GORE® Universal Pipe Gasket (Style 800)
Tech Notes

INSTALLING GORE® UNIVERSAL PIPE GASKETS (STYLE 800) IN GLASS-LINED STEEL EQUIPMENT

Overview

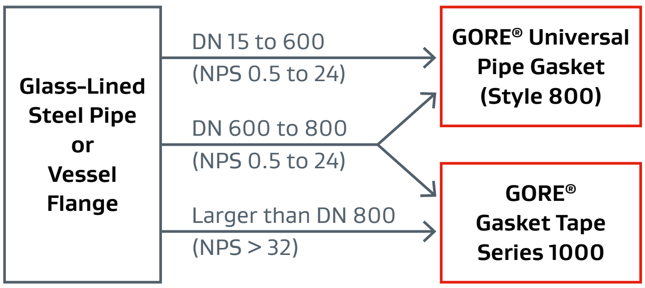
There are two main challenges to generating an effective joint design for glass-lined steel (GLS) equipment and piping: protecting the glass surfaces and forming a durable seal. With its low stress-to-seal properties and highly-conformable base material, GORE® Universal Pipe Gaskets (Style 800) – referred to as UPG – can effectively manage these issues. This technical note addresses the flange characteristics and operating conditions that can affect sealing. It summarizes industry best practices for gasket installation and provides GLS-specific recommendations and considerations for reliable sealing.

GLS equipment applications

GLS equipment and pipe is used in applications where chemical properties of the media are incompatible with the standard piping materials. The glass surface provides the chemical compatibility and wide temperature range needed for these challenging applications. The 100% ePTFE material used in UPG is fully chemically resistant and can be used in a wide temperature range. The surface of GLS flanges can be easily damaged, increasing the risk of leaks or expensive repairs. UPG gaskets help avoid surface damage and conform to deviations in the mating flanges. Maintaining the surface condition of the flange and the integrity of the seal helps to extend the pipe life and reduce the risk of leaks.

GLS applications most commonly use a Gore UPG gasket with a thickness of 6 mm. The main considerations for gasket thickness are the surface condition of the flange and the magnitude of any deformations.

- A 6 mm gasket can compensate for surface deviations up to 2 mm and still form a durable seal.
- For flanges with a diameter of 24" (DN 600) or greater, or those that have larger deviations, use a form-in-place gasket material such as GORE® Gasket Tape Series 1000, which is available in thickness up to 9 mm and can be shimmed to add more gasket material if needed for large deviations.



Typical flange configurations

Typically, GLS flanges are configured as either:

- a stub-end with j-clamps providing the load to seal the joint
- a stub with loose rings attached that are bolted to complete the flange joint.

In most GLS flanges, the sealing surface typically has a slight crown, which can contribute to alignment issues and deviations in the mating surface. While GLS manufacturers have reduced the surface variability of current flanges, UPG still acts as a buffer for these deviations. UPG readily conforms to the flange surfaces and creates a seal at lower stresses compared to harder commodity PTFE materials.

Together, improving life

Ring gasket ID configurations

UPG ring gaskets are available in two specialized inner diameter (ID) configurations designed to give additional protection to the glass surface of the flange:

- **GLS ID:** This extends the gasket ID to the beginning of the flange radius to cover the entire sealing surface. As UPG has minimal creep it does not extend into the pipe's fluid area, even during service.
- **NPS ID:** This nominal pipe size (NPS) ID, also known as "old standard," accommodates a legacy industry practice. Designed for flange sizes up to NPS 12 (according to ASME B16.5), it extends the gasket ID past the flange radius to the pipe bore diameter. Since this gasket ID extends slightly past the flange-sealing surface into the media, this configuration is less ideal than the GLS ID. However, NPS ID does meet the glass surface-protection requirement.

Standard Pipe ID gaskets are not recommended for GLS flanges, as they do not cover and protect the entire sealing surface from damage. Consult with your Gore team if you have any questions about the use of standard gasket dimensions.

Flange torque capacity

GLS pipe and equipment manufacturers specify torque limits based on the stress capacity of the flanges. These limits are intended to reduce the risk of flange deflection which could crack the glass surface. Many manufacturers provide assumptions behind their limits.

- Compare any assumptions to actual installation conditions to ensure all materials conform to appropriate guidelines.
- Ideally, an installation design should include a reasonable margin to compensate for common threats to forming a reliable seal.
- No installation should use a torque that is outside of the range specified by the equipment manufacturer.

If a conflict is revealed, consult with Gore to help resolve the issue.

Torque specifications for GLS are typically lower than ASME or EN guidelines for steel flanges, which limits the sealing stress that can be applied to the gasket. Gore's low stress-to-seal UPG gasket is especially well-suited for GLS, as it can form a durable seal against up to 10 bar (145 psi) of pressure with as little as 10 MPa (1450 psi) sealing stress. See Gore's UPG data sheet for additional details about sealing requirements. Use the link or QR codes below to see Gore's suggested guidelines for UPG gaskets in standard GLS flanges.

Glass-Lined Steel Torque Tables

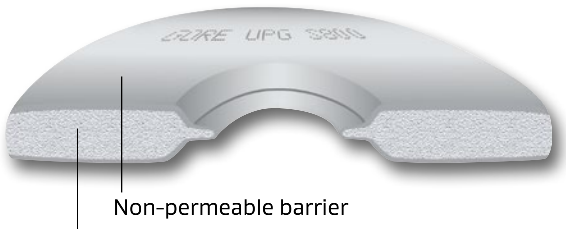
EN standard

ASME standard

Bolted joint configurations

The use of a model helps form a complete understanding of the bolted flange joint. A model can reveal the specific conditions required for a durable seal as well as suitable design margins to guard against future leaks. Models are based on a number of key factors:

- the compressed area of the gasket
- the amount and strength of available bolting
- the gasket material's stress-to-seal characteristics
- the flange's capacity to support the bolts
- operational factors (e.g., temperature and pressure)



GLS flange models typically have a crowned flange mating surface. The gasket material characteristics determine the minimum sealing forces to create a seal. UPG gaskets combine a full density "skin" with a conformable core. This reduces the risk of media permeating the installed gasket, and provides the low stress-to-seal performance. The crowned surface can help build additional margin because of the stress concentration at the peak of the crown.

The joint model can compensate for creep by building margin into the design and by using best practices during installation. Trays and packing supports can add gaskets to a joint and increase the risk of bolt load loss. The ePTFE material in UPG gaskets has a multi-axis expanded structure, which reduces thermal creep through increased strength in the "X–Y" directions. Using best practices such as re-torquing after initial installation and re-torquing after a thermal cycle can reduce the effect of creep. A design model with an increased margin can also reduce the risk of leaks after installation.

Torque recommendation

A key parameter from the bolted joint model is the torque recommendation for the installation. The value is based on applying adequate stress on the gasket to form a durable seal as well as sufficient design margin to reduce the risk of leaks. The bolted joint model will reveal the design limiting factor that sets the maximum force that can be applied to the gasket. In GLS flange joints, the limitation is commonly set by the manufacturer's maximum torque specification for the flange. Weak bolts can also be a limiting factor in the model. A typical design process would identify the constraining component (flange limit, bolt strength or other factor), then evaluate the available stress to seal under these conditions. If the available gasket stress meets the material recommendations, the next step would be to evaluate the design margin and make a risk assessment. Temperatures nearing 100 °C and above would suggest thermal creep would be a design concern and sufficient margin would be beneficial to reduce risk.

Severe operating conditions may require margin of almost twice the standard material guidelines to mitigate risk of leaks. Gore can provide support to create bolted joint models for higher-risk applications with temperatures > 75 °C and pressures > 7 Bar (100 psi).

Installation guidelines

Standard best practices will deliver performance close to the design model. ASME PCC-1 is a useful industry reference for best practices related to bolted joint installation in standard steel flanges. GLS flanges will follow most of these standard guidelines, but the specific material considerations for the glass surface suggest a few modifications. This document provides a high-level summary of some industry best practices. Significant additional detail is available in the industry documents. A key point for best practices is to follow an installation procedure that will maximize the potential for a gasket to form a durable seal. A quality installation reduces the risk of leaks and results in considerable cost savings.

Summary of key best practices per ASME PCC-1

- Well lubricated (if permitted) new hardware for installation
- Calibrated torque wrench
- Multi-pass torquing procedure to reach target w/star pattern: 20–30%, 50–70%, 100% of final torque
- Circular passes at 100% torque until the nuts stop turning
- Re-torque after 4 hours

Re-torque guidelines

Re-torque after a minimum wait of four hours from initial installation, however, 24 hours is preferred. This delayed re-torque will compensate for "cold creep" in the gasket due to initial loading from the bolts.

Re-torque after thermal cycling and return to ambient conditions. Do not re-torque if the system is above 60 °C (140 °F). Some installations may not be able to re-torque after start, which increases the design considerations for margin. If a leak test with steam or at some elevated temperature approaching operating conditions is planned, a re-torque after cool-down can help reduce the impact of thermal creep from the gaskets.

Special considerations for GLS piping

ASME PCC-1 was written mainly focused on standard steel flanges. However, GLS's slight surface crown and smooth delicate surface need to be treated differently. A conservative approach to GLS pipe flange installation suggests a more gradual loading of the flange.

- A four-pass tightening sequence (25%, 50%, 75%, 100% of final torque) followed by circular passes, may benefit GLS through more uniform compression of the gasket around the flange.
- This conservative four-pass process may be appropriate for flanges with significant deviations or installations with little design margin.

A similar conservative process can be used for the final circular pass at 100% of torque.

- The ASME PCC-1 guideline for installation is to continue circular passes at 100% of final torque until the nuts do not appear to move when torqued.
- However, for GLS flanges, do a maximum of two circular passes, to avoid over-compression of the gasket where stress may be concentrated at deviations in the GLS surface.

The use of a conservative, alternate installation process is a judgement call by the end user. Variables that guide this decision include the condition of the piping flanges, operating conditions, and design margin in the bolted joint model. Gore can help review applications and plan an installation process.

Support

Gore offers a number of documents to help you understand the parameters for successful sealing with UPG gaskets, along with information about our complete gasket portfolio: **gore.com/UPG**

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