofile gasket in place of the isolation gasket before hydrotest, then to hydrotest the line, and then remove the spiral wound or Kamprofile gasket and replace it with an isolating gasket. This keeps the isolation gasket relatively dry and more likely to pass a resistance isolation test. The looming issue is that now the

pipeline has an unproven connection, and operators must hope that during system start-up the unproven gasket does not leak or blow out. Additional personnel time dedicated to installing two gaskets in the same flange limits the effectiveness of installation crews to meet timeline goals and system start-up dates, which can translate into lost production and significant expense. There are also safety considerations to take into account. Installing the gaskets in the same flange twice can double the potential for injuries and can double the potential for flange/bolt/nut damage. Another risk involves lubricant on the bolts. When installing a spiral wound or Kamprofile gasket, an installer could mistakenly apply a metallic based lubricant (which is typically fine for a spiral wound or Kamprofile gasket) that could later ruin the isolating properties of an isolating kit.

### Glass reinforced epoxy isolating gaskets

Now, why would an isolating gasket lose a large share of its isolating properties after a hydrotest? One possible reason is the gasket was simply oversized on the inside diameter or off-set, allowing water to sit in the gap. This is mostly understood by users and will not be a primary piece of this article. The greater insight is that it was generally thought that glass reinforced epoxy (GRE) isolating gaskets absorb very little water. That is entirely true when the GRE is tested for water absorption in an ASTM D570 test. During that test, the GRE sample is simply placed in water for somewhere between 24 - 72 hrs until equilibrium is achieved, then weighed to determine a water absorption percentage. The percentage of water absorption for GRE is typically extremely low (around 0.1 - 0.2%). We must remember though, that this test utilises unpressurised water. Under pressure, the water absorption story is entirely different.

Under pressure, water will also find its way through the body of GRE materials, and this will dramatically reduce the electrical resistance of the gasket.

It would be ideal to install an insulating kit, perform a hydrotest, and then leave the gasket in place knowing that it will isolate even after hydrotesting. But is this even possible? The answer is yes.

### A barrier for the gasket

A patent was awarded not long ago to a design that protects the GRE from the media by utilising a PTFE barrier. The barrier is more than just a barrier, it is also the primary sealing element for the isolating gasket. The PTFE seal is interlocked into the GRE/316 stainless steel core and during installation conforms to the flange surface, creating a very tight seal. This not only keeps the media from entering the GRE, but also provides the isolation gasket with other benefits, such as better resistance to sour gas media and other aggressive mediums (GRE materials are not



Figure 1. Performing a pipeline hydro test.

given a high rating for chemical resistance to sour gas), and the elimination of the need for exotic metal cores (many isolation gaskets are traditionally 316 stainless steel cores with a GRE lamination on both sides). Due to the isolation properties of GRE, galvanic corrosion should not occur, but some customers want the metal core to match the exotic metallurgy of the piping system. Since the metal core of the PTFE inside diameter (ID) seal gasket is not exposed to the media, this need is eliminated and is a much lower cost solution. The PTFE ID seal also creates a 'longer path' for isolation. A traditional metal cored isolating gasket has approximately 0.070 in. of insulating material on the metal core. Electricity must span the 0.070 in. to electrically bridge the gap. For the PTFE ID seal, the PTFE is 0.260 in. thick, creating a longer span for electricity to bridge.

During a hydrotest, this ID seal prevents water from penetrating into the body of the GRE. This effectively keeps the GRE material dry even when the gasket is exposed to liquids in the pipe stream. So, how do we know moisture is not getting by the PTFE seal/barrier? A pre/post-hydrotest has been performed on standard GRE/316SS cored gaskets in comparison to the PTFE ID sealed 316SS cored gaskets, and the results are dramatic.

### Test parameters/procedure

#### ➤ Isolation test (pre-hydro) – dry:

- Temperature: Ambient.
- Orientation: Flow = Vertical.
- Pressure: 0 psig.
- Gasket size/class: 2 in./600#.
- Gasket types: G10/316SS core and VCS-ID.
- Number of samples: 3 each.
- Mylar sleeves/G10/ZPS washers.
- Bolt torque: 62 ft/lb.

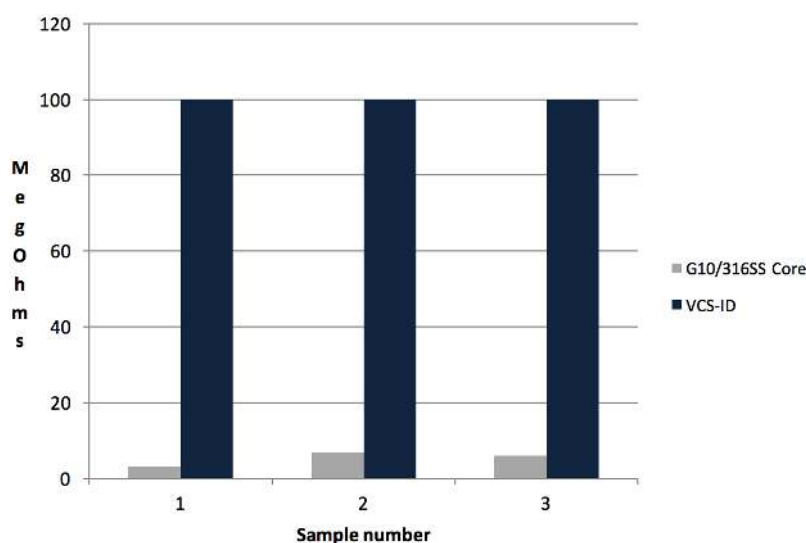


Figure 2. Post-hydro results.

- Take flange-flange and flange-bolt readings.
- Megger setting: 500V DC.
- Isolation test (post-hydro) – wet:
  - Temperature: Ambient.
  - Orientation: Flow = Vertical.
  - Pressure: 2220 psig.
  - Media: Water.
  - Gasket size/class: 2 in./600#.
  - Gasket types: G10/316SS core & VCS-ID.
  - Number of samples: 3 each.
  - Mylar sleeves/G10/ZPS washers.
  - Bolt torque: 62 ft/lb.
  - Test duration: 15 min.
  - Megger setting: 500V DC.

To a casual observer watching a hydrotest in the field, they may feel that the isolating gasket is performing as intended after the hydrotest simply because it is not leaking. However, if the isolating gasket does not have a PTFE ID seal, it is likely absorbing moisture under pressure and losing much of its electrical resistivity. There is no standard for the acceptable resistance for an isolating gasket, however you can see from the aforementioned test that a standard G10/316SS isolating gasket had only an average of 5 MΩ of resistance (post-hydro and without an ID seal), while the PTFE ID seal gasket had an average resistance value of 100 GΩ.

At this point it is important to stress that the correct isolation test will depend heavily on the alternate electrical paths that can be taken, isolation of other metal work and adjacency to a section of above-grade piping. In general, it is best to measure isolation with a radio frequency meter, audio frequency pipe locator or magnetometer system (NACE SP0286-2007). An ohmmeter can drive voltage through an alternate path, and in the case of hydrotests, this can be any residual water in the system not properly measuring the true isolating capabilities of the gasket.

As is clear, a PTFE seal on the ID can make a tremendous amount of difference between an isolating gasket that effectively manages the isolation of a CP system and any typical stray AC or DC currents, to one that allows 'leak by' and reduces the performance of both the isolating gasket and CP system. The PTFE ID seal can also benefit a user by minimising the negative impact of iron sulfide or black powder build-up on isolation, by reducing the risk of chemical attack on GRE, and through improved sealability. 