

FlatSeal™ Guide 1

Fundamentals of Flat Gasket Technology

This FlatSeal™ Guide explains the most important fundamentals, design requirements and boundary conditions that need to be considered when creating a successful sealing system with **gaskets manufactured from fiber, PTFE, graphite and mica**.

Uses of Flat Gaskets

Flat gaskets are used to create detachable connections for housings or pipelines. They compensate for any unavoidable unevenness on sealing surfaces caused by manufacturing processes, preventing media from escaping as effectively as possible.

Flat Gasket Requirements

The gasket material must be chemically resistant to the media being sealed. In addition, it must be able to cope with any mechanical loads within the sealing joint – especially under in-application temperatures.

Types of Leakage

There are two types of leakage, dependent on the location from which it occurs (Figure 1). Surface leakage involves leaks between the seal and the sealing surface, while cross-sectional leakage occurs through the cross-section of the gasket material.

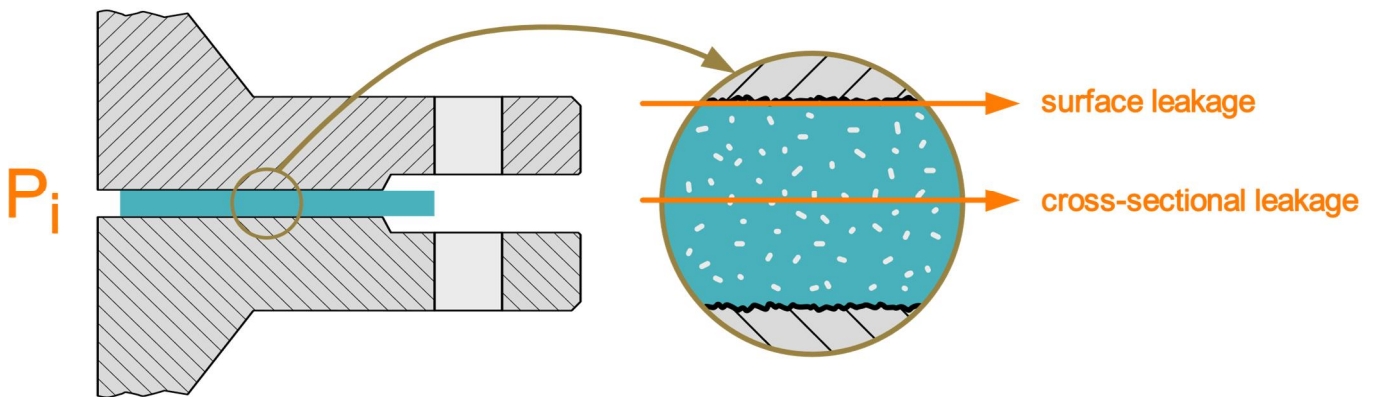


Figure 1: Types of leakage

Flat Gasket Properties

To ensure the flat gasket can adapt to the unevenness of the sealing surface, the sealing material chosen must be deformable – in other words, it must be compressible (see Compressibility, according to ASTM F36J).

This property is achieved by a degree of microporosity within the gasket. Depending on the material, interrelated leakage paths can occur within the seal, resulting in an amount of cross-sectional leakage. Every gasket material is therefore a compromise between adaptability and cross-sectional tightness. Modern materials (such as HMF17) solve this problem through careful material composition and an improved manufacturing process.



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Design Requirements for Sealing Systems

By far the most important property of a sealing system is the surface pressure that is acting on the seal. The more surface pressure, the better the sealing material adapts to any unevenness of the surface, preventing surface leakage, and the greater the degree that internal microporosity is eliminated, preventing cross-sectional leakage (Figure 2).

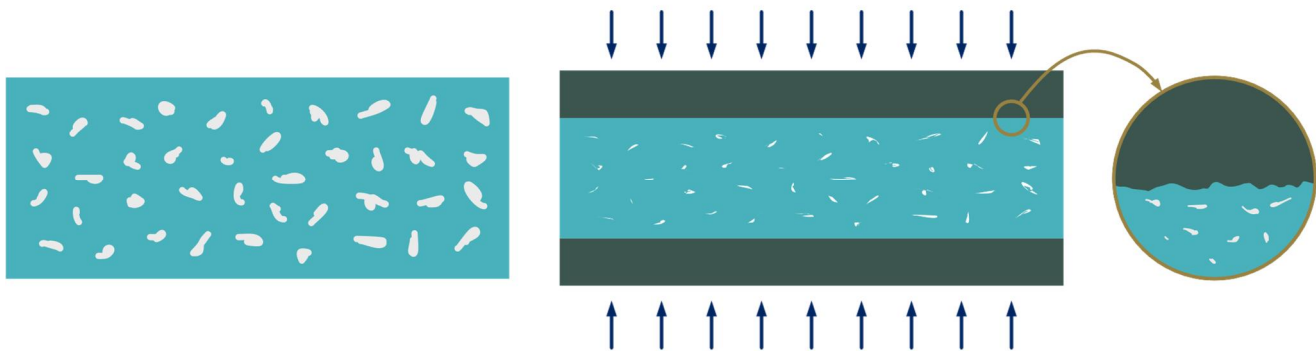


Figure 2: Surface pressure on the seal causes it to adapt to surface unevenness and reduces internal microporosity, reducing leakage

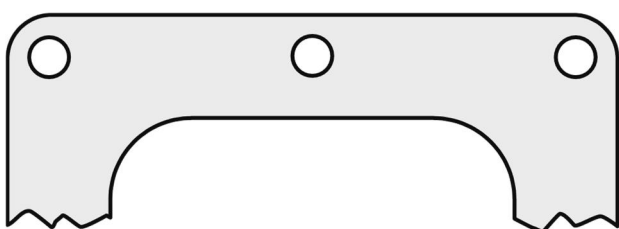
The level of surface pressure mainly depends on two factors: the available bolt load and the sealing surface to be compressed. This leads to the following important conclusion:



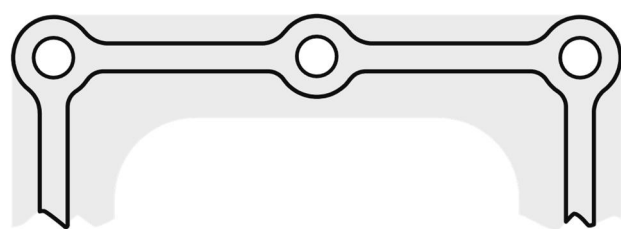
A sealing connection does not exist because of the surface, but due to surface pressure! The geometry of the seal should only be as large as necessary. It is better to have one more bolt than one less!

Ideal Gasket Geometry

1. Gaskets should be as thick as necessary to be able to sufficiently compensate for unevenness, and as thin as possible to minimize the risk of cross-sectional leakage. The thickness should also optimize the mechanical properties – especially under temperature. Reasonable gasket thicknesses range between approximately 0.5 mm and 2.0 mm.
2. Thickness/web width ratio: In order to maintain the character of a flat gasket, the gasket thickness and the web width of the gasket should preferably not fall below an aspect ratio of 1:5. Since this is difficult to achieve, especially for ‘sealing washers’ due to their geometry, seal thickness should not exceed 1.0 mm.
3. Optimized geometry (Figure 3): Often a significant improvement of the sealing system can be achieved by optimizing the sealing geometry (see FlatSeal™ Guide 4).



Housing geometry



Optimized gasket geometry



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Figure 3: Comparison of housing geometry and optimized gasket geometry

Further Information

Other FlatSeal™ Guides deal with the following basic topics:

- FlatSeal™ Guide 1 – Fundamentals of Flat Gasket Technology
- FlatSeal™ Guide 2 – Choice of Sealing Material
- FlatSeal™ Guide 3 – Installation Instructions
- FlatSeal™ Guide 4 – Optimized Gasket Geometry
- FlatSeal™ Guide 5 – Lubrication of Bolts
- FlatSeal™ Guide 6 – Roughness of Sealing Surfaces
- FlatSeal™ Guide 7 – Service Life of Sealing Systems
- FlatSeal™ Guide 8 – Shelf Life of Sealing Materials
- FlatSeal™ Guide 9 – Tolerances Cut Parts
- FlatSeal™ Guide 10 – Temperature Test

