

SIGRAFLEX® EMAIL

Multilayer gasket sheet made of SIGRAFLEX flexible graphite foil reinforced with flat stainless steel especially for use in PTFE envelope gaskets



SIGRAFLEX EMAIL is a multilayer gasket sheet made of SIGRAFLEX Z-grade flexible graphite foils reinforced with two 0.05 mm thick stainless steel foils using our proven SIGRAFLEX HOCHDRUCK technology.

It has been developed specially for use in PTFE envelope gaskets.

Applications

- Soft core material for PTFE envelope gaskets for use in enamelled pipe work, vessels, stub connections and access apertures.
- Soft core material for PTFE envelope gaskets for use in steel pipework with increased requirements for operational safety, tightness and product purity, including aggressive and hazardous media, media according TA Luft (German clean air act) or in the pharmaceutical industry.



↑ Cross-section

Properties

The graphite's good recovery behaviour, the stainless steel foil reinforcements and the adhesive-free, high strength connection of the individual layers using our SIGRAFLEX HOCHDRUCK technology significantly improve the sealing characteristics of PTFE envelope gaskets:

- Despite the influence of flow processes in the PTFE the graphite foil layers are prevented from sliding away from the smooth metal reinforcements due to the special adhesive-free graphite/metal connection of SIGRAFLEX EMAIL.
- The good long-term recovery behaviour of flexible graphite even at high temperatures can compensate for cold and warm flow characteristics specific to PTFE, which enables the production of PTFE envelope gaskets requiring a minimum of retightening.
- Owing to the excellent chemical resistance, high thermal stability and good sealing properties of this optimized core material, good leak-tightness is maintained even if the PTFE envelope is damaged.
- Excellent bursting safety due to two metal reinforcements.
- Great adaptability and hence good gasket stress distribution as a result of the flexible graphite's good compressibility, avoiding damage of enamelled components even if flanges are distorted.
- Good handling properties as a result of high rigidity and mechanical strength.
- Easy to process by punching.
- Asbestos-free (no associated health risk).
- No ageing of the gasket due to the material properties of PTFE, graphite and stainless steel.



↑ SIGRAFLEX EMAIL gaskets, cut open

Recommended design of PTFE envelope gaskets

The following design recommendations are based on a sealing system developed jointly with leading companies in the chemical industry. The following quality criteria for EMAIL gaskets have been established:

- High leak tightness thanks to the PTFE envelope
- Good sealing properties even if the PTFE envelope is damaged
- Minimum need for retightening, but retightening shall be possible
- Continuous maximum service temperature of 230 °C [depending on operating pressure]
- Good long-term recovery behaviour
- Robust handling properties
- Favourable price-performance ratio
- Low overall costs (gasket, installation, reloading, longevity)
- Bursting and blow-out safety

Up to a diameter of 200 mm, PTFE envelope gaskets are designed in a thickness of 4 mm without a corrugated ring, incorporating a 3 mm thick SIGRAFLEX EMAIL soft material layer. For larger diameters, the following recommendations are given:

DN	Corrugated ring	SIGRAFLEX EMAIL
≤ 200	0	1 x 3 mm
250 – 450	1	2 x 2 mm
500 – 800	1	2 x 3 mm
> 800	1	4 x 2 mm ¹⁾

¹⁾ overlapped design

Where flange distortions exceed 0.5 mm, the area between corrugated ring and graphite top layer is filled with segments made of SIGRAFLEX STANDARD.

Assembly instructions

In addition to our detailed assembly instructions, which we make available in our Download Center, the following specific recommendations apply to PTFE envelope gaskets:

- As a result of the cold and warm flow characteristics of the PTFE envelope, bolt loading decreases after installation and temperature changes. Under certain service conditions it is therefore recommended to retighten the bolts to the specified values. In general it is recommended that the bolts are retightened with operating temperatures above 100 °C, please note that retightening shall be performed at room temperature.
- The application range of PTFE envelope gaskets is determined by the mechanical properties of enamelled flanges. Due to the low load-bearing capacity of enamelled flanges, manufacturers of enamelled vessels and pipe work recommend relatively low gasket stresses.
- The manufacturers of enamelled vessels give specific recommendations for tightening and retightening.
- The maximum permissible torque values for enamelled flanges specified by these manufacturers must always be adhered to. Exceeding these values may result in damage to the enamel layer.

Material data of SIGRAFLEX® EMAIL

Typical properties	Units	V20011Z3E	V30011Z3E
Thickness	mm	2	3
Dimensions	m	1.5 x 1.5	1.5 x 1.5
Density of graphite	g/cm ³	1.1	1.1
Ash content of graphite (DIN 51903)	%	≤ 0.15	≤ 0.15
Purity	%	≥ 99.85	≥ 99.85
Total halogen content (Cl, F, B, I)	ppm	≤ 40	≤ 40
Total sulphur content	ppm	< 300	< 300
Reinforcing steel sheet details		Smooth stainless steel foil	Smooth stainless steel foil
ASTM material number		316L	316L
Thickness	mm	0.05	0.05
Number of sheets		2	2
Residual stress (DIN 52913)	$\sigma_{D 16 h, 300^{\circ}C, 50 N/mm^2}$	N/mm ²	≥ 48
Gasket factors (DIN E 2505/DIN 28090-1)			
Gasket width $b_0 = 20$ mm			
	σ_{VU}	N/mm ²	20
	σ_{V0}	N/mm ²	130
	σ_{B0}	N/mm ²	110
	m		1.3
Compression factors (DIN 28090-2)			
Compressibility	ϵ_{KSW}	%	35
Recovery at 20 °C	ϵ_{KRW}	%	5
Hot creep	ϵ_{WSW}	%	< 3
Recovery at 300 °C	ϵ_{WRW}	%	4
Young's modulus at 20 N/mm ² (DIN 28090-1)		N/mm ²	750
Compressibility (ASTM F36)		%	37
Recovery (ASTM F36)		%	17

Definitions

σ_{VU}	Recommended minimum gasket assembly stress
σ_{BU}	Minimum gasket assembly stress in service, where σ_{BU} is the product of internal pressure p_i and gasket factor m for test and in service ($\sigma_{BU} = p_i \times m$)
σ_{V0}	Maximum permissible gasket stress at 20 °C
$\sigma_{B0 \text{ at } 300^{\circ}C}$	Maximum permissible gasket stress in service
ϵ_{KSW}	Compression set under a gasket stress of 35 N/mm ²
ϵ_{KRW}	Gasket recovery after reduction in gasket stress from 35 N/mm ² to 1 N/mm ²
ϵ_{WSW}	Gasket creep compression under a gasket stress of 50 N/mm ² at 300 °C after 16 h
ϵ_{WRW}	Recovery after reduction in gasket stress from 50 N/mm ² to 1 N/mm ²

The percentage changes in thickness of ϵ_{KSW} , ϵ_{KRW} , ϵ_{WSW} and ϵ_{WRW} are relative to the initial thickness.

Unless stated otherwise, all values are valid at room temperature, typical, non-binding and subject to change. Please note some values correspond to the graphite foil only. For engineering or design purposes please contact our technical sales team.

Product overview

Products	Characteristics	Recommended applications
SIGRAFLEX FOIL F.../C/E/Z/APX/APX2®	Flexible, soft, continuous	- 250 °C to approx. 550 °C, for die-formed packing rings, filler material for spiral wound gaskets, facing material for kammprofile and corrugated gaskets
SIGRAFLEX STANDARD L...CI	Unreinforced, impregnated	Raised-face flanges, enamel or glass flanges, highly corrosive media
SIGRAFLEX ECONOMY V...C4	Reinforced with bonded stainless steel foil	Pumps, fittings, gas supply and waste gas pipelines
SIGRAFLEX UNIVERSAL V...C2I	Reinforced with tanged stainless steel, impregnated	Pipework and vessels in the chemical and petrochemical industries and in power generation plants
SIGRAFLEX UNIVERSAL PRO V...C2IP	Reinforced with tanged stainless steel, impregnated	TA Luft applications, for pipework and vessels in the chemical and petrochemical industries and in power generation plants
SIGRAFLEX SELECT V16010C3I	Reinforced with stainless steel foil, adhesive-free, impregnated	TA Luft applications, raised-face flanges, pipework in the chemical and petrochemical industries
SIGRAFLEX HOCHDRUCK V...Z3I	Multilayer material, reinforced with stainless steel foil, adhesive-free, impregnated	Universal sealing sheet, also for solving sealing problems in pipework, process equipment, tongue-and-groove flanges and non-standard joints in the chemical, petrochemical and nuclear industries and in power generation plants
SIGRAFLEX HOCHDRUCK PRO V...Z3IP	Multilayer material, reinforced with stainless steel foil, adhesive-free, impregnated	Universal sealing sheet for TA Luft applications, also for solving sealing problems in pipework, process equipment, tongue-and-groove flanges and non-standard joints in the chemical, petrochemical and nuclear industries and in power generation plants
SIGRAFLEX APX2 HOCHDRUCK V...W3	Multilayer material, reinforced with stainless steel foil, adhesive-free	Universal sealing sheet, also for solving sealing problems in high temperature applications in pipework, process equipment, tongue-and-groove flanges and non-standard joints in the chemical and petrochemical industries and in power generation plants
SIGRAFLEX MF® V...MF	Adhesive-free laminate made of graphite, stainless steel and PTFE	Maximum requirements for sealability (TA Luft), safety and process hygiene; sealed joints in the chemical, petrochemical, pharmaceutical and food industries
SIGRAFLEX EMAIL V...Z3E	Reinforced with stainless steel foil, adhesive-free	PTFE-envelope gaskets for enameled pipework, vessels and stub connections, etc.



Additional information on our SIGRAFLEX sealing materials can be found under "Download Center" on our homepage.

www.sigraflex.com/downloads



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