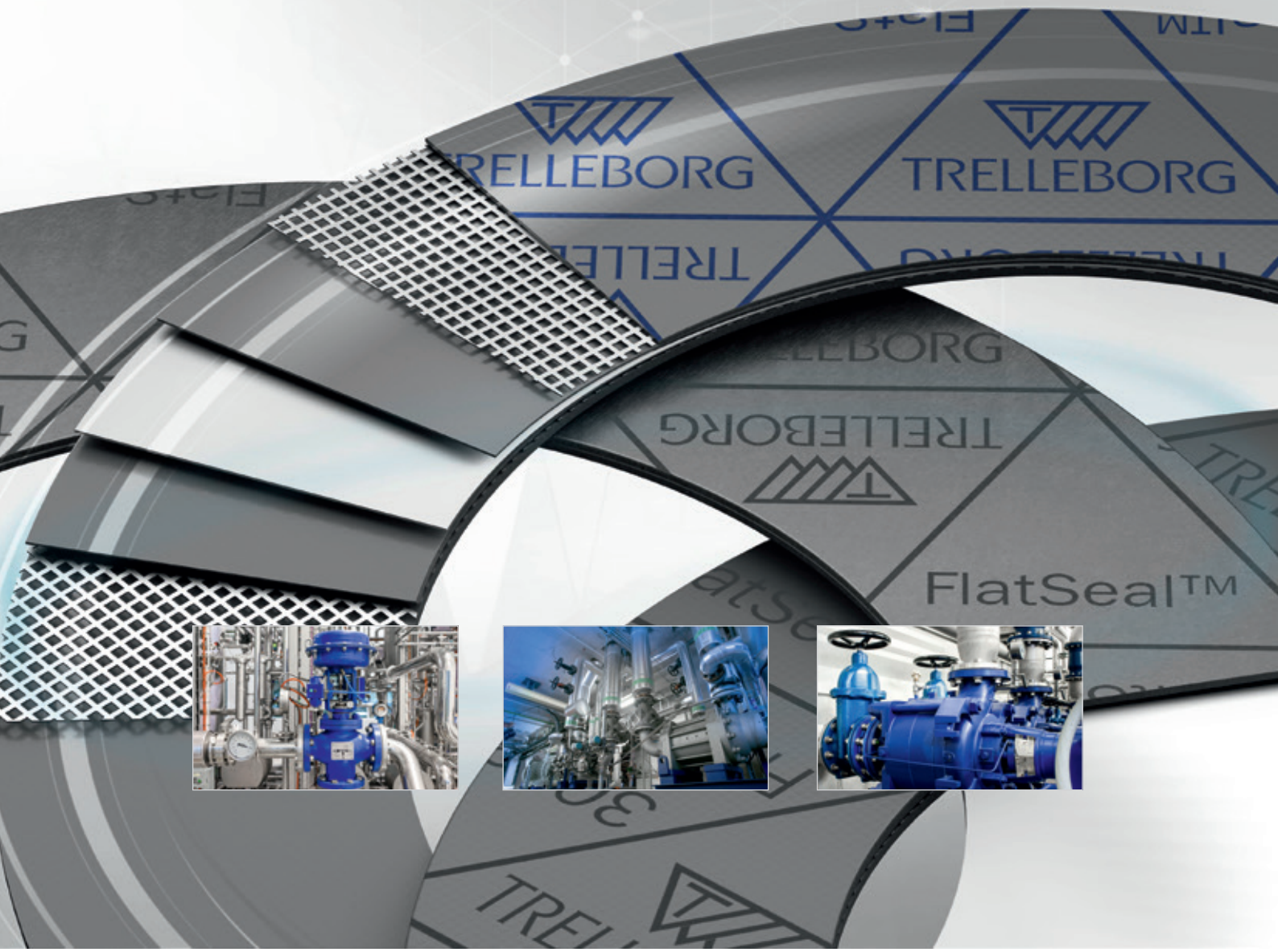
FlatSeal™ HMF30 Series

EXPANDED GRAPHITE GASKETS FOR MAXIMUM PERFORMANCE IN HIGH TEMPERATURE APPLICATIONS



YOUR PARTNER FOR SEALING TECHNOLOGY

Gaskets for Challenging Enviro

Effective sealing of flanges in applications containing extreme heat, hazardous chemicals or when low creep properties are required, is extremely challenging. Conventional rubber bonded gasket materials cannot seal in high temperatures. Graphite gaskets, particularly those made using high-purity, expanded graphite, offer the optimum solution for the most extreme environments.

High-performance graphite gaskets

Manufactured using advanced processing technology, the FlatSeal™ HMF30 series is a family of expanded graphite gaskets designed to effectively seal under extreme temperatures and pressures and in applications containing harsh chemicals.

Applications

The FlatSeal™ HMF30 series is suitable for use in a wide range of challenging processing applications, which contain:

- Steam
- Heat carrier oil
- Aggressive chemicals
- Exhaust gas

For high temperature applications

Universal chemical compatibility

Outstanding resistance to oxidation

Excellent adaptability to flange unevenness

nments

Features & Benefits

- Suitable for temperatures from -270 °C to +550 °C / -454 °F to +1022 °F
- Retains sealing performance with changing loads
- Maximum adaptability to flange unevenness
- Outstanding low creep properties in high temperature applications
- Universal chemical compatibility
- XP Technology maximizes oxidation resistance and minimizes downtime for maintenance due to excellent anti-stick properties
- Meets TA Luft (Technical Instructions on Air Quality Control) fugitive emissions requirements
- Suitable for designs that must comply with VDI (Verein Deutscher Ingenieure, German Association of Engineers) guideline 2290

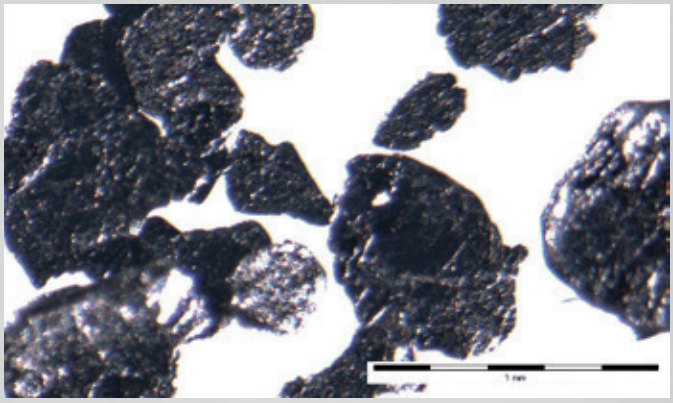
Ensuring the highest quality every step of the way

Using a state-of-the-art production process, HMF FlatSeal™ gaskets are manufactured with the highest quality raw materials. Every batch of material must match precise specifications and is subject to rigorous inspection to ensure that only approved materials are used in production.

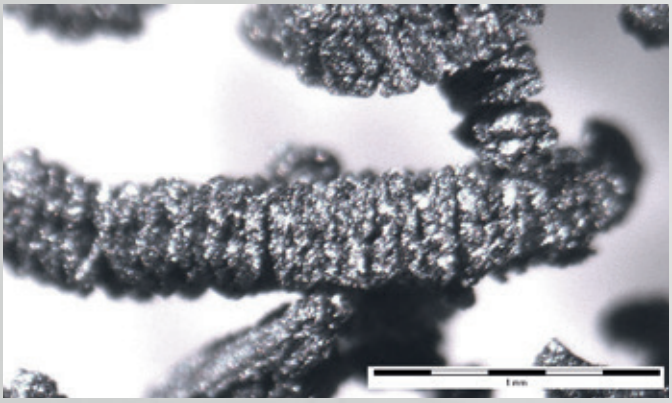
To guarantee consistent high quality at all steps, a process control system monitors and controls the preparation of formulations, their blending operation, and the process that forms the material sheet from which a FlatSeal™ is formed.

Transforming brittle powder into a pliable foil

During the production process, a pure, ground graphite powder (flakes) is expanded into flexible and soft graphite which is then formed into foil, giving the material its unique sealing properties.



Flakes of high-purity graphite

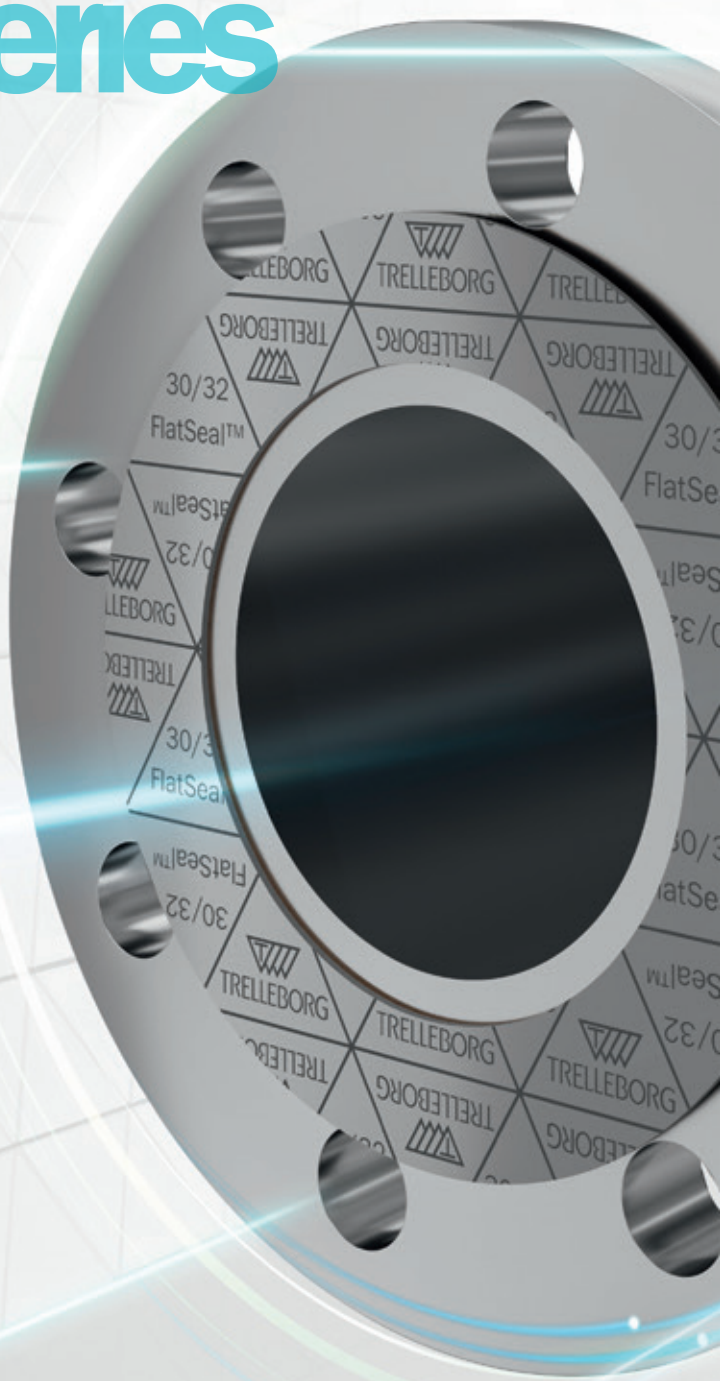


Expanded graphite

The FlatSeal™ HMF30 Series

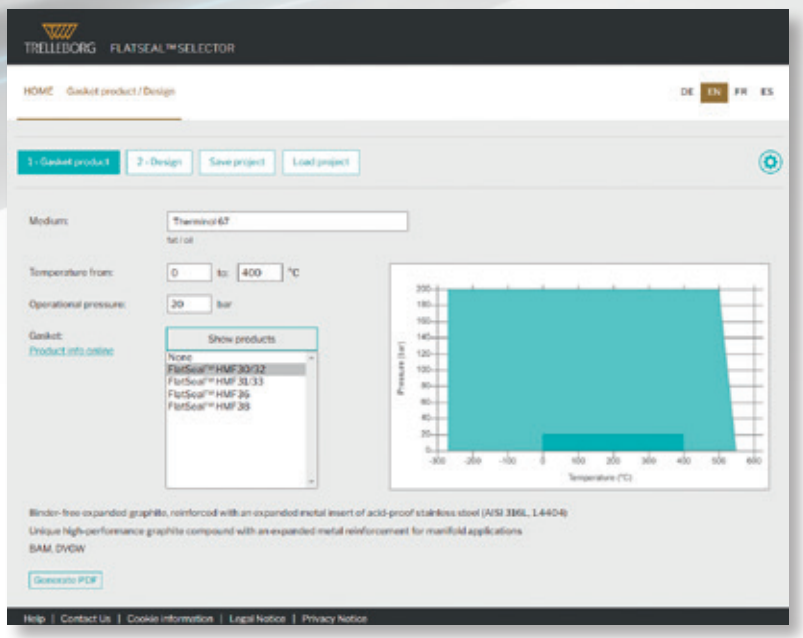
The FlatSeal™ HMF30 series of graphite based flat gaskets has been specially engineered for use in extreme operating environments. Each material consists of a high-performance graphite foil, which can be combined with a metal layer or layers and XP Technology, giving each material its own unique performance profile.

General Data	Description
FlatSeal™ HMF30	• With expanded metal insert
FlatSeal™ HMF31	• With expanded metal insert • Fulfills fugitive emission requirements (TA Luft)
FlatSeal™ HMF32	• With expanded metal insert • Features XP Technology
FlatSeal™ HMF33	• With expanded metal insert • Features XP Technology • Fulfills fugitive emission requirements (TA Luft)
FlatSeal™ HMF35	• Pre-compressed graphite sheet without metal reinforcement
FlatSeal™ HMF36	• Multilayer gasket with expanded and flat metal inserts for highest mechanical stability • Features XP Technology • Fugitive emission requirements (TA Luft)
FlatSeal™ HMF38	• Reinforced with flat metal insert • For complex geometries and thin gasket thicknesses



FlatSeal™ Selector

In addition to the FlatSeal™ HMF30 series, Trelleborg Sealing Solutions offers a wide variety of FlatSeal™ options in materials engineered for specific operating conditions.



Need help specifying a FlatSeal™ for your application?

The new FlatSeal™ Selector helps you select a material based on operating conditions and calculates the surface pressure in your application.

www.trelleborg.com/seals/tools

Versatile Graphite Gaskets

Made from high quality expanded graphite, FlatSeal™ gaskets in HMF30 and HMF32 are excellent all-around gaskets for high temperature and pressure applications. They demonstrate wide-ranging media compatibility and can withstand alternating loads.

FlatSeal™ HMF30

Reinforced with an expanded metal layer, FlatSeal™ HMF30 suitable for a wide range of uses , which optimizes logistics and handling processes.

FlatSeal™ HMF32

FlatSeal™ HMF32 combines the characteristics of FlatSeal™ HMF30 with innovative XP Technology. This makes graphite more resistant to oxidation for extended sealing performance and significantly reduces graphite deposits on sealing surfaces, facilitating maintenance processes.

Optimized sealing performance to meet fugitive emissions requirements

Specially engineered to meet fugitive emissions requirements, FlatSeal™ gaskets in HMF31 and HMF33 feature a special impregnation to minimize leakage at the flange in high temperature and pressure applications. These gaskets are suitable for use in applications that must comply with TA Luft and VDI guideline 2290.

FlatSeal™ HMF31

FlatSeal™ HMF31 is an excellent all-round standard gasket, ideal for a broad range of processing applications.

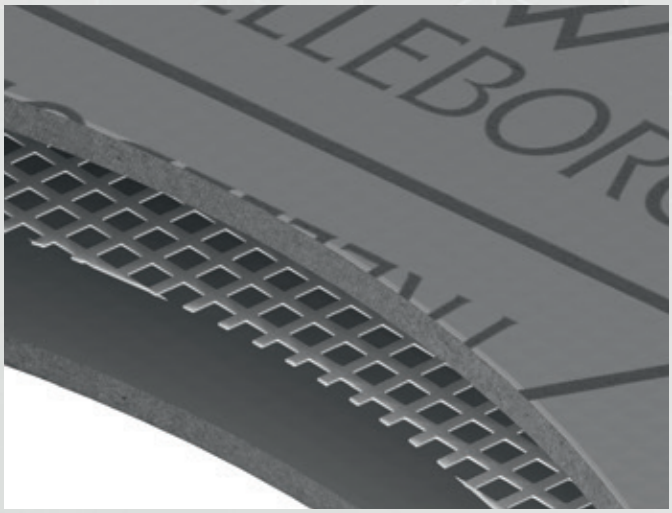
FlatSeal™ HMF33

Enhanced with XP Technology, FlatSeal™ HMF33 offers superior leakage performance with maximum oxidation resistance to extend gasket life and features anti-stick properties, simplifying gasket replacement processes.

Expanded Metal Layer

FlatSeal™ in HMF30, HMF31, HMF32 HMF33 and HMF36 is reinforced with an expanded metal layer, made from acid-resistant steel. With its unique, three dimensional geometry, this insert:

- Optimizes surface pressure distribution
- Enhances sealing performance of graphite foil
- Makes narrower gasket widths possible with its unique grid geometry
- Increases the mechanical stability of the gasket
- Improves gasket handling



A close-up view of FlatSeal™ HMF31 with an expanded metal layer.

Enclosed entirely by the graphite foil, the expanded metal layer optimizes surface pressure distribution and lowers the risk of separation of the layers when the gasket is bent. This simplifies handling and installation of the gasket on the flange.

The expanded metal layer has a height of approximately 0.4 mm / 0.015 inch and is produced by stretching a 0.15 mm / 0.006 inch stainless steel foil. In comparison to gaskets with a tanged metal layer, surface pressure distribution is optimized, making installation of the gasket faster.

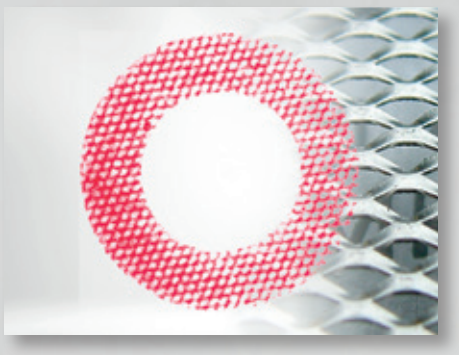
Fujifilm Testing

Fujifilm testing is performed to examine how different insert designs perform when surface pressure is applied.

The expanded metal insert optimizes the distribution of surface pressure increasing sealing performance.

Test conditions:

- Fujifilm sensitivity: medium (10-50 MPa)
- Gasket thickness: 2.0 mm / 0.08 in
- Surface pressure: 30 MPa / 4350 psi

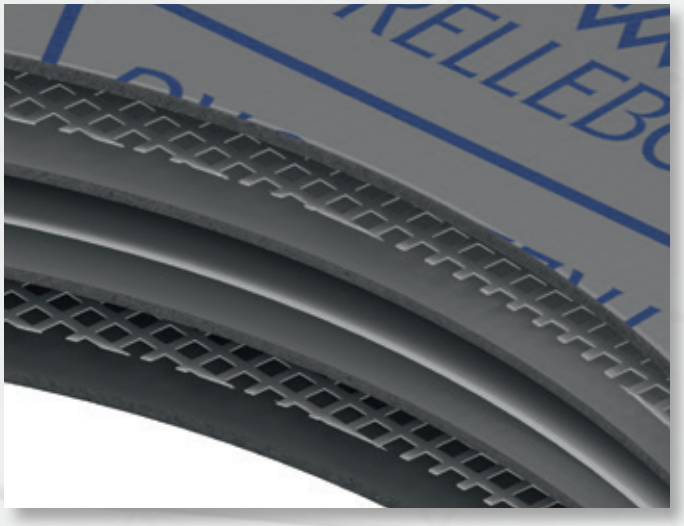


Expanded Metal

Tanged Metal

Smooth Metal

FlatSeal™ HMF36



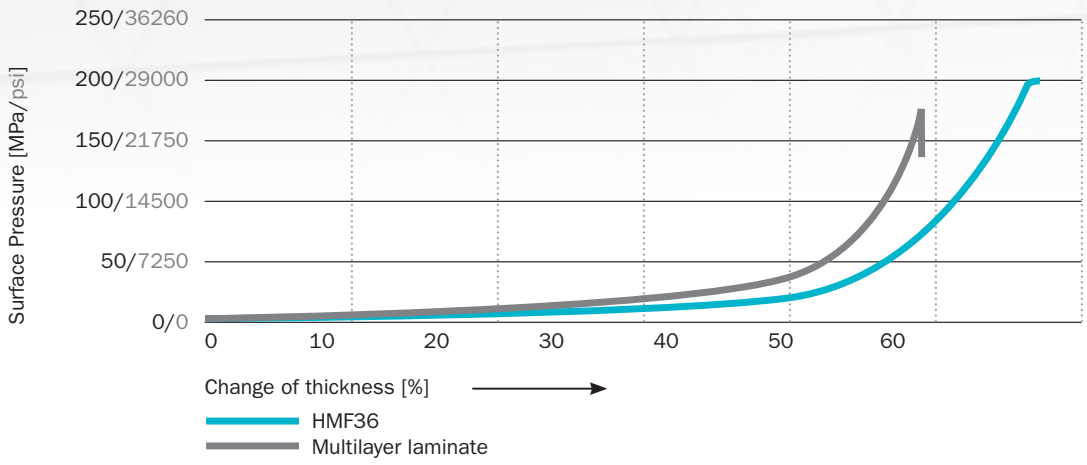
Unique multilayer structure for superior performance
With its innovative multilayer concept, FlatSeal™ HMF36 offers outstanding adaptability to flange surfaces and the highest mechanical stability. It is made from expanded graphite foil reinforced with a combination of expanded and smooth metal layers.

The outer layers of graphite foil are reinforced with expanded metal inserts, enhancing the adaptability of the flat gasket. This enables tight sealing, compensates for flange unevenness and moderate damage, and facilitates handling and installation processes.

This high-performance flat gasket is suitable for use in operating environments with extremely high pressures and temperatures and can withstand changing loads. It meets TA Luft fugitive emissions requirements and can be used in designs that must comply with VDI guideline 2290.

FlatSeal™ HMF36 is equipped with XP Technology, which extends service life and simplifies maintenance operations.

Compression chart according to DIN 28090-1



FlatSeal™ HMF38

For complex gasket geometries
Specially engineered for filigree and complex geometries and thin gasket thicknesses, FlatSeal™ HMF38 is composed of expanded graphite foil, reinforced with a smooth metal layer.

Compared to conventional tanged metal gaskets, it offers the following benefits:

- Enables gaskets with thicknesses under one millimeter
- Facilitates complex geometries with narrow gaskets widths
- Prevents injury during handling from burrs
- Eliminates contact corrosion at the flange surfaces due to projecting metal

This unique performance profile makes FlatSeal™ HMF38 ideal for numerous OEM and processing industry applications, including fittings, compressors, pumps and valves.

XP Technology

XP Technology is an inorganic treatment of the graphite foil, to enhance product properties.

EXTENDING FLATSEALTM SERVICE LIFE BY OPTIMIZING OXIDATION RESISTANCE

When an oxidant, such as oxygen, is present in an application, graphite gaskets are subject to oxidation at higher temperatures. This leads to a loss of graphite mass, thereby decreasing the sealing performance of the gasket.
Innovative XP Technology makes graphite more resistant to oxidation, which improves the long-term sealing performance of gaskets in high-temperature applications.
XP Technology is long-lasting and resistant to chemicals over the full temperature range.

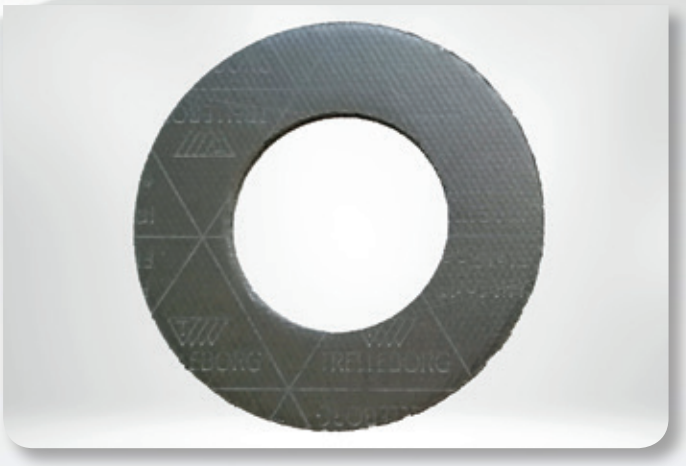
Benefits of XP Technology

- Increased oxidation resistance extends gasket service life
- Anti-stick properties in high temperature applications
- Saves time during maintenance operations
- Reduces downtime
- Prevents flange damage

Oxidation restistance, with and without XP Technology

Gaskets were placed in an oven containing air for four hours at 670 °C / 1238 °F.

Standard graphite gasket



FlatSeal™ gaskets with XP Technology

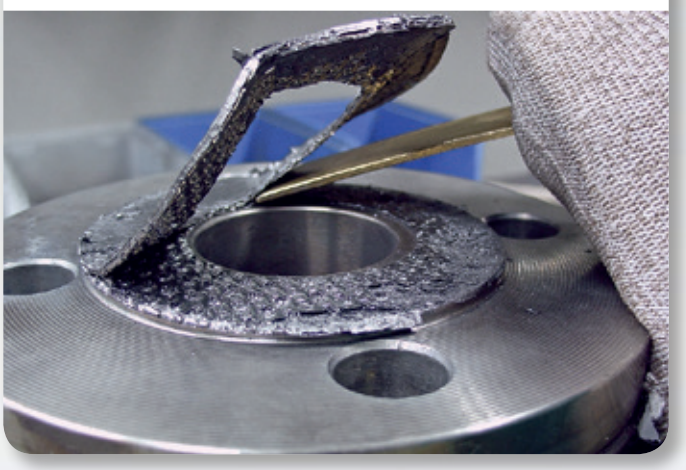
OUTSTANDING ANTI-STICK PROPERTIES

In addition to maximizing oxidation resistance, XP Technology provides outstanding anti-stick properties. Gaskets retain anti-stick properties over a full range of temperatures. In addition, due to the inorganic, inert structure of this technology, it demonstrates universal chemical compatibility.

Simplifying Flange Maintenance

XP Technology significantly reduces graphite deposits on the sealing surfaces. This facilitates gasket removal and simplifies cleaning of the flanges, optimizing maintenance operations, while protecting the sealing surface of the flange.

Tongue-and-groove flange connections are a particularly tough challenge when gaskets need to be replaced. Investigations show that leakage problems, attributed to incomplete removal of old gasket residue, are not unusual. By using FlatSeal™ gaskets, enhanced with XP Technology, cleaning processes are simplified.



In applications with conventional graphite gaskets, cleaning processes are time consuming requiring manual removal of all gasket residue.

FlatSeal™ gaskets with XP Technology simplify cleaning processes and protect sealing surfaces, optimizing maintenance operations and minimizing the risk of damage to the flange.

Proven Performance

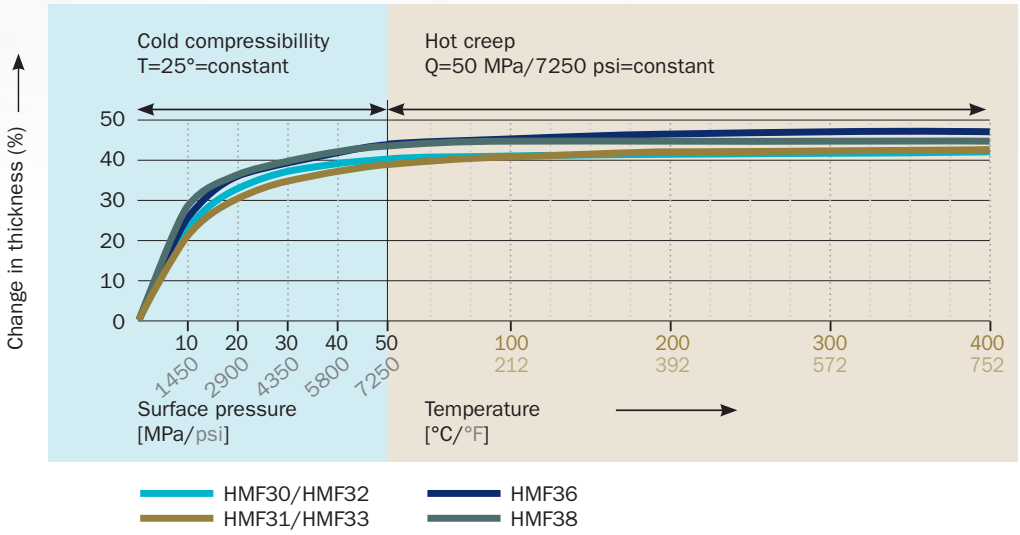
Numerous tests are performed on gasket materials, ranging from chemical compatibility testing to tests to verify the mechanical strength and sealing of the materials. When needed, customer-specific tests are conducted to ensure optimum gasket performance in the application.
Please contact your local Customer Service Center for test data to support the application design and to support with selection of the material most suitable for the operating environment of your application.

Temperature tests demonstrate superior results

Temperature testing consists of two parts:

- First, the gasket is compressed at room temperature between two surfaces. The curve in the graph indicates the adaptability of the gasket during installation.
- In the second part of the test, the temperature is increased at a specified speed, while the surface pressure from the first step is held constant – the system is not allowed to “relax” as a result of gasket compression. The test significantly exceeds real-life operating conditions where the load on the gasket would be lower, thereby proving gasket performance.

Temperature Test
at 50 MPa - sample thickness: 2.0 mm



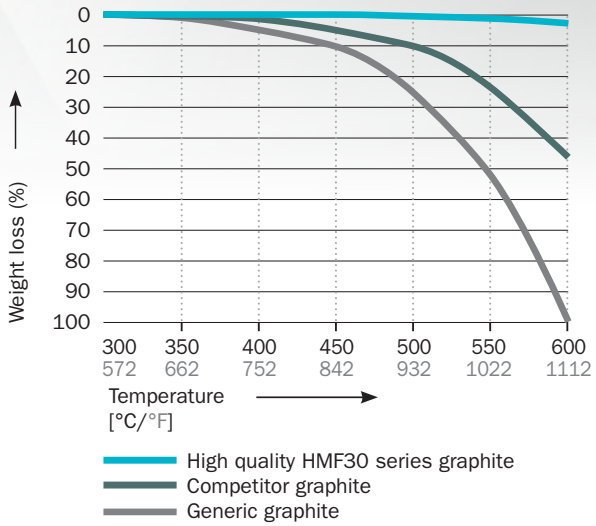
Oxidation resistant graphite

In order to provide reliable sealing, graphite gaskets must be resistant to oxidation. Since graphite purity is not a sufficient indicator of oxidation resistance, it is necessary to test oxidation properties. Graphite foil used in FlatSeal™ HMF30 series gaskets has undergone testing to ensure reliable, long-term performance in high temperature applications.

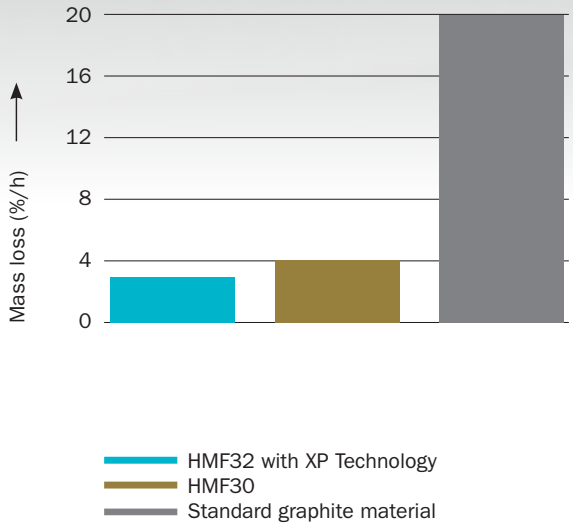
Meeting quality requirements

Tests were performed to verify that FlatSeal™ HMF 30 series gaskets, with and without XP Technology, meet the quality requirements defined in EN 14772. This standard specifies that weight loss of graphite, due to oxidation, must be under four percent per hour over four hours at 670 °C / 1238 °F. XP Technology enhances the oxidation resistance of the graphite foil, reducing mass loss to under three percent per hour.

Weight loss indicating oxidation resistance of pure graphite foil (99%)



Loss of graphite mass due to oxidation

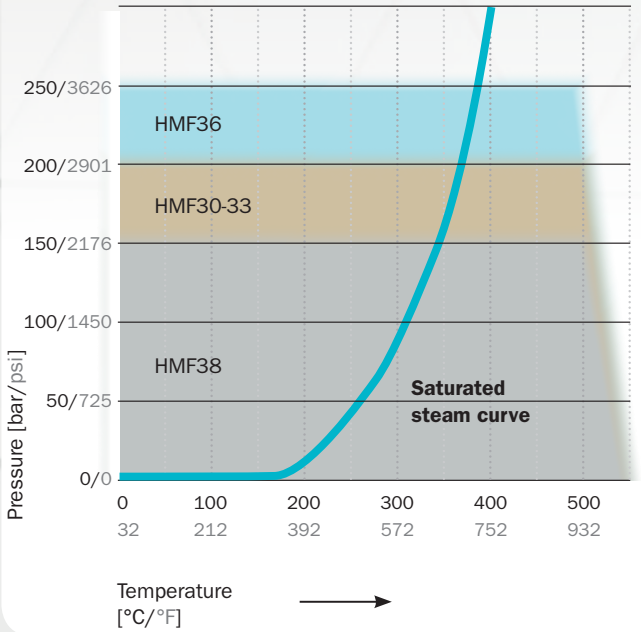


Material Information

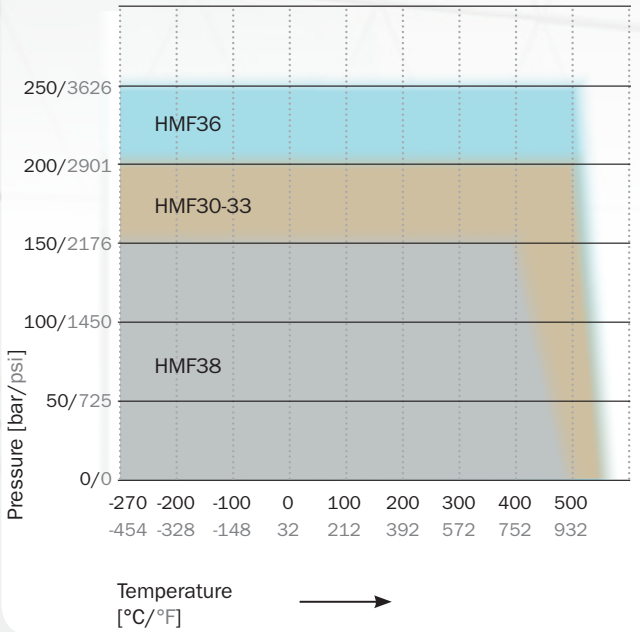
The temperature and pressure recommendations in the graphs apply to gaskets 2.0 mm / 0.08 inch thick that are used with raised face flanges. Higher stresses are possible when thinner gaskets are used. The recommendations are based on material characteristics and installation conditions.

The information provided should therefore be considered cautious estimates rather than specific operational limits. Please contact your local Customer Solution Center to verify that this material is suitable for the operating environment in your application.

Water/water vapor



Other Media*



* Other media refers to media commonly used in gasket applications that is not chemically critical.

General Data	HMF30/32	HMF31/33	HMF36	HMF38
Color	graphite gray	graphite gray	graphite gray	graphite gray
Printing color	black (HMF30) blue (HMF32)	black (HMF31) blue (HMF33)	blue	black

Physical Properties	Standard	Unit	Specifications (Modal Values)			
			Gasket Thickness			
			2.0 mm / 0.8 inch	2.0 mm / 0.8 inch	2.0 mm / 0.8 inch	1.0 mm / 0.4 inch
Graphite purity	DIN 51903	[%]	> 99	> 99	99,5	≥ 98
Density	DIN 28090-2	[g/cm³]	1,35	1,37	1,20	1,40
Residual stress (+300°C / +572°F)	DIN 52913	[N/mm²]	≥ 45	≥ 45	≥ 45	≥ 45
Compressibility	ASTM F36J	[%]	37	37	50	40
Recovery	ASTM F36J	[%]	15	17	10	15
Cold compressibility	DIN 28090-2	[%]	35	36	45	-
Cold recovery	DIN 28090-2	[%]	4	5	4	-
Hot creep	DIN 28090-2	[%]	2	3	3	-
Hot recovery	DIN 28090-2	[%]	2	4	3	-
Specific leakage rate	DIN 3535-6	[mg/(s*m)]	0,07	≤ 0,01	≤ 0,01	0,05
Oxidation value with XP Technology	DIN 28090-2	[%/h]	≤ 3	≤ 3	≤ 3	-
Oxidation value without XP Technology	DIN 28090-2	[%/h]	≤ 4	≤ 4	-	≤ 4
Tensile strength transverse	DIN 52910	[N/mm²]	8	8	16	25
Total chloride content	DIN 28090-2	[ppm]	≤ 50	≤ 50	≤ 50	≤ 50
Leachable chloride content	PV 01605	[ppm]	≤ 20	≤ 20	≤ 20	≤ 20
Total fluoride content	DIN 51723	[ppm]	≤ 50	≤ 50	≤ 50	≤ 50

Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

Trelleborg Sealing Solutions is a leading developer, manufacturer and supplier of precision seals, bearings and custom-molded polymer components. It focuses on meeting the most demanding needs of aerospace, automotive and general industrial customers with innovative solutions.

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If you'd like to talk to Trelleborg Sealing Solutions, find your local contact at: www.trelleborg.com/seals/worldwide

Version no: 9900100ENGI0822