
To: General Distribution Date: January 10, 2017
From: Gasket Applications Engineering
Subject: HDPE Flanges: Gaskets for "Flange Adapters" and Stub End Connections

This bulletin addresses the issues, challenges, and recommended gaskets for HDPE (High Density Polyethylene) piping.

The challenge of HDPE connections: Garlock gasketing Applications frequently receives inquiries from customers and engineering firms for applications involving HDPE piping. HDPE stands for high density polyethylene. This piping material has been around a while but seems to be gaining popularity. The most challenging applications are where a bolted joint is to be buried. This is common in fire suppression systems, where a plastic pipe needs to be buried in order to survive a fire. HDPE is also used in other underground systems, including potable "drinking" water. Most of the piping is fused (no flanges) but where it connects to a valve, pump, or other device, it will be a bolted connection. And buried bolted connections are a challenge! Why? Because it's impossible to retorque the bolts once the pipe is buried, and because the desired service life is decades, not years.

Some bolted connections can be made with no gasket at all, because the HDPE surfaces will seal against each other in many applications. However, a gasket is usually recommended for connections to metal flanges, and most customers prefer a gasket in all bolted joints.

Bolts: Most buried connections will utilize a corrosion resistant fastener. Since the allowable bolt torques on HDPE connections are considerably lower than the values for carbon steel flanges, most fasteners will probably be low strength (around 30,000 psi yield).

Flange configuration: Most HDPE bolted connections utilize "lap joint" type connections, with the HDPE acting like a raised face and a separate metal backer flange for the bolting. The manufacturers have two designs that are similar to lap joints: "flange adapters" and "stub-ends". (We would treat these joints the same but it's good to be familiar with these terms so that we are speaking the same language.) There are "flange adapters", which have long pipe sections that will be fused to the pipe, or "stub-ends", which are similar except the HDPE section is very short, making the fused joint very close to the bolted joint. In both types, the bolts are inserted in the metal flange, since the HDPE stops INSIDE the bolt circle (Figure 1)



Figure 1 (3" 150lb HDPE with metal flange backer)

Available compressive load: In addition to the long service life and lack of access to the connection once it's buried, there is another significant challenge: the available compressive load on the gasket. Most manufacturers of HDPE piping subscribe to the recommendations of the Plastic Pipe Institute, or PPI. (<http://plasticpipe.org/>) They created the document known as TN-38, **Bolt Torque For Polyethylene Flanged Joints**. The PPI typically limits the compressive stress on the faces of the pipe connections to 1800 psi. There is a well known relaxation inherent in the flange material, such that the stress quickly drops to approximately 600 psi. The PPI and pipe manufacturing members recommend a retorquing after initial bolt-up. However, even with retorquing, the stress will eventually drop to the 400-600 psi range.

Why the compressive load is an issue: The PPI leaves the responsibility for gasket selection to the customer and the gasket manufacturer. The challenge to gasket manufacturers is finding a gasket that can handle pressures that may exceed 200 psig, but must also seal well at these relatively low stresses. It's important to understand that non-metallic gaskets do not hold pressure by tensile strength alone; in many cases tensile is a small part of the pressure capability of the gasket. Instead, it is mostly the frictional force between the gasket and flange face that holds the gasket in place. Since the compressive load from the bolts determines the friction force between the gasket and flanges, the pressure capability of the gasketed joint depends largely on the compressive load applied. As we said above, the compressive load on an HDPE flange is considerably lower than we typically recommend.

Gaskets: Many of these systems use a rubber gasket or a cloth-inserted (CI) rubber. These are not perfect solutions, since some rubber gaskets have blown out at higher pressures, while many CI rubber gaskets have leaked or wept through the fabric. Garlock Application Engineering is very wary of using low durometer non-inserted rubber in these assemblies, since our maximum recommended stress is 900 psi for rubber with hardness less than 70 Shore A. An installation stress of 900 psi will represent very low bolt stresses and torques. The use of low bolt loads at installation often leads to leaks.

Some customers have used standard fiber gaskets such as BLUEGARD® Style 3000 or 3200, even though the normal recommended minimum stress on these styles is 3600 to 4800 psi; far above the standard 1800 psi used in HDPE connections. These have not always been successful.

We have had success with GYLON® Style 3545 in HDPE flange adapters, and this style is mentioned in the TN-38 guidelines.

For the last few years we have been recommending, and have had success, with MULTI-SWELL™ Style 3760 and Style 3760U (NSF 61). Style 3760U is the unbranded version of MULTI-SWELL which is certified to NSF-61 for drinking water. One project for potable water included larger pipe sizes, up to 54”.

We consider both GYLON® Style 3545 and MULTI-SWELL™ Styles 3760/3760U as the best options in these flanges, even though the available compressive loads are lower than we recommend.