

OE-3: 2018-05

August 2018

Gaskets for High-Density Polyethylene Flanges

PURPOSE

This Operating Experience Level 3 (OE-3) document provides information about recent gasket failures in flanged joints of High-Density Polyethylene (HDPE) piping.

BACKGROUND

HDPE piping joints are typically thermal fusion welded joints, but flanges may also be used.



Figure 1. HDPE flange adaptor with metal backing ring

When flanges are used, an HDPE flange adaptor with a metal backing ring is fused to HDPE piping, as shown in Figure 1.

The HDPE flange adaptors are used to connect to other flanged fittings, such as valves, elbows, tees, etc., with gaskets inserted between the flanged fittings.



Damaged gasket

INCIDENT DESCRIPTION

In 2018, two HDPE flange adaptor gaskets on two different valves that were part of an underground fire suppression system at a Department of Energy (DOE) nuclear facility in Amarillo, TX failed, causing several weeks of unplanned interruptions to nuclear facility operations. Fire suppression water was isolated to two nuclear facilities, requiring nuclear operations to be paused and fire watches to be established. Both couplings were installed by the same contractor and had been in service for approximately eight years. Both flanges were correctly torqued to 160 foot-pounds with no indication of the necessary re-torque.

The initial failure of the gasket caused a low flow, high-pressure leak that was not detected for some time. With the system pressure operating at approximately 150 pounds per square inch (psi), the orifice created by the failure of the gasket(s) between the two flanged faces created a water jet, which eroded the metal valve flange and bolts.



Bolt cut from the water leak between the flange faces



A section of the eroded valve flange



Flange face erosion

DISCUSSION

Because HDPE will relax after the flange bolts are torqued, a re-torque after 24 hours is required. Even after the bolts are re-torqued, the face stresses drop to 400–600 psi. The lower face stress reduces the friction for maintaining the gasket in between the flange faces. The challenge is finding a gasket that can handle pressures that may exceed 200 psi, gauge (psig), but also seal well at relatively low stresses.

Due to the many inquiries from customers and engineering firms for gasket applications involving HDPE piping, Garlock, a gasket manufacturer, published a memo in January 2017 recommending using either GYLON® Style 3545 or MULTI-SWELL™ Styles 3760/3760U as the best options for HDPE flanges, even though the available compressive loads are lower than recommended. The reinforced gasket material of the GYLON and MULTI-SWELL has proven to prevent the internal water pressure from damaging the gasket under low-compression loads.

Other gasket manufacturers may have similar gaskets that will work for this application. It is important for the Design Engineer to work with the gasket manufacturer to properly specify the correct gasket.

RECOMMENDATIONS

When using HPDE piping with flanged joints, ensure that the flange bolts are re-torqued at least 24 hours after gasket installation.

When evaluating gasket material, be sure to include any surge pressure that could be caused by opening valve and starting pumps. Also, include any additional design/safety factors in your gasket calculation. And, directly work with the gasket manufacturer in making a selection.

REFERENCES

[Garlock Sealing Technologies Memo](#), "HDPE Flanges: Gaskets for 'Flange Adapters' and Stub End Connections," dated January 10, 2017.

Plastic Pipe Institute TN-38, *Bolt Torque for Polyethylene Flanged Joints*, dated July 2011.

Questions regarding this OE-3 document can be directed to Brian Rhodes, Pantex Facility Representative, at (806) 477-7561 or brian.rhodes@npo.doe.gov.

This OE-3 document requires no follow-up report or written response.

Josh Silverman
Director, Office of Environmental Protection and
ES&H Reporting
Office of Environment, Health, Safety and Security